

**CPC****COOPERATIVE PATENT CLASSIFICATION****G05B**

**CONTROL OR REGULATING SYSTEMS IN GENERAL; FUNCTIONAL ELEMENTS OF SUCH SYSTEMS; MONITORING OR TESTING ARRANGEMENTS FOR SUCH SYSTEMS OR ELEMENTS** (fluid-pressure actuators or systems acting by means of fluids in general [F15B](#); valves per se [F16K](#); characterised by mechanical features only [G05G](#); sensitive elements, see the appropriate subclass, e.g. [G12B](#), subclass of [G01](#), [H01](#); correcting units, see the appropriate subclass, e.g. [H02K](#))

**NOTES**

1. This subclass covers features of control systems or elements for regulating specific variables, which are clearly more generally applicable.
2. This subclass does not cover applications of such systems or elements, which are covered by subclass [G05D](#) or [G05F](#).
3. In this subclass, the following terms or expressions are used with the meanings indicated :
  - "automatic controller" means a system, circuit, or device in which a signal from the detecting element is compared with a signal representing the desired value and which operates in such a way as to reduce the deviation. The automatic controller generally does not include the sensitive element, i.e. that element which measures the value of the condition to be corrected, or the correcting element, i.e. that element which adjusts the condition to be corrected;
  - "electric" includes "electromechanical", "electrohydraulic" or "electropneumatic".
4. In this subclass, details or specific control systems are classified in the group relevant to that system, if not otherwise provided for.

**G05B 1/00**

**Comparing elements, i.e. elements for effecting comparison directly or indirectly between a desired value and existing or anticipated values** (comparing phase or frequency of two electric signals [H03D 13/00](#))

**G05B 1/01**

- . electric

**G05B 1/02**

- . . for comparing analogue signals

**G05B 1/022**

- . . . {using discharge tubes}

**G05B 1/025**

- . . . {using inductance means}

**G05B 1/027**

- . . . {using impedance bridges}

**G05B 1/03**

- . . for comparing digital signals

**G05B 1/04**

- . . with sensing of the position of the pointer of a measuring instrument

**G05B 1/06**

- . . . continuous sensing

**G05B 1/08**

- . . . stepwise sensing

**G05B 1/11**

- . fluidic

**G05B 5/00**

**Anti-hunting arrangements**

**G05B 5/01**

- . electric

**G05B 5/04**

- . fluidic

|                   |   |
|-------------------|---|
| <b>G05B 6/00</b>  | <b>Internal feed-back arrangements for obtaining particular characteristics, e.g. proportional, integral, differential</b> ( <a href="#">in automatic controllers G05B 11/00</a> )  |
| G05B 6/02         | . electric  |
| G05B 6/05         | . fluidic   |
| <b>G05B 7/00</b>  | <b>Arrangements for obtaining smooth engagement or disengagement of automatic control</b>   |
| G05B 7/02         | . electric  |
| G05B 7/04         | . fluidic   |
| <b>G05B 9/00</b>  | <b>Safety arrangements</b> ( <a href="#">G05B 7/00 takes precedence</a> ; safety arrangements in programme-control systems <a href="#">G05B 19/048</a> , <a href="#">G05B 19/406</a> ; safety valves <a href="#">F16K 17/00</a> ; emergency protective circuit arrangements in general <a href="#">H02H</a> ) |
| G05B 9/02         | . electric  |
| G05B 9/03         | . . with multiple-channel loop, i.e. redundant control systems  |
| G05B 9/05         | . fluidic   |
| <b>G05B 11/00</b> | <b>Automatic controllers</b> ( <a href="#">G05B 13/00 takes precedence</a> )  |
| G05B 11/01        | . electric  |
| G05B 11/011       | . . {details of the correcting means}   |
| G05B 11/012       | . . {details of the transmission means}   |
| G05B 11/013       | . . . {using discharge tubes}   |
| G05B 11/015       | . . . {using rotating amplifiers}   |
| G05B 11/016       | . . . {using inductance means}  |
| G05B 11/017       | . . . {using photo-electric means}  |
| G05B 11/018       | . . . {using thermal amplifiers}  |
| G05B 11/06        | . . in which the output signal represents a continuous function of the deviation from the desired value, i.e. continuous controllers ( <a href="#">G05B 11/26 takes precedence</a> )  |
| G05B 11/10        | . . . the signal transmitted being dc   |
| G05B 11/12        | . . . the signal transmitted being modulated on an ac carrier   |
| G05B 11/14        | . . in which the output signal represents a discontinuous function of the deviation from the desired value, i.e. discontinuous controllers ( <a href="#">G05B 11/26 takes precedence</a> )  |
| G05B 11/16        | . . . Two-step controllers, e.g. with on-off action   |
| G05B 11/18        | . . . Multi-step controllers  |
| G05B 11/26        | . . in which the output signal is a pulse-train   |
| G05B 11/28        | . . . using pulse-height modulation; using pulse-width modulation   |
| G05B 11/30        | . . . using pulse-frequency modulation  |
| G05B 11/32        | . . with inputs from more than one sensing element; with outputs to more than one correcting element  |
| G05B 11/36        | . . with provision for obtaining particular characteristics, e.g. proportional, integral, differential  |

- G05B 11/38 . . . for obtaining a proportional characteristic
- G05B 11/40 . . . for obtaining an integral characteristic
- G05B 11/42 . . . for obtaining a characteristic which is both proportional and time-dependent, e.g. P.I., P.I.D.
- G05B 11/44 . pneumatic only
- G05B 11/46 . . without auxiliary power
- G05B 11/48 . . with auxiliary power
- G05B 11/50 . . . in which the output signal represents a continuous function of the deviation from the desired value i.e. continuous controllers
- G05B 11/52 . . . in which the output signal represents a discontinuous function of the deviation from the desired value, i.e. discontinuous controllers
- G05B 11/54 . . . . Two-step controllers, e.g. with on-off action
- G05B 11/56 . . . . Multi-step controllers
- G05B 11/58 . . with inputs from more than one sensing element; with outputs to more than one correcting element
- G05B 11/60 . hydraulic only
- G05B 13/00** **Adaptive control systems, i.e. systems automatically adjusting themselves to have a performance which is optimum according to some preassigned criterion** ([G05B 19/00](#) takes precedence; details of the computer [G06F 15/18](#))
- G05B 13/02 . electric
- G05B 13/0205 . . {not using a model or a simulator of the controlled system}
- G05B 13/021 . . . {in which a variable is automatically adjusted to optimise the performance}
- G05B 13/0215 . . . . {using trial and error method, including "peak-holding"}
- G05B 13/022 . . . . {using a perturbation of the variable}
- G05B 13/0225 . . . . . {being a periodic perturbation}
- G05B 13/023 . . . . . {being a random or a self-induced perturbation}
- G05B 13/0235 . . . . {using steepest descent or ascent method}
- G05B 13/024 . . . {in which a parameter or coefficient is automatically adjusted to optimise the performance}
- G05B 13/0245 . . . . {not using a perturbation signal}
- G05B 13/025 . . . . {using a perturbation signal}
- G05B 13/0255 . . . {the criterion being a time-optimal performance criterion}
- G05B 13/026 . . . {using a predictor}
- G05B 13/0265 . . {the criterion being a learning criterion}
- G05B 13/027 . . . {using neural networks only}
- G05B 13/0275 . . . {using fuzzy logic only}
- G05B 13/028 . . . {using expert systems only}
- G05B 13/0285 . . . {using neural networks and fuzzy logic}
- G05B 13/029 . . . {using neural networks and expert systems}
- G05B 13/0295 . . . {using fuzzy logic and expert systems}
- G05B 13/04 . . involving the use of models or simulators

- G05B 13/041 . . . {in which a variable is automatically adjusted to optimise the performance}
- G05B 13/042 . . . {in which a parameter or coefficient is automatically adjusted to optimise the performance}
- G05B 13/044 . . . . {not using a perturbation signal}
- G05B 13/045 . . . . {using a perturbation signal}
- G05B 13/047 . . . {the criterion being a time optimal performance criterion}
- G05B 13/048 . . . {using a predictor}
  
- G05B 15/00** **Systems controlled by a computer** ([G05B 13/00](#), [G05B 19/00](#) take precedence; automatic controllers with particular characteristics [G05B 11/00](#); computers per se [G06](#))
- G05B 15/02 . electric
  
- G05B 17/00** **Systems involving the use of models or simulators of said systems** ([G05B 13/00](#), [G05B 15/00](#), [G05B 19/00](#) take precedence; analogue computers for specific processes, systems, or devices, e.g. simulators [G06G 7/48](#))
- G05B 17/02 . electric
  
- G05B 19/00** **Programme-control systems** (specific applications see the relevant places, e.g. [A47L 15/46](#); clocks with attached or built-in means operating any device at a preselected time interval [G04C 23/00](#); marking or sensing record carriers with digital information [G06K](#); information storage [G11](#); time or time-programme switches which automatically terminate their operation after the programme is completed [H01H 43/00](#))
- G05B 19/02 . electric
- G05B 19/04 . . Programme control other than numerical control, i.e. in sequence controllers or logic controllers ([G05B 19/418](#) takes precedence; numerical control [G05B 19/18](#))
- G05B 19/0405 . . . {Programme-control specially adapted for machine tool control and not otherwise provided for ([B23Q](#) takes precedence; [G05B 19/06](#) to [G05B 19/16](#) take precedence)}
- G05B 19/041 . . . {Function-oriented details}
- G05B 19/0415 . . . . {adapting phase duration according to measured parameters}
- G05B 19/042 . . . using digital processors ([G05B 19/05](#) takes precedence)
- G05B 19/0421 . . . . {Multiprocessor system}
- G05B 19/0423 . . . . {Input/output}
- G05B 19/0425 . . . . . {Safety, monitoring}
- G05B 19/0426 . . . . {Programming the control sequence}
- G05B 19/0428 . . . . {Safety, monitoring ([G05B 19/0423](#) takes precedence)}
- G05B 19/045 . . . using logic state machines, consisting only of a memory or a programmable logic device containing the logic for the controlled machine and in which the state of its outputs is dependent on the state of its inputs or part of its own output states, e.g. binary decision controllers, finite state controllers
- G05B 19/048 . . . Monitoring; Safety

- G05B 19/05      . . . Programmable logic controllers, e.g. simulating logic interconnections of signals according to ladder diagrams or function charts
- G05B 19/052    . . . . {Linking several PLC's}
- G05B 19/054    . . . . {Input/output}
- G05B 19/056    . . . . {Programming the PLC}
- G05B 19/058    . . . . {Safety, monitoring}
- G05B 19/06     . . . using cams, discs, rods, drums, or the like ([mechanical programme-control apparatus G05G 21/00](#))
- G05B 19/063    . . . . {for sequential programme-control without delivering a reference value}
- G05B 19/066    . . . . {for delivering "step function", a slope function or a continuous function}
- G05B 19/07     . . . where the programme is defined in the fixed connection of electrical elements, e.g. potentiometers, counters, transistors
- G05B 19/075    . . . . {for delivering a step function, a slope or a continuous function ([G05B 19/06 takes precedence](#); function generators per se [H03K](#), [G06G](#))}
- G05B 19/08     . . . using plugboards, cross-bar distributors, matrix switches, or the like
- G05B 19/10     . . . using selector switches
- G05B 19/102    . . . . {for input of programme steps, i.e. setting up sequence}
- G05B 19/104    . . . . . {characterised by physical layout of switches; switches co-operating with display; use of switches in a special way}
- G05B 19/106    . . . . {for selecting a programme, variable or parameter}
- G05B 19/108    . . . . . {characterised by physical layout of switches; switches co-operating with display; use of switches in a special way}
- G05B 19/12     . . . using record carriers
- G05B 19/122    . . . . {using cards, tapes or discs having conductive paths ([G05B 19/128 takes precedence](#))}
- G05B 19/124    . . . . {using tapes, cards or discs with optically sensed marks or codes ([G05B 19/128](#), [G05B 19/14 take precedence](#))}
- G05B 19/126    . . . . {using cards, tapes or discs having protuberances ([G05B 19/128 takes precedence](#))}
- G05B 19/128    . . . . {the workpiece itself serves as a record carrier, e.g. by its form, by marks or codes on it}
- G05B 19/14     . . . . using punched cards or tapes {([G05B 19/128 takes precedence](#))}
- G05B 19/16     . . . . using magnetic record carriers {([G05B 19/128 takes precedence](#))}
- G05B 19/18     . . Numerical control [NC], i.e. automatically operating machines, in particular machine tools, e.g. in a manufacturing environment, so as to execute positioning, movement or co-ordinated operations by means of programme data in numerical form ([G05B 19/418 takes precedence](#))
- G05B 19/182    . . . {characterised by the machine tool function, e.g. thread cutting, cam making, tool direction control ([G05B 19/21 to G05B 19/40 take precedence](#))}
- G05B 19/184    . . . . {Generation of cam-like surfaces}
- G05B 19/186    . . . . {Generation of screw- or gearlike surfaces}

- G05B 19/188 . . . {characterised by special applications and not provided for in the relevant subclasses, (e.g. making dies, filament winding)}
- G05B 19/19 . . . characterised by positioning or contouring control systems, e.g. to control position from one programmed point to another or to control movement along a programmed continuous path

**NOTE**

In this group, the measuring system for an axis is used to measure the displacement along that axis. This measurement is used as position-feedback in the servo-control system.

- G05B 19/195 . . . . {Controlling the position of several slides on one axis}
- G05B 19/21 . . . . using an incremental digital measuring device
- G05B 19/23 . . . . . for point-to-point control
- G05B 19/231 . . . . . {the positional error is used to control continuously the servomotor according to its magnitude}
- G05B 19/232 . . . . . {with speed feedback only}
- G05B 19/234 . . . . . {with current or torque feedback only}
- G05B 19/235 . . . . . {with force or acceleration feedback only}
- G05B 19/237 . . . . . {with a combination of feedback covered by [G05B 19/232](#) to [G05B 19/235](#)}
- G05B 19/238 . . . . . {the positional error is only used to control speed in steps according to distance left, or to give a stop signal when error reaches zero}
- G05B 19/25 . . . . . for continuous-path control
- G05B 19/251 . . . . . {the positional error is used to control continuously the servomotor according to its magnitude}
- G05B 19/253 . . . . . {with speed feedback only}
- G05B 19/255 . . . . . {with current or torque feedback only}
- G05B 19/256 . . . . . {with force or acceleration feedback only}
- G05B 19/258 . . . . . {with a combination of feedback covered by [G05B 19/253](#) to [G05B 19/256](#)}
- G05B 19/27 . . . . . using an absolute digital measuring device
- G05B 19/29 . . . . . for point-to-point control
- G05B 19/291 . . . . . {the positional error is used to control continuously the servomotor according to its magnitude}
- G05B 19/293 . . . . . {with speed feedback only}
- G05B 19/295 . . . . . {with current or torque feedback only}
- G05B 19/296 . . . . . {with force or acceleration feedback only}
- G05B 19/298 . . . . . {with a combination of feedback covered by [G05B 19/293](#) to [G05B 19/296](#)}
- G05B 19/31 . . . . . for continuous-path control
- G05B 19/311 . . . . . {the positional error is used to control continuously the servomotor according to its magnitude}
- G05B 19/313 . . . . . {with speed feedback only}

|              |           |  |
|--------------|-----------|--|
| G05B 19/315  | . . . . . | {with current or torque feedback only}   |
| G05B 19/316  | . . . . . | {with force or acceleration feedback only}   |
| G05B 19/318  | . . . . . | {with a combination of feedback covered by <a href="#">G05B 19/313</a> to <a href="#">G05B 19/316</a> }  |
| G05B 19/33   | . . . . . | using an analogue measuring device   |
| G05B 19/35   | . . . . . | for point-to-point control   |
| G05B 19/351  | . . . . . | {the positional error is used to control continuously the servomotor according to its magnitude}   |
| G05B 19/353  | . . . . . | {with speed feedback only}   |
| G05B 19/355  | . . . . . | {with current or torque feedback only}   |
| G05B 19/356  | . . . . . | {with force or acceleration feedback only}   |
| G05B 19/358  | . . . . . | {with a combination of feedback covered by <a href="#">G05B 19/353</a> to <a href="#">G05B 19/356</a> }  |
| G05B 19/37   | . . . . . | for continuous-path control  |
| G05B 19/371  | . . . . . | {the positional error is used to control continuously the servomotor according to its magnitude}   |
| G05B 19/373  | . . . . . | {with speed feedback only}   |
| G05B 19/375  | . . . . . | {with current or torque feedback only}   |
| G05B 19/376  | . . . . . | {with force or acceleration feedback only}   |
| G05B 19/378  | . . . . . | {with a combination of feedback covered by <a href="#">G05B 19/373</a> to <a href="#">G05B 19/376</a> }  |
| G05B 19/39   | . . . . . | using a combination of the means covered by at least two of the preceding sub-groups <a href="#">G05B 19/21</a> , <a href="#">G05B 19/27</a> , and <a href="#">G05B 19/33</a>  |
| G05B 19/40   | . . . . . | Open loop systems, e.g. using stepping motor   |
| G05B 19/401  | . . . . . | characterised by control arrangements for measuring, e.g. calibration and initialisation, measuring workpiece for machining purposes ( <a href="#">G05B 19/19</a> takes precedence)  |
| G05B 19/4015 | . . . . . | {going to a reference at the beginning of machine cycle, e.g. for calibration}   |
| G05B 19/402  | . . . . . | characterised by control arrangements for positioning, e.g. centring a tool relative to a hole in the workpiece, additional detection means to correct position ( <a href="#">G05B 19/19</a> takes precedence)                                   |
| G05B 19/404  | . . . . . | characterised by control arrangements for compensation, e.g. for backlash, overshoot, tool offset, tool wear, temperature, machine construction errors, load, inertia ( <a href="#">G05B 19/19</a> , <a href="#">G05B 19/41</a> take precedence) |
| G05B 19/406  | . . . . . | characterised by monitoring or safety ( <a href="#">G05B 19/19</a> takes precedence)   |
| G05B 19/4061 | . . . . . | Avoiding collision or forbidden zones  |
| G05B 19/4062 | . . . . . | Monitoring servoloop, e.g. overload of servomotor, loss of feedback or reference   |
| G05B 19/4063 | . . . . . | Monitoring general control system ( <a href="#">G05B 19/4062</a> takes precedence)   |
| G05B 19/4065 | . . . . . | Monitoring tool breakage, life or condition  |
| G05B 19/4067 | . . . . . | Restoring data or position after power failure or other interruption   |
| G05B 19/4068 | . . . . . | Verifying part programme on screen, by drawing or other means  |



- G05B 19/4069 . . . . Simulating machining process on screen ([G05B 19/4068 takes precedence](#))
- G05B 19/408 . . . characterised by data handling or data format, e.g. reading, buffering or conversion of data
- G05B 19/4083 . . . . {Adapting programme, configuration}
- G05B 19/4086 . . . . {Coordinate conversions; Other special calculations}
- G05B 19/409 . . . characterised by using manual input [MDI] or by using control panel, e.g. controlling functions with the panel; characterised by control panel details, by setting parameters ([G05B 19/408](#), [G05B 19/4093 take precedence](#))
- G05B 19/4093 . . . characterised by part programming, e.g. entry of geometrical information as taken from a technical drawing, combining this with machining and material information to obtain control information, named part programme, for the NC machine
- G05B 19/40931 . . . . {concerning programming of geometry}
- G05B 19/40932 . . . . . {Shape input}
- G05B 19/40933 . . . . . {Selecting figure elements from a menu table}
- G05B 19/40935 . . . . . {Selection of predetermined shapes and defining the dimensions with parameter input}
- G05B 19/40936 . . . . . {Defining geometry with a high level language}
- G05B 19/40937 . . . . {concerning programming of machining or material parameters, pocket machining}
- G05B 19/40938 . . . . . {Tool management}
- G05B 19/4097 . . . characterised by using design data to control NC machines, e.g. CAD/CAM ([G05B 19/4093 takes precedence](#); CAD in general [G06F 17/50](#))
- G05B 19/4099 . . . . Surface or curve machining, making 3D objects, e.g. desktop manufacturing
- G05B 19/41 . . . characterised by interpolation, e.g. the computation of intermediate points between programmed end points to define the path to be followed and the rate of travel along that path ([G05B 19/25](#), [G05B 19/31](#), [G05B 19/37](#), [G05B 19/39](#), [G05B 19/40 take precedence](#))
- G05B 19/4103 . . . . Digital interpolation
- G05B 19/4105 . . . . Analog interpolation
- G05B 19/414 . . . Structure of the control system, e.g. common controller or multiprocessor system, interface to servo, programmable interface controller
- G05B 19/4141 . . . . {characterised by a controller or microprocessor per axis}
- G05B 19/4142 . . . . {characterised by the use of a microprocessor ([G05B 19/4141 takes precedence](#))}
- G05B 19/4144 . . . . {characterised by using multiplexing for control system}
- G05B 19/4145 . . . . {characterised by using same processor to execute programmable controller and numerical controller function [CNC] and PC controlled NC [PCNC]}
- G05B 19/4147 . . . . {characterised by using a programmable interface controller [PIC]}
- G05B 19/4148 . . . . {characterised by using several processors for different functions, distributed (real-time) systems ([G05B 19/4141 takes precedence](#))}



- G05B 19/4155 . . . characterised by programme execution, i.e. part programme or machine function execution, e.g. selection of a programme
- G05B 19/416 . . . characterised by control of velocity, acceleration or deceleration ([G05B 19/19 takes precedence](#))
- G05B 19/4163 . . . . {Adaptive control of feed or cutting velocity ([without NC B23Q 15/12](#))}
- G05B 19/4166 . . . . {Controlling feed or in-feed ([G05B 19/4163 takes precedence](#))}
- G05B 19/418 . . Total factory control, i.e. centrally controlling a plurality of machines, e.g. direct or distributed numerical control [DNC], flexible manufacturing systems [FMS], integrated manufacturing systems [IMS], computer integrated manufacturing [CIM]
- G05B 19/41805 . . . {characterised by assembly}
- G05B 19/4181 . . . {characterised by direct numerical control [DNC]}
- G05B 19/41815 . . . {characterised by the cooperation between machine tools, manipulators and conveyer or other workpiece supply system, workcell}
- G05B 19/4182 . . . . {manipulators and conveyer only}
- G05B 19/41825 . . . . {machine tools and manipulators only, machining centre}
- G05B 19/4183 . . . {characterised by data acquisition, e.g. workpiece identification}
- G05B 19/41835 . . . {characterised by programme execution}
- G05B 19/4184 . . . {characterised by fault tolerance, reliability of production system}
- G05B 19/41845 . . . {characterised by system universality, reconfigurability, modularity}
- G05B 19/4185 . . . {characterised by the network communication}
- G05B 19/41855 . . . . {by local area network [LAN], network structure}
- G05B 19/4186 . . . . {by protocol, e.g. MAP, TOP}
- G05B 19/41865 . . . {characterised by job scheduling, process planning, material flow}
- G05B 19/4187 . . . . {by tool management}
- G05B 19/41875 . . . {characterised by quality surveillance of production}
- G05B 19/4188 . . . {characterised by CIM planning or realisation}
- G05B 19/41885 . . . {characterised by modeling, simulation of the manufacturing system}
- G05B 19/4189 . . . {characterised by the transport system}
- G05B 19/41895 . . . . {using automatic guided vehicles [AGV] ([control of position or course of AGV's G05D 1/00](#))}
- G05B 19/42 . . Recording and play-back systems, i.e. in which the programme is recorded from a cycle of operations, e.g. the cycle of operations being manually controlled, after which this record is played back on the same machine
- G05B 19/4202 . . . {preparation of the programme medium using a drawing, a model}
- G05B 19/4205 . . . . {in which a drawing is traced or scanned and corresponding data recorded}
- G05B 19/4207 . . . . {in which a model is traced or scanned and corresponding data recorded}
- G05B 19/421 . . . Teaching successive positions by mechanical means, e.g. by mechanically-coupled handwheels to position tool head or end effector ([G05B 19/423 takes precedence](#))

- G05B 19/423 . . . Teaching successive positions by walk-through, i.e. the tool head or end effector being grasped and guided directly, with or without servo-assistance, to follow a path
- G05B 19/425 . . . Teaching successive positions by numerical control, i.e. commands being entered to control the positioning servo of the tool head or end effector
- G05B 19/427 . . . Teaching successive positions by tracking the position of a joystick or handle to control the positioning servo of the tool head, master-slave control ([G05B 19/423 takes precedence](#))
- G05B 19/43 . fluidic
- G05B 19/44 . . pneumatic
- G05B 19/46 . . hydraulic
- G05B 21/00** **Systems involving sampling of the variable controlled** ([G05B 13/00 to G05B 19/00 take precedence](#); transmission systems for measured values [G08C](#); electronic switching or gating [H03K 17/00](#))
- G05B 21/02 . electric
- G05B 23/00** **Testing or monitoring of control systems or parts thereof** (monitoring of programme-control systems [G05B 19/048](#), [G05B 19/406](#))
- G05B 23/02 . Electric testing or monitoring
  - WARNING**
  - As from June 1st, 2011 documents of this group are being continuously reclassified to its subgroups]
- G05B 23/0202 . . {in which a transfer function of a process is calculated}
- G05B 23/0205 . . {by means of a monitoring system capable of detecting and responding to faults}
  - WARNING**
  - Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0208 . . . {characterized by the configuration of the monitoring system}
  - WARNING**
  - Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/021 . . . . {adopting a different treatment of each operating region or a different mode of the monitored system, e.g. transient modes; different operating configurations of monitored system}
  - WARNING**
  - Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0213 . . . . {Modular or universal configuration of the monitoring system, e.g. monitoring system having modules that may be combined to build monitoring program; monitoring system that can be applied to legacy systems; adaptable monitoring system; using different communication protocols}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0216 . . . . {Human interface functionality, e.g. monitoring system providing help to the user in the selection of tests or in its configuration}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0218 . . . {characterised by the fault detection method dealing with either existing or incipient faults}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0221 . . . . {Preprocessing measurements, e.g. data collection rate adjustment; Standardization of measurements; Time series or signal analysis, e.g. frequency analysis or wavelets; Trustworthiness of measurements; Indexes therefor; Measurements using easily measured parameters to estimate parameters difficult to measure; Virtual sensor creation; De-noising; Sensor fusion; Unconventional preprocessing inherently present in specific fault detection methods like PCA-based methods}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0224 . . . . {Process history based detection method, e.g. whereby history implies the availability of large amounts of data}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0227 . . . . {Qualitative history assessment, whereby the type of data acted upon e.g. waveforms, images or patterns, is not relevant, e.g. rule based assessment; if-then decisions}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0229 . . . . . {knowledge based, e.g. expert systems; genetic algorithms}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0232 . . . . . {based on qualitative trend analysis, e.g. system evolution}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0235 . . . . . {based on a comparison with predetermined threshold or range , e.g. "classical methods", carried out during normal operation; threshold adaptation or choice; when or how to compare with the threshold}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0237 . . . . . {based on parallel systems, e.g. comparing signals produced at the same time by same type systems and detect faulty ones by noticing differences among their responses}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/024 . . . . . {Quantitative history assessment, e.g. mathematical relationships between available data; Functions therefor; Principal component analysis [PCA]; Partial least square [PLS]; Statistical classifiers, e.g. Bayesian networks, linear regression or correlation analysis; Neural networks}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0243 . . . . . {model based detection method, e.g. first-principles knowledge model}  
**WARNING**  
 Not complete pending the completion of a reclassification; see  
 also [G05B 23/02](#)
- G05B 23/0245 . . . . . {based on a qualitative model, e.g. rule based; if-then decisions}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)

- G05B 23/0248 . . . . . {Causal models, e.g. fault tree; digraphs; qualitative physics}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0251 . . . . . {Abstraction hierarchy, e.g. "complex systems" i.e. system is divided in subsystems, subsystems are monitored and results are combined to decide on status of whole system}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0254 . . . . . {based on a quantitative model, e.g. mathematical relationships between inputs and outputs; functions: observer, Kalman filter, residual calculation, Neural Networks}  
**WARNING**  
 Not complete pending the completion of a reclassification;  
 see also [G05B 23/02](#)
- G05B 23/0256 . . . . . {injecting test signals and analyzing monitored process response, e.g. injecting the test signal while interrupting the normal operation of the monitored system; superimposing the test signal onto a control signal during normal operation of the monitored system}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0259 . . . {characterized by the response to fault detection}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0262 . . . . . {Confirmation of fault detection, e.g. extra checks to confirm that a failure has indeed occurred}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0264 . . . . . {Control of logging system, e.g. decision on which data to store; time-stamping measurements}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

- G05B 23/0267 . . . . {Fault communication, e.g. human machine interface [HMI]}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/027 . . . . {Alarm generation, e.g. communication protocol; Forms of alarm}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0272 . . . . {Presentation of monitored results, e.g. selection of status reports to be displayed; Filtering information to the user}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0275 . . . . {Fault isolation and identification, e.g. classify fault; estimate cause or root of failure}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0278 . . . . {Qualitative, e.g. if-then rules; Fuzzy logic; Lookup tables; Symptomatic search; FMEA}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0281 . . . . {Quantitative, e.g. mathematical distance; Clustering; Neural networks; Statistical analysis}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)
- G05B 23/0283 . . . . {Predictive maintenance, e.g. involving the monitoring of a system and, based on the monitoring results, taking decisions on the maintenance schedule of the monitored system; Estimating remaining useful life [RUL] (preventive maintenance, i.e. planning maintenance according to the available resources without monitoring the system [G06Q 10/06](#))}  
**WARNING**  
 Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

G05B 23/0286 . . . . {Modifications to the monitored process, e.g. stopping operation or adapting control}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

G05B 23/0289 . . . . {Reconfiguration to prevent failure, e.g. usually as a reaction to incipient failure detection}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

G05B 23/0291 . . . . {Switching into safety or degraded mode, e.g. protection and supervision after failure}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

G05B 23/0294 . . . . {Optimizing process, e.g. process efficiency, product quality}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

G05B 23/0297 . . . . {Reconfiguration of monitoring system, e.g. use of virtual sensors; change monitoring method as a response to monitoring results}

**WARNING**

Not complete pending the completion of a reclassification; see also [G05B 23/02](#)

**G05B 24/00** **Open-loop automatic control systems not otherwise provided for**

G05B 24/02 . electric

G05B 24/04 . fluidic

**G05B 99/00** **Subject matter not provided for in other groups of this subclass**

**G05B 2219/00** **Program-control systems**

G05B 2219/10 . Plc systems

G05B 2219/11 . . Plc I-O input output

G05B 2219/1101 . . . Remote I-O

G05B 2219/1102 . . . Speed up I-O manipulation

G05B 2219/1103 . . . Special, intelligent I-O processor, also plc can only access via processor

G05B 2219/1104 . . . Display state of connection of I-O

G05B 2219/1105 . . . I-O

G05B 2219/1106 . . . Pneumatic, hydraulic output module connected to plc module



|                |       |  |
|----------------|-------|--|
| G05B 2219/1107 | . . . | Hardware expansion of function of plc, programmable, connected in output line        |
| G05B 2219/1108 | . . . | Relay module   |
| G05B 2219/1109 | . . . | Expansion, extension of I-O  |
| G05B 2219/1110 | . . . | Verifying ram data correct, validity, reload faulty data with correct data           |
| G05B 2219/1111 | . . . | I-o grouped on one board   |
| G05B 2219/1112 | . . . | Bit addressing, handling   |
| G05B 2219/1113 | . . . | Address setting  |
| G05B 2219/1114 | . . . | Address by module name   |
| G05B 2219/1115 | . . . | Avoid to give two different addresses to same I-O, no duplicate                      |
| G05B 2219/1116 | . . . | Position of module in loop, ring determines address of module                        |
| G05B 2219/1117 | . . . | Parallel input addressed as memory   |
| G05B 2219/1118 | . . . | Peripherals have a key to determine kind of peripheral                               |
| G05B 2219/1119 | . . . | Key is 8-resistors connected to either 0-or-1 to form a byte key                     |
| G05B 2219/1121 | . . . | Read key multiplexed, 16-bit wide, connect some resistors to reversed potential      |
| G05B 2219/1122 | . . . | Program address module after installation, connect programmer into module            |
| G05B 2219/1123 | . . . | Poll and detect connected I-O addresses, not connected means high address            |
| G05B 2219/1124 | . . . | Transfer address to module, decrement, send this as address for next module          |
| G05B 2219/1125 | . . . | I-O addressing   |
| G05B 2219/1126 | . . . | Conversion table between original defined module address and actual physical address |
| G05B 2219/1127 | . . . | Selector for I-O, multiplex for I-O  |
| G05B 2219/1128 | . . . | Several networks linked to host computer   |
| G05B 2219/1129 | . . . | Serial addressed modules on bus  |
| G05B 2219/1131 | . . . | I-O connected to a bus   |
| G05B 2219/1132 | . . . | High speed bus between plc and plc or programming device                             |
| G05B 2219/1133 | . . . | Sensor actuator, asi, bus, network   |
| G05B 2219/1134 | . . . | Fieldbus   |
| G05B 2219/1135 | . . . | Profibus   |
| G05B 2219/1136 | . . . | Canbus   |
| G05B 2219/1137 | . . . | Peer to peer communication   |
| G05B 2219/1138 | . . . | Configuration of I-O   |
| G05B 2219/1139 | . . . | By using software configurable circuit, integrated, pga between cpu and I-O          |
| G05B 2219/1141 | . . . | Modify manually, using keyboard configuration of module                              |
| G05B 2219/1142 | . . . | Load in replacement I-O stored configuration   |
| G05B 2219/1143 | . . . | Base configuration contains all I-O modules, deselect not present modules            |

|                |       |   |
|----------------|-------|---|
| G05B 2219/1144 | . . . | Program, program I-O module   |
| G05B 2219/1145 | . . . | Normal scan of I-O and direct acces of some I-O independent from normal scan    |
| G05B 2219/1146 | . . . | Scanning sequence as function of previous logic expression                      |
| G05B 2219/1147 | . . . | Variable rate of scan   |
| G05B 2219/1148 | . . . | If I-O module cannot be scanned in time, report to controller                   |
| G05B 2219/1149 | . . . | I-o in groups, serviced according to critical inputs, tasks matched to I-O      |
| G05B 2219/1151 | . . . | Fast scanning of I-O to put I-O status in image table                           |
| G05B 2219/1152 | . . . | I-O module delivers interrupt on event, store port and 10ms timestamp in buffer |
| G05B 2219/1153 | . . . | Scan only some I-O registers, use flags   |
| G05B 2219/1154 | . . . | Reading repeatedly input state, try again                                       |
| G05B 2219/1155 | . . . | Switching over from one input to another one                                    |
| G05B 2219/1156 | . . . | Special latches release all simultaneously                                      |
| G05B 2219/1157 | . . . | I-O used either as input or as output   |
| G05B 2219/1158 | . . . | Control of output current   |
| G05B 2219/1159 | . . . | Image table, memory   |
| G05B 2219/1161 | . . . | Signal processing, detect or deliver analog signals                             |
| G05B 2219/1162 | . . . | Forcing I-O   |
| G05B 2219/1163 | . . . | Multiplexer for analog signals  |
| G05B 2219/1164 | . . . | Latch for output or input   |
| G05B 2219/1165 | . . . | Disable I-O card by preventing current flow                                     |
| G05B 2219/1166 | . . . | Create optimum data blocks for transmission                                     |
| G05B 2219/1167 | . . . | Pulse wave output   |
| G05B 2219/1168 | . . . | Peak amplitude for input, nul amplitude for activating output                   |
| G05B 2219/1169 | . . . | Activating output if input changes, transition input and output not yet on      |
| G05B 2219/1171 | . . . | Detect only input variation, changing, transition state of variable             |
| G05B 2219/1172 | . . . | Direct negation, inversion of inputsignal                                       |
| G05B 2219/1173 | . . . | Activating output only if powersupply is sufficient                             |
| G05B 2219/1174 | . . . | Input activates directly output and vice versa                                  |
| G05B 2219/1175 | . . . | Activating output repeatedly for guaranteed turning on of output                |
| G05B 2219/1176 | . . . | I-O signal processing, adaption, conditioning, conversion of signal levels      |
| G05B 2219/1177 | . . . | Insertion mistake   |
| G05B 2219/1178 | . . . | Display states of I-O in time   |
| G05B 2219/1179 | . . . | Safety, on error, fault, block, inhibit output                                  |
| G05B 2219/1181 | . . . | Detection of I-O faults, shut down of I-O                                       |
| G05B 2219/1182 | . . . | I-O isolation, optical  |
| G05B 2219/1183 | . . . | On error shut off output by independent system, not normal I-O                  |
| G05B 2219/1184 | . . . | Test ability of input for on, off capability                                    |
| G05B 2219/1185 | . . . | Feedback of output status to input module and compare with command              |

|                 |       |  |
|-----------------|-------|--|
| G05B 2219/1186  | . . . | Redundant inputs parallel, outputs series, load safe switch off, AND condition   |
| G05B 2219/1187  | . . . | Test input value with stored limits, permissible range, plausibility             |
| G05B 2219/1188  | . . . | Detection of inserted boards, inserting extra memory, availability of boards     |
| G05B 2219/1189  | . . . | Duplicated I-O also triple   |
| G05B 2219/1191  | . . . | I-O voter  |
| G05B 2219/1192  | . . . | Output of interfaces parallel, for safe load switch on, OR condition             |
| G05B 2219/1193  | . . . | I-O ram as buffer for signals and self test for I-O bus                          |
| G05B 2219/1194  | . . . | Send dummy, check data to I-O to check correct I-O connection                    |
| G05B 2219/1195  | . . . | Critical I-O monitored by safety module connected to plc, other I-Os by plc self |
| G05B 2219/1196  | . . . | Intelligent, smart I-O can function independently, monitoring limit values       |
| G05B 2219/1197  | . . . | Each interface, module has simulation module which takes over control            |
| G05B 2219/1198  | . . . | Activate output only if power sufficient   |
| G05B 2219/1199  | . . . | Inserting or taking out of boards during power on, hot plug in                   |
| G05B 2219/12    | . .   | Plc mp multi processor system  |
| G05B 2219/1201  | . . . | Each plc can act as master, flying master  |
| G05B 2219/1202  | . . . | Modules with same hardware and software  |
| G05B 2219/1203  | . . . | Expand logical expression over multiple controllers                              |
| G05B 2219/1204  | . . . | Multiprocessing, several plc's, distributed logic control                        |
| G05B 2219/1205  | . . . | Memory access for different processors, memory arbitration, mailbox              |
| G05B 2219/1206  | . . . | All processors are loaded with same program, only part of program is loaded      |
| G05B 2219/1207  | . . . | Download programcode to node, I-O and execute programcode                        |
| G05B 2219/1208  | . . . | Communication, exchange of control, I-O data between different plc,              |
| G05B 2219/1209  | . . . | Exchange control, I-O data to other plc, individually, without host              |
| G05B 2219/1211  | . . . | Exchange control, I-O data to other plc, using separate synchronizing,           |
| G05B 2219/1212  | . . . | Exchange control data between plc's only when other plc's are inactive           |
| G05B 2219/1213  | . . . | All plc send their input to a common image memory, output directly send out      |
| G05B 2219/1214  | . . . | Real-time communication between plc, Ethernet for configuration, monitor         |
| G05B 2219/1215  | . . . | Master slave system  |
| G05B 2219/1216  | . . . | Interlock problem, avoid sending data to slave when slave processes data         |
| G05B 2219/13    | . .   | Plc programming  |
| G05B 2219/13001 | . . . | Interrupt handling   |
| G05B 2219/13002 | . . . | Transfer rom content to ram, load ram from non volatile memory                   |
| G05B 2219/13003 | . . . | Initial program load, host to controller   |
| G05B 2219/13004 | . . . | Programming the plc  |
| G05B 2219/13005 | . . . | Subroutine   |
| G05B 2219/13006 | . . . | Prom burning   |

|                 |       |  |
|-----------------|-------|--|
| G05B 2219/13007 | . . . | Program hardwired logic, pld, fpga when out of machine, or inactive                  |
| G05B 2219/13008 | . . . | Quicker execution of jumps when repeating same kind of operation                     |
| G05B 2219/13009 | . . . | State machine instructions   |
| G05B 2219/13011 | . . . | Batch control  |
| G05B 2219/13012 | . . . | Using other programs, adapting program to machine, exchanging or rom                 |
| G05B 2219/13013 | . . . | Transferring ram to eprom see also prom burning                                      |
| G05B 2219/13014 | . . . | Expanding functions of display by modular hardware                                   |
| G05B 2219/13015 | . . . | Semi automatic, manual automatic   |
| G05B 2219/13016 | . . . | Jump while output is disabled, or disabling output when running test instruction     |
| G05B 2219/13017 | . . . | Macro instructions   |
| G05B 2219/13018 | . . . | Conversion ladder diagram to decision system, machine code, language                 |
| G05B 2219/13019 | . . . | Translate program in order to be used on different plc                               |
| G05B 2219/13021 | . . . | Convert Petri net to ladder diagram  |
| G05B 2219/13022 | . . . | Convert source program to intermediate program                                       |
| G05B 2219/13023 | . . . | Convert natural language, graphic to coded states, input                             |
| G05B 2219/13024 | . . . | Convert digital logic of hardware circuit into plc software                          |
| G05B 2219/13025 | . . . | Convert batch recipe into plc program  |
| G05B 2219/13026 | . . . | Convert ladder to event chaining, internal state for fpga or similar                 |
| G05B 2219/13027 | . . . | Convert time chart to relation vector to calculate plc I-O state as function of time |
| G05B 2219/13028 | . . . | Convert plc type program in pc type program for running in pc environment            |
| G05B 2219/13029 | . . . | Enter values with incremental keys   |
| G05B 2219/13031 | . . . | Use of touch screen  |
| G05B 2219/13032 | . . . | Different menus on screen, softkeys  |
| G05B 2219/13033 | . . . | Code wheel to enter data, push button to accept                                      |
| G05B 2219/13034 | . . . | Operator interface derived from comment label in program                             |
| G05B 2219/13035 | . . . | Name, address duplication detection for program components, symbols                  |
| G05B 2219/13036 | . . . | Tracing, use of dummy ladder to collect signals together in one                      |
| G05B 2219/13037 | . . . | Tracing  |
| G05B 2219/13038 | . . . | Comment, message data displayed with program instructions                            |
| G05B 2219/13039 | . . . | Print out of program, printer for program  |
| G05B 2219/13041 | . . . | Display ladder or logic diagram, mnemonics, switch between two display               |
| G05B 2219/13042 | . . . | Display logic diagram, LOP   |
| G05B 2219/13043 | . . . | Display statement, instruction list, IL, BL, AWL                                     |
| G05B 2219/13044 | . . . | Display as flow chart, SFC, FUP  |
| G05B 2219/13045 | . . . | Additional data to restore ladder diagram from machine instructions                  |
| G05B 2219/13046 | . . . | Display status of edited program segments: inserted, deleted, replaced               |
| G05B 2219/13047 | . . . | Display data on chart with comment, message about type of data                       |
| G05B 2219/13048 | . . . | Display of ladder, RLD, RLL, KOP   |

|                 |       |  |
|-----------------|-------|--|
| G05B 2219/13049 | . . . | Display progress of program, state, highlight, colour                              |
| G05B 2219/13051 | . . . | Display status of I-O in intelligible, easy to understand language                 |
| G05B 2219/13052 | . . . | Display of ladder diagram  |
| G05B 2219/13053 | . . . | Edit by use of a ladder mask, raster, enter a symbol and select place in mask      |
| G05B 2219/13054 | . . . | Enter a symbol and number of times symbol to be used in ladder diagram             |
| G05B 2219/13055 | . . . | Place cursor, enter symbol, move cursor  |
| G05B 2219/13056 | . . . | Edit conversion, jump table interactively  |
| G05B 2219/13057 | . . . | Automatic search for unused, available address; assign to symbol                   |
| G05B 2219/13058 | . . . | One instruction of plc generates a whole independent sequence, relay               |
| G05B 2219/13059 | . . . | If not able to execute instruction block, skip and execute next                    |
| G05B 2219/13061 | . . . | Selection between sequential and conditional program                               |
| G05B 2219/13062 | . . . | Booting  |
| G05B 2219/13063 | . . . | Synchronization between modules  |
| G05B 2219/13064 | . . . | Execute reverse sequence   |
| G05B 2219/13065 | . . . | Tasks for executing several programs asynchronously                                |
| G05B 2219/13066 | . . . | Execute next step if state, control zone changes                                   |
| G05B 2219/13067 | . . . | Use of variables, symbols in instructions, to indicate mechanisms, interfaces      |
| G05B 2219/13068 | . . . | Program divided in operation blocks, groups, tasks each executed                   |
| G05B 2219/13069 | . . . | Execute bit operation during instruction fetch cycle for word operation            |
| G05B 2219/13071 | . . . | Non time critical program by processor, time critical program by hardware          |
| G05B 2219/13072 | . . . | Super scalar computing   |
| G05B 2219/13073 | . . . | Several interacting programs, each for a separate machine, exchange of start, stop |
| G05B 2219/13074 | . . . | Result of bit operation can modify or stop instruction execution                   |
| G05B 2219/13075 | . . . | User program, then interlock program to override certain conditions                |
| G05B 2219/13076 | . . . | Interprete in pc a ladder diagram, use of sequence engine                          |
| G05B 2219/13077 | . . . | Interlock conditions stored in tables  |
| G05B 2219/13078 | . . . | Sequence operation and interlock set programs are separated                        |
| G05B 2219/13079 | . . . | Solving stored logic function if value is equal target value                       |
| G05B 2219/13081 | . . . | Select between initialisation and normal control instructions sequence plc         |
| G05B 2219/13082 | . . . | Parallel execution of bit operations   |
| G05B 2219/13083 | . . . | Jumps  |
| G05B 2219/13084 | . . . | Rom or eprom with conditional instructions   |
| G05B 2219/13085 | . . . | Plc controls several machines in sequence  |
| G05B 2219/13086 | . . . | Priority interrupt   |
| G05B 2219/13087 | . . . | Separate interrupt controller for modules  |
| G05B 2219/13088 | . . . | Analyzing only relevant rows of ladder diagram                                     |
| G05B 2219/13089 | . . . | Skip part of expression evaluation if no influence on end result                   |
| G05B 2219/13091 | . . . | Use of precalculated and stored values to speed up calculations                    |

|                 |       |  |
|-----------------|-------|--|
| G05B 2219/13092 | . . . | Speed up, evaluation of expressions between brackets                               |
| G05B 2219/13093 | . . . | Using functions like arithmetic timers in program                                  |
| G05B 2219/13094 | . . . | Using a-d convertor as function  |
| G05B 2219/13095 | . . . | Pid regulator  |
| G05B 2219/13096 | . . . | Fuzzy control function   |
| G05B 2219/13097 | . . . | Function is true macro program, not subroutine, conversion to machine              |
| G05B 2219/13098 | . . . | Nc function to control axis, written in C or not                                   |
| G05B 2219/13099 | . . . | Function block, OOP, various functions grouped, called by name as servo            |
| G05B 2219/13101 | . . . | Function block instance, only one function block exists, several instances         |
| G05B 2219/13102 | . . . | Function is a user written program, separate from rest                             |
| G05B 2219/13103 | . . . | Adaptive selftuning regulator  |
| G05B 2219/13104 | . . . | Assembly, machine code, instruction list, AWL, IL, BL                              |
| G05B 2219/13105 | . . . | Two or more languages, ladder diagram or progression, basic program                |
| G05B 2219/13106 | . . . | Natural language, use simple words like move, rotate,                              |
| G05B 2219/13107 | . . . | Logic symbols, plan LOP, functional block symbols FBS, functional programming FUP  |
| G05B 2219/13108 | . . . | Flow diagram, sequential function chart with transitions and states SFC<br>Grafcet |
| G05B 2219/13109 | . . . | Pld programmable logic device software for plc                                     |
| G05B 2219/13111 | . . . | Expert system  |
| G05B 2219/13112 | . . . | Petri net  |
| G05B 2219/13113 | . . . | Read image of sequence ladder diagram, flow chart drawing, translate into code     |
| G05B 2219/13114 | . . . | Use of relative addresses for program  |
| G05B 2219/13115 | . . . | Optimize ladder diagram block by rearrangement of serial and parallel              |
| G05B 2219/13116 | . . . | Machine code, instruction for processor  |
| G05B 2219/13117 | . . . | Two languages, ladder diagram and machine code for processor                       |
| G05B 2219/13118 | . . . | Decompiler, translate machine code to hll, reverse processing, easy modification   |
| G05B 2219/13119 | . . . | Compiler   |
| G05B 2219/13121 | . . . | DDE direct data exchange, DLL dynamic library linking                              |
| G05B 2219/13122 | . . . | Flow chart program activates several ladder diagrams, each controls one machine    |
| G05B 2219/13123 | . . . | C language   |
| G05B 2219/13124 | . . . | Step language  |
| G05B 2219/13125 | . . . | Use of virtual, logical connections  |
| G05B 2219/13126 | . . . | Csl computer simulation language   |
| G05B 2219/13127 | . . . | Hybrid sfc for description of sequence, ladder diagram for conditions, interlock   |
| G05B 2219/13128 | . . . | Relay ladder diagram, RLL RLD KOP  |
| G05B 2219/13129 | . . . | Automatic documentation of program   |
| G05B 2219/13131 | . . . | Select out several languages: FBD, SFC, RLL or RLD                                 |

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| G05B 2219/13132 | . . . | Select out several languages: FBD and SFC  |
| G05B 2219/13133 | . . . | Select control languages out of FB RLL or RLD, SFC, ST   |
| G05B 2219/13134 | . . . | Two or more languages mixed, RLD, SFC, FBD, IL, ST, relay ladder, function block, sequential function, instruction list, structured text mixed to form logic control program |
| G05B 2219/13135 | . . . | Using audio and-or video playback  |
| G05B 2219/13136 | . . . | Translate spreadsheet into code  |
| G05B 2219/13137 | . . . | Interpreter considers hierarchy of plc in system structure for programming it  |
| G05B 2219/13138 | . . . | High level language HLL, structured text ST, resembles pascal  |
| G05B 2219/13139 | . . . | CAD, design plc system by inputting desired failure, fault behaviour   |
| G05B 2219/13141 | . . . | Derive sequence program from design, cad data of machine   |
| G05B 2219/13142 | . . . | Debugging, tracing   |
| G05B 2219/13143 | . . . | Manual testing   |
| G05B 2219/13144 | . . . | GUI graphical user interface, icon, function bloc editor, OI operator interface  |
| G05B 2219/13145 | . . . | Graphical input of network of symbols, simulation on screen, translate to machine  |
| G05B 2219/13146 | . . . | Process image blocks have a relation to software function blocks   |
| G05B 2219/13147 | . . . | Program using time charts  |
| G05B 2219/13148 | . . . | Object oriented programming  |
| G05B 2219/13149 | . . . | Encapsulated actuator model with standardized interface: state, action, interlock  |
| G05B 2219/13151 | . . . | Correction of program using grammatical error detection  |
| G05B 2219/13152 | . . . | Modification of program  |
| G05B 2219/13153 | . . . | Modification, change of program in real time   |
| G05B 2219/13154 | . . . | Patching rom to correct program  |
| G05B 2219/13155 | . . . | Inserting instructions in program  |
| G05B 2219/13156 | . . . | IC-memory card   |
| G05B 2219/13157 | . . . | Tape   |
| G05B 2219/13158 | . . . | Non volatile memory, no battery  |
| G05B 2219/13159 | . . . | Cassette   |
| G05B 2219/13161 | . . . | Easily exchangeable rom, eprom cassette, earom   |
| G05B 2219/13162 | . . . | Core memory  |
| G05B 2219/13163 | . . . | Light pen  |
| G05B 2219/13164 | . . . | Remote and local programming unit, control panel   |
| G05B 2219/13165 | . . . | Program plc by independent build in processor  |
| G05B 2219/13166 | . . . | Program intelligent I-O separate from main plc   |
| G05B 2219/13167 | . . . | Personal computer pc   |
| G05B 2219/13168 | . . . | With contact pins  |
| G05B 2219/13169 | . . . | Voice, oral, vocal, speech announcement  |
| G05B 2219/13171 | . . . | Portable, detachable programming unit  |



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| G05B 2219/13172 | . . . | Remote programming from computer  |
| G05B 2219/13173 | . . . | Selection out of all possible programs with switch  |
| G05B 2219/13174 | . . . | Pc, computer connected to plc to simulate machine   |
| G05B 2219/13175 | . . . | For each input corresponding delay time for output response                                 |
| G05B 2219/13176 | . . . | Functionality of a complex controlled systems, composed of sub-systems                      |
| G05B 2219/13177 | . . . | Select next stimuli as function of input state of previous step, so useless stimuli skipped |
| G05B 2219/13178 | . . . | Reiterate simulation till minimum delay stimuli, original contact stat                      |
| G05B 2219/13179 | . . . | Reiterate simulation for different conditions or subsystems                                 |
| G05B 2219/13181 | . . . | Selection of limited stimuli, inputs for simulation   |
| G05B 2219/13182 | . . . | With petrinets  |
| G05B 2219/13183 | . . . | Connect simulation card with overlay into control system, to learn programming              |
| G05B 2219/13184 | . . . | Pc, computer connected to plc to simulate only part of machine                              |
| G05B 2219/13185 | . . . | Software function module for simulation   |
| G05B 2219/13186 | . . . | Simulation, also of test inputs   |
| G05B 2219/13187 | . . . | Checking validity of data   |
| G05B 2219/13188 | . . . | Checking program data, parity, key  |
| G05B 2219/13189 | . . . | On error, look in table for alternative allowed next instruction                            |
| G05B 2219/13191 | . . . | Inhibit next step if signature fails, response different from stored response               |
| G05B 2219/13192 | . . . | Eeprom and software interlock, user cannot change ram data                                  |
| G05B 2219/13193 | . . . | Examine needed I-O, detect connected I-O, execute program only if proper I-O                |
| G05B 2219/13194 | . . . | Build in measurement processing time and input time, input time must be smaller             |
| G05B 2219/13195 | . . . | Protected programs, running these programs  |
| G05B 2219/13196 | . . . | Check if instruction for special module is valid for that module                            |
| G05B 2219/13197 | . . . | Host and remote version of ladder program, avoid different versions                         |
| G05B 2219/13198 | . . . | Safety, forbid dangerous instruction, instruction order while programming                   |
| G05B 2219/13199 | . . . | On error choose another program   |
| G05B 2219/14    | . .   | Plc safety  |
| G05B 2219/14001 | . . . | Detect direction, sign of change of signal  |
| G05B 2219/14002 | . . . | Independent processor, coprocessor monitors plc   |
| G05B 2219/14003 | . . . | Pc, personal computer monitors contact data of several plc's                                |
| G05B 2219/14004 | . . . | On error I-O control state is substituted by actual state to continue                       |
| G05B 2219/14005 | . . . | Alarm   |
| G05B 2219/14006 | . . . | Safety, monitoring in general   |
| G05B 2219/14007 | . . . | Plc as standalone for safety control of machine   |
| G05B 2219/14008 | . . . | Pc monitors plc   |
| G05B 2219/14009 | . . . | Manual override control, digital or analog, between plc and machine                         |
| G05B 2219/14011 | . . . | Explosion free control, intrinsically safe  |

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| G05B 2219/14012 | . . . | Safety integrity level, safety integrated systems, SIL, SIS                      |
| G05B 2219/14013 | . . . | IN , dual plc worker coworker, switch, OUT persistency                           |
| G05B 2219/14014 | . . . | Redundant processors and I-O   |
| G05B 2219/14015 | . . . | Dual plc's, processors and dual I-O  |
| G05B 2219/14016 | . . . | Triple plc's, processors and dual I-O, triple modular redundant                  |
| G05B 2219/14017 | . . . | Triple plc's, processors and triple I-O  |
| G05B 2219/14018 | . . . | IN, plc and comparator, error detector, backup, standby plc, switch, update OUT  |
| G05B 2219/14019 | . . . | Dual IN, crosscoupled relay, dual AND, dual OUT                                  |
| G05B 2219/14021 | . . . | IN, direct link parallel to plc, AND, OUT  |
| G05B 2219/14022 | . . . | Dual IN, dual plc with dual OUT comparator, dual AND, dual OUT                   |
| G05B 2219/14023 | . . . | IN, three plc and 2-out-of-3 processor voter, 2-out-of-3 output voter, OUT       |
| G05B 2219/14024 | . . . | Dual IN, three plc with comparator, dual 2-out-of-3 output voter, dual OUT       |
| G05B 2219/14025 | . . . | Dual IN, relay parallel to plc with comparator, dual AND, feedback OUT, dual OUT |
| G05B 2219/14026 | . . . | IN, relay, direct link parallel to plc, AND, OUT                                 |
| G05B 2219/14027 | . . . | IN, plc and comparator, feedback OUT, OUT  |
| G05B 2219/14028 | . . . | Dual IN, plc and comparator, feedback OUT, AND, OUT                              |
| G05B 2219/14029 | . . . | Dual IN, plc and comparator, feedback OUT, dual AND, OUT                         |
| G05B 2219/14031 | . . . | Dual plc, dual I-O, single actuator, crosscoupling IN and OUT                    |
| G05B 2219/14032 | . . . | Dual plc, dual I-O, crosscoupling analog IN of first plc to OUT of second plc    |
| G05B 2219/14033 | . . . | Dual plc, dual I-O bus, dual I-O amplifier                                       |
| G05B 2219/14034 | . . . | Quad system, dual worker coworker, output voter, switch                          |
| G05B 2219/14035 | . . . | Single analog I-O IN, dual signal processing, dual plc                           |
| G05B 2219/14036 | . . . | Detection of fault in processor  |
| G05B 2219/14037 | . . . | Fault in I-O communication   |
| G05B 2219/14038 | . . . | Fault in I-O racks, point level  |
| G05B 2219/14039 | . . . | Fault in sensor, actuator  |
| G05B 2219/14041 | . . . | Influence of execution of interrupts   |
| G05B 2219/14042 | . . . | Process time   |
| G05B 2219/14043 | . . . | Detection of abnormal temperature  |
| G05B 2219/14044 | . . . | Operating time test for over or under conditions                                 |
| G05B 2219/14045 | . . . | Parameter, over or under condition detection                                     |
| G05B 2219/14046 | . . . | Current flow   |
| G05B 2219/14047 | . . . | Open circuit, broken line, cable   |
| G05B 2219/14048 | . . . | Short circuit  |
| G05B 2219/14049 | . . . | Broken led, signalling device  |
| G05B 2219/14051 | . . . | Correct polarity of supply   |
| G05B 2219/14052 | . . . | Detect missing module  |
| G05B 2219/14053 | . . . | Power failure, loss, abnormal battery  |

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| G05B 2219/14054 | . . . | Self test   |
| G05B 2219/14055 | . . . | Make log, journal, history file of state changes                            |
| G05B 2219/14056 | . . . | Monitor only particular devices which are required for execution of process |
| G05B 2219/14057 | . . . | Compare response time, time interval with reference response time, interval |
| G05B 2219/14058 | . . . | Diagnostic, using expert, knowledge based system                            |
| G05B 2219/14059 | . . . | Selftest of voting, switching unit  |
| G05B 2219/14061 | . . . | On-off-line diagnostic  |
| G05B 2219/14062 | . . . | Diagnostic of dead state, machine does not function anymore                 |
| G05B 2219/14063 | . . . | Diagnostic of degrading performance   |
| G05B 2219/14064 | . . . | Portable diagnostic unit, offline   |
| G05B 2219/14065 | . . . | Checking step, diagnostic routine at end of each scan                       |
| G05B 2219/14066 | . . . | Look up table to determine particular fault conditions                      |
| G05B 2219/14067 | . . . | Log, history of key, input information before last fault occurred           |
| G05B 2219/14068 | . . . | Compare operation time of each independent block, group with stored         |
| G05B 2219/14069 | . . . | Dual watch dog, one for operating system, other for user program            |
| G05B 2219/14071 | . . . | Test of equipment, system without using actual system                       |
| G05B 2219/14072 | . . . | Test of I-O scanner   |
| G05B 2219/14073 | . . . | Real time modeling of plc behaviour, display pictogram of system            |
| G05B 2219/14074 | . . . | Signature analysis, recorded states, zones are compared to actual           |
| G05B 2219/14075 | . . . | Test of interface   |
| G05B 2219/14076 | . . . | Test of sensor  |
| G05B 2219/14077 | . . . | Detect difference in signal between identical channels, if plausible        |
| G05B 2219/14078 | . . . | If fault in next cycle persists, declare channel faulty                     |
| G05B 2219/14079 | . . . | If signal out of range, use for next cycle previous detected signal         |
| G05B 2219/14081 | . . . | Take average, mean of two valid signals of same input                       |
| G05B 2219/14082 | . . . | Sample input signal again to verify if signal is correct                    |
| G05B 2219/14083 | . . . | Derive diagnostic program from model needed for sequence program            |
| G05B 2219/14084 | . . . | Remote diagnostic   |
| G05B 2219/14085 | . . . | Memory testing  |
| G05B 2219/14086 | . . . | Watch dog   |
| G05B 2219/14087 | . . . | Selecting parameters or states to be displayed on panel, displaying states  |
| G05B 2219/14088 | . . . | Display result of computation, calculation                                  |
| G05B 2219/14089 | . . . | Display of control states on cards, by leds                                 |
| G05B 2219/14091 | . . . | Message generation, composer from variables and states, zones               |
| G05B 2219/14092 | . . . | Display menu and its code, sense code, compare with registered code         |
| G05B 2219/14093 | . . . | Display matrix of relay, contact symbols, select and show time              |
| G05B 2219/14094 | . . . | Display instruction with corresponding states, markers                      |
| G05B 2219/14095 | . . . | Library of pictures to display process, pictogram                           |

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| G05B 2219/14096 | . . . | Voice, vocal, speech alarm   |
| G05B 2219/14097 | . . . | Display of error messages  |
| G05B 2219/14098 | . . . | Displaying instructions for monitoring state of machine                        |
| G05B 2219/14099 | . . . | What kind of fault, first fault latch indication                               |
| G05B 2219/14101 | . . . | Indication of status in a ready, off, running of fault state                   |
| G05B 2219/14102 | . . . | Fault stages, confinement, logical segregation of I-O, separate modules        |
| G05B 2219/14103 | . . . | Detection on or off-line, latency from failure occurrence to fault recognition |
| G05B 2219/14104 | . . . | Fault masking, redundant module is selected, fault will not propagate          |
| G05B 2219/14105 | . . . | Retry, reacquire input data and start fault sequence again                     |
| G05B 2219/14106 | . . . | Reconfiguration of components or graceful degradation, degrade                 |
| G05B 2219/14107 | . . . | Recovery, after detection or reconfiguration, effect an error eliminati        |
| G05B 2219/14108 | . . . | Restart of processing  |
| G05B 2219/14109 | . . . | Repair on or off-line  |
| G05B 2219/14111 | . . . | Reintegration, after correction of fault, failed module reinserted             |
| G05B 2219/14112 | . . . | Diagnostic, troubleshooting  |
| G05B 2219/14113 | . . . | Fault tolerant objectives for equipment, controller                            |
| G05B 2219/14114 | . . . | Integrity, error detector, switch off controller, fail safe                    |
| G05B 2219/14115 | . . . | Rapid recovery after fault detection   |
| G05B 2219/14116 | . . . | Safe, emergency shutdown, esd of system  |
| G05B 2219/14117 | . . . | Emergency shut down of control processor, power down                           |
| G05B 2219/14118 | . . . | Interlock of control switches  |
| G05B 2219/14119 | . . . | Inhibit remote control   |
| G05B 2219/14121 | . . . | Dual hand control  |
| G05B 2219/14122 | . . . | Prevent conflicting writing of data; use lock flags                            |
| G05B 2219/14123 | . . . | Majority voting, dynamic redundant, persistency and integrity                  |
| G05B 2219/14124 | . . . | Redundant network, client server nodes   |
| G05B 2219/14125 | . . . | Redundant I-O racks, interfaces to points                                      |
| G05B 2219/14126 | . . . | Redundant I-O points, two sensors, actuators for same point                    |
| G05B 2219/14127 | . . . | Redundant communication between processor and I-O                              |
| G05B 2219/14128 | . . . | Redundant I-O rack has spare slots, hot repair feature, spare blocks f         |
| G05B 2219/14129 | . . . | Primary, worker and backup, coworker plc for testing I-O                       |
| G05B 2219/14131 | . . . | Workby plc, all plc function in parallel, synchronous data exchange            |
| G05B 2219/14132 | . . . | Dual plc, each monitors other  |
| G05B 2219/14133 | . . . | Each plc is different from others  |
| G05B 2219/14134 | . . . | Each plc is programmed by different person                                     |
| G05B 2219/14135 | . . . | Single plc, load between two I-O to plus and two I-O to ground                 |
| G05B 2219/14136 | . . . | Redundancy, masking redundancy, avoid failure but no fault detection           |
| G05B 2219/14137 | . . . | Restart, power up of processor, outputs are off, disabled or hold last state   |
| G05B 2219/14138 | . . . | Each independent operation block, group has own restart, home position         |
| G05B 2219/14139 | . . . | On the fly software replacement in case of error                               |

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| G05B 2219/14141 | . . . | Restart  |
| G05B 2219/14142 | . . . | Low impedance bus  |
| G05B 2219/14143 | . . . | Structure, low pass filter, debouncing input, output driver with ramp                |
| G05B 2219/14144 | . . . | Galvanic isolation   |
| G05B 2219/14145 | . . . | Serial feedback of several states of output  |
| G05B 2219/15    | . .   | Plc structure of the system  |
| G05B 2219/15001 | . . . | Local remote switch control  |
| G05B 2219/15002 | . . . | Image table in I-O expansion module  |
| G05B 2219/15003 | . . . | Interbus-s   |
| G05B 2219/15004 | . . . | Identity kind of module, control unit connected                                      |
| G05B 2219/15005 | . . . | Set switches defining control function   |
| G05B 2219/15006 | . . . | Set configuration from master control station  |
| G05B 2219/15007 | . . . | On reinsertion board, power up, program setting, configuration automatically set     |
| G05B 2219/15008 | . . . | Identify connected I-O and store in address table                                    |
| G05B 2219/15009 | . . . | Object oriented configuring, graphical display of plant                              |
| G05B 2219/15011 | . . . | Configuration of operating system  |
| G05B 2219/15012 | . . . | Configuration software for networks  |
| G05B 2219/15013 | . . . | Set configuration, address of connected module from fixed non volatile               |
| G05B 2219/15014 | . . . | Configure priorities of different tasks  |
| G05B 2219/15015 | . . . | Assign functions to group of complete or partial cells, modules                      |
| G05B 2219/15016 | . . . | Initialize amount of memory space needed in module                                   |
| G05B 2219/15017 | . . . | Optical fiber  |
| G05B 2219/15018 | . . . | Communication, serial data transmission, modem                                       |
| G05B 2219/15019 | . . . | RS232 serial   |
| G05B 2219/15021 | . . . | Convertor between plc and pc built into serial communication line                    |
| G05B 2219/15022 | . . . | Synchronous serial data transmission   |
| G05B 2219/15023 | . . . | Data packet, each module reads input stream and replaces with output                 |
| G05B 2219/15024 | . . . | RS422, balanced lines, xor, only one transmitter, receiver, RS485                    |
| G05B 2219/15025 | . . . | Before starting communication between modules, initialize modules                    |
| G05B 2219/15026 | . . . | Detection of data transmission faults  |
| G05B 2219/15027 | . . . | RS485, MPI multipoint interface, multiple transmitters, receivers connected          |
| G05B 2219/15028 | . . . | Controller and device have several formats and protocols, select common one          |
| G05B 2219/15029 | . . . | I-O communicates with local bus at one end and with fieldbus at other end            |
| G05B 2219/15031 | . . . | RS485 for service connection to module   |
| G05B 2219/15032 | . . . | Exchange objects having I-O, configuration, status, parameters, functions attributes |
| G05B 2219/15033 | . . . | Exchange objects between cpu and intelligent I-O, stored in their memory             |

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| G05B 2219/15034 | . . . | Serial transmission using one line for data and one line for clock                 |
| G05B 2219/15035 | . . . | Select between simplex, only reading I-O data or duplex, also writing to interface |
| G05B 2219/15036 | . . . | Control words for interface itself and for connected I-O                           |
| G05B 2219/15037 | . . . | Fail safe communication  |
| G05B 2219/15038 | . . . | Internet, tcp-ip, web server see under S05B219-40                                  |
| G05B 2219/15039 | . . . | Display of reference, set value, of measured, feedback value                       |
| G05B 2219/15041 | . . . | Sense area of screen, compare if corresponds with correct area                     |
| G05B 2219/15042 | . . . | Synoptic display of process, mimic diagram   |
| G05B 2219/15043 | . . . | Lcd, 7-segment displays ten different states                                       |
| G05B 2219/15044 | . . . | Multiple lcd, alphanumerical display   |
| G05B 2219/15045 | . . . | Portable display unit  |
| G05B 2219/15046 | . . . | Low-high intensity display, flashing   |
| G05B 2219/15047 | . . . | Colour display   |
| G05B 2219/15048 | . . . | Microprocessor   |
| G05B 2219/15049 | . . . | Timer, counter, clock-calendar, flip-flop as peripheral                            |
| G05B 2219/15051 | . . . | Dual port memory   |
| G05B 2219/15052 | . . . | Communication processor, link interface  |
| G05B 2219/15053 | . . . | Microcontroller  |
| G05B 2219/15054 | . . . | LIFO for storing intermediate results  |
| G05B 2219/15055 | . . . | FIFO   |
| G05B 2219/15056 | . . . | DMA  |
| G05B 2219/15057 | . . . | FPGA field programmable gate array   |
| G05B 2219/15058 | . . . | Tristate interface   |
| G05B 2219/15059 | . . . | Floating point coprocessor   |
| G05B 2219/15061 | . . . | RISC processor for plc   |
| G05B 2219/15062 | . . . | Battery backup   |
| G05B 2219/15063 | . . . | Real time clock  |
| G05B 2219/15064 | . . . | MMU, memory management unit  |
| G05B 2219/15065 | . . . | Optimize program memory space  |
| G05B 2219/15066 | . . . | Use of external memory   |
| G05B 2219/15067 | . . . | Using a mixture of memories  |
| G05B 2219/15068 | . . . | SBC single board computer, UCM universal control module                            |
| G05B 2219/15069 | . . . | Use of function modules with timer, counter, relay functions and I-O               |
| G05B 2219/15071 | . . . | Circuit in module connected to bus over two contacts, closed in operat             |
| G05B 2219/15072 | . . . | Modules in daisy chain, connected by parallel cable                                |
| G05B 2219/15073 | . . . | Interface card, module has own power supply independent from pc                    |
| G05B 2219/15074 | . . . | Modules on bus and direct connection between them for additional logic             |
| G05B 2219/15075 | . . . | Each connected module has own power suppl  |
| G05B 2219/15076 | . . . | Stackthrough modules, modules are stacked, no need for backplane                   |



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| G05B 2219/15077 | . . . | Modular structure, memory tables hold data about type of connected apparatus and data format |
| G05B 2219/15078 | . . . | Modules, construction of system  |
| G05B 2219/15079 | . . . | Multitasking, real time multitasking   |
| G05B 2219/15081 | . . . | Period length ratio between application and communication task is settable                   |
| G05B 2219/15082 | . . . | Dos operating plc system   |
| G05B 2219/15083 | . . . | Operating system, microsoft windows  |
| G05B 2219/15084 | . . . | MSDOS  |
| G05B 2219/15085 | . . . | Windows NT   |
| G05B 2219/15086 | . . . | Windows-95   |
| G05B 2219/15087 | . . . | Open control system  |
| G05B 2219/15088 | . . . | Prestabilized power supply followed by another stabilized power supply                       |
| G05B 2219/15089 | . . . | Double, parallel power supply, double, two rails for power supply                            |
| G05B 2219/15091 | . . . | Power and data bus   |
| G05B 2219/15092 | . . . | Power supply with extended range inputs  |
| G05B 2219/15093 | . . . | For each module a power supply   |
| G05B 2219/15094 | . . . | Clock for power converters also for microprocessor and I-O                                   |
| G05B 2219/15095 | . . . | Power supply for input, output derived from microprocessor pin                               |
| G05B 2219/15096 | . . . | Cpu controls power supply on I-O modules   |
| G05B 2219/15097 | . . . | Power supply   |
| G05B 2219/15098 | . . . | Switching power on only when system needs control, stand by                                  |
| G05B 2219/15099 | . . . | Bus arbitration  |
| G05B 2219/15101 | . . . | Personal computer pc and plc, slot plc, same kernel  |
| G05B 2219/15102 | . . . | Programmer simulates, behaves like a programming drum  |
| G05B 2219/15103 | . . . | Microprogram stored in rom or ram  |
| G05B 2219/15104 | . . . | Microprogram rom is externally attached  |
| G05B 2219/15105 | . . . | Hardwired logic to accelerate, speed up execution of instructions                            |
| G05B 2219/15106 | . . . | High speed limited function sub plc together with slow speed general                         |
| G05B 2219/15107 | . . . | Linesolver, columnsolver   |
| G05B 2219/15108 | . . . | Intelligent I-O is a plc itself, with limited interface                                      |
| G05B 2219/15109 | . . . | Intelligent interface is much faster than main plc   |
| G05B 2219/15111 | . . . | Intelligent interface behaves like a plc, by special communication pro                       |
| G05B 2219/15112 | . . . | Two cpu control plc, select cpu, video switch, with special key                              |
| G05B 2219/15113 | . . . | Common display, monitor for two controlling cpu  |
| G05B 2219/15114 | . . . | Coprocessor connected to main via bus and separate channel                                   |
| G05B 2219/15115 | . . . | Pc serves as plc, programming panel, monitoring panel  |
| G05B 2219/15116 | . . . | Pc implements plc, in application program, plc instruction register                          |
| G05B 2219/15117 | . . . | Radio link, wireless   |
| G05B 2219/15118 | . . . | Shared memory  |



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| G05B 2219/15119 | . . . | Backplane controller  |
| G05B 2219/15121 | . . . | Plc build into application, like power inverter   |
| G05B 2219/15122 | . . . | Less frequent used subroutines arranged at high addresses                                   |
| G05B 2219/15123 | . . . | Plc with build in console, I-O and communication  |
| G05B 2219/15124 | . . . | Plc integrated in plug, connector   |
| G05B 2219/15125 | . . . | Multiple kernels  |
| G05B 2219/15126 | . . . | Calculate duration of cycle   |
| G05B 2219/15127 | . . . | Bit and word, byte oriented instructions, boolean and arithmetic operations                 |
| G05B 2219/15128 | . . . | Ternary logic instead of binary   |
| G05B 2219/15129 | . . . | Separating address and databus  |
| G05B 2219/15131 | . . . | Pipeline registers  |
| G05B 2219/15132 | . . . | Bank switching  |
| G05B 2219/15133 | . . . | Opto isolation, optical separation  |
| G05B 2219/16    | . .   | Plc to applications   |
| G05B 2219/161   | . . . | Nuclear plant   |
| G05B 2219/162   | . . . | Transfer line   |
| G05B 2219/163   | . . . | Domotique, domestic, home control, automation, smart, intelligent house                     |
| G05B 2219/20    | . .   | Pc systems  |
| G05B 2219/21    | . .   | Pc I-O input output   |
| G05B 2219/21001 | . . . | Analog input  |
| G05B 2219/21002 | . . . | Neural classifier for inputs, groups inputs into classes                                    |
| G05B 2219/21003 | . . . | Proximity switch as input   |
| G05B 2219/21004 | . . . | Microprocessor plus electromechanical, cam control for output                               |
| G05B 2219/21005 | . . . | Several slave modules connected to same I-O of master, multiplexed by master                |
| G05B 2219/21006 | . . . | Detect position switches, connect resistances, analog value gives position                  |
| G05B 2219/21007 | . . . | A processor to evaluate signals of detector only, I-O processor                             |
| G05B 2219/21008 | . . . | Read in analog values by microprocessor, potentiometer, resistor taps                       |
| G05B 2219/21009 | . . . | Display states of I-O   |
| G05B 2219/21011 | . . . | Forcing I-O   |
| G05B 2219/21012 | . . . | Configurable I-O  |
| G05B 2219/21013 | . . . | Microcontroller and power output switches integrated on same chip                           |
| G05B 2219/21014 | . . . | Interface, module with relays   |
| G05B 2219/21015 | . . . | Easy expansion, extension of I-O  |
| G05B 2219/21016 | . . . | I-O has own power supply  |
| G05B 2219/21017 | . . . | Use of stack memory between processor and machine   |
| G05B 2219/21018 | . . . | Connect sensors to a concentrator, concentrators to bus                                     |
| G05B 2219/21019 | . . . | Split, separate urgent from non urgent, interrupt from status inputs, store in two register |

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| G05B 2219/21021 | . . . | Intelligent I-O, executes tasks independently from main cpu                                    |
| G05B 2219/21022 | . . . | Telephone ring interface, detect ring sequence to control devices                              |
| G05B 2219/21023 | . . . | Midi interface   |
| G05B 2219/21024 | . . . | Analog output  |
| G05B 2219/21025 | . . . | To address single module, assign a group with only that single module                          |
| G05B 2219/21026 | . . . | Indirect addressing of I-O through a control register  |
| G05B 2219/21027 | . . . | Address extension, module with several I-O, command has subaddress for each I-O                |
| G05B 2219/21028 | . . . | Address of module determined by position   |
| G05B 2219/21029 | . . . | Address of module determined by function of module   |
| G05B 2219/21031 | . . . | Address of module determined by signature : type, value of measured, controlled data of module |
| G05B 2219/21032 | . . . | Controlled module in a ring, each module detects its own address                               |
| G05B 2219/21033 | . . . | Serial transfer address to each module, decrement, if zero module found                        |
| G05B 2219/21034 | . . . | Address I-O  |
| G05B 2219/21035 | . . . | Identification with serial header  |
| G05B 2219/21036 | . . . | Each connected module has own address and address of originator of message                     |
| G05B 2219/21037 | . . . | Serial time multiplex bus, programming each module with one delayed line TDM                   |
| G05B 2219/21038 | . . . | Special clock line, module counts clock until equal to its address                             |
| G05B 2219/21039 | . . . | Slaves, modules in daisy chain, each handles control data, transmits to next                   |
| G05B 2219/21041 | . . . | Detect length of packet of pulses to recognise address   |
| G05B 2219/21042 | . . . | Address a group, a zone  |
| G05B 2219/21043 | . . . | Device address and subdevice address and function address                                      |
| G05B 2219/21044 | . . . | Modules with same address are each selected by different transmission speed                    |
| G05B 2219/21045 | . . . | Modules with same address are each selected by different modulation                            |
| G05B 2219/21046 | . . . | Address a single module out of a group   |
| G05B 2219/21047 | . . . | Select module if address of module equals required address, compare addresses                  |
| G05B 2219/21048 | . . . | Compare fixed address of module to required address  |
| G05B 2219/21049 | . . . | Poll and detect connected I-O modules, address terminator, address line high                   |
| G05B 2219/21051 | . . . | Modules able to communicate to other modules are connected to arbiter                          |
| G05B 2219/21052 | . . . | Modules having a common function are allocated ascending number to address                     |
| G05B 2219/21053 | . . . | Each unit, module has unique identification code, set during manufacturing, fMAC address       |
| G05B 2219/21054 | . . . | Connector on bus has two rows of contacts, if one contact is connected, other not              |

- G05B 2219/21055 . . . Number of halfwaves equals number of I-O, send block of halfwaves, synchro gap
- G05B 2219/21056 . . . Decoding on module, module can be inserted anywhere, fixed address in bus connector
- G05B 2219/21057 . . . Buslines connecting modules are offset by one line from module to module
- G05B 2219/21058 . . . Find address by activating power and detect which address gives feedback
- G05B 2219/21059 . . . I-O in address space
- G05B 2219/21061 . . . Adapter bus connected to centronics
- G05B 2219/21062 . . . Pc and I-O bus manager and network nodes linked to I-O clusters
- G05B 2219/21063 . . . Bus, I-O connected to a bus
- G05B 2219/21064 . . . Calibration: automatic of a-d convertor, store null and maximum in eeprom
- G05B 2219/21065 . . . Module calibrates connected sensor
- G05B 2219/21066 . . . Disconnect data line from module before, reconnect after configuration
- G05B 2219/21067 . . . Set group of module by hardware for each module, no program protocol
- G05B 2219/21068 . . . Configure input signals either as interrupt or status signals
- G05B 2219/21069 . . . At start up check I-O and store addresses in secure device
- G05B 2219/21071 . . . Configuration, each module has a settable address, code wheel, encoder
- G05B 2219/21072 . . . Write, modify address into module by optical means, laser
- G05B 2219/21073 . . . Each module has push button, trigger circuit to initialise address setting
- G05B 2219/21074 . . . Master has keyboard to enter address of called slave
- G05B 2219/21075 . . . Initialise each module random, count down, if zero master sets address
- G05B 2219/21076 . . . Plug, connector with build in decoding, encoding for module
- G05B 2219/21077 . . . Module address fixed, defined by fixed identification lines on motherboard
- G05B 2219/21078 . . . Fixed address of slot on motherboard changed, using address convertor, decoder
- G05B 2219/21079 . . . Allocate at start up also to each controlled device a code for the master
- G05B 2219/21081 . . . At start up, check I-O configuration and store addresses in ram
- G05B 2219/21082 . . . At start, send first address to all modules, manually trigger first module and so on
- G05B 2219/21083 . . . At start up detect if connected devices are input or output devices
- G05B 2219/21084 . . . Actuate module, seek response by counting up address, store address on response
- G05B 2219/21085 . . . Define type of I-O, analog, digital, pulse
- G05B 2219/21086 . . . Configuration menu program for I-O
- G05B 2219/21087 . . . Define sensor type, resistance, thermocouple, thermistor, voltage, current
- G05B 2219/21088 . . . Define name and address of I-O
- G05B 2219/21089 . . . Detect configuration of I-O regulary
- G05B 2219/21091 . . . First module initializes its address, then signals next to do same, serial
- G05B 2219/21092 . . . At start up, autoconfigure module for proper I-O execution, bootstrap

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| G05B 2219/21093 | . . . | Module has a configuration part for own logic and one for application logic                    |
| G05B 2219/21094 | . . . | Different connectors for serial transmission as function of machine or connected sensor        |
| G05B 2219/21095 | . . . | Screen, display connected directed to control system via optical fibre                         |
| G05B 2219/21096 | . . . | Connection of machine to pc via centronics, parallel port                                      |
| G05B 2219/21097 | . . . | DMA  |
| G05B 2219/21098 | . . . | Connect pc to machine, controller, module via serial port                                      |
| G05B 2219/21099 | . . . | Two independent interfaces, one for pc, other for remote monitoring                            |
| G05B 2219/21101 | . . . | Connect I-O interface to joystick port   |
| G05B 2219/21102 | . . . | Pc control of device over normal remote control connected between them                         |
| G05B 2219/21103 | . . . | Connect pc to machine, controller, module via PCMCIA   |
| G05B 2219/21104 | . . . | Wire pc connector to output of controlled module, for printer, modem, other module             |
| G05B 2219/21105 | . . . | Read in data only if value changes, transition to save processor time                          |
| G05B 2219/21106 | . . . | If specific I-O not updated in memory, priority access of I-O, data directly to microprocessor |
| G05B 2219/21107 | . . . | Change sensivity of detection if input value is very low                                       |
| G05B 2219/21108 | . . . | Module, I-O module consisting of counters and comparators                                      |
| G05B 2219/21109 | . . . | Field programmable gate array, fpga as I-O module  |
| G05B 2219/21111 | . . . | Each module has a push button to bypass control and switch module on                           |
| G05B 2219/21112 | . . . | Each module has push button to turn module off   |
| G05B 2219/21113 | . . . | Bus interface has multiplexer, control register, data shift register                           |
| G05B 2219/21114 | . . . | Universal input, AC or DC  |
| G05B 2219/21115 | . . . | Same connector can represent either input or output  |
| G05B 2219/21116 | . . . | Universal cabling; control interface between processor and devices                             |
| G05B 2219/21117 | . . . | Universal I-O, same pin is input or output, bidirectional                                      |
| G05B 2219/21118 | . . . | Two sensors on same line, superpose pulsed digital on analog signal                            |
| G05B 2219/21119 | . . . | Circuit for signal adaption, voltage level shift, filter noise                                 |
| G05B 2219/21121 | . . . | Output only enabled during a short period of positive going power supply                       |
| G05B 2219/21122 | . . . | Programmable signal discrimination, input can be used for several functions                    |
| G05B 2219/21123 | . . . | Impedance matching   |
| G05B 2219/21124 | . . . | A-d conversion if input signal is analog, no a-d conversion if input signal is digital         |
| G05B 2219/21125 | . . . | Digital value of analog signals depends on range between signal and threshold                  |
| G05B 2219/21126 | . . . | Signal processing, filter input  |
| G05B 2219/21127 | . . . | Signal adaption I-O  |
| G05B 2219/21128 | . . . | Change control signal, first max or min signal, then normal desired signal                     |
| G05B 2219/21129 | . . . | Low pass filter for input  |

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| G05B 2219/21131 | . . . | Sample two input values, one in positive wave, other in negative wave, average   |
| G05B 2219/21132 | . . . | Window for signal  |
| G05B 2219/21133 | . . . | Module to adapt connection of signals to general connector                       |
| G05B 2219/21134 | . . . | Signal adaption circuit build into connector                                     |
| G05B 2219/21135 | . . . | On closing contact, clean contact with large current, then normal signal current |
| G05B 2219/21136 | . . . | Detection of zero crossing for command and maximum for reading value             |
| G05B 2219/21137 | . . . | Analog to digital conversion, ADC, DAC   |
| G05B 2219/21138 | . . . | Variable filtering as function of kind of sensor signal                          |
| G05B 2219/21139 | . . . | Input activates directly output and vice versa                                   |
| G05B 2219/21141 | . . . | Latched I-O  |
| G05B 2219/21142 | . . . | Read input signal when switching power supply is not switched                    |
| G05B 2219/21143 | . . . | Sample analog signal between superposed digital signal                           |
| G05B 2219/21144 | . . . | Link between input and output, output only activated if corresponding input on   |
| G05B 2219/21145 | . . . | Fuse in case of overcurrent  |
| G05B 2219/21146 | . . . | If real status is different from controlled status stop motor                    |
| G05B 2219/21147 | . . . | Time critical I-O shut off by I-O module, otherwise by processor                 |
| G05B 2219/21148 | . . . | Over current protection on clock line  |
| G05B 2219/21149 | . . . | If read write error, keep last I-O status for next cycle                         |
| G05B 2219/21151 | . . . | Activate output only if power sufficient   |
| G05B 2219/21152 | . . . | If output defect, switch it off  |
| G05B 2219/21153 | . . . | In order to follow higher data input rate, shut off non essential peripherals    |
| G05B 2219/21154 | . . . | Over current protection  |
| G05B 2219/21155 | . . . | Over voltage protection  |
| G05B 2219/21156 | . . . | Over temperature protection  |
| G05B 2219/21157 | . . . | Broken, open line, cable, circuit, faulty connection                             |
| G05B 2219/21158 | . . . | Activate I-O only after system stabilises from start up                          |
| G05B 2219/21159 | . . . | If I-O defect, warning light, operator pushes button, cpu disconnects I-O        |
| G05B 2219/21161 | . . . | Send dummy, check data to I-O to check correct I-O connection                    |
| G05B 2219/21162 | . . . | Detect short circuit of cable  |
| G05B 2219/21163 | . . . | Test I-O if functional or safe value   |
| G05B 2219/21164 | . . . | Resistors between transmitter and receiver, against disturbances                 |
| G05B 2219/21165 | . . . | Zenerdiodes for protection of output of transmitter, input of receiver           |
| G05B 2219/21166 | . . . | Output state, over resistance, coupled back to input to monitor output           |
| G05B 2219/21167 | . . . | Intelligent I-O monitors also local load, controlled object                      |
| G05B 2219/21168 | . . . | Couple, feedback each output to corresponding input to verify output             |
| G05B 2219/21169 | . . . | Low voltage protection   |
| G05B 2219/22    | . .   | Pc multi processor system  |

- G05B 2219/2202 . . . Controller calculates a control parameter from values sent by other controllers
- G05B 2219/2203 . . . Grid, array of controllers
- G05B 2219/2204 . . . Use default values if communication with other controllers not available
- G05B 2219/2205 . . . Multicore
- G05B 2219/2206 . . . Microprocessor for display and parameter input, link to control microprocessor
- G05B 2219/2207 . . . Microcontroller combined with state sequencer
- G05B 2219/2208 . . . Each processor controls a different function of the machine
- G05B 2219/2209 . . . Only one processor is permitted to execute a common function at a time
- G05B 2219/2211 . . . Active controllers are allocated more time if request rate is low
- G05B 2219/2212 . . . All processors are loaded with same program, only part of program is used
- G05B 2219/2213 . . . Local processor uses data from own local store and data from other stations
- G05B 2219/2214 . . . Multicontrollers, multimicrocomputers, multiprocessing
- G05B 2219/2215 . . . Process directly process signals without interrupt or polling
- G05B 2219/2216 . . . Define module independent and module specific element, interconnection, capability
- G05B 2219/2217 . . . First cluster runs normal program, second cluster runs different program
- G05B 2219/2218 . . . Join two clusters of processors together
- G05B 2219/2219 . . . Processor starts application program only if it receives predetermined data
- G05B 2219/2221 . . . Only common memory in host, master, no local memory in slave, local controller
- G05B 2219/2222 . . . Use of priority levels for gaining access to resources
- G05B 2219/2223 . . . Use a different frequency to address each processor
- G05B 2219/2224 . . . Processor sends data to next, downstream processor
- G05B 2219/2225 . . . Communication, CPU accesses own I-O and next CPU over dual port memory
- G05B 2219/2226 . . . Processor accesses own I-O and I-O of all processors connected on his right
- G05B 2219/2227 . . . Common memory as well as local memory
- G05B 2219/2228 . . . Master detects and configures slaves
- G05B 2219/2229 . . . Multiprocessing, change over from master slave to peer to peer, no master
- G05B 2219/2231 . . . Master slave
- G05B 2219/2232 . . . Master executes modified program on slave demand
- G05B 2219/2233 . . . Each slave can control several other slaves
- G05B 2219/2234 . . . Each slave can function in stand alone if master fails
- G05B 2219/2235 . . . Each slave has library of states during which operation is permitted to start
- G05B 2219/2236 . . . Master determines critical time when each of slaves must be controlled

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| G05B 2219/2237  | . . . | Selection of master or slave  |
| G05B 2219/2238  | . . . | Several masters at same time  |
| G05B 2219/2239  | . . . | Reallocate, reschedule execution of controlled functions if one processor fails                     |
| G05B 2219/2241  | . . . | Real time database, each processor stores in local memory used variables                            |
| G05B 2219/2242  | . . . | Program references to variable by absolute address, update of absolute address                      |
| G05B 2219/2243  | . . . | Detect incompatibilites between control devices   |
| G05B 2219/23    | . .   | Pc programming  |
| G05B 2219/23001 | . . . | Expansion of control words, code of standard language to increase functionality                     |
| G05B 2219/23002 | . . . | Petrinet  |
| G05B 2219/23003 | . . . | Bumpless control transfer, map corresponding operation states to operation tables                   |
| G05B 2219/23004 | . . . | Build up program so that safety conditions are met, select most stable states                       |
| G05B 2219/23005 | . . . | Expert design system, uses modeling, simulation, to control design process                          |
| G05B 2219/23006 | . . . | Finite state modeling   |
| G05B 2219/23007 | . . . | CAD to develop sequential control system, use data also to test                                     |
| G05B 2219/23008 | . . . | Computer aided software engineering, program generation, case tools, CASE                           |
| G05B 2219/23009 | . . . | Automatic documentation of program  |
| G05B 2219/23011 | . . . | Sequence control design using pc, cad of control system CADCS                                       |
| G05B 2219/23012 | . . . | Derive sequence program from design, cad data of machine CADCS                                      |
| G05B 2219/23013 | . . . | Build up program by selecting function modules as function of amount paid for it, charging, payment |
| G05B 2219/23014 | . . . | Conversion of ASCII scripting language to machine code  |
| G05B 2219/23015 | . . . | Convert input signals to universal machine control signals represented by music                     |
| G05B 2219/23016 | . . . | Accelerate input, exponent as function of pressure, time, turning speed, keys for 10-to-1           |
| G05B 2219/23017 | . . . | Page, scroll key  |
| G05B 2219/23018 | . . . | Enter parameters by combinations of keys and duration of actuation of keys                          |
| G05B 2219/23019 | . . . | Joystick delivers reference function as function of speed of its movement, except about null        |
| G05B 2219/23021 | . . . | Gesture programming, camera sees hand, displays it on screen, grasp buttons                         |
| G05B 2219/23022 | . . . | Production design metaphore, tool, operation like input system                                      |
| G05B 2219/23023 | . . . | Control knobs, levers integrated into display, display parameters near knobs                        |
| G05B 2219/23024 | . . . | Delivers reference when in neutral position, otherwise delivers desired value                       |



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| G05B 2219/23025 | . . . | Overlay, template for keys with different meaning  |
| G05B 2219/23026 | . . . | Recognise user input pattern and present possible intended program                       |
| G05B 2219/23027 | . . . | Database with information on how to control or test different appliances                 |
| G05B 2219/23028 | . . . | Switch function of panel, detect this and execute other orders                           |
| G05B 2219/23029 | . . . | Up down, increment decrement keys, jog, sequentially show functions or values            |
| G05B 2219/23031 | . . . | Simulate control panel to give remote instructions                                       |
| G05B 2219/23032 | . . . | Input of data from second control unit if first fails                                    |
| G05B 2219/23033 | . . . | Variable pressure on key gives input value   |
| G05B 2219/23034 | . . . | Press once on key to raise signal, twice to lower signal                                 |
| G05B 2219/23035 | . . . | Same knob, different functions, turn for pulses, push to enter value                     |
| G05B 2219/23036 | . . . | Same knob, different function, normal for parameter, value, pushed to enter value        |
| G05B 2219/23037 | . . . | Touch key integrated in display  |
| G05B 2219/23038 | . . . | Select function by amplitude of analog value, potentiometer, resistor taps               |
| G05B 2219/23039 | . . . | Remote programmer  |
| G05B 2219/23041 | . . . | Enter analog value   |
| G05B 2219/23042 | . . . | Only increment key   |
| G05B 2219/23043 | . . . | Remote and local control panel, programming unit, switch                                 |
| G05B 2219/23044 | . . . | Transparent overlay with touch sensors, put over display panel, select function          |
| G05B 2219/23045 | . . . | Function key changes function as function of program, associated pictogram               |
| G05B 2219/23046 | . . . | Selection out of menu by function keys   |
| G05B 2219/23047 | . . . | Operating, repair manual stored in memory  |
| G05B 2219/23048 | . . . | Knob to select program serves also as indicator for progress of program                  |
| G05B 2219/23049 | . . . | Control panel serial, RS232 connected to controller                                      |
| G05B 2219/23051 | . . . | Remote control, enter program remote, detachable programmer                              |
| G05B 2219/23052 | . . . | Matrix, plugboard like control panel with modules for display, switches                  |
| G05B 2219/23053 | . . . | Knob with tactile feedback, representing clicks, detents programmed                      |
| G05B 2219/23054 | . . . | Simulate response on entered parameters and display, quicker response                    |
| G05B 2219/23055 | . . . | Cursor keys to select cells of a spreadsheet with control parameter, enter value         |
| G05B 2219/23056 | . . . | Foot pedal, control, operated  |
| G05B 2219/23057 | . . . | Position of knob, pedal detected by encoder, addresses memory for functions              |
| G05B 2219/23058 | . . . | Knob, pedal selects ranges, functions and controls in each range as function of position |
| G05B 2219/23059 | . . . | Configuration of pedal, knob with code card, adapt pedal to person                       |
| G05B 2219/23061 | . . . | Variable range of knob, pedal for each function, adapt to person                         |
| G05B 2219/23062 | . . . | Position of knob, pedal detected by bundle of optical fibres                             |
| G05B 2219/23063 | . . . | Double, two foot pedal   |

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|-----------------|-------|---|
| G05B 2219/23064 | . . . | Entry of function or parameter during manipulation of tool, operation             |
| G05B 2219/23065 | . . . | Manual override of program  |
| G05B 2219/23066 | . . . | Same knob starts two different functions  |
| G05B 2219/23067 | . . . | Control, human or man machine interface, interactive, HMI, MMI                    |
| G05B 2219/23068 | . . . | Give instructions, messages to operator   |
| G05B 2219/23069 | . . . | Illuminated, lighting up keys, build in led, display, show sequence data entry    |
| G05B 2219/23071 | . . . | If up, down key is selected, linear display of values appears, pops up            |
| G05B 2219/23072 | . . . | Telephone, dial as control panel  |
| G05B 2219/23073 | . . . | Keyboard decoding by microprocessor   |
| G05B 2219/23074 | . . . | Each control unit can control own associated load or as central control           |
| G05B 2219/23075 | . . . | Control unit can switch load on off or can also go into program mode              |
| G05B 2219/23076 | . . . | Pushbuttons to manually up or down control of motor also for entry of program     |
| G05B 2219/23077 | . . . | Reconfigurable remote programmer, learn control signals for different devices     |
| G05B 2219/23078 | . . . | Input a code representing a sequence of operations                                |
| G05B 2219/23079 | . . . | Local programmer can switch to remote to use same capabilities as remote          |
| G05B 2219/23081 | . . . | MMI design, operator workplace design   |
| G05B 2219/23082 | . . . | Enter parameters with two hands, dead man knob, switch, pedal                     |
| G05B 2219/23083 | . . . | Joystick with buttons for menu and function selection, scrolling, +sign and -sign |
| G05B 2219/23084 | . . . | Synoptic display of available, selectable control modules with their functions    |
| G05B 2219/23085 | . . . | Several users can enter data simultaneously to same processor                     |
| G05B 2219/23086 | . . . | Menu is sequentially selected and read from cd disk and guides operator           |
| G05B 2219/23087 | . . . | Programmable selector switch, can be programmed by connected apparatus            |
| G05B 2219/23088 | . . . | Same switch to power control and to set references of several devices             |
| G05B 2219/23089 | . . . | Key cap label rewritten, changed to indicate changed or alternate functions       |
| G05B 2219/23091 | . . . | Multiple consoles, panels to issue concurrent commands to different groups I-O    |
| G05B 2219/23092 | . . . | Soft up down keys, simulated on screen  |
| G05B 2219/23093 | . . . | Input a code representing a device function                                       |
| G05B 2219/23094 | . . . | Debounce key  |
| G05B 2219/23095 | . . . | If knob pushed during power up, knob can be used afterwards as data input         |
| G05B 2219/23096 | . . . | Use single button, knob to enter code number, equals number of pushes             |
| G05B 2219/23097 | . . . | Messages to operator in mother tongue, selection out of different languages       |

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| G05B 2219/23098 | . . . | Manual control, via microprocessor instead of direct connection to actuators              |
| G05B 2219/23099 | . . . | Switches on panel, connected to serial port   |
| G05B 2219/23101 | . . . | Enter quality parameters to select control parameters                                     |
| G05B 2219/23102 | . . . | Quality parameter is low energy consumption of machine                                    |
| G05B 2219/23103 | . . . | Quality parameter is high production rate   |
| G05B 2219/23104 | . . . | Change display of window to another as function of settable active display time of window |
| G05B 2219/23105 | . . . | Window, drop, pull down menus   |
| G05B 2219/23106 | . . . | Cockpit metaphore, condensed representation, urgent things better shown                   |
| G05B 2219/23107 | . . . | Push on flashing alarm indicator, corresponding window pops up on whole screen            |
| G05B 2219/23108 | . . . | Floorplan, room metaphore, dedicated windows, unchangeable but can be selectable          |
| G05B 2219/23109 | . . . | Configuration of display device, operator panel   |
| G05B 2219/23111 | . . . | Adapt control signal logarithmic  |
| G05B 2219/23112 | . . . | Ramp, slope connection between two reference values                                       |
| G05B 2219/23113 | . . . | Reread, retransmit several times data for valid data, redundant command                   |
| G05B 2219/23114 | . . . | Maintain parameter setting for a while to avoid changes due to noise                      |
| G05B 2219/23115 | . . . | Buffer  |
| G05B 2219/23116 | . . . | Input signal can be sent simultaneously to several processors                             |
| G05B 2219/23117 | . . . | Lookup table, interpolation between points  |
| G05B 2219/23118 | . . . | Column and line select in memory to access address data in second memory, tree            |
| G05B 2219/23119 | . . . | Display state, variable only when needed, energy saving                                   |
| G05B 2219/23121 | . . . | Display graphics with corresponding text  |
| G05B 2219/23122 | . . . | Display on off time chart for different events  |
| G05B 2219/23123 | . . . | Production report   |
| G05B 2219/23124 | . . . | Notepad, message from other operator  |
| G05B 2219/23125 | . . . | Switch display to show different things, test or normal state                             |
| G05B 2219/23126 | . . . | Display tree structure of whole system or relevant info after function selection          |
| G05B 2219/23127 | . . . | Switch from one kind of display to other, selected by duration discrimination             |
| G05B 2219/23128 | . . . | Switch from one kind of display to other when parameter is changed                        |
| G05B 2219/23129 | . . . | Animated display, changes as function of parameters                                       |
| G05B 2219/23131 | . . . | Select on large display part of pictogram to show on display of used workstation          |
| G05B 2219/23132 | . . . | Multifunction display   |
| G05B 2219/23133 | . . . | Animated, rotating fan indicates speed, flashing bulb for intensity                       |
| G05B 2219/23134 | . . . | Display history of used, selected programs, their frequency                               |

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| G05B 2219/23135 | . . . | Display to console, panel which sends parameters, commands                                |
| G05B 2219/23136 | . . . | Display all subsystems, select one and display screen corresponding to subsystem          |
| G05B 2219/23137 | . . . | Display program step, instruction number  |
| G05B 2219/23138 | . . . | Linear, bar display of variables  |
| G05B 2219/23139 | . . . | Segment display   |
| G05B 2219/23141 | . . . | Flat panel, thin film electro luminescent   |
| G05B 2219/23142 | . . . | Colour display  |
| G05B 2219/23143 | . . . | Adjustable display  |
| G05B 2219/23144 | . . . | Kind of display, matrix like display, large surface                                       |
| G05B 2219/23145 | . . . | Blinking, flickering display  |
| G05B 2219/23146 | . . . | Programmable, reconfigurable via microprocessor or coding switches                        |
| G05B 2219/23147 | . . . | LCD liquid crystal display  |
| G05B 2219/23148 | . . . | Helmet display, mounted on head of operator   |
| G05B 2219/23149 | . . . | Dual, two displays  |
| G05B 2219/23151 | . . . | Highlight   |
| G05B 2219/23152 | . . . | Large and several smaller displays for each workstation, each own cursor on large display |
| G05B 2219/23153 | . . . | Controlled load, lightbulb, roller blind itself acts as display to acknowledge command    |
| G05B 2219/23154 | . . . | Line of light diodes LED  |
| G05B 2219/23155 | . . . | Display on screen reference value and sequence steps                                      |
| G05B 2219/23156 | . . . | Show upper, lower value, position with upper, lower segment of 7-segment display          |
| G05B 2219/23157 | . . . | Display process, synoptic, legend, pictogram, mimic                                       |
| G05B 2219/23158 | . . . | Display of evaluated and selectable program   |
| G05B 2219/23159 | . . . | Display plurality of parameters simultaneously  |
| G05B 2219/23161 | . . . | Hand held terminal PDA displays machine control program when user is near that machine    |
| G05B 2219/23162 | . . . | Display real time or time already elapsed or rest time for program                        |
| G05B 2219/23163 | . . . | Display enlarged, zoomed detail and small overall schematic, plan                         |
| G05B 2219/23164 | . . . | Display data on a scrolling line, ticker display  |
| G05B 2219/23165 | . . . | Display of parameter plus permissible, allowable range                                    |
| G05B 2219/23166 | . . . | Display program in fast, quick, speed mode  |
| G05B 2219/23167 | . . . | Display of selected sequence, permissible sequence  |
| G05B 2219/23168 | . . . | Display progress of program   |
| G05B 2219/23169 | . . . | Operation field together with control parameters  |
| G05B 2219/23171 | . . . | Display dynamic change of process, animation  |
| G05B 2219/23172 | . . . | Different states with one LED, blinking, on and off or different colours                  |
| G05B 2219/23173 | . . . | Display modified program together with original program to see differences                |
| G05B 2219/23174 | . . . | Display of parameter and several suggested values for that parameter                      |

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| G05B 2219/23175 | . . . | What to display: program channels, running of program  |
| G05B 2219/23176 | . . . | Display entered data for each controlled station   |
| G05B 2219/23177 | . . . | Indicate all selected devices operating currently  |
| G05B 2219/23178 | . . . | Display status of currently selected controlled devices  |
| G05B 2219/23179 | . . . | Warning display if heavy energy consuming program steps are selected                                 |
| G05B 2219/23181 | . . . | Use of sound, acoustic, voice  |
| G05B 2219/23182 | . . . | 3D display of controlled system  |
| G05B 2219/23183 | . . . | Display effects of high level commands   |
| G05B 2219/23184 | . . . | Display different states by using two leds, first blinks, then second, then both                     |
| G05B 2219/23185 | . . . | Setting of internal dipswitches, jumpers   |
| G05B 2219/23186 | . . . | Visual display of workpiece with actions to execute on   |
| G05B 2219/23187 | . . . | Display number of each program   |
| G05B 2219/23188 | . . . | Software independent and dependent of hardware   |
| G05B 2219/23189 | . . . | Information is code  |
| G05B 2219/23191 | . . . | Command to control simultaneously several machines   |
| G05B 2219/23192 | . . . | A limited number of programs to be used by plurality of machines, multiplex                          |
| G05B 2219/23193 | . . . | Memory stores lifetime, different settings, configurations of controlled device                      |
| G05B 2219/23194 | . . . | Check validity data by writing in sector control data and check data                                 |
| G05B 2219/23195 | . . . | Memory stores available, allowable, possible options, variations, alternatives of program or modules |
| G05B 2219/23196 | . . . | From lookup table and real time clock, select actual daylight period                                 |
| G05B 2219/23197 | . . . | Curve entered with pen on touchscreen  |
| G05B 2219/23198 | . . . | Disk with segments connected to separate input of microprocessor, represents different values        |
| G05B 2219/23199 | . . . | Reference value, setpoint for regulator  |
| G05B 2219/23201 | . . . | Value is analog signal   |
| G05B 2219/23202 | . . . | Curve, surface represents analog value, line, surface follower                                       |
| G05B 2219/23203 | . . . | Curve represents analog value, tv scan   |
| G05B 2219/23204 | . . . | Reference in coded form  |
| G05B 2219/23205 | . . . | Reference together with sequence commands  |
| G05B 2219/23206 | . . . | Set reference as function of position, for compensations   |
| G05B 2219/23207 | . . . | Capacitive detection of line   |
| G05B 2219/23208 | . . . | Potentiometer  |
| G05B 2219/23209 | . . . | Linear potentiometers with multiple sliders  |
| G05B 2219/23211 | . . . | Limit value to tolerances, ranges, plausibility  |
| G05B 2219/23212 | . . . | Store entered data, program status, reread regularly, against data loss                              |
| G05B 2219/23213 | . . . | Check validity of entered data   |
| G05B 2219/23214 | . . . | Checksum CRC   |

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| G05B 2219/23215 | . . . | Check data validity in ram, keep correct validity, compare rom ram  |
| G05B 2219/23216 | . . . | Extend processing time by extending enable signal with special output signal                                  |
| G05B 2219/23217 | . . . | Parallel processing   |
| G05B 2219/23218 | . . . | Interrupt queued requests only at the end of each segment of each of requests                                 |
| G05B 2219/23219 | . . . | Different tasks in different memory, called as function of priority of tasks                                  |
| G05B 2219/23221 | . . . | Each event can have two sub events, device can be activated twice in cycle                                    |
| G05B 2219/23222 | . . . | On off time tables, as function of angle, each linked to groups for device selection, pointer                 |
| G05B 2219/23223 | . . . | During each cycle, different on off sequences can be used   |
| G05B 2219/23224 | . . . | Offset on off signals for different sections  |
| G05B 2219/23225 | . . . | Program system from more than one source  |
| G05B 2219/23226 | . . . | Table with data on how to execute the same function in different modules                                      |
| G05B 2219/23227 | . . . | Environment conditions affect execution of program  |
| G05B 2219/23228 | . . . | Program execution, if external programs exist, execute them instead of internal                               |
| G05B 2219/23229 | . . . | Execute first current program, then select new program  |
| G05B 2219/23231 | . . . | Mark objects, execute sequence according to mark  |
| G05B 2219/23232 | . . . | Execute program from added, expansion rom, memory   |
| G05B 2219/23233 | . . . | Input state executes immediately corresponding block program  |
| G05B 2219/23234 | . . . | In real time loop do one of the control modules and a safety module program                                   |
| G05B 2219/23235 | . . . | Set address code in register to switch between program in ram and in eprom, flash                             |
| G05B 2219/23236 | . . . | Table lookup driven system  |
| G05B 2219/23237 | . . . | Program execution by message passing  |
| G05B 2219/23238 | . . . | TV microprocessor executes also home control, monitoring of appliances  |
| G05B 2219/23239 | . . . | Execute other program during idle time of main program, or between interrupts                                 |
| G05B 2219/23241 | . . . | Idle, during idle time of main program, a game can be played  |
| G05B 2219/23242 | . . . | Synthesize time logic circuits  |
| G05B 2219/23243 | . . . | Specification language  |
| G05B 2219/23244 | . . . | Ascii script: one line is read each time, each letter controls a device                                       |
| G05B 2219/23245 | . . . | Block, buffer the inputs when executing critical process, read them when finished, for a finite state machine |
| G05B 2219/23246 | . . . | Create control program by demonstrating behaviours using widget and inferencing them                          |
| G05B 2219/23247 | . . . | Widget have states, properties, events associated, demonstrate control behaviour                              |
| G05B 2219/23248 | . . . | Integrate function blocks from different machines; CORBA, RMI protocols                                       |
| G05B 2219/23249 | . . . | Using audio and or video playback   |



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| G05B 2219/23251 | . . . | Use two or more different programming languages in same program                   |
| G05B 2219/23252 | . . . | High level language HLL, basic, control language                                  |
| G05B 2219/23253 | . . . | Expert system   |
| G05B 2219/23254 | . . . | Interactive programming, sentence on screen filled in by operator                 |
| G05B 2219/23255 | . . . | Object oriented programming, OOP  |
| G05B 2219/23256 | . . . | Hybrid programming, part sequence, part continuous                                |
| G05B 2219/23257 | . . . | Grafcet   |
| G05B 2219/23258 | . . . | GUI graphical user interface, icon, function bloc editor, labview                 |
| G05B 2219/23259 | . . . | Synchronous language  |
| G05B 2219/23261 | . . . | Use control template library  |
| G05B 2219/23262 | . . . | DDE direct data exchange, DLL dynamic library linking                             |
| G05B 2219/23263 | . . . | C++   |
| G05B 2219/23264 | . . . | Assembly language, pass parameters by registers instead of stack                  |
| G05B 2219/23265 | . . . | Select device driver for actuator, sensor   |
| G05B 2219/23266 | . . . | Compiler  |
| G05B 2219/23267 | . . . | Program derived from sequence time diagram and stored in table                    |
| G05B 2219/23268 | . . . | Forth   |
| G05B 2219/23269 | . . . | Program provides for communication protocol with device, equipment                |
| G05B 2219/23271 | . . . | Decompiler, translate machine code to HLL , reverse processing, easy modification |
| G05B 2219/23272 | . . . | Natural language, use simple words like move, rotate                              |
| G05B 2219/23273 | . . . | Select, associate the real hardware to be used in the program                     |
| G05B 2219/23274 | . . . | Link graphical data for display automatically into program                        |
| G05B 2219/23275 | . . . | Use of parser   |
| G05B 2219/23276 | . . . | Use of virtual, logical connections   |
| G05B 2219/23277 | . . . | Use of separate interface software, main program calls functions from it          |
| G05B 2219/23278 | . . . | Program by data flow  |
| G05B 2219/23279 | . . . | Enter simple words: start motor, pc translates boolean equations into orders      |
| G05B 2219/23281 | . . . | PEARL process experimental automation real time language                          |
| G05B 2219/23282 | . . . | Detect erroneous instructions in asic systems                                     |
| G05B 2219/23283 | . . . | Debugging, breakpoint   |
| G05B 2219/23284 | . . . | Eliminate redundant states in finite state machine                                |
| G05B 2219/23285 | . . . | Enable, disable hardware logic to implement finite state machines                 |
| G05B 2219/23286 | . . . | Graphical representation of finite machine states to help operator                |
| G05B 2219/23287 | . . . | Executing sequential program concurrently with state machine instructions         |
| G05B 2219/23288 | . . . | Adaptive states; learning transitions   |
| G05B 2219/23289 | . . . | State logic control, finite state, tasks, machine, fsm                            |
| G05B 2219/23291 | . . . | Process, graphic programming of a process, text and images                        |



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| G05B 2219/23292 | . . . | Use of model of process, divided in part models with IN, OUT and actuator            |
| G05B 2219/23293 | . . . | Automated assembly of machine control software, reusable software components         |
| G05B 2219/23294 | . . . | Whole program to first processor, transfer to next processor if not for 1st          |
| G05B 2219/23295 | . . . | Load program and data for multiple processors  |
| G05B 2219/23296 | . . . | Load, update new program without test program, save memory space                     |
| G05B 2219/23297 | . . . | Remote load of program with cellular, wireless, satellite connection                 |
| G05B 2219/23298 | . . . | Remote load of program, through internet   |
| G05B 2219/23299 | . . . | Remote load of program, through fieldbus   |
| G05B 2219/23301 | . . . | Load program from file system of a controller  |
| G05B 2219/23302 | . . . | Load program in data blocks  |
| G05B 2219/23303 | . . . | Load program, optical connection between programmer and eprom                        |
| G05B 2219/23304 | . . . | Download program from host   |
| G05B 2219/23305 | . . . | Transfer program into prom with passwords  |
| G05B 2219/23306 | . . . | Load program from host, remote load, non volatile card to volatile, ram              |
| G05B 2219/23307 | . . . | Initial program loader, ipl, bootstrap loader  |
| G05B 2219/23308 | . . . | Transfer program from ram to eprom, flash, card                                      |
| G05B 2219/23309 | . . . | System boot only allowed after inputting user identification, password               |
| G05B 2219/23311 | . . . | Load new program together with test program  |
| G05B 2219/23312 | . . . | Load program from attached device to control that device                             |
| G05B 2219/23313 | . . . | Load program to initial configure machine, then erase and install userprogram        |
| G05B 2219/23314 | . . . | Switch between initialisation, program, test, end of programming, erase mode         |
| G05B 2219/23315 | . . . | Normal and emulated, pass through for disabled persons modes                         |
| G05B 2219/23316 | . . . | Standby, inactive, sleep or active, operation mode                                   |
| G05B 2219/23317 | . . . | Safe mode, secure program, environment in case of error, intrusion                   |
| G05B 2219/23318 | . . . | Mode, two mode, directly from console or download from host                          |
| G05B 2219/23319 | . . . | Microprocessor control or manual control   |
| G05B 2219/23321 | . . . | Switch between manual, automatic, inching or step by step mode, select mode          |
| G05B 2219/23322 | . . . | Hand, manual or automatic  |
| G05B 2219/23323 | . . . | Select between entry and execution of program  |
| G05B 2219/23324 | . . . | Separate update program onboard  |
| G05B 2219/23325 | . . . | Transfer modified data from ram to eprom, flash after system have run several cycles |
| G05B 2219/23326 | . . . | Clone, duplicate hardware functions of another device                                |
| G05B 2219/23327 | . . . | Modification of program in real time   |
| G05B 2219/23328 | . . . | Modification program   |
| G05B 2219/23329 | . . . | Modification, correction entered values  |
| G05B 2219/23331 | . . . | Patch program during non execution, tables to load modified program                  |

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| G05B 2219/23332 | . . . | Override stored parameters   |
| G05B 2219/23333 | . . . | Modify program and store it  |
| G05B 2219/23334 | . . . | Use of table with addresses for different modules, write new table if modified   |
| G05B 2219/23335 | . . . | History, log of program modifications  |
| G05B 2219/23336 | . . . | Identification of program, application, device to be controlled                  |
| G05B 2219/23337 | . . . | Modify if history of program coincides with history of modifying data            |
| G05B 2219/23338 | . . . | Transfer modified program from ram to eprom, flash                               |
| G05B 2219/23339 | . . . | Update diskette, cassette initiates bootstrap program to load eeprom, flash      |
| G05B 2219/23341 | . . . | Only new module in high level language, combine with existing modules            |
| G05B 2219/23342 | . . . | Pluggable rom, smart card  |
| G05B 2219/23343 | . . . | Earom, alterable eeprom, erasable  |
| G05B 2219/23344 | . . . | Changeable memory, program   |
| G05B 2219/23345 | . . . | Memory is eeprom   |
| G05B 2219/23346 | . . . | Permeability of pin sets frequency of oscillator, record carrier                 |
| G05B 2219/23347 | . . . | Eprom  |
| G05B 2219/23348 | . . . | Programmed parameter values in memory, rom, function selection and entry, no cpu |
| G05B 2219/23349 | . . . | Pluggable pin module, fits in corresponding female receptacle, coded plug        |
| G05B 2219/23351 | . . . | Film   |
| G05B 2219/23352 | . . . | Ram rom memory   |
| G05B 2219/23353 | . . . | Endless tape, loop   |
| G05B 2219/23354 | . . . | Hard disk  |
| G05B 2219/23355 | . . . | Magnetic card  |
| G05B 2219/23356 | . . . | Programmable, pluggable module, logic set up on front of module                  |
| G05B 2219/23357 | . . . | Grammophone record, disk   |
| G05B 2219/23358 | . . . | Program card with integrated control panel, flexible circuit                     |
| G05B 2219/23359 | . . . | Screw like form of record carrier  |
| G05B 2219/23361 | . . . | Ram card with write protection switch  |
| G05B 2219/23362 | . . . | Floppy diskette  |
| G05B 2219/23363 | . . . | Barcode  |
| G05B 2219/23364 | . . . | Bubble memory  |
| G05B 2219/23365 | . . . | Ferrite memory   |
| G05B 2219/23366 | . . . | Temperature induced on tape, sensors read temperature as program data            |
| G05B 2219/23367 | . . . | Card with picture of work to be done, together with selectable codes             |
| G05B 2219/23368 | . . . | VRAM videoram  |
| G05B 2219/23369 | . . . | Memory in controlled device is ram, rom  |
| G05B 2219/23371 | . . . | Fixed and variable memory for parameters or user program                         |

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| G05B 2219/23372 | . . . | XY matrix, switching controlled by pc  |
| G05B 2219/23373 | . . . | Interactive guidance by voice message  |
| G05B 2219/23374 | . . . | Set potentiometer automatically  |
| G05B 2219/23375 | . . . | Function switch, knob with piezo, strain gauge                                     |
| G05B 2219/23376 | . . . | Template for program, set values to template                                       |
| G05B 2219/23377 | . . . | Touch screen, with representation of buttons, machine on screen                    |
| G05B 2219/23378 | . . . | Touch sensitive key  |
| G05B 2219/23379 | . . . | Knob, delivering pulses, digipot, electronic potentiometer                         |
| G05B 2219/23381 | . . . | Balls with different properties circulate and form the sequence                    |
| G05B 2219/23382 | . . . | Knobs with build in illumination, legend   |
| G05B 2219/23383 | . . . | Lightpen   |
| G05B 2219/23384 | . . . | Tape, card with magnetic, luminescent, iron particles for sequence                 |
| G05B 2219/23385 | . . . | Programming pencil, touch probe  |
| G05B 2219/23386 | . . . | Voice, vocal command or message  |
| G05B 2219/23387 | . . . | Trackball  |
| G05B 2219/23388 | . . . | Mixture of different means, joystick, keys, pedals, fader, potentiometer           |
| G05B 2219/23389 | . . . | Modular program, each process has corresponding program module                     |
| G05B 2219/23391 | . . . | Each module can transfer data to I-O or other module and has parameter memory      |
| G05B 2219/23392 | . . . | Change execution time ratio of several programs                                    |
| G05B 2219/23393 | . . . | Set finish, end time and total program time to calculate, derive begin, start time |
| G05B 2219/23394 | . . . | Set time constant  |
| G05B 2219/23395 | . . . | Set value of limit switches, high low value  |
| G05B 2219/23396 | . . . | Enter start and end of selected program  |
| G05B 2219/23397 | . . . | Set day, week  |
| G05B 2219/23398 | . . . | Set start time and duration  |
| G05B 2219/23399 | . . . | Adapt set parameter as function of measured conditions                             |
| G05B 2219/23401 | . . . | Programmer has connection with pc to enter parameters into system directly by pc   |
| G05B 2219/23402 | . . . | Edit reference value on screen by lightpen   |
| G05B 2219/23403 | . . . | Store edited program also in detachable programmer, can be used elsewhere          |
| G05B 2219/23404 | . . . | If data error detected, switch automatically to program mode                       |
| G05B 2219/23405 | . . . | Change settings of events for a whole group of related events                      |
| G05B 2219/23406 | . . . | Programmer device, portable, handheld detachable programmer                        |
| G05B 2219/23407 | . . . | Program machine during execution of other program in real time                     |
| G05B 2219/23408 | . . . | Handheld programmer has cover to protect operator from environment                 |
| G05B 2219/23409 | . . . | Portable, detachable programmer has emulation for fixed control panel              |
| G05B 2219/23411 | . . . | Voltage supply or allow, not inhibit signal to memory on connection of programmer  |

- G05B 2219/23412 . . . Discriminate with id code the module to be programmed
- G05B 2219/23413 . . . Remote programmer can only program a device if nearby, narrow beam communication
- G05B 2219/23414 . . . Pc as detachable program, debug, monitor device for control system
- G05B 2219/23415 . . . Program each station with specific data, all, global with general, common data
- G05B 2219/23416 . . . Enter application program into I-O module, like motion program, servo program
- G05B 2219/23417 . . . Read program from pluggable memory card
- G05B 2219/23418 . . . Read tape, card forward, backward, in two directions
- G05B 2219/23419 . . . Automatic passage of tape to reader
- G05B 2219/23421 . . . Record program on tape, disk, memory
- G05B 2219/23422 . . . Learn parameters by producing a small number of objects
- G05B 2219/23423 . . . Record playback
- G05B 2219/23424 . . . Select construction element from function library
- G05B 2219/23425 . . . Selection of program, adaptive to process
- G05B 2219/23426 . . . Layout of program choice around knob according to used intensity
- G05B 2219/23427 . . . Selection out of several programs, parameters
- G05B 2219/23428 . . . Select program from look up tables as function of detector states, pointer, index to program
- G05B 2219/23429 . . . Selection as function of connected machine
- G05B 2219/23431 . . . Change program on detection of deviations
- G05B 2219/23432 . . . Select as function of different connected tools, each tool has its parameters
- G05B 2219/23433 . . . Selection of program as function of connected keyboard, panel
- G05B 2219/23434 . . . Select automatically preferred program data, ordered to most used program
- G05B 2219/23435 . . . Select a program per zone to be controlled
- G05B 2219/23436 . . . Select by dipswitches on power on
- G05B 2219/23437 . . . Each operator can select his own program, data entry
- G05B 2219/23438 . . . Select application program as well as connected control device
- G05B 2219/23439 . . . Select additional programfunctions by pushing two different keys
- G05B 2219/23441 . . . Select between user program selection or service program selection
- G05B 2219/23442 . . . As function of colour or number code on object to be treated
- G05B 2219/23443 . . . Upon detected function changes of remote device, activate proper local program
- G05B 2219/23444 . . . Select as function of surface property, characteristic of object handled by machine
- G05B 2219/23445 . . . Real time simulation
- G05B 2219/23446 . . . HIL hardware in the loop, simulates equipment to which a control module is fixed
- G05B 2219/23447 . . . Uses process simulator to develop, simulate faults, fault tree

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| G05B 2219/23448 | . . . | Find optimum solution by simulating process with constraints on inputs                         |
| G05B 2219/23449 | . . . | Use of an additional dedicated processor for emulating sensor output                           |
| G05B 2219/23451 | . . . | Software in the loop, bypass function, execute new program parts on external device            |
| G05B 2219/23452 | . . . | Simulate sequence on display to control program, test functions                                |
| G05B 2219/23453 | . . . | Pc simulates equipment and is connected to sequencer to test program                           |
| G05B 2219/23454 | . . . | Execute program in fast mode, real system has no time to respond                               |
| G05B 2219/23455 | . . . | Determine capability of machine by simulating model of capability of its parts                 |
| G05B 2219/23456 | . . . | Model machine for simulation   |
| G05B 2219/23457 | . . . | Programmer magnetically attachable to machine  |
| G05B 2219/23458 | . . . | Remote controller pluggable, attachable to pc  |
| G05B 2219/23459 | . . . | Keyboard attachable, pluggable into household apparatus  |
| G05B 2219/23461 | . . . | Module has coded cams darking optical detectors  |
| G05B 2219/23462 | . . . | No local entry panel, only central remote programmer for all appliances                        |
| G05B 2219/23463 | . . . | Before controlling module execute monitoring of module and its resources                       |
| G05B 2219/23464 | . . . | Use signatures to know module is not corrupt, cfc, control flow checking                       |
| G05B 2219/23465 | . . . | Master processor blocks input of data to slaves  |
| G05B 2219/23466 | . . . | Block, latch entry keys once program launched  |
| G05B 2219/23467 | . . . | Code and program on two objects to be assembled, compared for compatibility                    |
| G05B 2219/23468 | . . . | Before switch to execution of second, non failsafe program, inhibit I-O for it                 |
| G05B 2219/23469 | . . . | Execute alternatively a failsafe, proven program and a non failsafe program                    |
| G05B 2219/23471 | . . . | Interrupt after set time non failsafe program, switch to failsafe program                      |
| G05B 2219/23472 | . . . | Confirmation of user for the selection of a program setting                                    |
| G05B 2219/23473 | . . . | Program stopped if consumed current to high  |
| G05B 2219/24    | . . . | Pc safety  |
| G05B 2219/24001 | . . . | Maintenance, repair  |
| G05B 2219/24002 | . . . | Clock failing, adaptive to clock   |
| G05B 2219/24003 | . . . | Emergency stop   |
| G05B 2219/24004 | . . . | If control lever, joystick, handle is released, spring return to neutral                       |
| G05B 2219/24005 | . . . | Inhibit update control program if default values has been changed by program during processing |
| G05B 2219/24006 | . . . | Code coverage memory:contains data about addressed addresses during program run                |
| G05B 2219/24007 | . . . | Backup data if microprocessor not responding   |
| G05B 2219/24008 | . . . | Safety integrity level, safety integrated systems SIL SIS                                      |
| G05B 2219/24009 | . . . | If board, card is retrieved, then disconnect first power, then block machine                   |

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| G05B 2219/24011 | . . . | Transmit warning, error message to all devices in a list                                    |
| G05B 2219/24012 | . . . | Use camera of handheld device, head mounted display   |
| G05B 2219/24013 | . . . | Unlatch all relays in common with micorprocessor  |
| G05B 2219/24014 | . . . | Protection to extract, insert circuit board   |
| G05B 2219/24015 | . . . | Monitoring  |
| G05B 2219/24016 | . . . | Unlatch for reparation  |
| G05B 2219/24017 | . . . | Powering up, starting machine supervised by microprocessor                                  |
| G05B 2219/24018 | . . . | Computer assisted repair, diagnostic  |
| G05B 2219/24019 | . . . | Computer assisted maintenance   |
| G05B 2219/24021 | . . . | Separate processor for monitoring system  |
| G05B 2219/24022 | . . . | Stop error message after a number of repeated error events                                  |
| G05B 2219/24023 | . . . | Stop error message after permission operator, acknowledgement                               |
| G05B 2219/24024 | . . . | Safety, surveillance  |
| G05B 2219/24025 | . . . | Remove board with system on power, hot plug in, swap, docking, life insertion               |
| G05B 2219/24026 | . . . | Latch, block unlatch, unblock   |
| G05B 2219/24027 | . . . | Circuit, independent from microprocessor, detects contact switch to allow power to actuator |
| G05B 2219/24028 | . . . | Explosion free control, intrinsically safe  |
| G05B 2219/24029 | . . . | Alarm if wrong device, apparatus is connected to control module                             |
| G05B 2219/24031 | . . . | Fpga takes over control if emergency or programmed stop, to shut down sequence              |
| G05B 2219/24032 | . . . | Power on reset, powering up   |
| G05B 2219/24033 | . . . | Failure, fault detection and isolation  |
| G05B 2219/24034 | . . . | Model checker, to verify and debug control software   |
| G05B 2219/24035 | . . . | Superpose testsignal on normal I-O lines, through transfo and rectifier                     |
| G05B 2219/24036 | . . . | Test signal generated by microprocessor, for all I-O tests                                  |
| G05B 2219/24037 | . . . | Switch on pin of microprocessor for test  |
| G05B 2219/24038 | . . . | Several test signals stored in memory and used as input signals                             |
| G05B 2219/24039 | . . . | Test sequence time and sequence profile   |
| G05B 2219/24041 | . . . | Pc as detachable debug, monitor device for control system                                   |
| G05B 2219/24042 | . . . | Signature analysis, compare recorded with current data, if error then alarm                 |
| G05B 2219/24043 | . . . | Test memory comparing with known stored valid memory states                                 |
| G05B 2219/24044 | . . . | Second controller monitors diagnostics system of first controller                           |
| G05B 2219/24045 | . . . | Test if memory card is inserted, present  |
| G05B 2219/24046 | . . . | Test if controller has enough memory available  |
| G05B 2219/24047 | . . . | Count certain number of errors, faults before delivering alarm, stop                        |
| G05B 2219/24048 | . . . | Remote test, monitoring, diagnostic   |
| G05B 2219/24049 | . . . | Use of control bits   |
| G05B 2219/24051 | . . . | Two test pins, one for input and one for output   |

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| G05B 2219/24052 | . . . | Set switch on for diagnostic  |
| G05B 2219/24053 | . . . | Diagnostic of controlled machine  |
| G05B 2219/24054 | . . . | Self diagnostic   |
| G05B 2219/24055 | . . . | Trace, store a working, operation history                                   |
| G05B 2219/24056 | . . . | Portable, detachable module to input test signals, read test results        |
| G05B 2219/24057 | . . . | Set jumper on board to change user mode to diagnostic mode                  |
| G05B 2219/24058 | . . . | Remote testing, monitoring independent from normal control by pc            |
| G05B 2219/24059 | . . . | Diagnostic programmed in state logic  |
| G05B 2219/24061 | . . . | Simulator, generates input signals, shows output signals of logic           |
| G05B 2219/24062 | . . . | During simulation, test inhibit output to actuators                         |
| G05B 2219/24063 | . . . | Select signals as function of priority, importance for diagnostic           |
| G05B 2219/24064 | . . . | Sample rate variable as function of importance of alarm signals             |
| G05B 2219/24065 | . . . | Real time diagnostics   |
| G05B 2219/24066 | . . . | Monitor only devices essential to current process                           |
| G05B 2219/24067 | . . . | Processor stores variables, events and date in eeprom, for external monitor |
| G05B 2219/24068 | . . . | Find intermittent errors  |
| G05B 2219/24069 | . . . | Diagnostic  |
| G05B 2219/24071 | . . . | Online service documentation  |
| G05B 2219/24072 | . . . | Detect faulty circuit, display on screen and replace it                     |
| G05B 2219/24073 | . . . | Avoid propagation of fault  |
| G05B 2219/24074 | . . . | Probability of defect, seriousness or severity of defect, fault             |
| G05B 2219/24075 | . . . | Predict control element state changes, event changes                        |
| G05B 2219/24076 | . . . | Markov model for safety analysis  |
| G05B 2219/24077 | . . . | Module detects wear, changes of controlled device, statistical evaluation   |
| G05B 2219/24078 | . . . | Debounce, correct periodicity of command                                    |
| G05B 2219/24079 | . . . | Detect correct command wave form  |
| G05B 2219/24081 | . . . | Detect valid sequence of commands   |
| G05B 2219/24082 | . . . | Detect if driver, actuation circuit is correct                              |
| G05B 2219/24083 | . . . | Detect if actuators are correct, react                                      |
| G05B 2219/24084 | . . . | Remote and local monitoring, local result to remote, remote takes action    |
| G05B 2219/24085 | . . . | Analyze, trace fault signals according to tree, table                       |
| G05B 2219/24086 | . . . | Expert system, guidance operator, locate fault and indicate how to repair   |
| G05B 2219/24087 | . . . | After correct repair, update fault tree                                     |
| G05B 2219/24088 | . . . | Simulate process graphically using feedback from real, to prevent or repair |
| G05B 2219/24089 | . . . | Change colour of message after reading message                              |
| G05B 2219/24091 | . . . | Display indication out of order, alarm indication                           |
| G05B 2219/24092 | . . . | Warning display lights, lamps, leds on module                               |
| G05B 2219/24093 | . . . | Display, show place of error, fault   |



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| G05B 2219/24094 | . . . | Voice alarm   |
| G05B 2219/24095 | . . . | Show timely order of errors   |
| G05B 2219/24096 | . . . | Show number of error event  |
| G05B 2219/24097 | . . . | Camera monitors controlled machine  |
| G05B 2219/24098 | . . . | Scan and display states of all actuators if controller fails                      |
| G05B 2219/24099 | . . . | On error, send error over lightdiode to external pc, display                      |
| G05B 2219/24101 | . . . | Stop error message after a certain time   |
| G05B 2219/24102 | . . . | Display status of controller  |
| G05B 2219/24103 | . . . | Graphical display of proces as function of detected alarm signals                 |
| G05B 2219/24104 | . . . | Operator can select a graphical screen at his will as help diagnostic             |
| G05B 2219/24105 | . . . | Perform an initial display process to check displays                              |
| G05B 2219/24106 | . . . | Display instructions, program statements together with monitored parameter value  |
| G05B 2219/24107 | . . . | Display centrally detected user, function changes of remote device                |
| G05B 2219/24108 | . . . | Correct fault so that microprocessor functions correctly, without reset           |
| G05B 2219/24109 | . . . | Execute first diagnostic, service program before normal control program           |
| G05B 2219/24111 | . . . | Inhibit control until control lever is first set to neutral position              |
| G05B 2219/24112 | . . . | Delay software reset until critical operations are finished                       |
| G05B 2219/24113 | . . . | No transmission of errors to central during intervention of maintenance operator  |
| G05B 2219/24114 | . . . | Continue program if crashed microprocessor, program module is not crucial         |
| G05B 2219/24115 | . . . | Continue critical operation only if detector, operator input is satisfied         |
| G05B 2219/24116 | . . . | Reprogram inserted module, reread parameters to enable operation machine          |
| G05B 2219/24117 | . . . | If error detected, shut down  |
| G05B 2219/24118 | . . . | Inhibit, disable control if program module not inserted or wrong module addressed |
| G05B 2219/24119 | . . . | Compare control states to allowed and forbidden combination of states             |
| G05B 2219/24121 | . . . | On fault, detect bit pattern to indicate kind of fault and stop program           |
| G05B 2219/24122 | . . . | Inhibit automatic control if in manual control                                    |
| G05B 2219/24123 | . . . | Alarm filtering, level and direct precursor, required action, blocking condition  |
| G05B 2219/24124 | . . . | Identification of program, if not assigned for machine, reject, stop              |
| G05B 2219/24125 | . . . | Watchdog, check at timed intervals  |
| G05B 2219/24126 | . . . | Program stopped if instruction not executed or if output module is missing        |
| G05B 2219/24127 | . . . | Disable, inhibit control signal in I-O interface if alarm status set              |
| G05B 2219/24128 | . . . | Command and intermediate error feedback used to verify correct execution          |
| G05B 2219/24129 | . . . | means for safety such as resettable fuse, PPTC                                    |
| G05B 2219/24131 | . . . | Noise rejection, shielding board, bus, lines                                      |
| G05B 2219/24132 | . . . | Over voltage protection   |

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| G05B 2219/24133 | . . . | Ground each module and total system   |
| G05B 2219/24134 | . . . | Use of high voltage 28-Volt logic level   |
| G05B 2219/24135 | . . . | Use of infra red for optical limit switch against day light                       |
| G05B 2219/24136 | . . . | Monitor load state of battery   |
| G05B 2219/24137 | . . . | Non volatile memory to store program on power loss                                |
| G05B 2219/24138 | . . . | Battery backup  |
| G05B 2219/24139 | . . . | Recovery from power loss, failure   |
| G05B 2219/24141 | . . . | Capacitor backup  |
| G05B 2219/24142 | . . . | Program has a protected, independent part and a free programmable part            |
| G05B 2219/24143 | . . . | Inhibit control if device does not answer a start signal within time interval     |
| G05B 2219/24144 | . . . | Load new program, overwrite old program only if machine is halted                 |
| G05B 2219/24145 | . . . | Test for collision of actuated devices, articles, if interference inhibit entry   |
| G05B 2219/24146 | . . . | Configure actuators to be switched off in case of emergency stop                  |
| G05B 2219/24147 | . . . | Program entry, inhibit manual control if in automatic mode                        |
| G05B 2219/24148 | . . . | Inhibit local control if in remote  |
| G05B 2219/24149 | . . . | Inhibit program entry if an essential sensor of apparatus is missing, broken      |
| G05B 2219/24151 | . . . | Inhibit programming if physical resources are missing, no gas for heating         |
| G05B 2219/24152 | . . . | Normal and emergency program are integrated                                       |
| G05B 2219/24153 | . . . | System controller can control independent from host                               |
| G05B 2219/24154 | . . . | Password with time limited access to system, protect protocol                     |
| G05B 2219/24155 | . . . | Load, enter program if device acknowledges received password, security signal     |
| G05B 2219/24156 | . . . | Inhibit program entry, keyboard by entering sequence of certain keys              |
| G05B 2219/24157 | . . . | Block, inhibit certain inputs by entering certain keycode                         |
| G05B 2219/24158 | . . . | Access only for service, hide, forbidden tamperfree keys, program                 |
| G05B 2219/24159 | . . . | Several levels of security, passwords   |
| G05B 2219/24161 | . . . | Use of key, in key is stored access level   |
| G05B 2219/24162 | . . . | Biometric sensor, fingerprint as user access password                             |
| G05B 2219/24163 | . . . | Authentication tag in configuration file  |
| G05B 2219/24164 | . . . | Parts of program accesible only during execution, no access with programming tool |
| G05B 2219/24165 | . . . | Use codes to activate features of controller                                      |
| G05B 2219/24166 | . . . | Permit from several operators to allow access                                     |
| G05B 2219/24167 | . . . | Encryption, password, user access privileges                                      |
| G05B 2219/24168 | . . . | Identify connected programmer to allow control, program entry                     |
| G05B 2219/24169 | . . . | Identification of last person who changed program                                 |
| G05B 2219/24171 | . . . | Supervisor code to change passwords   |
| G05B 2219/24172 | . . . | Use of second password, different from first                                      |
| G05B 2219/24173 | . . . | One sensor, two I-O channels each for different processor                         |

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| G05B 2219/24174 | . . . | One channel is used for communication while other is tested, in redundant I-O   |
| G05B 2219/24175 | . . . | Redundant communication channel, if one fails use the other                     |
| G05B 2219/24176 | . . . | Central controller may override redundant controller                            |
| G05B 2219/24177 | . . . | State machine arbitrates which redundant controller is active                   |
| G05B 2219/24178 | . . . | Controlled device decides which redundant controller will be active             |
| G05B 2219/24179 | . . . | Redundant storage of control parameters   |
| G05B 2219/24181 | . . . | Fail silent nodes, replicated nodes grouped into fault tolerant units           |
| G05B 2219/24182 | . . . | Redundancy  |
| G05B 2219/24183 | . . . | If error, spare unit takes over, message to master, confirm new configuration   |
| G05B 2219/24184 | . . . | Redundant I-O, software comparison of both channels                             |
| G05B 2219/24185 | . . . | After repair, update redundant system during non critical periods               |
| G05B 2219/24186 | . . . | Redundant processors are synchronised   |
| G05B 2219/24187 | . . . | Redundant processors run identical programs                                     |
| G05B 2219/24188 | . . . | Redundant processors run different programs                                     |
| G05B 2219/24189 | . . . | Redundant processors monitor same point, common parameters                      |
| G05B 2219/24191 | . . . | Redundant processors are different in structure                                 |
| G05B 2219/24192 | . . . | Configurable redundancy   |
| G05B 2219/24193 | . . . | Two transducers for same parameter  |
| G05B 2219/24194 | . . . | One channel monitors correct programcode execution, other correct process state |
| G05B 2219/24195 | . . . | Compare data in channels at timed intervals, for equality                       |
| G05B 2219/24196 | . . . | Plausibility check in channels for correct sequence or result                   |
| G05B 2219/24197 | . . . | Dual analog output ports, second takes over if first fails                      |
| G05B 2219/24198 | . . . | Restart, reinitialize, boot system after fault detection, hanging up, stalling  |
| G05B 2219/24199 | . . . | Recover from fault, malfunction, go to safe state, correct and set new sequence |
| G05B 2219/24201 | . . . | Inhibit restart program if start switch fails in normal run mode                |
| G05B 2219/24202 | . . . | After failure and stop of program, special switch to restart                    |
| G05B 2219/24203 | . . . | Restart, recover from error only if detected states equal stored states         |
| G05B 2219/24204 | . . . | Select restore procedure corresponding to matched abnormal condition, table     |
| G05B 2219/24205 | . . . | Slow down processor activity if temperature rises above limit                   |
| G05B 2219/24206 | . . . | Identification by portable memory in a key                                      |
| G05B 2219/24207 | . . . | If processor overloaded, reduce messages sent by other systems to it            |
| G05B 2219/24208 | . . . | Go into safety mode if communications are interrupted                           |
| G05B 2219/24209 | . . . | Create film in case of error  |
| G05B 2219/24211 | . . . | Override normal program, execute urgency program so machine operates safe       |
| G05B 2219/24212 | . . . | Set off alarm state manually, acknowledge to restart normal control             |

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| G05B 2219/24213 | . . . | No shut down if after emergency detection, all control parameters are safe               |
| G05B 2219/24214 | . . . | Detect if analog output signal is within range   |
| G05B 2219/24215 | . . . | Scada supervisory control and data acquisition   |
| G05B 2219/24216 | . . . | Supervision of system  |
| G05B 2219/25    | . .   | Pc structure of the system   |
| G05B 2219/25001 | . . . | CEBUS consumers electronics bus  |
| G05B 2219/25002 | . . . | Interbus-S, output serial out, input serial in, as one shift register                    |
| G05B 2219/25003 | . . . | M3S bus with six lines, two power, two canbus, one to initialize, one as dead man switch |
| G05B 2219/25004 | . . . | Power and data bus   |
| G05B 2219/25005 | . . . | Fluid bus for communication in process system with several fluidic control modules       |
| G05B 2219/25006 | . . . | Interface connected to fieldbus  |
| G05B 2219/25007 | . . . | UMS bus  |
| G05B 2219/25008 | . . . | Different buses, protocols on same line, also dsl  |
| G05B 2219/25009 | . . . | Profinet-I-O, producer-consumer mode   |
| G05B 2219/25011 | . . . | Domotique, I-O bus, home automation, building automation                                 |
| G05B 2219/25012 | . . . | Two different bus systems  |
| G05B 2219/25013 | . . . | G64-bus  |
| G05B 2219/25014 | . . . | Fieldbus general name of bus connected to machines, detectors, actuators                 |
| G05B 2219/25015 | . . . | Gpib-488, ieee-488, hp bus, parallel instrumentation bus                                 |
| G05B 2219/25016 | . . . | Eiba bus, european installation bus association, ib installation bus                     |
| G05B 2219/25017 | . . . | ASI actuator sensor interface, bus, network  |
| G05B 2219/25018 | . . . | Only actuator bus, network   |
| G05B 2219/25019 | . . . | Parallel processors coupled to bus by configurable interface card                        |
| G05B 2219/25021 | . . . | Profibus   |
| G05B 2219/25022 | . . . | LAN local area network for controllers   |
| G05B 2219/25023 | . . . | Sercos serial real time communications system between servo and cpu                      |
| G05B 2219/25024 | . . . | Bitbus from intel  |
| G05B 2219/25025 | . . . | Only sensor bus  |
| G05B 2219/25026 | . . . | Lon local operating network, uses neuron chip with three microprocessors                 |
| G05B 2219/25027 | . . . | GSC general serial channel   |
| G05B 2219/25028 | . . . | Power, data and clock bus  |
| G05B 2219/25029 | . . . | Additional logic to mirror certain signals, permits node to adapt to bitrate             |
| G05B 2219/25031 | . . . | TTCAN bus, time triggered can bus  |
| G05B 2219/25032 | . . . | CAN, canbus, controller area network bus   |
| G05B 2219/25033 | . . . | structure, control, synchronization, data, alarm, connect I-O line to interface          |

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|-----------------|-------|---|
| G05B 2219/25034 | . . . | Connect module to data, monitor, control lines, extra I-O and power to connector              |
| G05B 2219/25035 | . . . | Star network  |
| G05B 2219/25036 | . . . | Two clocks, high frequency for normal and low frequency for battery low , sleep               |
| G05B 2219/25037 | . . . | Clock line and data line loop in a contrary sense, for data stability, settling               |
| G05B 2219/25038 | . . . | During negative cycle of power supply, processor is set to active, else inactive              |
| G05B 2219/25039 | . . . | Clock   |
| G05B 2219/25041 | . . . | Select between several clock signals  |
| G05B 2219/25042 | . . . | Clock derived from power supply   |
| G05B 2219/25043 | . . . | Superposition time and other pulses   |
| G05B 2219/25044 | . . . | Radio controlled clock  |
| G05B 2219/25045 | . . . | Electronic cam, encoder for sequence control as function of position, programmable switch pls |
| G05B 2219/25046 | . . . | Real time clock to sample I-O states and store them in memory                                 |
| G05B 2219/25047 | . . . | Common clock for redundant processors   |
| G05B 2219/25048 | . . . | Master clock and several frequency dividers, for motion and sequence control                  |
| G05B 2219/25049 | . . . | Master processor gives timing information to slaves   |
| G05B 2219/25051 | . . . | For serial communication a separate clock and data line                                       |
| G05B 2219/25052 | . . . | VCO voltage controlled oscillator   |
| G05B 2219/25053 | . . . | Frequency pulses as function of speed   |
| G05B 2219/25054 | . . . | Calibration timer, compare 1st, number of pulses during calibration with second counter       |
| G05B 2219/25055 | . . . | During calibration adapt vco, counter to deliver wanted frequency, pulses                     |
| G05B 2219/25056 | . . . | Automatic configuration of monitoring, control system as function of operator input, events   |
| G05B 2219/25057 | . . . | Configuration stored in distributed database for real time use                                |
| G05B 2219/25058 | . . . | Job setup, use also library to select job setup   |
| G05B 2219/25059 | . . . | Iterative configuration of identical modules, only config first one, copy to other            |
| G05B 2219/25061 | . . . | Configuration stored in central database  |
| G05B 2219/25062 | . . . | Detect physical location of field device  |
| G05B 2219/25063 | . . . | Force node into an inactive state when required   |
| G05B 2219/25064 | . . . | Update component configuration to optimize program execution                                  |
| G05B 2219/25065 | . . . | Configure attributes of parameters  |
| G05B 2219/25066 | . . . | Configuration stored in each unit   |
| G05B 2219/25067 | . . . | Graphic configuration control system  |
| G05B 2219/25068 | . . . | Check correct configuration of device   |
| G05B 2219/25069 | . . . | Pseudo redundance, eliminate failing element and reconfigure system                           |
| G05B 2219/25071 | . . . | Synoptique display of system configuration, layout, evolution                                 |

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| G05B 2219/25072 | . . . | Initialise each module during start up   |
| G05B 2219/25073 | . . . | Configuration of keys and related display, shown on keys                               |
| G05B 2219/25074 | . . . | Check system, change failing element, compare with stored configuration                |
| G05B 2219/25075 | . . . | Select interconnection of a combination of processor links to form network             |
| G05B 2219/25076 | . . . | Configure connected module only if allowed, registered module                          |
| G05B 2219/25077 | . . . | Each module can be programmed for number of input and output                           |
| G05B 2219/25078 | . . . | Store in ram a second program adapted to local conditions                              |
| G05B 2219/25079 | . . . | Function module makes bus termination, creates local bus on ok from central            |
| G05B 2219/25081 | . . . | Clone, copy configuration from first device, in teach mode, to second identical device |
| G05B 2219/25082 | . . . | Display name of configuration, to recognise how device has been set, programmed        |
| G05B 2219/25083 | . . . | For each subsystem a configuration   |
| G05B 2219/25084 | . . . | Select configuration as function of operator   |
| G05B 2219/25085 | . . . | Several function expansion units for master, main unit, universal system               |
| G05B 2219/25086 | . . . | Assign functions to group of complete or partial cells, modules                        |
| G05B 2219/25087 | . . . | Selector switch to set function of each module   |
| G05B 2219/25088 | . . . | Define scale value of analog signal, min and max value                                 |
| G05B 2219/25089 | . . . | Define state of digital signal, open, closed, maintained, momentary                    |
| G05B 2219/25091 | . . . | Of alternative and parallel parts of program into synchronised tasks                   |
| G05B 2219/25092 | . . . | Customized control features, configuration   |
| G05B 2219/25093 | . . . | During start, integration into machine, send module functionality to scheduler         |
| G05B 2219/25094 | . . . | At start, I-O modules receive functionality and check with its own functionality       |
| G05B 2219/25095 | . . . | Detect kind of display to configure display routine                                    |
| G05B 2219/25096 | . . . | Detect addresses of connected I-O, modules   |
| G05B 2219/25097 | . . . | Detect control panel connected, select corresponding program and parameters            |
| G05B 2219/25098 | . . . | Detect connected sensors, set parameters, gain automatically                           |
| G05B 2219/25099 | . . . | Detect configuration I-O and select needed program                                     |
| G05B 2219/25101 | . . . | Detect connected module, load corresponding parameters, variables into module          |
| G05B 2219/25102 | . . . | Detect connected actuator, by code, select compensation non linearity                  |
| G05B 2219/25103 | . . . | Detect during start, number of modules, groups, sub groups                             |
| G05B 2219/25104 | . . . | Detect transfer of control module, use mean default values instead of normal           |
| G05B 2219/25105 | . . . | By cable integrated in controlled machine, fixed                                       |
| G05B 2219/25106 | . . . | Pluggable card, magnetic, smart with configuration data, pulled out after loading      |



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| G05B 2219/25107 | . . . | Pluggable card, magnetic or smart with configuration data, staying in device         |
| G05B 2219/25108 | . . . | Dipswitches combined with bcd switch instead of multiple dipswitches                 |
| G05B 2219/25109 | . . . | Eeprom loaded from external device with configuration data                           |
| G05B 2219/25111 | . . . | Using broadcast message  |
| G05B 2219/25112 | . . . | Using firmware stored in processor   |
| G05B 2219/25113 | . . . | Strapping diodes   |
| G05B 2219/25114 | . . . | Jumpers  |
| G05B 2219/25115 | . . . | Card, board with configuration switches  |
| G05B 2219/25116 | . . . | Pluggable, detachable cassette loads configuration                                   |
| G05B 2219/25117 | . . . | Resistors, value, combination defines a digital value                                |
| G05B 2219/25118 | . . . | Matrix to connect sensor to corresponding actuator                                   |
| G05B 2219/25119 | . . . | Dipswitches dipschalter  |
| G05B 2219/25121 | . . . | What, which input or output to be connected to key or display                        |
| G05B 2219/25122 | . . . | Stop angle and status of different on off states                                     |
| G05B 2219/25123 | . . . | Change controller pin configuration  |
| G05B 2219/25124 | . . . | Configure attributes of parameters   |
| G05B 2219/25125 | . . . | Relationship between different functions of a controller                             |
| G05B 2219/25126 | . . . | Synchronize communication based on internal clock of micro processor                 |
| G05B 2219/25127 | . . . | Bus for analog and digital communication   |
| G05B 2219/25128 | . . . | Transmission with higher frequency than the processing frequency                     |
| G05B 2219/25129 | . . . | Programming a multitasking, virtual sensor network shared by various users           |
| G05B 2219/25131 | . . . | Collect several parameters and transmit in block to control microprocessor           |
| G05B 2219/25132 | . . . | Superposition data signals on power lines for actuators                              |
| G05B 2219/25133 | . . . | Serial parallel conversion   |
| G05B 2219/25134 | . . . | All interfaces load their data in shift register, then serial read out               |
| G05B 2219/25135 | . . . | On data line multiplex data and control words  |
| G05B 2219/25136 | . . . | Transmission with variable frequency, set by operator                                |
| G05B 2219/25137 | . . . | Optical window for communication   |
| G05B 2219/25138 | . . . | Transmit data from rotating devices  |
| G05B 2219/25139 | . . . | Use of separate buscouple interface  |
| G05B 2219/25141 | . . . | Normal display led used also for communication purposes                              |
| G05B 2219/25142 | . . . | Lan between host and main controller, other network between main and sub controllers |
| G05B 2219/25143 | . . . | Buffer for communication between two cpu   |
| G05B 2219/25144 | . . . | Between microcomputers, processors   |
| G05B 2219/25145 | . . . | I-O communicates with local bus at one end and with fieldbus at other end            |
| G05B 2219/25146 | . . . | Communication between main and expansion unit, only clock and data                   |



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| G05B 2219/25147 | . . . | Before communication, check if optical fiber is correctly attached                    |
| G05B 2219/25148 | . . . | Before communication, check if I-O is powered   |
| G05B 2219/25149 | . . . | Receiver detects communication error and requests emitter to retransmit data          |
| G05B 2219/25151 | . . . | Check appropriate protocol voltage levels   |
| G05B 2219/25152 | . . . | Parity detection  |
| G05B 2219/25153 | . . . | Checking communication  |
| G05B 2219/25154 | . . . | Detect error, repeat transmission on error, retransmit                                |
| G05B 2219/25155 | . . . | Encoded transmission against noise  |
| G05B 2219/25156 | . . . | Full echo communication check, echo back  |
| G05B 2219/25157 | . . . | Checksum CRC  |
| G05B 2219/25158 | . . . | Watchdog  |
| G05B 2219/25159 | . . . | Respond to signal if initialisation and address are received within set interval      |
| G05B 2219/25161 | . . . | Only receiving station, read several times message, select correct one or reject      |
| G05B 2219/25162 | . . . | Contention, if several transmitters avoid collision, by separate transmittor code     |
| G05B 2219/25163 | . . . | Transmit twice, redundant, same data on different channels, check each channel        |
| G05B 2219/25164 | . . . | Loopback  |
| G05B 2219/25165 | . . . | Token ring network  |
| G05B 2219/25166 | . . . | USB, firewire, ieee-1394  |
| G05B 2219/25167 | . . . | Receive commands through mobile telephone   |
| G05B 2219/25168 | . . . | Domotique, access through internet protocols  |
| G05B 2219/25169 | . . . | Half duplex, repeater   |
| G05B 2219/25171 | . . . | Serial, RS232   |
| G05B 2219/25172 | . . . | Duplex  |
| G05B 2219/25173 | . . . | SCSI  |
| G05B 2219/25174 | . . . | Ethernet  |
| G05B 2219/25175 | . . . | Modem, codec coder decoder  |
| G05B 2219/25176 | . . . | RS485, differential data signals, xor   |
| G05B 2219/25177 | . . . | Using fm frequency modulation, fsk, biphase code                                      |
| G05B 2219/25178 | . . . | Serial communication, data, also repeater   |
| G05B 2219/25179 | . . . | Parallel  |
| G05B 2219/25181 | . . . | Repeater  |
| G05B 2219/25182 | . . . | Serial between host and modules, nodes, parallel in node to microcontroller           |
| G05B 2219/25183 | . . . | Serial AND-OR parallel interface in one circuit                                       |
| G05B 2219/25184 | . . . | Number of modules interfaces optimized in relation to applications with which to link |
| G05B 2219/25185 | . . . | Single serial line, virtual second line is earth                                      |

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| G05B 2219/25186 | . . . | Bluetooth  |
| G05B 2219/25187 | . . . | Transmission of signals, medium, ultrasonic, radio   |
| G05B 2219/25188 | . . . | Superposition high frequency data signal on power lines, current carrier                     |
| G05B 2219/25189 | . . . | Current mode sensor I-O, current loop, 40-mA loop instead of voltage                         |
| G05B 2219/25191 | . . . | Current loop   |
| G05B 2219/25192 | . . . | Infrared   |
| G05B 2219/25193 | . . . | Coaxial cable  |
| G05B 2219/25194 | . . . | Twin core, twisted cable   |
| G05B 2219/25195 | . . . | Multiwire cable, parallel  |
| G05B 2219/25196 | . . . | Radio link, transponder  |
| G05B 2219/25197 | . . . | Optical, glass fiber   |
| G05B 2219/25198 | . . . | Brouter: transfers data from wireless to wired networks, router: wired to wired              |
| G05B 2219/25199 | . . . | Router brouter broadcast configuration data periodically to update control units             |
| G05B 2219/25201 | . . . | Program communication between remote I-O and controller via remote connection program object |
| G05B 2219/25202 | . . . | Internet, tcp-ip, web server : see under S05B219-40  |
| G05B 2219/25203 | . . . | Keep correct order of messages sent, of messages sequence                                    |
| G05B 2219/25204 | . . . | Translate between different communication protocols  |
| G05B 2219/25205 | . . . | Encrypt communication  |
| G05B 2219/25206 | . . . | Protocol: only devices with changed states communicate their states, event                   |
| G05B 2219/25207 | . . . | Only devices with changed states can receive control signals for actuator                    |
| G05B 2219/25208 | . . . | Control message, address and command portion   |
| G05B 2219/25209 | . . . | Device status answer, response, acknowledge  |
| G05B 2219/25211 | . . . | Broadcast mode, length message, command, address of originator and destination               |
| G05B 2219/25212 | . . . | Master address node, node answers ready, master sends command, node executes it              |
| G05B 2219/25213 | . . . | Synchronisation, address and data  |
| G05B 2219/25214 | . . . | Wait, delay after message  |
| G05B 2219/25215 | . . . | Time triggered protocol for fault tolerant real time application                             |
| G05B 2219/25216 | . . . | Packet switching   |
| G05B 2219/25217 | . . . | Configure communication protocol, select between several                                     |
| G05B 2219/25218 | . . . | Broadcast mode, originator, destinator address, command, check data                          |
| G05B 2219/25219 | . . . | Probe packet to determine best route for messages  |
| G05B 2219/25221 | . . . | Identification of messages and their relative priority                                       |
| G05B 2219/25222 | . . . | Mailbox, email, mail system  |
| G05B 2219/25223 | . . . | Slave has registers to indicate master, acknowledge, transfer address, read write            |
| G05B 2219/25224 | . . . | Fieldbus messages services fms   |

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| G05B 2219/25225 | . . . | Peripheral messages services pms, for sensor actuator                                     |
| G05B 2219/25226 | . . . | Combine CSMA-CD and TDM time multiplexed for rapid status exchange                        |
| G05B 2219/25227 | . . . | Polling time is variable for each node, as function of time needed for each node          |
| G05B 2219/25228 | . . . | Scheduling communication on bus   |
| G05B 2219/25229 | . . . | Partition control software among distributed controllers                                  |
| G05B 2219/25231 | . . . | Command, task has deadline, time limit to be executed                                     |
| G05B 2219/25232 | . . . | DCS, distributed control system, decentralised control unit                               |
| G05B 2219/25233 | . . . | Avoid communication delay by sending command and event, if event present, execute command |
| G05B 2219/25234 | . . . | Direct communication between two modules instead of normal network                        |
| G05B 2219/25235 | . . . | Associate a sequence function to each control element, event signature                    |
| G05B 2219/25236 | . . . | Detail, detect presence of operator to wake up system                                     |
| G05B 2219/25237 | . . . | Drive record carrier  |
| G05B 2219/25238 | . . . | Personalize message   |
| G05B 2219/25239 | . . . | Relay assisted triac, in series for safety  |
| G05B 2219/25241 | . . . | Serial bus controller   |
| G05B 2219/25242 | . . . | Relay   |
| G05B 2219/25243 | . . . | Digital filter  |
| G05B 2219/25244 | . . . | State matrix connected to controller  |
| G05B 2219/25245 | . . . | Keyboard encoder chip used as sequence controller   |
| G05B 2219/25246 | . . . | Habituation, rehabilitation and recovery chip, responds only to critical information      |
| G05B 2219/25247 | . . . | Program drum and reverse drum driven by timer motor                                       |
| G05B 2219/25248 | . . . | Microcontroller as time switch  |
| G05B 2219/25249 | . . . | Counter, timer plus microprocessor for real time , jitter                                 |
| G05B 2219/25251 | . . . | Real time clock   |
| G05B 2219/25252 | . . . | Microprocessor  |
| G05B 2219/25253 | . . . | Transputer  |
| G05B 2219/25254 | . . . | DSP digital signal processor  |
| G05B 2219/25255 | . . . | Neural network  |
| G05B 2219/25256 | . . . | Module is timer with variable time delay  |
| G05B 2219/25257 | . . . | Microcontroller   |
| G05B 2219/25258 | . . . | ASIC  |
| G05B 2219/25259 | . . . | Bus arbiter   |
| G05B 2219/25261 | . . . | Hand calculator as time switch  |
| G05B 2219/25262 | . . . | Oscillator to multiply pulses to counter  |
| G05B 2219/25263 | . . . | Solid state simulating relay logic  |
| G05B 2219/25264 | . . . | Synchronizer for pulses   |
| G05B 2219/25265 | . . . | Flash memory  |
| G05B 2219/25266 | . . . | Microcontroller combined with plc   |

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| G05B 2219/25267 | . . . | Shift register  |
| G05B 2219/25268 | . . . | PLD programmable logic device   |
| G05B 2219/25269 | . . . | Lifo  |
| G05B 2219/25271 | . . . | Neuron controller, for lan  |
| G05B 2219/25272 | . . . | Hall sensor, switch   |
| G05B 2219/25273 | . . . | Fuzzy logic combined with delay element   |
| G05B 2219/25274 | . . . | Communication processor, link interface   |
| G05B 2219/25275 | . . . | Analog switch   |
| G05B 2219/25276 | . . . | Fifo  |
| G05B 2219/25277 | . . . | Tristate  |
| G05B 2219/25278 | . . . | Timer plus microprocessor   |
| G05B 2219/25279 | . . . | Switch on power, awake device from standby if detects action on device            |
| G05B 2219/25281 | . . . | Detect usage of machine, adapt sleep mode timer                                   |
| G05B 2219/25282 | . . . | Alternative energy for fieldbus devices   |
| G05B 2219/25283 | . . . | Evaluate available energy prior to wireless transmitter-receiver activation       |
| G05B 2219/25284 | . . . | Standby only for memory, prom   |
| G05B 2219/25285 | . . . | Standby only for real time clock  |
| G05B 2219/25286 | . . . | Switch on power, awake controlled machine from standby if command signal          |
| G05B 2219/25287 | . . . | Power for display leds I-O only when case is open                                 |
| G05B 2219/25288 | . . . | Detector to standby state if signal below certain level                           |
| G05B 2219/25289 | . . . | Energy saving, brown out, standby, sleep, powerdown modus for microcomputer       |
| G05B 2219/25291 | . . . | Set module, component to sleep if no event or no other module needs it            |
| G05B 2219/25292 | . . . | Standby for display, switch on if operator wants to use it                        |
| G05B 2219/25293 | . . . | Identify control parameters for several workpieces, control, both in parallel     |
| G05B 2219/25294 | . . . | Part, workpiece, code, tool identification  |
| G05B 2219/25295 | . . . | Identification has information on relationship with other controllers             |
| G05B 2219/25296 | . . . | Identification module, type connected I-O, device                                 |
| G05B 2219/25297 | . . . | Identify controlled element, valve, and read characteristics                      |
| G05B 2219/25298 | . . . | System identification   |
| G05B 2219/25299 | . . . | Address memory with variable frequency  |
| G05B 2219/25301 | . . . | Expansion of system, memory   |
| G05B 2219/25302 | . . . | Program and data in separate memory   |
| G05B 2219/25303 | . . . | Decode processor status bits to switch, select between memories                   |
| G05B 2219/25304 | . . . | Memory subdivided in separate blocks, high, low addressable with same address     |
| G05B 2219/25305 | . . . | MMA, memory management, set ram and eprom part for flash memory, store state also |
| G05B 2219/25306 | . . . | Modules with hardwired logic  |

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| G05B 2219/25307 | . . . | Each module has file with all components in module and the available components  |
| G05B 2219/25308 | . . . | Ecu, standard processor connects to asic connected to specific application       |
| G05B 2219/25309 | . . . | Module in ring for power supply and ring for command signals                     |
| G05B 2219/25311 | . . . | Each module near controlled machine  |
| G05B 2219/25312 | . . . | Pneumatic, hydraulic modules, controlled valves                                  |
| G05B 2219/25313 | . . . | Clamp module on controlled system by magnet                                      |
| G05B 2219/25314 | . . . | Modular structure, modules   |
| G05B 2219/25315 | . . . | Module, sequence from module to module, structure                                |
| G05B 2219/25316 | . . . | Control unit and actuator in one unit, module                                    |
| G05B 2219/25317 | . . . | Control unit, sensor and actuator in one unit, module                            |
| G05B 2219/25318 | . . . | Power supply module in common for all modules                                    |
| G05B 2219/25319 | . . . | Standard connector between modules   |
| G05B 2219/25321 | . . . | Connection modules by flexible printed circuit, printed cable, multiway, ribbon  |
| G05B 2219/25322 | . . . | Stackthrough modules, modules are stacked, no need for backplane                 |
| G05B 2219/25323 | . . . | Intelligent modules  |
| G05B 2219/25324 | . . . | Modules connected to serial bus  |
| G05B 2219/25325 | . . . | Each connected module has own power supply                                       |
| G05B 2219/25326 | . . . | Module with low maintenance connected to removable module with high maintenance  |
| G05B 2219/25327 | . . . | Single channel module  |
| G05B 2219/25328 | . . . | Module connected to parallel bus   |
| G05B 2219/25329 | . . . | Each module, segment has only either a sensor or an actuator                     |
| G05B 2219/25331 | . . . | Module connected to canbus and to controlled device                              |
| G05B 2219/25332 | . . . | Module capability concerns allowable I-O and required sequence of operations     |
| G05B 2219/25333 | . . . | Modules on bus and direct connection between them for additional logic functions |
| G05B 2219/25334 | . . . | Each module contains several channels, each with an input and an output          |
| G05B 2219/25335 | . . . | Each module has connections to actuator, sensor and to a fieldbus for expansion  |
| G05B 2219/25336 | . . . | Cascaded modules, one module connects to other, I-O, computing expansion         |
| G05B 2219/25337 | . . . | Sbc single board computer, stand alone   |
| G05B 2219/25338 | . . . | Microprocessor   |
| G05B 2219/25339 | . . . | Supervisory plus control computer  |
| G05B 2219/25341 | . . . | Single chip programmable controller  |
| G05B 2219/25342 | . . . | Real time controller   |
| G05B 2219/25343 | . . . | Real time multitasking   |

- G05B 2219/25344 . . . In one cycle, application task is executed, if time is left, communication or user interface task is executed
- G05B 2219/25345 . . . Linux, preemption, low-latency patches for real time linux
- G05B 2219/25346 . . . Several operating systems in one device
- G05B 2219/25347 . . . Multitasking machine control
- G05B 2219/25348 . . . Windows expansion for real time control under windows
- G05B 2219/25349 . . . Operating system, Microsoft Windows
- G05B 2219/25351 . . . MSDOS
- G05B 2219/25352 . . . Preemptive for critical tasks combined with non preemptive, selected by attribute
- G05B 2219/25353 . . . Inductive coupling of power, transformer
- G05B 2219/25354 . . . Power or secondary control signal derived from received signal
- G05B 2219/25355 . . . Motor winding used as power transformator
- G05B 2219/25356 . . . Inductive coupling of power and signal
- G05B 2219/25357 . . . Regulation of energy coupling
- G05B 2219/25358 . . . During detection of input, switch over to dc power
- G05B 2219/25359 . . . Special power supply
- G05B 2219/25361 . . . DC-DC convertor on board
- G05B 2219/25362 . . . UPS, no break
- G05B 2219/25363 . . . Dual power supply, for digital circuit and for analog signals
- G05B 2219/25364 . . . For each module a powersupply
- G05B 2219/25365 . . . Initialize parameters
- G05B 2219/25366 . . . Detect code, kind connected machine, device before execution of program
- G05B 2219/25367 . . . Control of periodic, synchronous and asynchronous, event driven tasks together
- G05B 2219/25368 . . . Start group of motors, machines in sequence, power up, down sequence
- G05B 2219/25369 . . . Control of states, real time
- G05B 2219/25371 . . . Recharge apparatus with material, only when needed or during specific time
- G05B 2219/25372 . . . Sequence command, next step if reference equals ramp signal level
- G05B 2219/25373 . . . Detection position of program drum
- G05B 2219/25374 . . . Home selection
- G05B 2219/25375 . . . If error, execute subroutine for alternative command, no shut down
- G05B 2219/25376 . . . Repeat part of program, kind of subroutine
- G05B 2219/25377 . . . New sequence as function of deviation from predicted result, state
- G05B 2219/25378 . . . Stop machine after execution of some instructions on tape, marked by code
- G05B 2219/25379 . . . Operation on rotating table provided with a plurality of cases
- G05B 2219/25381 . . . Restart program at predetermined position, crash recovery after power loss
- G05B 2219/25382 . . . Skip sequences

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| G05B 2219/25383 | . . . | Jump  |
| G05B 2219/25384 | . . . | Analog I-O to microprocessor to set switch moment for next step                 |
| G05B 2219/25385 | . . . | Control speed of conveyor as function of missing objects, to speed up           |
| G05B 2219/25386 | . . . | Program execution as function of direction, forward or backward                 |
| G05B 2219/25387 | . . . | Control sequences so as to optimize energy use by controlled machine            |
| G05B 2219/25388 | . . . | Race conditions   |
| G05B 2219/25389 | . . . | Macro's, subroutines  |
| G05B 2219/25391 | . . . | Start, stop sequence of different parts of machine, copier, textile, glass      |
| G05B 2219/25392 | . . . | Convert control signal to deliver pulse modified in time and width              |
| G05B 2219/25393 | . . . | Speed, delay, stand still of record carrier controlled, more commands possible  |
| G05B 2219/25394 | . . . | Execute next step on feedback of result of previous step                        |
| G05B 2219/25395 | . . . | Clock dependant, select next cyclus, step as function of parameter              |
| G05B 2219/25396 | . . . | Add pulses or stop pulses as function of changing clock, speed to compensate    |
| G05B 2219/25397 | . . . | Compare real date with programmed date, if equal execute next command           |
| G05B 2219/25398 | . . . | Sampling period is a product of integer number and scheduler interrupt period   |
| G05B 2219/25399 | . . . | Variable, settable clock or cycle, phase duration                               |
| G05B 2219/25401 | . . . | Compensation of control signals as function of changing supply voltage          |
| G05B 2219/25402 | . . . | Detect occurence of signal by higher sampling when parameter value within range |
| G05B 2219/25403 | . . . | Compare real clock time with programmed time, if equal execute next command     |
| G05B 2219/25404 | . . . | Command order is delayed as function of expected and real delay                 |
| G05B 2219/25405 | . . . | Command order is delayed, corrected as function of speed                        |
| G05B 2219/25406 | . . . | Delay as function of detected characteristics of controlled element             |
| G05B 2219/25407 | . . . | Delay between operations  |
| G05B 2219/25408 | . . . | Given order is latched for a certain delay in order te execute order surely     |
| G05B 2219/25409 | . . . | Feedforward of control signal to compensate for delay in execution              |
| G05B 2219/25411 | . . . | Priority interrupt  |
| G05B 2219/25412 | . . . | Separate interrupt for, from each interface                                     |
| G05B 2219/25413 | . . . | Interrupt, event, state change triggered  |
| G05B 2219/25414 | . . . | Interrupt without saving register states  |
| G05B 2219/25415 | . . . | Between processors using a single line and a switch                             |
| G05B 2219/25416 | . . . | Interrupt   |
| G05B 2219/25417 | . . . | Identify capabilities necessary to produce article                              |
| G05B 2219/25418 | . . . | Enter description of capabilities of each module                                |
| G05B 2219/25419 | . . . | Scheduling  |
| G05B 2219/25421 | . . . | Using resource data relative to each component, module of control system        |



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| G05B 2219/25422 | . . . | Aperiodic scheduling, executed only on certain condition                        |
| G05B 2219/25423 | . . . | Verification of controlled value by comparing with recorded value, signature    |
| G05B 2219/25424 | . . . | Mixture of wall connectors, some with fixed address others no address           |
| G05B 2219/25425 | . . . | Personal computer   |
| G05B 2219/25426 | . . . | Microcontroller in smart card directly controls machine, runs control program   |
| G05B 2219/25427 | . . . | Controller inside socket, wall connector, distributor, junction box             |
| G05B 2219/25428 | . . . | Field device  |
| G05B 2219/25429 | . . . | Microprocessor mounted near controlled machine, cheaper line connection         |
| G05B 2219/25431 | . . . | Dual Port memory  |
| G05B 2219/25432 | . . . | Multiplex   |
| G05B 2219/25433 | . . . | Dataflow processor  |
| G05B 2219/25434 | . . . | Microprocessor and control logic integrated on same circuit board               |
| G05B 2219/25435 | . . . | Multiplex for analog signals  |
| G05B 2219/25436 | . . . | Main board connected to bundle of analog input lines                            |
| G05B 2219/25437 | . . . | Main board coupled to bundle of digital and analog input lines                  |
| G05B 2219/25438 | . . . | Counter controls device, machine directly or via decoder                        |
| G05B 2219/25439 | . . . | Use of flexible printed circuit   |
| G05B 2219/25441 | . . . | Piggy back mounting   |
| G05B 2219/25442 | . . . | Europa card   |
| G05B 2219/25443 | . . . | Connect pc card to industrial bus, additional timing and adapting logic         |
| G05B 2219/25444 | . . . | Stick label over opening for card, to seal opening and indicate program status  |
| G05B 2219/25445 | . . . | Electric wiring inside pneumatic, hydraulic path                                |
| G05B 2219/25446 | . . . | Serial port has power connected to pin for external device                      |
| G05B 2219/25447 | . . . | Detachable program unit can be replaced by supplementary display                |
| G05B 2219/25448 | . . . | Control module is pluggable into wall connector                                 |
| G05B 2219/25449 | . . . | Constructive details  |
| G05B 2219/25451 | . . . | Connect module to bus using interface with adaptive logic                       |
| G05B 2219/25452 | . . . | Bootstrap logic and ram integrated in serial connector                          |
| G05B 2219/25453 | . . . | Encoder, control knob connected to same microprocessor pins as keyboard matrix  |
| G05B 2219/25454 | . . . | Retrofitting  |
| G05B 2219/25455 | . . . | Buscouple interface can be integrated in actuator                               |
| G05B 2219/25456 | . . . | Piggy back controller, old controller functions as before, new functions by new |
| G05B 2219/25457 | . . . | Replace old processor by more powerful processor on additional card             |
| G05B 2219/25458 | . . . | Opto isolation, optical separation  |
| G05B 2219/25459 | . . . | Reed relay separation   |
| G05B 2219/25461 | . . . | Transformer separation  |

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| G05B 2219/25462 | . . . | Galvanic separation, galvanic isolation  |
| G05B 2219/25463 | . . . | Optical separation for signals, transformer separation for power                       |
| G05B 2219/25464 | . . . | MBO motherboard, backplane special layout  |
| G05B 2219/25465 | . . . | Output of one module connected to input next module by lines on motherboard            |
| G05B 2219/25466 | . . . | Motherboard has data, address, power and module identification lines                   |
| G05B 2219/25467 | . . . | Detect if expansion board is connected   |
| G05B 2219/25468 | . . . | Disconnect automatically high voltage supply when taking out a module                  |
| G05B 2219/25469 | . . . | Inserting or taking out circuit boards during power on                                 |
| G05B 2219/25471 | . . . | Replace existing control system with new different system in real time                 |
| G05B 2219/25472 | . . . | Synchronise controllers, sensors, measurement with data bus                            |
| G05B 2219/25473 | . . . | Compensation variable cycle time, synchronized processes                               |
| G05B 2219/25474 | . . . | Synchronize microprocessor with process or I-O   |
| G05B 2219/25475 | . . . | Sequence synchronized with machine axis, like knitting machine                         |
| G05B 2219/25476 | . . . | Synchronous state change by clock as function of allowed states to skip certain states |
| G05B 2219/25477 | . . . | Master waits for signal from slave, slave active thereafter, during limited time       |
| G05B 2219/25478 | . . . | Synchronize several controllers using syncline   |
| G05B 2219/25479 | . . . | Synchronize controllers using messages, add transmission time afterwards               |
| G05B 2219/25481 | . . . | Broadcast to each controller an address of part of program to be used                  |
| G05B 2219/25482 | . . . | Synchronize several sequential processes, adjust                                       |
| G05B 2219/25483 | . . . | Synchronize several controllers using messages over data bus                           |
| G05B 2219/25484 | . . . | Synchronize microprocessor and connected, controlled state machine                     |
| G05B 2219/26    | . . . | Pc applications  |
| G05B 2219/2601  | . . . | Dispense machine glue, paste, flow   |
| G05B 2219/2602  | . . . | Wafer processing   |
| G05B 2219/2603  | . . . | Steering car   |
| G05B 2219/2604  | . . . | Test of external equipment   |
| G05B 2219/2605  | . . . | Wastewater treatment   |
| G05B 2219/2606  | . . . | Tape transport, take up, rewind, play  |
| G05B 2219/2607  | . . . | Infusion controller  |
| G05B 2219/2608  | . . . | Hospital bed   |
| G05B 2219/2609  | . . . | Process control  |
| G05B 2219/2611  | . . . | Microprocessor driven caliper, to measure length distances                             |
| G05B 2219/2612  | . . . | Data acquisition interface   |
| G05B 2219/2613  | . . . | Household appliance in general   |
| G05B 2219/2614  | . . . | HVAC, heating, ventilation, climate control  |
| G05B 2219/2615  | . . . | Audio, video, tv, consumer electronics device  |
| G05B 2219/2616  | . . . | Earth moving, work machine   |

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| G05B 2219/2617 | . . . | Eye, ophthalmic, surgery system                                   |
| G05B 2219/2618 | . . . | Lubrication, greasing   |
| G05B 2219/2619 | . . . | Wind turbines   |
| G05B 2219/2621 | . . . | Conveyor, transfert line  |
| G05B 2219/2622 | . . . | Press   |
| G05B 2219/2623 | . . . | Combustion motor  |
| G05B 2219/2624 | . . . | Injection molding   |
| G05B 2219/2625 | . . . | Sprinkler, irrigation, watering                                   |
| G05B 2219/2626 | . . . | Sewing  |
| G05B 2219/2627 | . . . | Grinding machine  |
| G05B 2219/2628 | . . . | Door, window  |
| G05B 2219/2629 | . . . | Assembly line   |
| G05B 2219/2631 | . . . | Blasting, explosion   |
| G05B 2219/2632 | . . . | Hemodialysis  |
| G05B 2219/2633 | . . . | Washing, laundry  |
| G05B 2219/2634 | . . . | Loom, weaving   |
| G05B 2219/2635 | . . . | Glass forming   |
| G05B 2219/2636 | . . . | Reproduction, image copying machine                               |
| G05B 2219/2637 | . . . | Vehicle, car, auto, wheelchair                                    |
| G05B 2219/2638 | . . . | Airconditioning   |
| G05B 2219/2639 | . . . | Energy management, use maximum of cheap power, keep peak load low |
| G05B 2219/2641 | . . . | Fork lift, material handling vehicle                              |
| G05B 2219/2642 | . . . | Domotique, domestic, home control, automation, smart house        |
| G05B 2219/2643 | . . . | Oven, cooking   |
| G05B 2219/2644 | . . . | Sterilizer  |
| G05B 2219/2645 | . . . | Vending, distribute drinks  |
| G05B 2219/2646 | . . . | Printing  |
| G05B 2219/2647 | . . . | Dentist   |
| G05B 2219/2648 | . . . | Central heating   |
| G05B 2219/2649 | . . . | Burner  |
| G05B 2219/2651 | . . . | Camera, photo   |
| G05B 2219/2652 | . . . | Medical scanner   |
| G05B 2219/2653 | . . . | Roller blind, shutter, sunshade                                   |
| G05B 2219/2654 | . . . | Fridge, refrigerator  |
| G05B 2219/2655 | . . . | Cd player   |
| G05B 2219/2656 | . . . | Instrumentation   |
| G05B 2219/2657 | . . . | Blood, urine analyzer   |
| G05B 2219/2658 | . . . | Heath pump  |
| G05B 2219/2659 | . . . | Elevator  |
| G05B 2219/2661 | . . . | Milking robot   |

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| G05B 2219/2662  | . . . | Photocopier   |
| G05B 2219/2663  | . . . | Tractor   |
| G05B 2219/2664  | . . . | Audio light, animation, stage, theatre light  |
| G05B 2219/2665  | . . . | Detonator, fuze   |
| G05B 2219/2666  | . . . | Toy   |
| G05B 2219/2667  | . . . | Crane   |
| G05B 2219/2668  | . . . | Fuel cells  |
| G05B 2219/2669  | . . . | Handling batches  |
| G05B 2219/2671  | . . . | Mail processing system  |
| G05B 2219/30    | . . . | Nc systems  |
| G05B 2219/31    | . . . | From computer integrated manufacturing till monitoring                                |
| G05B 2219/31001 | . . . | CIM, total factory control  |
| G05B 2219/31002 | . . . | Computer controlled agv conveys workpieces between buffer and cell                    |
| G05B 2219/31003 | . . . | Supervise route, reserve route and allocate route to vehicle, avoid collision         |
| G05B 2219/31004 | . . . | Move vehicle to battery charge or maintenance area                                    |
| G05B 2219/31005 | . . . | Detect obstacles on path of vehicle   |
| G05B 2219/31006 | . . . | Monitoring of vehicle   |
| G05B 2219/31007 | . . . | Floor plan, map stored in on-board computer of vehicle                                |
| G05B 2219/31008 | . . . | Cooperation mobile robots, carrying common pallet, object or pushing together         |
| G05B 2219/31009 | . . . | Connector between AGV and station   |
| G05B 2219/31011 | . . . | Communication network identical to transport network                                  |
| G05B 2219/31012 | . . . | Optimize number of vehicles   |
| G05B 2219/31013 | . . . | Second AGV with wafers already underway before processing first finished              |
| G05B 2219/31014 | . . . | Synchronization between AGV movement and workpiece treatment chambers                 |
| G05B 2219/31015 | . . . | Host, model group and workstation computer deliver each proper control data           |
| G05B 2219/31016 | . . . | General NC system executes tasks not present in specialised machine tools             |
| G05B 2219/31017 | . . . | Architecture, host controls several CNC, each acting as a server to a pmc             |
| G05B 2219/31018 | . . . | Virtual factory, modules in network, can be selected and combined at will             |
| G05B 2219/31019 | . . . | Each station along transferline is independent  |
| G05B 2219/31021 | . . . | Between lan and machine, communication adapter which serves also sensors              |
| G05B 2219/31022 | . . . | Planner and coordinator, decision and direct control level                            |
| G05B 2219/31023 | . . . | Master production scheduler and microprocessor and schedule analysis and shop control |
| G05B 2219/31024 | . . . | Superior controller and internal, external resources controller modules               |
| G05B 2219/31025 | . . . | PAC production activity controller  |

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| G05B 2219/31026 | . . . | Diagnostic controller coupled to field and to redundant process controllers                       |
| G05B 2219/31027 | . . . | Computer assisted manual assembly CAA, display operation, tool, result                            |
| G05B 2219/31028 | . . . | Selecting workpieces from one or more containers by robot with vision                             |
| G05B 2219/31029 | . . . | Program for assembly, show exploded article   |
| G05B 2219/31031 | . . . | Assembly, manipulator cell  |
| G05B 2219/31032 | . . . | Two workstations alternatively, one assembles, other is prepared for next                         |
| G05B 2219/31033 | . . . | Record on site dimensions of pipe, tube configuration, to install pipe                            |
| G05B 2219/31034 | . . . | Component identifier and location indicator corresponding to component                            |
| G05B 2219/31035 | . . . | Disable assembly if one of component compartments lacks   |
| G05B 2219/31036 | . . . | Load component into corresponding compartment, bin, storage before assembly                       |
| G05B 2219/31037 | . . . | Compartment, bin, storage vessel sensor to verify correct bin is loaded                           |
| G05B 2219/31038 | . . . | Watchdog, timer to alert if operator does not executes operation within time                      |
| G05B 2219/31039 | . . . | Count assembled parts, change program during assembly if number reached                           |
| G05B 2219/31041 | . . . | Machine balancing, distribute articles evenly over machines                                       |
| G05B 2219/31042 | . . . | Enter pallet configuration, geometry, number of parts   |
| G05B 2219/31043 | . . . | Bin, storage identifier and workstation identifier  |
| G05B 2219/31044 | . . . | Assembly of modular products, variant configurability   |
| G05B 2219/31045 | . . . | Show bin, compartment and number of parts to be pick up   |
| G05B 2219/31046 | . . . | Aid for assembly, show display on screen next workpiece, task, position to be assembled, executed |
| G05B 2219/31047 | . . . | Display image of finished workpiece on screen, show how, where to mount next part                 |
| G05B 2219/31048 | . . . | Project on workpiece, image of finished workpiece, info or a spot                                 |
| G05B 2219/31049 | . . . | Minimize assembly time, by grouping part types into pallet groups                                 |
| G05B 2219/31051 | . . . | Hybrid system, combine expert system with traveling salesman problem TSP                          |
| G05B 2219/31052 | . . . | Find feasible assembly sequences  |
| G05B 2219/31053 | . . . | Planning, generate assembly plans   |
| G05B 2219/31054 | . . . | Planning, layout of assembly system   |
| G05B 2219/31055 | . . . | Interpretation of assembly design data  |
| G05B 2219/31056 | . . . | Selection of assembly processes, preferred assembly sequences                                     |
| G05B 2219/31057 | . . . | Selection of assembly equipment, system   |
| G05B 2219/31058 | . . . | Determination of assembly tooling, fixture  |
| G05B 2219/31059 | . . . | Selection of inspection devices   |
| G05B 2219/31061 | . . . | Selection of assembly process parameters  |
| G05B 2219/31062 | . . . | Calculation of assembly times   |
| G05B 2219/31063 | . . . | Integrate assembly and task planning  |
| G05B 2219/31064 | . . . | Minimal precedence constraint for components, link between components                             |
| G05B 2219/31065 | . . . | Disassembly evaluation  |

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| G05B 2219/31066 | . . . | Virtual assembly disassembly planning  |
| G05B 2219/31067 | . . . | Assembly partitioning, find sub assembly removable without disturbing plan         |
| G05B 2219/31068 | . . . | Relative positioning of assembled parts with small geometric deviations            |
| G05B 2219/31069 | . . . | Cell controller, setup machine of cell during operation of other machines          |
| G05B 2219/31071 | . . . | Prevent order interference, no order to machine not setup for that order           |
| G05B 2219/31072 | . . . | Prevent batch breakup, no mix up of output of different machines                   |
| G05B 2219/31073 | . . . | Decide when to create or reconfigure a cell  |
| G05B 2219/31074 | . . . | Decide which machines are to be used in a cell                                     |
| G05B 2219/31075 | . . . | Modular cell elements  |
| G05B 2219/31076 | . . . | Controller for cell, for robot motion, for supervision                             |
| G05B 2219/31077 | . . . | Laser cutting table and handling and gripping and attachment robot and layup table |
| G05B 2219/31078 | . . . | Several machines and several buffers, storages, conveyors, robots                  |
| G05B 2219/31079 | . . . | Two workstations and two manipulators working together or independent              |
| G05B 2219/31081 | . . . | Detect position robot, agv relative to machine to start communication              |
| G05B 2219/31082 | . . . | NDDS network data delivery service, producers and consumers model                  |
| G05B 2219/31083 | . . . | In server store virtual nodes for controlled machines, with states for map         |
| G05B 2219/31084 | . . . | Part of module exchanges high level messages, other part proprietary messages      |
| G05B 2219/31085 | . . . | Application scripts; in web server, not sent to client                             |
| G05B 2219/31086 | . . . | Communication of carriage, agv data, workpiece data at each station                |
| G05B 2219/31087 | . . . | Transmission device between workcell and central control                           |
| G05B 2219/31088 | . . . | Network communication between supervisor and cell, machine group                   |
| G05B 2219/31089 | . . . | Direct communication between cooperating parts of a cell, not over server          |
| G05B 2219/31091 | . . . | One client handled by several servers  |
| G05B 2219/31092 | . . . | Network server for communication between plc's, using server                       |
| G05B 2219/31093 | . . . | Communication between sensors, actuators and gateway                               |
| G05B 2219/31094 | . . . | Data exchange between modules, cells, devices, processors                          |
| G05B 2219/31095 | . . . | Read write intelligent chip on workpiece, pallet, tool for data exchange           |
| G05B 2219/31096 | . . . | Data carrier, communication by exchange of floppy disk                             |
| G05B 2219/31097 | . . . | Display travels with workpiece, package, order, special orders can be inserted     |
| G05B 2219/31098 | . . . | Configuration editor for networking interconnection                                |
| G05B 2219/31099 | . . . | Configuration of transfer control between several subsystems                       |
| G05B 2219/31101 | . . . | Configuration file with format of relevant messages for different equipment        |
| G05B 2219/31102 | . . . | Program network controller, connected devices                                      |
| G05B 2219/31103 | . . . | Configure parameters of controlled devices   |
| G05B 2219/31104 | . . . | Remote configuration of parameters of controlled devices                           |
| G05B 2219/31105 | . . . | Remote control of network controller   |

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| G05B 2219/31106 | . . . | Auto configuration, each module responsible for own configuration                          |
| G05B 2219/31107 | . . . | Start up of object manager module  |
| G05B 2219/31108 | . . . | Can controller in full can, detects if message is for controller                           |
| G05B 2219/31109 | . . . | Can controller in basic can, microcontroller detects if message is for controller          |
| G05B 2219/31111 | . . . | Can controller and microcontroller integrated  |
| G05B 2219/31112 | . . . | Interface, SIOMS standard I-O for mechatronic systems, device drivers                      |
| G05B 2219/31113 | . . . | General, vendor independent display and control interface for sensor actuator              |
| G05B 2219/31114 | . . . | Sensor on off switch level can be set and displayed by detachable module                   |
| G05B 2219/31115 | . . . | Network controller   |
| G05B 2219/31116 | . . . | A-D interface between asi and fieldbus   |
| G05B 2219/31117 | . . . | Each node has several, three channels, for control, for data, for addressing               |
| G05B 2219/31118 | . . . | Universal interface between asi and fieldbus, for any fielddevice                          |
| G05B 2219/31119 | . . . | Fielddevice comprises also controller and pneumatic actuator and sensor                    |
| G05B 2219/31121 | . . . | Fielddevice, field controller, interface connected to fieldbus                             |
| G05B 2219/31122 | . . . | Bridge between networks  |
| G05B 2219/31123 | . . . | Multi mode network controller, monitor, control, configuration, maintenance                |
| G05B 2219/31124 | . . . | Interface between communication network and process control, store, exchange data          |
| G05B 2219/31125 | . . . | Signal, sensor adapted interfaces build into fielddevice                                   |
| G05B 2219/31126 | . . . | Transmitter coupled to fieldbus and to sensor, a-d conversion                              |
| G05B 2219/31127 | . . . | Repeater between two networks  |
| G05B 2219/31128 | . . . | No repeater, split into several analog segments and common digital, can, expansion         |
| G05B 2219/31129 | . . . | Universal interface for different fieldbus protocols                                       |
| G05B 2219/31131 | . . . | Field device with gateway functions for communication with pc and other field devices      |
| G05B 2219/31132 | . . . | FDT interfacing profibus field device drivers DTM with engineering tool                    |
| G05B 2219/31133 | . . . | Contactless connector, identify module wirelessly, short distance like less than twenty cm |
| G05B 2219/31134 | . . . | PCD profinet component description, field device description module                        |
| G05B 2219/31135 | . . . | Fieldbus   |
| G05B 2219/31136 | . . . | Name of bus, canbus, controller area network   |
| G05B 2219/31137 | . . . | Sercos serial real time communications system between servo and cpu                        |
| G05B 2219/31138 | . . . | Profibus process fieldbus  |
| G05B 2219/31139 | . . . | Lon local operating network, using neuron chip   |
| G05B 2219/31141 | . . . | Eiba european installation bus association   |
| G05B 2219/31142 | . . . | Devicenet, can based net   |



|                 |       |   |
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| G05B 2219/31143 | . . . | Sds smart distributed system, can based   |
| G05B 2219/31144 | . . . | Interbus-S  |
| G05B 2219/31145 | . . . | Ethernet  |
| G05B 2219/31146 | . . . | Bati bus, for home habitation building automation                                       |
| G05B 2219/31147 | . . . | Simatic S5-bus  |
| G05B 2219/31148 | . . . | Imbus   |
| G05B 2219/31149 | . . . | P-net   |
| G05B 2219/31151 | . . . | Lan local area network  |
| G05B 2219/31152 | . . . | Separate lan for sensors, detectors   |
| G05B 2219/31153 | . . . | Serial bus for plug in modules, each connection has own supply                          |
| G05B 2219/31154 | . . . | Actuator sensor bus, asi, intelligent actuator, motor, sensor                           |
| G05B 2219/31155 | . . . | Ringbus   |
| G05B 2219/31156 | . . . | Network structure, internet   |
| G05B 2219/31157 | . . . | Star network, hub   |
| G05B 2219/31158 | . . . | Wan wide area network   |
| G05B 2219/31159 | . . . | Intranet  |
| G05B 2219/31161 | . . . | Java programcode or simular active agents, programs, applets                            |
| G05B 2219/31162 | . . . | Wireless lan  |
| G05B 2219/31163 | . . . | Neutral bus with intelligent coupler for all kind of fieldbuses                         |
| G05B 2219/31164 | . . . | Bus for analog and digital communication  |
| G05B 2219/31165 | . . . | Control handover in wireless automation networks  |
| G05B 2219/31166 | . . . | Access data by name, object, stored in list, database                                   |
| G05B 2219/31167 | . . . | Object, data object as network variable   |
| G05B 2219/31168 | . . . | Use of node, sensor, actuator and control object  |
| G05B 2219/31169 | . . . | Object manager contains client, control and communication and start and planning server |
| G05B 2219/31171 | . . . | Each data object has corresponding identification for object manager, associative       |
| G05B 2219/31172 | . . . | All object managers use same algorithm to search server                                 |
| G05B 2219/31173 | . . . | Start different object manager as function of priority list                             |
| G05B 2219/31174 | . . . | Load, use different protocols, formats, emulators for different systems                 |
| G05B 2219/31175 | . . . | Message comprises identification of sender, receiver, command and parameter             |
| G05B 2219/31176 | . . . | Universal, same protocol to control all kind of drives, dc, ac, step motor              |
| G05B 2219/31177 | . . . | Protocol, sdhc serial data link control   |
| G05B 2219/31178 | . . . | Hdlc high level data link control   |
| G05B 2219/31179 | . . . | Master sends message with address of slave to all slaves, slave answers, interrupt      |
| G05B 2219/31181 | . . . | Controller and device have several formats and protocols, select common one             |
| G05B 2219/31182 | . . . | Address by pulse sequence, control by pulse width, module filters out own control       |

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|-----------------|-------|---|
| G05B 2219/31183 | . . . | Token ring  |
| G05B 2219/31184 | . . . | Fip fieldbus instrumentation protocol   |
| G05B 2219/31185 | . . . | Mapi message application interface for windows  |
| G05B 2219/31186 | . . . | TCP-IP internet protocol  |
| G05B 2219/31187 | . . . | Csma-cd csma-cd-w carrier sense multiple access collision detection wireless                      |
| G05B 2219/31188 | . . . | Combine csma-cd and tdm time multiplexed for rapid status exchange                                |
| G05B 2219/31189 | . . . | Time multiplex  |
| G05B 2219/31191 | . . . | Shorten header, message can be sent with less bytes, short form PDU                               |
| G05B 2219/31192 | . . . | Token passing protocol, priority token passing  |
| G05B 2219/31193 | . . . | Midi communication standard   |
| G05B 2219/31194 | . . . | Multimedia integration into fieldbus  |
| G05B 2219/31195 | . . . | WAP wireless application protocol, wireless web application                                       |
| G05B 2219/31196 | . . . | SOAP, describes available services and how to call them remotely                                  |
| G05B 2219/31197 | . . . | Near field communication nfc  |
| G05B 2219/31198 | . . . | VPN virtual private networks  |
| G05B 2219/31199 | . . . | UDP-IP  |
| G05B 2219/31201 | . . . | Frequency shift keying modulation, fsk  |
| G05B 2219/31202 | . . . | Semiconductor equipment communication standard SECS   |
| G05B 2219/31203 | . . . | Purpose, identification of messages, programs, variables  |
| G05B 2219/31204 | . . . | Blind node, executes control, data acquisition without having operator interfaces                 |
| G05B 2219/31205 | . . . | Remote transmission of measured values from site, local to host                                   |
| G05B 2219/31206 | . . . | Exchange of parameters, data, programs between two station, station and central or host or remote |
| G05B 2219/31207 | . . . | Master sends global files to autonomous controllers, feedback of process status                   |
| G05B 2219/31208 | . . . | Server node to watch, store message, variable, data between lon, network                          |
| G05B 2219/31209 | . . . | Master actuator sensor interface has priority over host, build into host                          |
| G05B 2219/31211 | . . . | Communicate diagnostic data from intelligent field device controller to central                   |
| G05B 2219/31212 | . . . | Intelligent local node can handle emergency without communication over net                        |
| G05B 2219/31213 | . . . | Synchronization of servers in network   |
| G05B 2219/31214 | . . . | Discontinuous communication controlled by server  |
| G05B 2219/31215 | . . . | Upon modification of data in one database, automatic update of mirror databases                   |
| G05B 2219/31216 | . . . | Handshake between machine and agv; readiness to load, unload workpiece                            |
| G05B 2219/31217 | . . . | Merge, synchronize process data and network data for trend analysis                               |
| G05B 2219/31218 | . . . | Scheduling communication on bus   |

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| G05B 2219/31219 | . . . | Fixed deadline monotonic scheduling dm, set each message id to unique priority                   |
| G05B 2219/31221 | . . . | Non preemptive earliest deadline ed, message id contains deadline                                |
| G05B 2219/31222 | . . . | Mixed traffic scheduler, ed for high speed and dm for low speed messages                         |
| G05B 2219/31223 | . . . | Main controller with three levels of serial networks   |
| G05B 2219/31224 | . . . | Supervisor, cell controllers in parallel bus, machine controllers in serial bus                  |
| G05B 2219/31225 | . . . | System structure, plc's and pc's communicate over lan  |
| G05B 2219/31226 | . . . | Multitasking server connected to general network and to nc machines                              |
| G05B 2219/31227 | . . . | External network for proces data, internal network for transport, handling only                  |
| G05B 2219/31228 | . . . | Host, gateways and parallel backbone, multiprocessor computer node, fieldbus                     |
| G05B 2219/31229 | . . . | Supervisor, master, workstation controller, automation, machine control                          |
| G05B 2219/31231 | . . . | Lan and stations and fieldbus, each station controls own I-O                                     |
| G05B 2219/31232 | . . . | Lan and station, each station has plc controlling own I-O over bus                               |
| G05B 2219/31233 | . . . | Map network and server in node and server controlled ethernet with machine nodes                 |
| G05B 2219/31234 | . . . | Host, router and backplane bus, communication with host or backplane                             |
| G05B 2219/31235 | . . . | St network, each module of first controls second similar network etc., tree                      |
| G05B 2219/31236 | . . . | Plc exclusive network connected to map   |
| G05B 2219/31237 | . . . | Host and rs232, rs485 to network controller and rs232 to controlled devices                      |
| G05B 2219/31238 | . . . | First network connected by repeater to second, second connected by repeater to third             |
| G05B 2219/31239 | . . . | Cache for server to fast support client  |
| G05B 2219/31241 | . . . | Remote control by a proxy or echo server, internet - intranet                                    |
| G05B 2219/31242 | . . . | Device priority levels on same bus, net, devices processes data of exactly lower priority device |
| G05B 2219/31243 | . . . | Add serial number to message from station to check missing messages in host                      |
| G05B 2219/31244 | . . . | Safety, reconnect network automatically if broken  |
| G05B 2219/31245 | . . . | Redundant bus, interbus, with two masters  |
| G05B 2219/31246 | . . . | Firewall   |
| G05B 2219/31247 | . . . | Reconnect network if connection was broken   |
| G05B 2219/31248 | . . . | Multiple data link layer masters, if one fails, other takes over                                 |
| G05B 2219/31249 | . . . | Display name of communication line and number of errors detected and corrected                   |
| G05B 2219/31251 | . . . | Redundant access, wireless and hardware access to fielddevices                                   |
| G05B 2219/31252 | . . . | Watchdog, client sends regulary message to server, server must answer                            |
| G05B 2219/31253 | . . . | Redundant object manager   |
| G05B 2219/31254 | . . . | Request from client waits until corresponding server functions again                             |

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| G05B 2219/31255 | . . . | Verify communication parameters, if wrong, refuse communication                            |
| G05B 2219/31256 | . . . | Object managers arranged in logical ring for monitoring purposes                           |
| G05B 2219/31257 | . . . | Redundant wireless links   |
| G05B 2219/31258 | . . . | Compensate control in case of missing message  |
| G05B 2219/31259 | . . . | Communication inhibited during certain process steps                                       |
| G05B 2219/31261 | . . . | Coordination control   |
| G05B 2219/31262 | . . . | Dcca dynamic coordinated concurrent activities   |
| G05B 2219/31263 | . . . | Imbedded learning for planner, executor, monitor, controller and evaluator                 |
| G05B 2219/31264 | . . . | Control, autonomous self learn knowledge, rearrange task, reallocate resources             |
| G05B 2219/31265 | . . . | Control process by combining history and real time data                                    |
| G05B 2219/31266 | . . . | Convey, transport tool to workcenter, central tool storage                                 |
| G05B 2219/31267 | . . . | Central tool storage, convey a whole tool drum, magazine to workcenter                     |
| G05B 2219/31268 | . . . | Central workpiece storage, convey workpiece, work pallet, holder to workcell               |
| G05B 2219/31269 | . . . | Convey tool and workpiece to workcenter  |
| G05B 2219/31271 | . . . | Priority workpiece pallet selected instead of routine workpiece pallet                     |
| G05B 2219/31272 | . . . | Avoid piling up, queue of workpieces, accomodate surges                                    |
| G05B 2219/31273 | . . . | Buffer conveyor along main conveyor  |
| G05B 2219/31274 | . . . | Convey products, move equipment according to production plan in memory                     |
| G05B 2219/31275 | . . . | Vehicle to convey workpieces is manually operable  |
| G05B 2219/31276 | . . . | Transport a lot to stations, each with different types of manufacturing equipment          |
| G05B 2219/31277 | . . . | Dispatching rules, shortest travel time or bidding based to reduce empty travel            |
| G05B 2219/31278 | . . . | Store optimum number of workpiece, between max min, in bins, compartment, save travel time |
| G05B 2219/31279 | . . . | Prevent introduction of two pallets in same cell   |
| G05B 2219/31281 | . . . | Calculate optimum path for conveying workpieces  |
| G05B 2219/31282 | . . . | Data acquisition, BDE MDE  |
| G05B 2219/31283 | . . . | Communication memory, storage, ram, eprom on workpiece or pallet                           |
| G05B 2219/31284 | . . . | Set begin and end of collection time for concerned machines, parameters                    |
| G05B 2219/31285 | . . . | Send required data to computer as function of specified condition                          |
| G05B 2219/31286 | . . . | Detect position of articles and equipment by receivers, identify objects by code           |
| G05B 2219/31287 | . . . | Indicate output for data, screen or printer or database                                    |
| G05B 2219/31288 | . . . | Archive collected data into history file   |
| G05B 2219/31289 | . . . | Read card with operator and another card with process, product, work order info            |
| G05B 2219/31291 | . . . | Store value detected signal and machine name and name of part of machine, mask             |

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| G05B 2219/31292 | . . . | Data in categories, each with a priority factor  |
| G05B 2219/31293 | . . . | Enter size measurements, store in data base, analyze and identify in size data group                 |
| G05B 2219/31294 | . . . | Compare measurements from sensors to detect defective sensors  |
| G05B 2219/31295 | . . . | Use integrated controller, processor during product, car assembly for ide, display, test             |
| G05B 2219/31296 | . . . | Identification, pallet object data and program code for station                                      |
| G05B 2219/31297 | . . . | Read only that ide information which is needed for specific operation                                |
| G05B 2219/31298 | . . . | Store on actual pallets also id of several other upstream, following pallets                         |
| G05B 2219/31299 | . . . | If workpiece rejected, write in id and erase operation code  |
| G05B 2219/31301 | . . . | Restore lost id by using entry number of preceding, following pallet                                 |
| G05B 2219/31302 | . . . | Verify id data and reread, rewrite or alarm on fault   |
| G05B 2219/31303 | . . . | If workpiece transferred to other pallet, transfer also id   |
| G05B 2219/31304 | . . . | Identification of workpiece and data for control, inspection, safety, calibration                    |
| G05B 2219/31305 | . . . | Robot arm identifies object during movement  |
| G05B 2219/31306 | . . . | Read identification only if object is present  |
| G05B 2219/31307 | . . . | Identification structure is partly a copy of operating structure                                     |
| G05B 2219/31308 | . . . | Capture image asynchronously with processing of analysis, identification                             |
| G05B 2219/31309 | . . . | Identification workpiece and time limit for processing of workpiece                                  |
| G05B 2219/31311 | . . . | Data are id, destination, number of pieces, alternative destination, process data                    |
| G05B 2219/31312 | . . . | Identify pallet, bag, box code   |
| G05B 2219/31313 | . . . | Measure weight, dimension and contents of box, tray  |
| G05B 2219/31314 | . . . | Store in workpiece detected defects  |
| G05B 2219/31315 | . . . | Use of data by host, send work order to operator after pallet detection                              |
| G05B 2219/31316 | . . . | Output test result report after testing, inspection  |
| G05B 2219/31317 | . . . | Outputs delivery ordersheet, relating to finished products, to packing cell                          |
| G05B 2219/31318 | . . . | Data analysis, using different formats like table, chart   |
| G05B 2219/31319 | . . . | Use data groups as inventory control value, adapt inventory need to new data                         |
| G05B 2219/31321 | . . . | Print, output finished product documentation, manual using id of all workpieces assembled, processed |
| G05B 2219/31322 | . . . | Work still to be done on workpiece   |
| G05B 2219/31323 | . . . | Database for CIM   |
| G05B 2219/31324 | . . . | Distributed real time knowledge, database  |
| G05B 2219/31325 | . . . | Machine selection support, use of database   |
| G05B 2219/31326 | . . . | Database to manage communication networks  |
| G05B 2219/31327 | . . . | Directory service for database   |
| G05B 2219/31328 | . . . | Objects report their location to directory service   |
| G05B 2219/31329 | . . . | Distributed, among several servers, directory service  |
| G05B 2219/31331 | . . . | Select manufacturing information by entering product number  |

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| G05B 2219/31332 | . . . | Back order management with back order, part maker delivery, production databases |
| G05B 2219/31333 | . . . | Database to backup and restore factory controllers                               |
| G05B 2219/31334 | . . . | Database with devices, configuration, of plant                                   |
| G05B 2219/31335 | . . . | Database of address of devices registers in different networks, mapping          |
| G05B 2219/31336 | . . . | Store machines performance; use it to control future machining                   |
| G05B 2219/31337 | . . . | Failure information database   |
| G05B 2219/31338 | . . . | Design, flexible manufacturing cell design                                       |
| G05B 2219/31339 | . . . | From parameters, build processes, select control elements and their connection   |
| G05B 2219/31341 | . . . | Design of factory information system   |
| G05B 2219/31342 | . . . | Design of process control system   |
| G05B 2219/31343 | . . . | Design of factory, manufacturing system control                                  |
| G05B 2219/31344 | . . . | Element, file server   |
| G05B 2219/31345 | . . . | Map backbone bus   |
| G05B 2219/31346 | . . . | Network manager  |
| G05B 2219/31347 | . . . | Communication adaptors between network and each machine                          |
| G05B 2219/31348 | . . . | Gateway  |
| G05B 2219/31349 | . . . | Server node as operator panel, with display for lon                              |
| G05B 2219/31351 | . . . | Expert system to select best suited machining centre                             |
| G05B 2219/31352 | . . . | Expert system integrates knowledges to control workshop                          |
| G05B 2219/31353 | . . . | Expert system to design cellular manufacturing systems                           |
| G05B 2219/31354 | . . . | Hybrid expert, knowledge based system combined with ann                          |
| G05B 2219/31355 | . . . | Fault, if one station defect, stop it, other stations take over                  |
| G05B 2219/31356 | . . . | Automatic fault detection and isolation  |
| G05B 2219/31357 | . . . | Observer based fault detection, use model  |
| G05B 2219/31358 | . . . | Markov model   |
| G05B 2219/31359 | . . . | Object oriented model for fault, quality control                                 |
| G05B 2219/31361 | . . . | Verify if right controllers are connected to carrier, conveyor controller        |
| G05B 2219/31362 | . . . | Verify correct configuration of system   |
| G05B 2219/31363 | . . . | Action, if one station defect, execute special program for other stations        |
| G05B 2219/31364 | . . . | If one station defect, return other stations to original programmed modes        |
| G05B 2219/31365 | . . . | Send message to most appropriate operator as function of kind of error           |
| G05B 2219/31366 | . . . | Operate faulty tool in degraded mode   |
| G05B 2219/31367 | . . . | MMS manufacturing message specification, rs511, iso9506                          |
| G05B 2219/31368 | . . . | MAP manufacturing automation protocol  |
| G05B 2219/31369 | . . . | Translation, conversion of protocol between two layers, networks                 |
| G05B 2219/31371 | . . . | VMD virtual manufacturing device for robot task control, cell                    |
| G05B 2219/31372 | . . . | Mes manufacturing execution system   |
| G05B 2219/31373 | . . . | Vou virtual operative organisational unit, extension of vmd                      |



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| G05B 2219/31374 | . | . | . | FAL fieldbus application layer, application service elements use and application relations are |
| G05B 2219/31375 | . | . | . | LAS link active scheduler, distribute bandwidth between processing nodes                       |
| G05B 2219/31376 | . | . | . | MFL material flow  |
| G05B 2219/31377 | . | . | . | From stored machine groups and relation machine workpiece, send workpiece to idle              |
| G05B 2219/31378 | . | . | . | Queue control  |
| G05B 2219/31379 | . | . | . | Master monitors controllers, updates production progress, allocates resources                  |
| G05B 2219/31381 | . | . | . | Matrix cluster, machines in cell according to parts, row is part, column is machines           |
| G05B 2219/31382 | . | . | . | Find shortest way, route   |
| G05B 2219/31383 | . | . | . | Compare ratio of running work with optimum, decrease number of idle machines                   |
| G05B 2219/31384 | . | . | . | Produce construction sequence, make parts, store, assemble equipment, ship                     |
| G05B 2219/31385 | . | . | . | Determine rate of MFL out of each process within each workstation                              |
| G05B 2219/31386 | . | . | . | Determine size of batch of material for each process to meet mfl rate                          |
| G05B 2219/31387 | . | . | . | If resources, material, pieces under tolerance level, renew them until upper level             |
| G05B 2219/31388 | . | . | . | Just in time JIT, kanban is box to control flow of workpiece                                   |
| G05B 2219/31389 | . | . | . | Pull type, client order decides manufacturing  |
| G05B 2219/31391 | . | . | . | Administration tasks and factory control tasks   |
| G05B 2219/31392 | . | . | . | Lims laboratory information and management system  |
| G05B 2219/31393 | . | . | . | Object oriented engineering data management  |
| G05B 2219/31394 | . | . | . | Field management, low level, instruments and controllers acting in real time                   |
| G05B 2219/31395 | . | . | . | Process management, specification, process and production data, middle level                   |
| G05B 2219/31396 | . | . | . | Business management, production, document, asset, regulatory management, high level            |
| G05B 2219/31397 | . | . | . | Instrument information management, subset of process management                                |
| G05B 2219/31398 | . | . | . | Simultaneous, concurrent engineering   |
| G05B 2219/31399 | . | . | . | Station corrects nc program, sends back modified program to program generator                  |
| G05B 2219/31401 | . | . | . | Keep notebook for keeping track of process, can be executed to make product                    |
| G05B 2219/31402 | . | . | . | Keep log book, for activities of a station, equipment  |
| G05B 2219/31403 | . | . | . | EDI electronic data exchange   |
| G05B 2219/31404 | . | . | . | Computer assisted complaint management, customer complaint                                     |
| G05B 2219/31405 | . | . | . | EDM electronic data management   |
| G05B 2219/31406 | . | . | . | Data management, shop management, memory management  |
| G05B 2219/31407 | . | . | . | Machining, work, process finish time estimation, calculation                                   |



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| G05B 2219/31408 | . . . | Cost calculation of use of certain machine types                                      |
| G05B 2219/31409 | . . . | Calculation approach time   |
| G05B 2219/31411 | . . . | Down time, loss time estimation, calculation  |
| G05B 2219/31412 | . . . | Calculate machining time, update as function of load, speed                           |
| G05B 2219/31413 | . . . | Estimate capacity of plant  |
| G05B 2219/31414 | . . . | Calculate amount of production energy, waste and toxic release                        |
| G05B 2219/31415 | . . . | Cost calculation in real time for a product manufactured                              |
| G05B 2219/31416 | . . . | Calculate effect of different actuators on optimal path sequence                      |
| G05B 2219/31417 | . . . | Calculate capacity by back propagating capacity, constraint from last to first module |
| G05B 2219/31418 | . . . | NC program management, support, storage, distribution, version, update                |
| G05B 2219/31419 | . . . | Select file from a list, directory  |
| G05B 2219/31421 | . . . | File with parameters for station and identification of station                        |
| G05B 2219/31422 | . . . | Upload, download programs, parameters from, to station to, from server                |
| G05B 2219/31423 | . . . | After cap, send resulting programs to different nc machines                           |
| G05B 2219/31424 | . . . | Print label of finished part, with info, history, attach to part, docket              |
| G05B 2219/31425 | . . . | Plan availability of operator for cell as function of time and operation calendar     |
| G05B 2219/31426 | . . . | Real time database management for production control                                  |
| G05B 2219/31427 | . . . | Production, CAPM computer aided production management                                 |
| G05B 2219/31428 | . . . | Production management for lot production and for individual components of lot         |
| G05B 2219/31429 | . . . | Predict end of job execution, schedule new job beforehand                             |
| G05B 2219/31431 | . . . | Identify and classify excess raw material; reuse                                      |
| G05B 2219/31432 | . . . | Keep track of conveyed workpiece, batch, tool, conditions of stations, cells          |
| G05B 2219/31433 | . . . | Diagnostic unit per zone of manufacturing   |
| G05B 2219/31434 | . . . | Zone supervisor, collects error signals from, and diagnoses different zone            |
| G05B 2219/31435 | . . . | Paging support with display board, status monitoring and report compiling             |
| G05B 2219/31436 | . . . | Host monitors plc, control processor without interrupting its program                 |
| G05B 2219/31437 | . . . | Monitoring, global and local alarms   |
| G05B 2219/31438 | . . . | Priority, queue of alarms   |
| G05B 2219/31439 | . . . | Alarms can be warning, alert or fault   |
| G05B 2219/31441 | . . . | Simocode, overload protection, detection of trips, life time connected to fieldbus    |
| G05B 2219/31442 | . . . | Detect if operation on object has been executed correctly in each station             |
| G05B 2219/31443 | . . . | Keep track of nc program, recipe program  |
| G05B 2219/31444 | . . . | Compare actual manufacturing sequence with simulated sequence, correct actual         |
| G05B 2219/31445 | . . . | Detect changed working conditions, to correct machine load, balance                   |
| G05B 2219/31446 | . . . | Detect if workpiece, object present   |

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| G05B 2219/31447 | . . . | Process error event detection and continuous process image detection, storage        |
| G05B 2219/31448 | . . . | Display at central computer, slave displays for each machine unit                    |
| G05B 2219/31449 | . . . | Monitor workflow, to optimize business, industrial processes                         |
| G05B 2219/31451 | . . . | Petrinet for monitoring process  |
| G05B 2219/31452 | . . . | Send a warning message before that an event has to be monitored                      |
| G05B 2219/31453 | . . . | Repeat sending warnings to operator until certain event is monitored                 |
| G05B 2219/31454 | . . . | Keep track of vehicles   |
| G05B 2219/31455 | . . . | Monitor process status   |
| G05B 2219/31456 | . . . | Product progress, taking into account products on vehicle                            |
| G05B 2219/31457 | . . . | Factory remote control, monitoring through internet                                  |
| G05B 2219/31458 | . . . | Test workpiece during transport  |
| G05B 2219/31459 | . . . | Library with metrology plan for different type of workpieces                         |
| G05B 2219/31461 | . . . | Use risk analysis to identify process parts that should be specially monitored       |
| G05B 2219/31462 | . . . | Add time stamp to alarm message  |
| G05B 2219/31463 | . . . | Status of whole system calculated from status of its components                      |
| G05B 2219/31464 | . . . | Select between different models corresponding to diff process control configurations |
| G05B 2219/31465 | . . . | Determine which variables of the system to be monitored                              |
| G05B 2219/31466 | . . . | Display position of different workpieces, tools in system                            |
| G05B 2219/31467 | . . . | Display of operating conditions of machines, workcells, selected programs            |
| G05B 2219/31468 | . . . | Display jig, pallet number, status and clamp jig number                              |
| G05B 2219/31469 | . . . | Graphical display of process as function of detected alarm signals                   |
| G05B 2219/31471 | . . . | Operator can select a graphical screen at his will as help diagnostic                |
| G05B 2219/31472 | . . . | Graphical display of process   |
| G05B 2219/31473 | . . . | Fisheye view, sharp detailed view of main subject, rest much smaller, navigate       |
| G05B 2219/31474 | . . . | Icon display for quick access of detailed information                                |
| G05B 2219/31475 | . . . | Zoom or pan display for flexible access to information                               |
| G05B 2219/31476 | . . . | Display of several transactions, sub-displays for other transactions                 |
| G05B 2219/31477 | . . . | Display correlated data so as to represent the degree of correlation                 |
| G05B 2219/31478 | . . . | Display all processes together or select only one                                    |
| G05B 2219/31479 | . . . | Operator select part of process he wants to see, video image is displayed            |
| G05B 2219/31481 | . . . | Safety monitoring system, redundant display, print systems for process data          |
| G05B 2219/31482 | . . . | Verify working state of printers, displays, switch over if defect                    |
| G05B 2219/31483 | . . . | Verify monitored data if valid or not by comparing with reference value              |
| G05B 2219/31484 | . . . | Operator confirms data if verified data is correct, otherwise amends data            |
| G05B 2219/31485 | . . . | Verify and update all related data in relational database                            |
| G05B 2219/32    | . .   | Operator till task planning  |

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| G05B 2219/32001 | . . . | Computer assisted machining, signals guide operator to manual machine object   |
| G05B 2219/32002 | . . . | Operator interface, manual control at cell, if host fails or priority  |
| G05B 2219/32003 | . . . | Manual control at central control to control workcell, select pallet   |
| G05B 2219/32004 | . . . | Graphical, textual instructions, sheet for operator to resume process  |
| G05B 2219/32005 | . . . | Graphical, text operator instructions synchronous with product distribution  |
| G05B 2219/32006 | . . . | Operator addresses machines to give commands or retrieve data  |
| G05B 2219/32007 | . . . | Operator is assisted by expert system for advice and delegation of tasks   |
| G05B 2219/32008 | . . . | Operator changes schedule, workload in allowed range by graphical interface  |
| G05B 2219/32009 | . . . | Optimal task allocation between operator and machine   |
| G05B 2219/32011 | . . . | Operator adapts manufacturing as function of sensed values   |
| G05B 2219/32012 | . . . | Operator must signify his continued attendance at the workstation  |
| G05B 2219/32013 | . . . | Operator marks processes, scheduler detects marks, releases control to operator  |
| G05B 2219/32014 | . . . | Augmented reality assists operator in maintenance, repair, programming, assembly, use of head mounted display with 2-D 3-D display and voice feedback, voice and gesture command |
| G05B 2219/32015 | . . . | Optimize, process management, optimize production line   |
| G05B 2219/32016 | . . . | Minimize setup time of machines  |
| G05B 2219/32017 | . . . | Adapt real process as function of changing simulation model, changing for better results   |
| G05B 2219/32018 | . . . | Adapt process as function of results of quality measuring until maximum quality  |
| G05B 2219/32019 | . . . | Dynamic reconfiguration to maintain optimal design, fabrication, assembly  |
| G05B 2219/32021 | . . . | Energy management, balance and limit power to tools  |
| G05B 2219/32022 | . . . | Ordering, remote ordering, enter article and operations needed, create jobfile   |
| G05B 2219/32023 | . . . | Print label, instructions for operator and job code for machining parameters   |
| G05B 2219/32024 | . . . | Remote ordering, electronic selection article and fitting to form of client  |
| G05B 2219/32025 | . . . | Automatic marking of article   |
| G05B 2219/32026 | . . . | Order code follows article through all operations  |
| G05B 2219/32027 | . . . | Order, plan, execute, confirm end order, if unfeasible execute exception operation   |
| G05B 2219/32028 | . . . | Electronic catalog, to select material, resources, make lists with prices  |
| G05B 2219/32029 | . . . | Enter also delivery location, transport means, kind of truck   |
| G05B 2219/32031 | . . . | Use item and structure information   |
| G05B 2219/32032 | . . . | Salesman creates order, system answers back with price, estimated date   |
| G05B 2219/32033 | . . . | Send article design, needed material, packaging and shipping info to manufacturer  |
| G05B 2219/32034 | . . . | Electronic market, network broker  |

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| G05B 2219/32035 | . . . | Compose, configure article and order   |
| G05B 2219/32036 | . . . | Enter data, values for custom made articles  |
| G05B 2219/32037 | . . . | Order picking  |
| G05B 2219/32038 | . . . | Client can develop programs, parts on remote server located by manufacturer                |
| G05B 2219/32039 | . . . | Send also testing program  |
| G05B 2219/32041 | . . . | Combine orders from different customers  |
| G05B 2219/32042 | . . . | Halting, initiating or resuming production of a product on order                           |
| G05B 2219/32043 | . . . | Program, information flow  |
| G05B 2219/32044 | . . . | Shift workpiece and agv, carriage data in memory on advance to next station                |
| G05B 2219/32045 | . . . | Each machine knows sequence of pallets, each pallet knows sequence of operations           |
| G05B 2219/32046 | . . . | On detection workpiece code load program for workpiece from central                        |
| G05B 2219/32047 | . . . | Workcell end instruction selects next workpiece with related program                       |
| G05B 2219/32048 | . . . | Wait state between two successive machining steps  |
| G05B 2219/32049 | . . . | Store program data, manufacturing history on workpiece, shifts to next                     |
| G05B 2219/32051 | . . . | Central control, modify program slave computers as function of production demand from host |
| G05B 2219/32052 | . . . | Lookup table, identify job to be executed by master or slave                               |
| G05B 2219/32053 | . . . | Adjust work parameter as function of other cell  |
| G05B 2219/32054 | . . . | Send request for object carry out to other cell  |
| G05B 2219/32055 | . . . | Identify workpiece, read status centrally, machine, adapt status centrally                 |
| G05B 2219/32056 | . . . | Balance load of workstations by grouping tasks   |
| G05B 2219/32057 | . . . | Control cell as function of correlation between stored and detected machine state          |
| G05B 2219/32058 | . . . | Execute program as function of deviation from predicted state, result                      |
| G05B 2219/32059 | . . . | Send code, data for workpiece to each workstation to be used, update data                  |
| G05B 2219/32061 | . . . | Central controls modules grouped according to function                                     |
| G05B 2219/32062 | . . . | Set machines to new lot work, send them operation schedule, nc and handling data           |
| G05B 2219/32063 | . . . | Adapt speed of tool as function of deviation from target rate of workpieces                |
| G05B 2219/32064 | . . . | Production change over   |
| G05B 2219/32065 | . . . | Synchronise set points of processes  |
| G05B 2219/32066 | . . . | Central stores operation code in id and in concerned station                               |
| G05B 2219/32067 | . . . | Change combinations of operation codes in station, id for flexibility                      |
| G05B 2219/32068 | . . . | Execution at station only permitted if operation code of station and id equal              |
| G05B 2219/32069 | . . . | Use of multiple id to prepare program for station before pallet in station                 |
| G05B 2219/32071 | . . . | Adaptive fuzzy controller, tunes itself as function of machine parameter variation         |

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| G05B 2219/32072 | . . . | Distributed fuzzy controllers   |
| G05B 2219/32073 | . . . | If inspection needed, stop machining, execute separate inspection program     |
| G05B 2219/32074 | . . . | History of operation of each machine  |
| G05B 2219/32075 | . . . | Predict workpiece measurements from measurements of previous workpieces       |
| G05B 2219/32076 | . . . | Adjust feedback from previous processes as function of elapsed time           |
| G05B 2219/32077 | . . . | Batch control system  |
| G05B 2219/32078 | . . . | Calculate process end time, form batch of workpieces and transport to process |
| G05B 2219/32079 | . . . | Use of common resources   |
| G05B 2219/32081 | . . . | Sub batch, machine, assemble only part of the whole batch                     |
| G05B 2219/32082 | . . . | Planing, material requiring planning MRP, request                             |
| G05B 2219/32083 | . . . | Alternative, variant operation planning, revision specification of product    |
| G05B 2219/32084 | . . . | Planning of configuration of product, based on components                     |
| G05B 2219/32085 | . . . | Layout of factory, facility, cell, production system planning                 |
| G05B 2219/32086 | . . . | Integrate process planning and job shop scheduling                            |
| G05B 2219/32087 | . . . | Decentral planning, each plant involved takes part of global                  |
| G05B 2219/32088 | . . . | Master production planning, highest level                                     |
| G05B 2219/32089 | . . . | Action and material and technology combined to manufacture product            |
| G05B 2219/32091 | . . . | Algorithm, genetic algorithm, evolution strategy                              |
| G05B 2219/32092 | . . . | Heuristic algorithm, accept feasible solution and attempt to improve it       |
| G05B 2219/32093 | . . . | Search, adaptive, after each iteration some search directions are forbidden   |
| G05B 2219/32094 | . . . | Dedicated language for batch processing, enter number of workpieces           |
| G05B 2219/32095 | . . . | Text, menu driven editor for batch programming, phase sequence, parameters    |
| G05B 2219/32096 | . . . | Batch, recipe configuration for flexible batch control                        |
| G05B 2219/32097 | . . . | Recipe programming for flexible batch   |
| G05B 2219/32098 | . . . | Batch programming using oop   |
| G05B 2219/32099 | . . . | CAPP computer aided machining and process planning                            |
| G05B 2219/32101 | . . . | CASE based process planning, using older, known case                          |
| G05B 2219/32102 | . . . | Select machine type   |
| G05B 2219/32103 | . . . | Select size of tool   |
| G05B 2219/32104 | . . . | Data extraction from geometric models for process planning                    |
| G05B 2219/32105 | . . . | Calculate machining axis, best feasible orientation for machining             |
| G05B 2219/32106 | . . . | Calculate machining volumes for turning operations                            |
| G05B 2219/32107 | . . . | Operative process planning  |
| G05B 2219/32108 | . . . | From order, production time divide into special and normal operations         |
| G05B 2219/32109 | . . . | Divide process into machining methods   |
| G05B 2219/32111 | . . . | PPS production planning system  |

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| G05B 2219/32112 | . . . | PPS and MS Office integrated   |
| G05B 2219/32113 | . . . | Machine load and characteristic curves   |
| G05B 2219/32114 | . . . | Part type selection, for simultaneous processing   |
| G05B 2219/32115 | . . . | Machine grouping, each machine in each group performs same operations                    |
| G05B 2219/32116 | . . . | Production ratio, proportion in which selected part types will be produced               |
| G05B 2219/32117 | . . . | Resource allocation, of number of pallets, fixtures of each type to part type            |
| G05B 2219/32118 | . . . | Loading, allocates operations and tools to selected part type                            |
| G05B 2219/32119 | . . . | Order handling and manufacturing module and offline monitoring                           |
| G05B 2219/32121 | . . . | Read identification of pallet, conveyor and enter data for manufacturing                 |
| G05B 2219/32122 | . . . | Documentation of programmable electronic system  |
| G05B 2219/32123 | . . . | Use of ms windows for automation, connected to mms manufacturing message system          |
| G05B 2219/32124 | . . . | Program hybrid system, part sequence, part continuous                                    |
| G05B 2219/32125 | . . . | Maple manufacturing application programming environment                                  |
| G05B 2219/32126 | . . . | Hyperlink, access to program modules and to hardware modules in www, web server, browser |
| G05B 2219/32127 | . . . | Read identification of part and generate automatically manufacturing conditions          |
| G05B 2219/32128 | . . . | Gui graphical user interface   |
| G05B 2219/32129 | . . . | Select program for specified machine from library, file server                           |
| G05B 2219/32131 | . . . | Use job graph  |
| G05B 2219/32132 | . . . | SFC shop floor control, to develop and build control system for factory                  |
| G05B 2219/32133 | . . . | Commands from program of other controller cause recompilation of local program           |
| G05B 2219/32134 | . . . | Dynamic generation of web pages from program code  |
| G05B 2219/32135 | . . . | APC advanced process control applications  |
| G05B 2219/32136 | . . . | Web service oriented architecture for manufacturing and automation                       |
| G05B 2219/32137 | . . . | Configure, connect, combine different program modules                                    |
| G05B 2219/32138 | . . . | Select hardware, devices at workstation, needed for, to be used at cell, node            |
| G05B 2219/32139 | . . . | Select at workstation control parameters for cell, node                                  |
| G05B 2219/32141 | . . . | Define type of I-O, analog, digital, pulse   |
| G05B 2219/32142 | . . . | Define device, module description using xml format file                                  |
| G05B 2219/32143 | . . . | Use css style sheets as control parameters   |
| G05B 2219/32144 | . . . | Define device description using dd files   |
| G05B 2219/32145 | . . . | Manual, enter identification, name workpiece and teach manufacturing data                |
| G05B 2219/32146 | . . . | Display parts, manufacturing conditions to enter conditions for selected part            |
| G05B 2219/32147 | . . . | Edit taught data to change operation parameters of workstations                          |



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| G05B 2219/32148 | . . . | Enter correction data at a station, also transmitted to all downstream stations  |
| G05B 2219/32149 | . . . | Display working condition data, real measured data and tolerance                 |
| G05B 2219/32151 | . . . | Prepare teach data by selecting data from two tables as function of type of work |
| G05B 2219/32152 | . . . | Inhibit further editing of entered parameters                                    |
| G05B 2219/32153 | . . . | Exchange data between user, cad, caq, nc, capp                                   |
| G05B 2219/32154 | . . . | Object, attribute for geometry, technology, function oop                         |
| G05B 2219/32155 | . . . | Editor and library for objects   |
| G05B 2219/32156 | . . . | Each defined object has corresponding set of geometrical macros                  |
| G05B 2219/32157 | . . . | Create a new object by combining existing objects                                |
| G05B 2219/32158 | . . . | Object groups, for object replication, naming, messaging and retrieving          |
| G05B 2219/32159 | . . . | Each hardware unit together with its software forms one object                   |
| G05B 2219/32161 | . . . | Object oriented control, programming   |
| G05B 2219/32162 | . . . | Tasks or control icons are linked to form a job                                  |
| G05B 2219/32163 | . . . | Indicate synchronisation tags on icons of tasks                                  |
| G05B 2219/32164 | . . . | Petrinet and procedural language combined  |
| G05B 2219/32165 | . . . | Petrinet   |
| G05B 2219/32166 | . . . | Convert petrinet to sequence program for cell and to control program for machine |
| G05B 2219/32167 | . . . | Convert petrinet to ladder diagram   |
| G05B 2219/32168 | . . . | Generation and analysis of synthesis rules for petrinet                          |
| G05B 2219/32169 | . . . | Stochastic pn, spn   |
| G05B 2219/32171 | . . . | Transform, convert operator goals and information into petri nets                |
| G05B 2219/32172 | . . . | Control petri net together with modeling petri net, cascaded                     |
| G05B 2219/32173 | . . . | Table, memory table with identification code for all parts to be used            |
| G05B 2219/32174 | . . . | Memory table parts classification and working, manufacturing conditions          |
| G05B 2219/32175 | . . . | Table with correlation between part codes and part classification                |
| G05B 2219/32176 | . . . | Correspondance between manufacturing part list and design part list              |
| G05B 2219/32177 | . . . | Computer assisted quality surveyance, caq  |
| G05B 2219/32178 | . . . | Normal and correction transferline, transfer workpiece if fault                  |
| G05B 2219/32179 | . . . | Quality control, monitor production tool with multiple sensors                   |
| G05B 2219/32181 | . . . | Monitor production, assembly apparatus with multiple sensors                     |
| G05B 2219/32182 | . . . | If state of tool, product deviates from standard, adjust system, feedback        |
| G05B 2219/32183 | . . . | Test cell  |
| G05B 2219/32184 | . . . | Compare time, quality, state of operators with threshold value                   |
| G05B 2219/32185 | . . . | Calculate entropy, disorder  |
| G05B 2219/32186 | . . . | Teaching inspection data, pictures and criteria and apply them for inspection    |
| G05B 2219/32187 | . . . | Correlation between controlling parameters for influence on quality parameters   |



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| G05B 2219/32188 | . . . | Teaching relation between controlling parameters and quality parameters           |
| G05B 2219/32189 | . . . | Compare between original solid model and measured manufactured object             |
| G05B 2219/32191 | . . . | Real time statistical process monitoring  |
| G05B 2219/32192 | . . . | After inspection create correction table with position, correction data           |
| G05B 2219/32193 | . . . | Ann, neural base quality management   |
| G05B 2219/32194 | . . . | Quality prediction  |
| G05B 2219/32195 | . . . | Feedforward quality control   |
| G05B 2219/32196 | . . . | Store audit, history of inspection, control and workpiece data into database      |
| G05B 2219/32197 | . . . | Inspection at different locations, stages of manufacturing                        |
| G05B 2219/32198 | . . . | Feedforward inspection data for calibration, manufacturing next stage             |
| G05B 2219/32199 | . . . | If number of errors grow, augment sampling rate for testing                       |
| G05B 2219/32201 | . . . | Build statistical model of past normal proces, compare with actual process        |
| G05B 2219/32202 | . . . | Integration and cooperation between processes                                     |
| G05B 2219/32203 | . . . | Effect of material constituents, components on product manufactured               |
| G05B 2219/32204 | . . . | Performance assurance; assure certain level of non-defective products             |
| G05B 2219/32205 | . . . | Use model error adapted to type of workpiece                                      |
| G05B 2219/32206 | . . . | Selection from a lot of workpieces to be inspected                                |
| G05B 2219/32207 | . . . | Action upon failure value, send warning, caution message to terminal              |
| G05B 2219/32208 | . . . | Rearrange production line   |
| G05B 2219/32209 | . . . | Stop production line  |
| G05B 2219/32211 | . . . | Outputs new workorders to operators   |
| G05B 2219/32212 | . . . | If parameter out of tolerance reject product                                      |
| G05B 2219/32213 | . . . | If parameter out of tolerance during limited time, accept product on condition    |
| G05B 2219/32214 | . . . | Display on screen what fault and which tool and what order to repair fault        |
| G05B 2219/32215 | . . . | If detected shape not correct, simulate new machine, tool and adapt path          |
| G05B 2219/32216 | . . . | If machining not optimized, simulate new parameters and correct machining         |
| G05B 2219/32217 | . . . | Finish defect surfaces on workpiece   |
| G05B 2219/32218 | . . . | Sort workpieces as function of quality data                                       |
| G05B 2219/32219 | . . . | Slow down production after failure  |
| G05B 2219/32221 | . . . | Correlation between defect and measured parameters to find origin of defect       |
| G05B 2219/32222 | . . . | Fault, defect detection of origin of fault, defect of product                     |
| G05B 2219/32223 | . . . | Fixture failure diagnosis, measure assembly, derive influence of fixture on error |
| G05B 2219/32224 | . . . | Identify parameters with highest probability of failure                           |
| G05B 2219/32225 | . . . | Randomize workpiece treatment order within lot to improve lot-to-lot comparisons  |

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| G05B 2219/32226 | . . . | Computer assisted repair, maintenance of system components                          |
| G05B 2219/32227 | . . . | On error detected by zone supervisor, maintenance of particular zone                |
| G05B 2219/32228 | . . . | Repair, rework of manufactured article  |
| G05B 2219/32229 | . . . | Repair fault product by replacing fault parts                                       |
| G05B 2219/32231 | . . . | Inspection and correction, repair station in one unit, correction data in memory    |
| G05B 2219/32232 | . . . | Inspection and correction, repair station are separate, transmit correction data    |
| G05B 2219/32233 | . . . | Scheduling repair   |
| G05B 2219/32234 | . . . | Maintenance planning  |
| G05B 2219/32235 | . . . | Sharing of data between process control and maintenance management computers        |
| G05B 2219/32236 | . . . | Automatic order of parts needed for maintenance schedule                            |
| G05B 2219/32237 | . . . | Repair and rework of defect, out of tolerance parts, reschedule                     |
| G05B 2219/32238 | . . . | Scheduler triggers generation of nc program for actual selected machine             |
| G05B 2219/32239 | . . . | Avoid deadlock, lockup  |
| G05B 2219/32241 | . . . | Resource editor   |
| G05B 2219/32242 | . . . | Reschedule without propagation of interruptions to other cells                      |
| G05B 2219/32243 | . . . | Rerouting parts   |
| G05B 2219/32244 | . . . | By using graphical display of array and selecting elements, rearrange them          |
| G05B 2219/32245 | . . . | Reentrant scheduling, workpiece can return to same machine                          |
| G05B 2219/32246 | . . . | Virtual reality based interface scheduler   |
| G05B 2219/32247 | . . . | Real time scheduler   |
| G05B 2219/32248 | . . . | Create schedule from elementary operations from database                            |
| G05B 2219/32249 | . . . | Repair, rework of defect, out of tolerance part in next station by reconfiguring it |
| G05B 2219/32251 | . . . | Normal and special order production lines for different types of workpiece          |
| G05B 2219/32252 | . . . | Scheduling production, machining, job shop  |
| G05B 2219/32253 | . . . | As a function of, change of machine operation                                       |
| G05B 2219/32254 | . . . | Work sequence, alternative sequence   |
| G05B 2219/32255 | . . . | Required time for work temperature control  |
| G05B 2219/32256 | . . . | Due dates, pieces must be ready, priority of dates, deadline                        |
| G05B 2219/32257 | . . . | Tool replacement minimization   |
| G05B 2219/32258 | . . . | Resource, machine assignment preferences, actual and anticipated load               |
| G05B 2219/32259 | . . . | Flexibility, polyvalent machine, large buffers, permutation operations, alternative |
| G05B 2219/32261 | . . . | Rearrange production line as function of operator rating                            |
| G05B 2219/32262 | . . . | Work manhours, number of operators and work place                                   |
| G05B 2219/32263 | . . . | Afo products, their components to be manufactured, lot selective                    |
| G05B 2219/32264 | . . . | Setup time  |
| G05B 2219/32265 | . . . | Waiting, queue time, buffer   |

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| G05B 2219/32266 | . . . | Priority orders   |
| G05B 2219/32267 | . . . | Dynamic throughput maximization   |
| G05B 2219/32268 | . . . | Available parts, available materials  |
| G05B 2219/32269 | . . . | Decision, of job release, select job to be launched next in shop                        |
| G05B 2219/32271 | . . . | Decision of job dispatching, select job to process next on each machine                 |
| G05B 2219/32272 | . . . | Decision of next visiting machine selection, where job is to go                         |
| G05B 2219/32273 | . . . | Decision of job pulling, select job to put in input buffer of next machine if conflicts |
| G05B 2219/32274 | . . . | Event is triggered when first unit of first lot enters or last unit leaves processing   |
| G05B 2219/32275 | . . . | Job, recipe cascading: no delay, next job is started immediatly when first is finished  |
| G05B 2219/32276 | . . . | For tool feeding schedule   |
| G05B 2219/32277 | . . . | Agv schedule integrated into cell schedule  |
| G05B 2219/32278 | . . . | Schedule of overhead material handlers, robot gantry                                    |
| G05B 2219/32279 | . . . | Operator scheduling for load, unload, walk and wait in a cell with plural machines      |
| G05B 2219/32281 | . . . | Single machine scheduling, one machine, several jobs                                    |
| G05B 2219/32282 | . . . | For a quick and slow production line  |
| G05B 2219/32283 | . . . | Machine scheduling, several machines, several jobs                                      |
| G05B 2219/32284 | . . . | Job shop, two, more operations may not occupy same machine simultaneously               |
| G05B 2219/32285 | . . . | Multi manipulator assembly cell   |
| G05B 2219/32286 | . . . | Monitoring items connected to certain different entities, activities                    |
| G05B 2219/32287 | . . . | Medical, chemical, biological laboratory  |
| G05B 2219/32288 | . . . | Create daily or weekly production matrix  |
| G05B 2219/32289 | . . . | Determine number of components, start of their production, allocate processor           |
| G05B 2219/32291 | . . . | Task sequence optimization  |
| G05B 2219/32292 | . . . | Large, medium and fine schedule, with feedback from fine to large                       |
| G05B 2219/32293 | . . . | Minimize work in progress, system at maximum productivity                               |
| G05B 2219/32294 | . . . | Maximize throughput of cell   |
| G05B 2219/32295 | . . . | Production start time from order and production specification, satisfaction degree      |
| G05B 2219/32296 | . . . | If error search in a repair library, trained by operator, to correct schedule           |
| G05B 2219/32297 | . . . | Adaptive scheduling, feedback of actual proces progress to adapt schedule               |
| G05B 2219/32298 | . . . | Designate at least two group of articles, first with priority, reschedule second        |
| G05B 2219/32299 | . . . | Divide job shop into number of workcenters  |
| G05B 2219/32301 | . . . | Simulate production, process stages, determine optimum scheduling rules                 |
| G05B 2219/32302 | . . . | Each pallet has working plan, information and machine selection data                    |

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| G05B 2219/32303 | . . . | Convert program to fit rescheduled machine                                       |
| G05B 2219/32304 | . . . | Minimize flow time, tact, shortest processing, machining time                    |
| G05B 2219/32305 | . . . | Fastest interrupt time, change jobs dynamically to fastest machine               |
| G05B 2219/32306 | . . . | Rules to make scheduling decisions   |
| G05B 2219/32307 | . . . | Last buffer first serve, lifo  |
| G05B 2219/32308 | . . . | Shortest, narrowest non full queue   |
| G05B 2219/32309 | . . . | Shortest remaining capacity  |
| G05B 2219/32311 | . . . | Shortest queue next  |
| G05B 2219/32312 | . . . | Largest imminent operation time  |
| G05B 2219/32313 | . . . | Shortest remaining processing time   |
| G05B 2219/32314 | . . . | Largest remaining processing time  |
| G05B 2219/32315 | . . . | Machine with least work  |
| G05B 2219/32316 | . . . | First buffer first serve, fifo   |
| G05B 2219/32317 | . . . | Smallest ratio for imminent processing time divided by total processing time     |
| G05B 2219/32318 | . . . | Smallest value of product of imminent processing time with total processing time |
| G05B 2219/32319 | . . . | Shortest imminent operation time, part of machining time                         |
| G05B 2219/32321 | . . . | Largest processing, machining time   |
| G05B 2219/32322 | . . . | Machines with least frequency of errors  |
| G05B 2219/32323 | . . . | Determine lot priority as function of sum of queue and processing time           |
| G05B 2219/32324 | . . . | Quality data determines optimum machine sequence selection, queuing rules        |
| G05B 2219/32325 | . . . | Object oriented scheduling, use machine, part, tool object and coordinator       |
| G05B 2219/32326 | . . . | Local scheduler, each machine own scheduler, independent from defective machines |
| G05B 2219/32327 | . . . | Structure, fuzzy logic expert system scheduler                                   |
| G05B 2219/32328 | . . . | Dynamic scheduling, resource allocation, multi agent negotiation                 |
| G05B 2219/32329 | . . . | Real time learning scheduler, uses ANN, fuzzy                                    |
| G05B 2219/32331 | . . . | Network of coordinating planning systems for each cell, factory                  |
| G05B 2219/32332 | . . . | Expert scheduler   |
| G05B 2219/32333 | . . . | Use of genetic algorithm   |
| G05B 2219/32334 | . . . | Use of reinforcement learning, agent acts, receives reward                       |
| G05B 2219/32335 | . . . | Use of ann, neural network   |
| G05B 2219/32336 | . . . | Normal, special order lines share some common machines, part of production line  |
| G05B 2219/32337 | . . . | Simulation, statechart SC  |
| G05B 2219/32338 | . . . | Use new conditions for model, check, calculate if model meets objectives         |
| G05B 2219/32339 | . . . | Object oriented modeling, design, analysis, implementation, simulation language  |
| G05B 2219/32341 | . . . | Grafcet model, graph based simulation  |

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| G05B 2219/32342 | . . . | Real time simulation  |
| G05B 2219/32343 | . . . | Derive control behaviour, decisions from simulation, behaviour modelling                                      |
| G05B 2219/32344 | . . . | Modular verification of real time systems   |
| G05B 2219/32345 | . . . | Of interconnection of cells, subsystems, distributed simulation   |
| G05B 2219/32346 | . . . | Using acd, activity cycle diagram   |
| G05B 2219/32347 | . . . | Knowledge based simulation engine, use answers from user, database  |
| G05B 2219/32348 | . . . | Process reengineering, rethink manufacturing process, continuous improve                                      |
| G05B 2219/32349 | . . . | Simulate effect of stoppages of production facilities, operate as function of simulation                      |
| G05B 2219/32351 | . . . | Visual, graphical animation of process  |
| G05B 2219/32352 | . . . | Modular modeling, decompose large system in smaller systems to simulate                                       |
| G05B 2219/32353 | . . . | Use elementary control task, finite state machine and loop, inhibit, synchronisation connections              |
| G05B 2219/32354 | . . . | Divide, analyse process into subprocesses, until elementary unit operations                                   |
| G05B 2219/32355 | . . . | Simulate control process using virtual bus  |
| G05B 2219/32356 | . . . | For diagnostics   |
| G05B 2219/32357 | . . . | Simulation of material handling, flexible conveyer system fcs   |
| G05B 2219/32358 | . . . | Strain, stress of manual work, operator strain  |
| G05B 2219/32359 | . . . | Modeling, simulating assembly operations  |
| G05B 2219/32361 | . . . | Master production scheduling  |
| G05B 2219/32362 | . . . | Bulk manufacturing, handling dry or fluid products  |
| G05B 2219/32363 | . . . | Batch job routing in operation overlapping  |
| G05B 2219/32364 | . . . | Simulate batch processing   |
| G05B 2219/32365 | . . . | For resource planning   |
| G05B 2219/32366 | . . . | Line performance evaluation   |
| G05B 2219/32367 | . . . | Parallel experimentation machines   |
| G05B 2219/32368 | . . . | Quality control   |
| G05B 2219/32369 | . . . | Cape-mode computer aided plant enterprise modeling environment for plant life cycle modelisation & management |
| G05B 2219/32371 | . . . | Predict failure time by analysing history fault logs of same machines in databases                            |
| G05B 2219/32372 | . . . | Petrinet, coloured, inhibitor arc, timed, object token Petrinet   |
| G05B 2219/32373 | . . . | Timed petrinet, timed event graph   |
| G05B 2219/32374 | . . . | Display of petrinet, graph editing  |
| G05B 2219/32375 | . . . | Petrinet synthesis tool   |
| G05B 2219/32376 | . . . | Coloured petrinet   |
| G05B 2219/32377 | . . . | Cbpn controlled batches petrinet, model influence control part on physical part                               |
| G05B 2219/32378 | . . . | Fuzzy timed petrinet  |

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| G05B 2219/32379 | . . . | Object oriented petrinets  |
| G05B 2219/32381 | . . . | Continuous petrinet, contrary of timed petrinet  |
| G05B 2219/32382 | . . . | Hybrid petrinet, comprises continuous and timed petrinet   |
| G05B 2219/32383 | . . . | Controlled speed continuous petrinet, considers delays in execution and transport time                 |
| G05B 2219/32384 | . . . | Fuzzy petrinet fpn   |
| G05B 2219/32385 | . . . | What is simulated, manufacturing process and compare results with real process                         |
| G05B 2219/32386 | . . . | Arm accurate robot motion time model, needed in scheduling   |
| G05B 2219/32387 | . . . | Effects of highspeed hardware operations on throughput, use scheduler                                  |
| G05B 2219/32388 | . . . | Autonomous flexible system, cells and agv autonomous   |
| G05B 2219/32389 | . . . | Reception, assembly, testing, management workorder, schedule, history, file, packing                   |
| G05B 2219/32391 | . . . | Machining center, pallet stocker, setup station, conveyor, control unit                                |
| G05B 2219/32392 | . . . | Warehouse and loading, unloading station and shop and machining centers and in out buffer              |
| G05B 2219/32393 | . . . | Host and central distribution control between storage and cells  |
| G05B 2219/32394 | . . . | Fractal manufacturing system with autonomous agents: observer, analyser, organiser, resolver, reporter |
| G05B 2219/32395 | . . . | Manufacturing structure is flow shop, mass production  |
| G05B 2219/32396 | . . . | Job shop, batch production system  |
| G05B 2219/32397 | . . . | Machining cells  |
| G05B 2219/32398 | . . . | Operator controls setting, changing of setting, of different machines                                  |
| G05B 2219/32399 | . . . | Select lan by switching bus connected to several lan   |
| G05B 2219/32401 | . . . | Select displays by switching bus connected to several displays   |
| G05B 2219/32402 | . . . | Select one lan to be connected to one display by central control                                       |
| G05B 2219/32403 | . . . | Supervisory control, monitor and control system, by operator or automatic                              |
| G05B 2219/32404 | . . . | Scada supervisory control and data acquisition   |
| G05B 2219/32405 | . . . | Hybrid supervisor control, des supervisor and diagnostic and alternate strategy route                  |
| G05B 2219/32406 | . . . | Distributed scada  |
| G05B 2219/32407 | . . . | Real time processing of data   |
| G05B 2219/32408 | . . . | Case based diagnosis to assist decision maker, operator  |
| G05B 2219/32409 | . . . | Adaptive agent for diagnostic, helps operator to describe new cases                                    |
| G05B 2219/32411 | . . . | Derive control data from displayed element, logic for it and feedback data                             |
| G05B 2219/32412 | . . . | One engineering, workstation can supervise several processes   |
| G05B 2219/32413 | . . . | Pc generates control strategy, download in plc to monitor and react to events                          |
| G05B 2219/32414 | . . . | Workstation has two displays, for process control and for general applications                         |
| G05B 2219/32415 | . . . | Select tools in next workcell during transport workpiece   |
| G05B 2219/32416 | . . . | Tool information for program to use and needed timing, adapt timing                                    |



- G05B 2219/32417 . . . Minimize number of tools, only a specific machine can process certain operations
- G05B 2219/32418 . . . Machine workload balance, same tools for pool of machines for same operations
- G05B 2219/32419 . . . All tools available, each part can fully be processed on a single machine
- G05B 2219/32421 . . . Tool management incorporated in kernel of nc control
- G05B 2219/32422 . . . Tool management and database management
- G05B 2219/32423 . . . Task planning
- G05B 2219/32424 . . . Task flow editing
- G05B 2219/33 . . Director till display
- G05B 2219/33001 . . . Director is the nc controller, computer
- G05B 2219/33002 . . . Artificial intelligence AI, expert, knowledge, rule based system KBS
- G05B 2219/33003 . . . Algorithm, hashing algorithm
- G05B 2219/33004 . . . Manual control of manipulator, machine
- G05B 2219/33005 . . . Manually but assisted by using sensors
- G05B 2219/33006 . . . Ama allocation manual automatic work between machine, manipulator and man
- G05B 2219/33007 . . . Automatically control, manually limited, operator can override control
- G05B 2219/33008 . . . Operate manually only in defined, limited zone area
- G05B 2219/33009 . . . ART adaptive resonance theory, place input patterns in clusters during learning
- G05B 2219/33011 . . . Link between hidden and input layer is sigmoid, and between output is linear
- G05B 2219/33012 . . . Kohonen network, single layer with neurodes, associated with codebook vector
- G05B 2219/33013 . . . Higher order multilayer artificial neural network ANN, input terms has square, cubic terms of input, output
- G05B 2219/33014 . . . BAM bidirectional associative memory artificial neural network
- G05B 2219/33015 . . . Time delay artificial neural network
- G05B 2219/33016 . . . Pi sigma network, summing in hidden layers, product in output layer
- G05B 2219/33017 . . . Local linear nested network, coarse at root, split up and build tree
- G05B 2219/33018 . . . Adaline network, n inputs with n weights, sum, one output
- G05B 2219/33019 . . . Lapart, two art with lateral priming connection between output and vigilance nodes
- G05B 2219/33021 . . . Connect plural macrocircuits, neural network modules in a larger network
- G05B 2219/33022 . . . One network for learned signal values, one network for unknown signal values
- G05B 2219/33023 . . . Ann with single, only one output
- G05B 2219/33024 . . . RAM artificial neural network , several lookup tables addressed by input section, output summed
- G05B 2219/33025 . . . Recurrent artificial neural network
- G05B 2219/33026 . . . Wavelet artificial neural network , wavelet orthogonal decomposition for artificial neural network approximation



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| G05B 2219/33027 | . . . | Artificial neural network controller  |
| G05B 2219/33028 | . . . | Function, rbf radial basis function network, gaussian network                           |
| G05B 2219/33029 | . . . | ANNS artificial neural network with sigmoid function                                    |
| G05B 2219/33031 | . . . | Spline membership function  |
| G05B 2219/33032 | . . . | Learn by changing input weights as function of position error                           |
| G05B 2219/33033 | . . . | Identification neural controller copies weight to system neural controller              |
| G05B 2219/33034 | . . . | Online learning, training   |
| G05B 2219/33035 | . . . | Slow learning combined with fast learning artificial neural network, two time scale ann |
| G05B 2219/33036 | . . . | Error back propagation  |
| G05B 2219/33037 | . . . | Learn parameters of network offline, not while controlling system                       |
| G05B 2219/33038 | . . . | Real time online learning, training, dynamic network                                    |
| G05B 2219/33039 | . . . | Learn for different measurement types, create for each a neural net                     |
| G05B 2219/33041 | . . . | Structure optimization and learning of artificial neural network by genetic algorithm   |
| G05B 2219/33042 | . . . | Non linear filtering, recursive least squares   |
| G05B 2219/33043 | . . . | Extended kalman filter  |
| G05B 2219/33044 | . . . | Supervised learning with second artificial neural network                               |
| G05B 2219/33045 | . . . | Selforganizing network  |
| G05B 2219/33046 | . . . | Forward propagation error   |
| G05B 2219/33047 | . . . | Dynamic node creation, increase internal nodes if error too large                       |
| G05B 2219/33048 | . . . | By using kd tree data structure and delaunay linear interpolation, triangulation        |
| G05B 2219/33049 | . . . | Cooperative coaching, each controller has own minimum, switch to lowest                 |
| G05B 2219/33051 | . . . | BBC behavior based control, stand alone module, cognitive, independent agent            |
| G05B 2219/33052 | . . . | Subsumption architecture, behavioral modules in layers, override older ones             |
| G05B 2219/33053 | . . . | Modular hardware, software, easy modification, expansion, generic, oop                  |
| G05B 2219/33054 | . . . | Control agent, an active logical entity that can control logical objects                |
| G05B 2219/33055 | . . . | Holon, agent executes task and cooperates with other, distributed control               |
| G05B 2219/33056 | . . . | Reinforcement learning, agent acts, receives reward, emotion, action selective          |
| G05B 2219/33057 | . . . | If no module available to execute task, adapt module and execute task                   |
| G05B 2219/33058 | . . . | Low level element designed for reliability, not for speed, only small task              |
| G05B 2219/33059 | . . . | High level competence, system action module sam, configuration and task modules         |
| G05B 2219/33061 | . . . | Behaviour fusion, each layer can influence other by suppression or amplification        |
| G05B 2219/33062 | . . . | Self repair   |
| G05B 2219/33063 | . . . | Generic coordination, master agent to data manager agent to tasks to active agent       |

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| G05B 2219/33064 | . . . | Manufacturing planning and control agent and domain blackboards                      |
| G05B 2219/33065 | . . . | Ontogenetic learning, agent learns and adapt its own behaviour                       |
| G05B 2219/33066 | . . . | Phylogenetic learning, group agents learn and adapts their behaviour                 |
| G05B 2219/33067 | . . . | HCP help based cooperation protocol, when to ask or give help from or to agent       |
| G05B 2219/33068 | . . . | CCP coordination cooperation protocol, make optimal decisions with other agents      |
| G05B 2219/33069 | . . . | Immune algorithm, agent distinguishes self and foreign, lymphocyte, antibody agent   |
| G05B 2219/33071 | . . . | Self sufficient, agent responsible for own energy, tools                             |
| G05B 2219/33072 | . . . | Two layer agent for execution of tasks and for communication, coordination           |
| G05B 2219/33073 | . . . | Ion control agent has communication, database, suggestion, decision, action, detect  |
| G05B 2219/33074 | . . . | Calculation loop, first one slow changing value, then several quick varying values   |
| G05B 2219/33075 | . . . | Calculate only necessary, critical values, to speed up calculation                   |
| G05B 2219/33076 | . . . | Optimize time by parallel execution of independent blocks by two processors          |
| G05B 2219/33077 | . . . | Calculation iterative, recursive   |
| G05B 2219/33078 | . . . | Error table, interpolate between two stored values to correct error                  |
| G05B 2219/33079 | . . . | Table with functional, weighting coefficients, function                              |
| G05B 2219/33081 | . . . | Parallel computing, pipeline   |
| G05B 2219/33082 | . . . | Data parallelism, one administrative process and many worker process                 |
| G05B 2219/33083 | . . . | Clock for microprocessor synchronized with pulses from encoder                       |
| G05B 2219/33084 | . . . | Clock for microprocessor synchronized with multiplexer                               |
| G05B 2219/33085 | . . . | Real time calendar clock   |
| G05B 2219/33086 | . . . | Interrupt frequency as function of rating of servomotor or desired control frequency |
| G05B 2219/33087 | . . . | Two clock, clock for software counter and calender clock, synchronized               |
| G05B 2219/33088 | . . . | Clock  |
| G05B 2219/33089 | . . . | Two clock, one for sequence control, one for motion control, pulses                  |
| G05B 2219/33091 | . . . | Two clock, one for controller and one for calibration                                |
| G05B 2219/33092 | . . . | Using several selectable and settable dividers                                       |
| G05B 2219/33093 | . . . | Real time clock interface between serial I-O and processor                           |
| G05B 2219/33094 | . . . | Send clock from pc board, via extension bus to PLL circuit on nc boards, to servo    |
| G05B 2219/33095 | . . . | External clock delivers interrupts for real time execution of programs               |
| G05B 2219/33096 | . . . | Use clock to control main spindle rotational speed                                   |
| G05B 2219/33097 | . . . | Variable ticks, align clocks, to synchronise cycles with other machine, robot        |
| G05B 2219/33098 | . . . | Several nc machines, dnc, cnc  |
| G05B 2219/33099 | . . . | Cnc, computer numerical control, swc, softwired control                              |

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| G05B 2219/33101 | . . . | Dnc, direct numerical control   |
| G05B 2219/33102 | . . . | Dnc and cnc combined  |
| G05B 2219/33103 | . . . | Object manager handles objects having own procedures, messages oop              |
| G05B 2219/33104 | . . . | Tasks, functions are distributed over different cpu                             |
| G05B 2219/33105 | . . . | Identification of type of connected module, motor, panel                        |
| G05B 2219/33106 | . . . | Configure I-O by using logical and physical address                             |
| G05B 2219/33107 | . . . | Designate each actuator by a name and corresponding operations                  |
| G05B 2219/33108 | . . . | Exchange of type of controller is easy, before operation, adapt control to type |
| G05B 2219/33109 | . . . | Select out of plurality of alternative control parameters                       |
| G05B 2219/33111 | . . . | Graphic configuration control, connect pictures, objects to each other          |
| G05B 2219/33112 | . . . | Configuration software for network  |
| G05B 2219/33113 | . . . | Initialise each drive during start, load data to drive and image to controller  |
| G05B 2219/33114 | . . . | Configure motion controller to drive any kind of motor type connected           |
| G05B 2219/33115 | . . . | Group functions   |
| G05B 2219/33116 | . . . | Configuration of motion control   |
| G05B 2219/33117 | . . . | Define function by user programmable basic operations                           |
| G05B 2219/33118 | . . . | Identify bus, interface select automatic adaption for bus, interface            |
| G05B 2219/33119 | . . . | Servo parameters in memory, configuration of control parameters                 |
| G05B 2219/33121 | . . . | Host loads program from attached module to control that module                  |
| G05B 2219/33122 | . . . | Adapt nc control to type of machine, read machine and measuring parameters      |
| G05B 2219/33123 | . . . | Identify kind of transducer, encoder used                                       |
| G05B 2219/33124 | . . . | Configuration of different kind of tool magazines, tool changers and buffers    |
| G05B 2219/33125 | . . . | System configuration, reconfiguration, customization, automatic                 |
| G05B 2219/33126 | . . . | Identification of address connected module, processor                           |
| G05B 2219/33127 | . . . | Display each control parameter by name and its value                            |
| G05B 2219/33128 | . . . | Different spindles, axis controlled by configured paths, channel                |
| G05B 2219/33129 | . . . | Group spindles, axis into motion groups, nc channel structure                   |
| G05B 2219/33131 | . . . | Synthesize programmable axis, to simulate a non existing, virtual axis          |
| G05B 2219/33132 | . . . | Configured function disabled if concerned axis not referenced                   |
| G05B 2219/33133 | . . . | For each action define function for compensation, enter parameters              |
| G05B 2219/33134 | . . . | Enter parameters for relationship between axis                                  |
| G05B 2219/33135 | . . . | Data compression before sending data to allow control of more axis, spindles    |
| G05B 2219/33136 | . . . | Com: communication, inter processor communication, either local or network      |
| G05B 2219/33137 | . . . | Time left during polling used for other communication, priority for polling     |
| G05B 2219/33138 | . . . | Control program and communication are totally separated                         |
| G05B 2219/33139 | . . . | Design of industrial communication system with expert system                    |

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| G05B 2219/33141 | . . . | Communication system software module independent from medium, protocol, address      |
| G05B 2219/33142 | . . . | Address switches on each controller, peripheral are set by operator                  |
| G05B 2219/33143 | . . . | Position of module in ring, loop determines address of module                        |
| G05B 2219/33144 | . . . | Module clock, synchronised by controller message, to send message in time slice      |
| G05B 2219/33145 | . . . | Count clock pulses to determine address of node, module                              |
| G05B 2219/33146 | . . . | Each node occupies in address space a length equal to number of bits to be exchanged |
| G05B 2219/33147 | . . . | Address peripheral, controller   |
| G05B 2219/33148 | . . . | CLS client server architecture, client consumes, server provides services            |
| G05B 2219/33149 | . . . | Publisher subscriber, publisher, master broadcasts data to slaves, subscriber        |
| G05B 2219/33151 | . . . | Distributed client server  |
| G05B 2219/33152 | . . . | Server has organisation, tree data to access user data, client sends also both       |
| G05B 2219/33153 | . . . | AR application relationship, cooperation through logical links                       |
| G05B 2219/33154 | . . . | Data exchange between processors of different axis of same or different cnc          |
| G05B 2219/33155 | . . . | Communication between motor current controller and position controller               |
| G05B 2219/33156 | . . . | Communication between two processors over shared, dualport ram                       |
| G05B 2219/33157 | . . . | Between processor and sensor, encoder  |
| G05B 2219/33158 | . . . | Remote procedure call to each other  |
| G05B 2219/33159 | . . . | Communication between acyclic and cyclic, loop programs                              |
| G05B 2219/33161 | . . . | Data exchange between controller and processors                                      |
| G05B 2219/33162 | . . . | Two bus, high speed and low speed bus, linked or not                                 |
| G05B 2219/33163 | . . . | Multichannel master bus  |
| G05B 2219/33164 | . . . | Bus timing adjustment by buffer with controller                                      |
| G05B 2219/33165 | . . . | Gpsc gpss general purpose serial channel, link                                       |
| G05B 2219/33166 | . . . | Rs485 bus to control several modules, motors   |
| G05B 2219/33167 | . . . | Bus arbitration, switch computer to different memory                                 |
| G05B 2219/33168 | . . . | Two bus, master bus and local servo bus  |
| G05B 2219/33169 | . . . | Name of bus, vme-bus   |
| G05B 2219/33171 | . . . | Std bus  |
| G05B 2219/33172 | . . . | Multibus   |
| G05B 2219/33173 | . . . | Bitbus   |
| G05B 2219/33174 | . . . | Sds smart distributed system, honeywell  |
| G05B 2219/33175 | . . . | Isa bus  |
| G05B 2219/33176 | . . . | Rs485, mpi multipoint, multidrop interface   |
| G05B 2219/33177 | . . . | Interface, scsi, parallel  |
| G05B 2219/33178 | . . . | Centronics   |
| G05B 2219/33179 | . . . | Pcmcia   |

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| G05B 2219/33181 | . . . | Isdn   |
| G05B 2219/33182 | . . . | Uart, serial datatransmission, modem   |
| G05B 2219/33183 | . . . | IEEE-488, hp interface, instrumentation  |
| G05B 2219/33184 | . . . | Rs232c to rs485 converter  |
| G05B 2219/33185 | . . . | Rs232c switch box, break out box, to connect different devices                     |
| G05B 2219/33186 | . . . | Circuit for signal adaption, voltage level shift, filter noise                     |
| G05B 2219/33187 | . . . | Serial transmission rs232c, rs422, rs485 communication link                        |
| G05B 2219/33188 | . . . | Twisted pair   |
| G05B 2219/33189 | . . . | Optical, glass fiber   |
| G05B 2219/33191 | . . . | Data exchange combined with inductively coupled power supply                       |
| G05B 2219/33192 | . . . | Radio link, wireless   |
| G05B 2219/33193 | . . . | Inductive transmission of measured values  |
| G05B 2219/33194 | . . . | Data and power supplied over optical fiber   |
| G05B 2219/33195 | . . . | Wave guide, also used as rails for movable station                                 |
| G05B 2219/33196 | . . . | Data and power each on a different line to all peripheral, bus                     |
| G05B 2219/33197 | . . . | Current loop 4-20-mA milliampere   |
| G05B 2219/33198 | . . . | Laser, light link, infrared  |
| G05B 2219/33199 | . . . | Transponder  |
| G05B 2219/33201 | . . . | Twisted pair combined with optical fiber for critical emc zones                    |
| G05B 2219/33202 | . . . | Single serial line, virtual second line is earth                                   |
| G05B 2219/33203 | . . . | Wireless transmission of power and data, inductively, rotary transformer           |
| G05B 2219/33204 | . . . | Optocoupler, galvanic separation, isolation  |
| G05B 2219/33205 | . . . | Coax or optical fiber or twisted pair  |
| G05B 2219/33206 | . . . | Ultrasonic   |
| G05B 2219/33207 | . . . | Physical means, radio, infra red, ultrasonic, inductive link                       |
| G05B 2219/33208 | . . . | Superposition of control signals on supply lines                                   |
| G05B 2219/33209 | . . . | Protocol, mailbox, email, mail system  |
| G05B 2219/33211 | . . . | Polling  |
| G05B 2219/33212 | . . . | Processor for communication with, evaluation of signals form detector to pc        |
| G05B 2219/33213 | . . . | Communication cpu to synchronize axis between different machines                   |
| G05B 2219/33214 | . . . | Bus between different axis controllers and cpu                                     |
| G05B 2219/33215 | . . . | Synchronization pulses on bus for axis controllers                                 |
| G05B 2219/33216 | . . . | Operational, real time for system, and service for configuration is non real time  |
| G05B 2219/33217 | . . . | Continuity communication controlled by client                                      |
| G05B 2219/33218 | . . . | Motor encoders, resolvers on common bus with drives, servo controllers             |
| G05B 2219/33219 | . . . | Drives, servo units, main control on internal net, lan, ethernet, tcp-ip, wireless |
| G05B 2219/33221 | . . . | Drives, servo units, sensors, motors, on local network, ethernet, tcp-ip, wireless |

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| G05B 2219/33222 | . . . | High speed serial link combined with medium speed serial link                    |
| G05B 2219/33223 | . . . | Serial ring, loop pam programmable axis manager                                  |
| G05B 2219/33224 | . . . | Several serial channels, each provided with d-a to terminals of servomotor       |
| G05B 2219/33225 | . . . | Interface nc machine to data server  |
| G05B 2219/33226 | . . . | Daisy chain  |
| G05B 2219/33227 | . . . | Safety, echo back to verify correctness message                                  |
| G05B 2219/33228 | . . . | Detection of line failure, breakage of transmission, failure of receiver         |
| G05B 2219/33229 | . . . | Differential amplifier, xor to cancel noise, balanced rs422                      |
| G05B 2219/33231 | . . . | Decoupling, to avoid noise, crosstalk between wires of bus                       |
| G05B 2219/33232 | . . . | Detect, respond to lost message  |
| G05B 2219/33233 | . . . | If servo data corrupt, use previous value, no repeat                             |
| G05B 2219/33234 | . . . | Detect bad data transfer   |
| G05B 2219/33235 | . . . | Redundant communication channels, processors and signal processing hardware      |
| G05B 2219/33236 | . . . | Add check data to message to check faulty communication                          |
| G05B 2219/33237 | . . . | Detect short circuit of bus  |
| G05B 2219/33238 | . . . | Switch from differential to single line communication if short between two wires |
| G05B 2219/33239 | . . . | Switch off, stop, halt transmission on detection of fault                        |
| G05B 2219/33241 | . . . | Compare results from two masters on two busses, if not equal shut down machines  |
| G05B 2219/33242 | . . . | Watchdog for datacommunication, on error switch off supply to bus modules        |
| G05B 2219/33243 | . . . | Detect quality of received data, message   |
| G05B 2219/33244 | . . . | Packet information exchange  |
| G05B 2219/33245 | . . . | Autosend, send information from cad station automatically to peripheral          |
| G05B 2219/33246 | . . . | Timing of transmission data to peripheral  |
| G05B 2219/33247 | . . . | Synchronize transfer, take over, change of parameters and reference values       |
| G05B 2219/33248 | . . . | Time window for each controller or controlled function                           |
| G05B 2219/33249 | . . . | Compress, pack data before transmission  |
| G05B 2219/33251 | . . . | Schedule periodic and aperiodic traffic, real time , time critical               |
| G05B 2219/33252 | . . . | Real time synchronous transmission, model  |
| G05B 2219/33253 | . . . | Correction data transmission errors, protection against noise, twisted pair      |
| G05B 2219/33254 | . . . | Serial position feedback, serial to parallel conversion and reverse              |
| G05B 2219/33255 | . . . | Transfer of data parallel  |
| G05B 2219/33256 | . . . | Resolver to digital conversion   |
| G05B 2219/33257 | . . . | Conversion of designed 3-D tolerance, allowance to real coordinates of machine   |
| G05B 2219/33258 | . . . | Common coordinate conversion for multiple heads, spindles                        |
| G05B 2219/33259 | . . . | Conversion of measuring robot coordinates to workpiece coordinates               |



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| G05B 2219/33261 | . . . | Conversion of detected pulses to voltage, frequency to voltage convertor         |
| G05B 2219/33262 | . . . | Current to voltage conversion  |
| G05B 2219/33263 | . . . | Conversion, transformation of coordinates, cartesian or polar                    |
| G05B 2219/33264 | . . . | Conversion of angle between links to linear displacement of actuator             |
| G05B 2219/33265 | . . . | Conversion of voltage, resistance to pulses                                      |
| G05B 2219/33266 | . . . | Pulse to frequency conversion, frequency to pulse                                |
| G05B 2219/33267 | . . . | Pneumatic, air to hydraulic conversion   |
| G05B 2219/33268 | . . . | D-A, A-D   |
| G05B 2219/33269 | . . . | Convert cartesian to machine coordinates   |
| G05B 2219/33271 | . . . | Convert workpiece to machine coordinates   |
| G05B 2219/33272 | . . . | Conversion, transformation of data before and after interpolator                 |
| G05B 2219/33273 | . . . | DCS distributed, decentralised controlsystem, multiprocessor                     |
| G05B 2219/33274 | . . . | Integrated communication and control, transmission delay, sampling rate effect   |
| G05B 2219/33275 | . . . | Distributed, decision made by negotiation among executive components, execute it |
| G05B 2219/33276 | . . . | Decentralized, each component makes own decision, executes only own decision     |
| G05B 2219/33277 | . . . | Distributed system with host as leader, host with multiple of agents             |
| G05B 2219/33278 | . . . | Cooperation between autonomous modules by receipts, messages, no synchronisation |
| G05B 2219/33279 | . . . | Expansion by using secondary access to each module, extension module             |
| G05B 2219/33281 | . . . | Architecture, nodes for communication and measuring on serial bus                |
| G05B 2219/33282 | . . . | Node with communication, transducer, common core, application specific modules   |
| G05B 2219/33283 | . . . | Customized nodes for desired functionality                                       |
| G05B 2219/33284 | . . . | Remote diagnostic  |
| G05B 2219/33285 | . . . | Diagnostic   |
| G05B 2219/33286 | . . . | Test, simulation analysator  |
| G05B 2219/33287 | . . . | Program panel to program, enter data for diagnostic                              |
| G05B 2219/33288 | . . . | Switch, select between normal and diagnostic control program                     |
| G05B 2219/33289 | . . . | During diagnostic of servocontroller, motor is isolated                          |
| G05B 2219/33291 | . . . | Logic analyser function of cnc   |
| G05B 2219/33292 | . . . | Storage oscilloscope function of cnc to diagnose servo drive, axis oscilloscope  |
| G05B 2219/33293 | . . . | For each actuated axis, set a bit in a word in memory, state of axis in word     |
| G05B 2219/33294 | . . . | Nc in case of propagation error, search previous module, origin of error         |
| G05B 2219/33295 | . . . | Fuzzy expert system for diagnostic, monitoring                                   |
| G05B 2219/33296 | . . . | ANN for diagnostic, monitoring   |
| G05B 2219/33297 | . . . | Diagnostic, test, debug  |
| G05B 2219/33298 | . . . | Remote videoconferencing   |



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| G05B 2219/33299 | . . . | Real time , online diagnostic, integrated in normal control system              |
| G05B 2219/33301 | . . . | Simulation during machining   |
| G05B 2219/33302 | . . . | Different sets of monitoring parameters for each operation mode                 |
| G05B 2219/33303 | . . . | Expert system for diagnostic, monitoring use of tree and probability            |
| G05B 2219/33304 | . . . | Display of diagnostic   |
| G05B 2219/33305 | . . . | Display of relevant errors together with time mark                              |
| G05B 2219/33306 | . . . | Configuration file to set how data will be displayed                            |
| G05B 2219/33307 | . . . | On error, failure, fault automatically search and dial maintenance person       |
| G05B 2219/33308 | . . . | If error message not clear, search help by index of message vocabulary          |
| G05B 2219/33309 | . . . | Error recovery, automated error recovery  |
| G05B 2219/33311 | . . . | System code for error recovery  |
| G05B 2219/33312 | . . . | Operator selects action, system stores state, zero based error state            |
| G05B 2219/33313 | . . . | Frames, database with environment and action, relate error to correction action |
| G05B 2219/33314 | . . . | Failure reason analysis, simple strategy or multiple outcome analysis           |
| G05B 2219/33315 | . . . | Failure detection and reconfiguration   |
| G05B 2219/33316 | . . . | On the fly software replacement on error  |
| G05B 2219/33317 | . . . | Alternative strategy driver revises control behaviour                           |
| G05B 2219/33318 | . . . | Knowledge acquisition   |
| G05B 2219/33319 | . . . | Interference justification network  |
| G05B 2219/33321 | . . . | Observation learning  |
| G05B 2219/33322 | . . . | Failure driven learning   |
| G05B 2219/33323 | . . . | Self diagnostic of boards, own test program                                     |
| G05B 2219/33324 | . . . | What to diagnose, whole system, test, simulate                                  |
| G05B 2219/33325 | . . . | Diagnostic of only machining, operation   |
| G05B 2219/33326 | . . . | Analyzer, diagnostic for servovalve   |
| G05B 2219/33327 | . . . | Self diagnostic of control system, servo system                                 |
| G05B 2219/33328 | . . . | Diagnostic for bus system of computer   |
| G05B 2219/33329 | . . . | Measuring system, encoder   |
| G05B 2219/33331 | . . . | Test, diagnostic of field device for correct device, correct parameters         |
| G05B 2219/33332 | . . . | Each processor can execute all programs   |
| G05B 2219/33333 | . . . | Network multiprocessing   |
| G05B 2219/33334 | . . . | Load balancing, distribution between processors                                 |
| G05B 2219/33335 | . . . | Microprocessor for max 3-D control otherwise host takes over for more axis      |
| G05B 2219/33336 | . . . | first dsp calculates commands for each motor, second dsp regulates position     |
| G05B 2219/33337 | . . . | For each axis a processor , microprocessor                                      |
| G05B 2219/33338 | . . . | DNC distributed, decentralised nc, concurrent, multiprocessing                  |
| G05B 2219/33339 | . . . | Controller with lowest operation rate is selected as master                     |
| G05B 2219/33341 | . . . | Peer to peer, change master if overloaded                                       |

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| G05B 2219/33342 | . . . | Master slave, supervisor, front end and slave processor, hierarchical structure |
| G05B 2219/33343 | . . . | Each slave stores communication program to be used by master, exchangeability   |
| G05B 2219/33344 | . . . | Each slave has several processors operating in parallel                         |
| G05B 2219/33345 | . . . | Several master modules, connection modules and slave modules                    |
| G05B 2219/33346 | . . . | Only memory of master module stores all position programs of slaves             |
| G05B 2219/33347 | . . . | Master sends servo address, speed, kind of interpolation to slave               |
| G05B 2219/33348 | . . . | Processor adapts signals to connected display                                   |
| G05B 2219/34    | . .   | Director, elements to supervisory   |
| G05B 2219/34001 | . . . | PLL phase locked loop   |
| G05B 2219/34002 | . . . | Analog multiplexer  |
| G05B 2219/34003 | . . . | Tri state driver  |
| G05B 2219/34004 | . . . | Shift register  |
| G05B 2219/34005 | . . . | Motion control chip, contains digital filter as control compensator             |
| G05B 2219/34006 | . . . | Fifo  |
| G05B 2219/34007 | . . . | Neuromine, input pulse train, can be inhibited or excited, output TTL, neuron   |
| G05B 2219/34008 | . . . | Asic application specific integrated circuit, single chip microcontroller       |
| G05B 2219/34009 | . . . | Coprocessor   |
| G05B 2219/34011 | . . . | MMU   |
| G05B 2219/34012 | . . . | Smart, intelligent I-O coprocessor, programmable sensor interface               |
| G05B 2219/34013 | . . . | Servocontroller   |
| G05B 2219/34014 | . . . | Sample hold circuit   |
| G05B 2219/34015 | . . . | Axis controller   |
| G05B 2219/34016 | . . . | Pulse processor   |
| G05B 2219/34017 | . . . | Vector processor  |
| G05B 2219/34018 | . . . | Forth controller  |
| G05B 2219/34019 | . . . | Array of processors, parallel computing   |
| G05B 2219/34021 | . . . | Dssp digital sensor signal processor  |
| G05B 2219/34022 | . . . | Dcasp digital controlled analog signal processor                                |
| G05B 2219/34023 | . . . | Risc processor  |
| G05B 2219/34024 | . . . | Fpga fieldprogrammable gate arrays  |
| G05B 2219/34025 | . . . | Polynomial analysis   |
| G05B 2219/34026 | . . . | Pga programmable gate array   |
| G05B 2219/34027 | . . . | Dual servo controller, for two motors   |
| G05B 2219/34028 | . . . | Hold relay  |
| G05B 2219/34029 | . . . | Pam programmable axis controller, to control large number of axis               |
| G05B 2219/34031 | . . . | Synchronous detector  |
| G05B 2219/34032 | . . . | Asic and microcontroller cooperate  |
| G05B 2219/34033 | . . . | Control processor and signal processor cooperate                                |

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| G05B 2219/34034 | . . . | Multiplier, prm, brm  |
| G05B 2219/34035 | . . . | Time relay  |
| G05B 2219/34036 | . . . | Saturable reactor   |
| G05B 2219/34037 | . . . | Brm followed by postprocessor to smooth curve               |
| G05B 2219/34038 | . . . | Web, http, ftp, internet, intranet server                   |
| G05B 2219/34039 | . . . | Access central database through internet                    |
| G05B 2219/34041 | . . . | Dda   |
| G05B 2219/34042 | . . . | Filter  |
| G05B 2219/34043 | . . . | Delay line  |
| G05B 2219/34044 | . . . | Mathematical coprocessor - processor                        |
| G05B 2219/34045 | . . . | Timer   |
| G05B 2219/34046 | . . . | Analog multiplier   |
| G05B 2219/34047 | . . . | Dsp digital signal processor                                |
| G05B 2219/34048 | . . . | Fourier transformation, analysis, fft                       |
| G05B 2219/34049 | . . . | Adder   |
| G05B 2219/34051 | . . . | Bcd   |
| G05B 2219/34052 | . . . | Software counter  |
| G05B 2219/34053 | . . . | Counters, tellers   |
| G05B 2219/34054 | . . . | Half serial half parallel                                   |
| G05B 2219/34055 | . . . | Correction 3-excesscode                                     |
| G05B 2219/34056 | . . . | Nine complement   |
| G05B 2219/34057 | . . . | Complement  |
| G05B 2219/34058 | . . . | Up-down   |
| G05B 2219/34059 | . . . | Preset counter  |
| G05B 2219/34061 | . . . | One counter per axis to unload cpu                          |
| G05B 2219/34062 | . . . | Comparator  |
| G05B 2219/34063 | . . . | Bcd   |
| G05B 2219/34064 | . . . | N+1 comparator  |
| G05B 2219/34065 | . . . | Fuzzy logic, controller                                     |
| G05B 2219/34066 | . . . | Fuzzy neural, neuro fuzzy network                           |
| G05B 2219/34067 | . . . | Multilayer fuzzy controller, execution and supervisor layer |
| G05B 2219/34068 | . . . | Fuzzy neural petri controller                               |
| G05B 2219/34069 | . . . | Shared memory   |
| G05B 2219/34071 | . . . | Content addressable memory                                  |
| G05B 2219/34072 | . . . | Non volatile memory, core memory                            |
| G05B 2219/34073 | . . . | Backup battery  |
| G05B 2219/34074 | . . . | Associative memory  |
| G05B 2219/34075 | . . . | Cognitive memory  |
| G05B 2219/34076 | . . . | Shared, common or dual port memory, ram                     |
| G05B 2219/34077 | . . . | Fuzzy, rules are function of material, tool used            |

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| G05B 2219/34078 | . . . | Membership functions as parameters for shape pattern                                |
| G05B 2219/34079 | . . . | Extract only rules needed to obtain result  |
| G05B 2219/34081 | . . . | Fuzzy art map neural network, one art for input map, lookup table, other for output |
| G05B 2219/34082 | . . . | Learning, online reinforcement learning   |
| G05B 2219/34083 | . . . | Interpolation general   |
| G05B 2219/34084 | . . . | Software interpolator using microprocessor  |
| G05B 2219/34085 | . . . | Software interpolator   |
| G05B 2219/34086 | . . . | At fixed periods pulses from table drive plural axis in unison                      |
| G05B 2219/34087 | . . . | Enter at fixed periods distances in counter for each axis, pulse distribution       |
| G05B 2219/34088 | . . . | Chamfer, corner shape calculation   |
| G05B 2219/34089 | . . . | Parametric, polynomial representation of path per axis as function of time          |
| G05B 2219/34091 | . . . | Interpolate backwards   |
| G05B 2219/34092 | . . . | Polar interpolation   |
| G05B 2219/34093 | . . . | Real time toolpath generation, no need for large memory to store values             |
| G05B 2219/34094 | . . . | Library with different kind of interpolation curves                                 |
| G05B 2219/34095 | . . . | Look ahead segment calculation  |
| G05B 2219/34096 | . . . | Approximate, replace curve, surface with circle, linear segments, least error       |
| G05B 2219/34097 | . . . | Calculate movement from part program offline, calculate axis references online      |
| G05B 2219/34098 | . . . | Slope fitting, fairing contour, curve fitting, transition                           |
| G05B 2219/34099 | . . . | Extrapolation   |
| G05B 2219/34101 | . . . | Data compression, look ahead segment calculation, max segment lenght                |
| G05B 2219/34102 | . . . | OCI on line interpolation   |
| G05B 2219/34103 | . . . | Taking planar slices from a 3-D shape   |
| G05B 2219/34104 | . . . | Postprocessor coarse fine   |
| G05B 2219/34105 | . . . | Area pocket machining, space filling curve, to cover whole surface                  |
| G05B 2219/34106 | . . . | Using spiral collapsed boundary, contour parallel machining                         |
| G05B 2219/34107 | . . . | Zigzag workpiece parallel sweeps, direction parallel machining                      |
| G05B 2219/34108 | . . . | Using zigzag isoparametric parallel sweeps  |
| G05B 2219/34109 | . . . | Using spiral scaled boundary  |
| G05B 2219/34111 | . . . | Using hilbert curves, fractals, only visible points of patches taken                |
| G05B 2219/34112 | . . . | TSP traveling sales problem, SOM self organizing map for tool path                  |
| G05B 2219/34113 | . . . | Determine centerline, medial axis and branches in shape                             |
| G05B 2219/34114 | . . . | Construct concentric polygons   |
| G05B 2219/34115 | . . . | Area, pocket machining for area with partially open boundary                        |
| G05B 2219/34116 | . . . | Machine workpiece along, parallel to smallest side, dimension                       |
| G05B 2219/34117 | . . . | Machine workpiece along, parallel to largest dimension                              |
| G05B 2219/34118 | . . . | Using a pseudo-random or random tool path   |

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| G05B 2219/34119 | . . . | Function generator, filter after interpolator to control position error  |
| G05B 2219/34121 | . . . | Edge generator   |
| G05B 2219/34122 | . . . | Function, profile generator  |
| G05B 2219/34123 | . . . | Sine cosine generator  |
| G05B 2219/34124 | . . . | Cordic processing  |
| G05B 2219/34125 | . . . | Sum squares  |
| G05B 2219/34126 | . . . | Overloop of counted axis pulses to servo                                 |
| G05B 2219/34127 | . . . | Brm followed by postprocessor to smooth curve                            |
| G05B 2219/34128 | . . . | General surface replaced by sphere, cylinder, toroid , calculate quickly |
| G05B 2219/34129 | . . . | Approximation for calculation  |
| G05B 2219/34131 | . . . | Split in approximation and accurate calculation                          |
| G05B 2219/34132 | . . . | Choosing largest, major coordinate axis                                  |
| G05B 2219/34133 | . . . | Choosing slowest axis  |
| G05B 2219/34134 | . . . | Choose optimal coordinate system   |
| G05B 2219/34135 | . . . | Spline   |
| G05B 2219/34136 | . . . | Ellipse, hyperbola   |
| G05B 2219/34137 | . . . | Helicoidal   |
| G05B 2219/34138 | . . . | Cubic interpolation  |
| G05B 2219/34139 | . . . | Parabolic interpolation  |
| G05B 2219/34141 | . . . | B-spline, NURBS non uniform rational b-spline                            |
| G05B 2219/34142 | . . . | Polynomial   |
| G05B 2219/34143 | . . . | Approximate corner by polynomial   |
| G05B 2219/34144 | . . . | Involute, evolute  |
| G05B 2219/34145 | . . . | Bezier interpolation, spline   |
| G05B 2219/34146 | . . . | Helical, spiral interpolation  |
| G05B 2219/34147 | . . . | Epitrochoid  |
| G05B 2219/34148 | . . . | Coons interpolation, patch   |
| G05B 2219/34149 | . . . | Circular interpolation   |
| G05B 2219/34151 | . . . | Analog   |
| G05B 2219/34152 | . . . | Circular interpolation in space, on arbitrary planes                     |
| G05B 2219/34153 | . . . | Linear interpolation   |
| G05B 2219/34154 | . . . | Analog   |
| G05B 2219/34155 | . . . | Third degree   |
| G05B 2219/34156 | . . . | Slope control, delta x, y proportional to x, y                           |
| G05B 2219/34157 | . . . | Synchronize interpolation of different axis boards, simultaneous start   |
| G05B 2219/34158 | . . . | Tangents form curve  |
| G05B 2219/34159 | . . . | Delta theta  |
| G05B 2219/34161 | . . . | Superposition curves, combine xy slides with other xy or polar slides    |
| G05B 2219/34162 | . . . | Linear in one axis, circular in other axis                               |
| G05B 2219/34163 | . . . | Rotate a segment   |

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| G05B 2219/34164 | . . . | Superposition manual control pulses on motion control pulses   |
| G05B 2219/34165 | . . . | 4-D via 2-D+2-D  |
| G05B 2219/34166 | . . . | Select between rectangular and polar controller, interpolator  |
| G05B 2219/34167 | . . . | Coarse fine, macro micro interpolation, preprocessor   |
| G05B 2219/34168 | . . . | External interpolation   |
| G05B 2219/34169 | . . . | Coarse interpolator, path calculator delivers position, speed, acceleration blocks                   |
| G05B 2219/34171 | . . . | Generate polynomial fitting in tolerance zone around polygon   |
| G05B 2219/34172 | . . . | Of the two or three axis, only one or two are controlled as function of tangent to other axis, plane |
| G05B 2219/34173 | . . . | Switch between involute, circular and linear interpolation   |
| G05B 2219/34174 | . . . | Rotate segment over a certain angle  |
| G05B 2219/34175 | . . . | Overlap, between two blocks, continuous, smooth speed change, movement                               |
| G05B 2219/34176 | . . . | Block segments, find next point on next segment by cross point circle and segment                    |
| G05B 2219/34177 | . . . | Calculate for different inclined segments stitch points evenly distributed                           |
| G05B 2219/34178 | . . . | Simulated pulse for better resolution  |
| G05B 2219/34179 | . . . | Variable interpolation speed or resolution   |
| G05B 2219/34181 | . . . | Adapt resolution as function of machining load, in corner, to keep constant surface speed            |
| G05B 2219/34182 | . . . | Variable resolution  |
| G05B 2219/34183 | . . . | Window path, contour of rectangle  |
| G05B 2219/34184 | . . . | Straight cut   |
| G05B 2219/34185 | . . . | Following line+circle  |
| G05B 2219/34186 | . . . | Degree line  |
| G05B 2219/34187 | . . . | Any angle, slope   |
| G05B 2219/34188 | . . . | Safety, stop, slowdown interpolator if speed, position, torque error too large                       |
| G05B 2219/34189 | . . . | On each axis, for each block, a software limit switch, for safe slow down                            |
| G05B 2219/34191 | . . . | Pneumatic  |
| G05B 2219/34192 | . . . | Memory management  |
| G05B 2219/34193 | . . . | Memory refresh   |
| G05B 2219/34194 | . . . | Bank switching, ping-pong memory for communication between processors                                |
| G05B 2219/34195 | . . . | Part program in consecutive memory blocks, each with spare space for corrections                     |
| G05B 2219/34196 | . . . | Memory management, dma direct memory access  |
| G05B 2219/34197 | . . . | Search blank memory space to load program, storage, memory allocation                                |
| G05B 2219/34198 | . . . | Electric and fluidic modules integrated on one substrate   |
| G05B 2219/34199 | . . . | Module with low maintenance connected to removable module with high maintenance                      |

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| G05B 2219/34201 | . . . | Each module uses functions of a real time kernel                               |
| G05B 2219/34202 | . . . | Reusable software, generic resource model library                              |
| G05B 2219/34203 | . . . | Module has a general, high level and a specific, proprietary part              |
| G05B 2219/34204 | . . . | Independent units, stackthrough in cabinet, no backplane                       |
| G05B 2219/34205 | . . . | Modular construction, plug-in module, lsi module                               |
| G05B 2219/34206 | . . . | Motion controller independent from nc, lmc local motor controller              |
| G05B 2219/34207 | . . . | Array vlsi processor   |
| G05B 2219/34208 | . . . | Motion controller  |
| G05B 2219/34209 | . . . | Microprocessor only for display  |
| G05B 2219/34211 | . . . | Microprocessor only for hand control   |
| G05B 2219/34212 | . . . | Microprocessor only for mdi, control panel                                     |
| G05B 2219/34213 | . . . | Same microprocessor for data input and for servocontrol                        |
| G05B 2219/34214 | . . . | I-apx-432 processor  |
| G05B 2219/34215 | . . . | Microprocessor   |
| G05B 2219/34216 | . . . | Programmable motion controller   |
| G05B 2219/34217 | . . . | Microprocessor with build in pwm   |
| G05B 2219/34218 | . . . | Transputer   |
| G05B 2219/34219 | . . . | Special interface, peripheral to motor   |
| G05B 2219/34221 | . . . | Computer delivers control pulses from table directly to motors                 |
| G05B 2219/34222 | . . . | Computer sends displacement and selected device to output register             |
| G05B 2219/34223 | . . . | Combined input output module, single module                                    |
| G05B 2219/34224 | . . . | Select appropriate interface, according to kind of tool or other detection     |
| G05B 2219/34225 | . . . | Interface board for measuring system, for resolver, encoder or interferometer  |
| G05B 2219/34226 | . . . | Select address of motor, control serial switches in power supply ring          |
| G05B 2219/34227 | . . . | Alterable connector board between controller and machine                       |
| G05B 2219/34228 | . . . | Counter takes over measuring and pwm task from microprocessor                  |
| G05B 2219/34229 | . . . | SIU serial interface unit takes over communication task from microprocessor    |
| G05B 2219/34231 | . . . | Interface controls either dc, ac or step motors                                |
| G05B 2219/34232 | . . . | Test with microcomputer self   |
| G05B 2219/34233 | . . . | Multiplexed subsystem stores state of controlling microprocessor on switch off |
| G05B 2219/34234 | . . . | Each subsystem has own interrupt which is switched on during multiplex         |
| G05B 2219/34235 | . . . | Control order of multiplexed axis  |
| G05B 2219/34236 | . . . | Multiplex for servos, actuators  |
| G05B 2219/34237 | . . . | Multiplexed d-a a-d  |
| G05B 2219/34238 | . . . | Hydraulic multiplexer  |
| G05B 2219/34239 | . . . | Multiplex for whole system   |
| G05B 2219/34241 | . . . | For reading data only  |
| G05B 2219/34242 | . . . | For measurement only   |



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| G05B 2219/34243 | . . . | Single feedback sensor, transducer for plurality, one at a time, driven tools    |
| G05B 2219/34244 | . . . | Multiplex for control only   |
| G05B 2219/34245 | . . . | Address several motors, each with its own identification                         |
| G05B 2219/34246 | . . . | OOC object oriented control  |
| G05B 2219/34247 | . . . | Machining objects are hierarchically organised                                   |
| G05B 2219/34248 | . . . | Machining object comprises a slide, a palet, workpieces, machining, a contour    |
| G05B 2219/34249 | . . . | Sub divide machining object in machining groups, geometry, start point, special  |
| G05B 2219/34251 | . . . | Cnc works with different operating systems, windows, os-2, vms in parallel       |
| G05B 2219/34252 | . . . | OSY operating system   |
| G05B 2219/34253 | . . . | Unix   |
| G05B 2219/34254 | . . . | Operating system controls selection and execution of program modules             |
| G05B 2219/34255 | . . . | Msdos  |
| G05B 2219/34256 | . . . | Api application programming interface  |
| G05B 2219/34257 | . . . | OS-2   |
| G05B 2219/34258 | . . . | Real time system, qnx, works together with non real time system, windows nt      |
| G05B 2219/34259 | . . . | Common language run time CLR, MS-NET, DOTNET, java run time environment          |
| G05B 2219/34261 | . . . | Windows, microsoft windows   |
| G05B 2219/34262 | . . . | DDE direct data exchange, DLL dynamic library linking                            |
| G05B 2219/34263 | . . . | OLE object linking and embedding, OPC ole for process control                    |
| G05B 2219/34264 | . . . | Odbc open database connectivity  |
| G05B 2219/34265 | . . . | Windows nt, windows-2000   |
| G05B 2219/34266 | . . . | Windows-95   |
| G05B 2219/34267 | . . . | Windows nt and cooperating real time extension                                   |
| G05B 2219/34268 | . . . | Cnc and pic controlled alternately by same processor, using timer                |
| G05B 2219/34269 | . . . | Programmable computer controller, plc implemented with pc                        |
| G05B 2219/34271 | . . . | Nc integrated into pic, plc, combination of commands                             |
| G05B 2219/34272 | . . . | Communication pc and nc, pic over file system of pc, direct access pc to nc, pic |
| G05B 2219/34273 | . . . | Pc and plc and nc integrated, pcnc concept                                       |
| G05B 2219/34274 | . . . | Connect pc card to industrial bus, with additional timing and adapting logic     |
| G05B 2219/34275 | . . . | Windows file server to control pc hosted boards under ms windows                 |
| G05B 2219/34276 | . . . | Pc has priority over cnc controller  |
| G05B 2219/34277 | . . . | Pc bypasses robot controller processor, access directly encoders, amplifiers     |
| G05B 2219/34278 | . . . | Motion control board, card, in pc  |

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| G05B 2219/34279 | . . . | Pc, personal computer as controller   |
| G05B 2219/34281 | . . . | Osaca open system architecture for control in automation, umc universal machine control |
| G05B 2219/34282 | . . . | Using special api's allowing user access to control machine, motion, servo              |
| G05B 2219/34283 | . . . | Using windows nt for general control and real time unix for motion, plc control         |
| G05B 2219/34284 | . . . | Using an operator console and a motion chassis connected by network                     |
| G05B 2219/34285 | . . . | Open system architecture, in general  |
| G05B 2219/34286 | . . . | Intelligent positioning I-O   |
| G05B 2219/34287 | . . . | Plc and motion controller combined  |
| G05B 2219/34288 | . . . | Plc as main controller for cnc  |
| G05B 2219/34289 | . . . | Plc as motion controller combined and plc for work type dependant data, parameter       |
| G05B 2219/34291 | . . . | Programmable interface, pic, plc  |
| G05B 2219/34292 | . . . | Filtering noise I-O   |
| G05B 2219/34293 | . . . | Image table   |
| G05B 2219/34294 | . . . | Diagnostic, locate failures   |
| G05B 2219/34295 | . . . | System, logic analyser, simulation  |
| G05B 2219/34296 | . . . | Level conversion  |
| G05B 2219/34297 | . . . | Analog input, comparator delivers interrupt   |
| G05B 2219/34298 | . . . | Custom window between pic, plc and nc, programmable adapter                             |
| G05B 2219/34299 | . . . | Memory with I-O and pointer, external I-O with map, edit map, pointer to adapt I-O      |
| G05B 2219/34301 | . . . | Nc system has direct access to I-O of pic, plc  |
| G05B 2219/34302 | . . . | Plc controls movement via nc, no direct interface to servo                              |
| G05B 2219/34303 | . . . | PNC is plc, pic and nc cooperation  |
| G05B 2219/34304 | . . . | Pc as input, edit device for plc  |
| G05B 2219/34305 | . . . | Connect, disconnect host computer by sleep command from local pc                        |
| G05B 2219/34306 | . . . | Power down, energy saving   |
| G05B 2219/34307 | . . . | On nc power on or off, synchronize power on or off of displays with own supply          |
| G05B 2219/34308 | . . . | Power supply sets relay switch, allows push button or automatic switch on off nc        |
| G05B 2219/34309 | . . . | Dual power supply, for digital circuit and for analog signals                           |
| G05B 2219/34311 | . . . | Energy saving by recuperating braking, deceleration energy                              |
| G05B 2219/34312 | . . . | Power supply for servo delivered by, derived from 4-20-mA current loop                  |
| G05B 2219/34313 | . . . | Power supply for communication delivered by, derived from 4-20-mA current loop          |
| G05B 2219/34314 | . . . | Slow down, limit speed for energy saving  |
| G05B 2219/34315 | . . . | Power supply turning on or shutting off   |
| G05B 2219/34316 | . . . | Install nc system, check voltages, power supply with incorporated a-d                   |

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| G05B 2219/34317 | . . . | Execute same program on different machines by differently addressing axis                            |
| G05B 2219/34318 | . . . | Verify if workpiece is already machined, by its weight   |
| G05B 2219/34319 | . . . | Sequence as function of nc controlled axis position, axis zone                                       |
| G05B 2219/34321 | . . . | Database for control of a single machine   |
| G05B 2219/34322 | . . . | Initialize execution program at reference position on workpiece                                      |
| G05B 2219/34323 | . . . | Commanding different axis in sequential order as function of direction of movement                   |
| G05B 2219/34324 | . . . | Switch some axis over to manual control, while other stay automatic                                  |
| G05B 2219/34325 | . . . | Speed up, optimize execution by combining instructions belonging together                            |
| G05B 2219/34326 | . . . | Program controls two operations simultaneously in opposite directions                                |
| G05B 2219/34327 | . . . | Modify, adapt system response to signals from process  |
| G05B 2219/34328 | . . . | Cueing commands table  |
| G05B 2219/34329 | . . . | Generate extended plc program during machining, execution of nc program                              |
| G05B 2219/34331 | . . . | First processor filters instructions for indexing only, all other instructions for second controller |
| G05B 2219/34332 | . . . | Program execution as function of direction, forward or backward                                      |
| G05B 2219/34333 | . . . | Multi threading  |
| G05B 2219/34334 | . . . | Scalability  |
| G05B 2219/34335 | . . . | First look ahead for acyclic execution, followed by cyclic execution                                 |
| G05B 2219/34336 | . . . | Avoid deadlock, lock-up  |
| G05B 2219/34337 | . . . | Manual to automatic, tracer  |
| G05B 2219/34338 | . . . | Execute control tasks, programs as well as user, application programs                                |
| G05B 2219/34339 | . . . | Single step execution of program   |
| G05B 2219/34341 | . . . | Choose between electronic cam or time-dependent as function of required machining accuracy           |
| G05B 2219/34342 | . . . | Matching closest patterns stored in database with actual components                                  |
| G05B 2219/34343 | . . . | Generation of electronic cam data from nc program  |
| G05B 2219/34344 | . . . | Standby commands, let proces wait while program controls other process                               |
| G05B 2219/34345 | . . . | Database for sequential control of several machines by messages                                      |
| G05B 2219/34346 | . . . | User program fetches part of system program when flags are set and detected                          |
| G05B 2219/34347 | . . . | Execute auxiliary function, tool change, while concurrent machining                                  |
| G05B 2219/34348 | . . . | Coordination of operations, different machines, robots execute different tasks                       |
| G05B 2219/34349 | . . . | Proper allocation of control components to the required task   |
| G05B 2219/34351 | . . . | Knowledge acquisition of environment   |
| G05B 2219/34352 | . . . | Explore discrete event properties, reliability, parallelism, availability                            |
| G05B 2219/34353 | . . . | Independent positioning motor controlled by microprocessor only if event, limit, pulse passed        |

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| G05B 2219/34354 | . . . | DES discrete event system, deds discrete event dynamic system                              |
| G05B 2219/34355 | . . . | List of failure events, list of actions, events, trigger actions                           |
| G05B 2219/34356 | . . . | Compensation variable interrupt execution delay, interrupt jitter                          |
| G05B 2219/34357 | . . . | Interrupt driven message passing network   |
| G05B 2219/34358 | . . . | Interrupt changed to uninterruptable interrupt   |
| G05B 2219/34359 | . . . | Real time based interrupt to control axis, other function                                  |
| G05B 2219/34361 | . . . | Mask for interrupts, inhibit during more important tasks                                   |
| G05B 2219/34362 | . . . | Sampling interrupt is product of integer times scheduler interrupt                         |
| G05B 2219/34363 | . . . | Encoder generates interrupt to synchronize closed loop                                     |
| G05B 2219/34364 | . . . | Delay interpolation interrupt as function of machining rates and feeds of machine groups   |
| G05B 2219/34365 | . . . | After interrupt of operation, do other task and go on - resume operation                   |
| G05B 2219/34366 | . . . | Interpolation interrupt so as to avoid fractions of command pulses                         |
| G05B 2219/34367 | . . . | Interrupts, different tasks foreground, midground, background                              |
| G05B 2219/34368 | . . . | Priority   |
| G05B 2219/34369 | . . . | Cause of interrupt is sensor and actuator failure  |
| G05B 2219/34371 | . . . | Abrupt change in system dynamics   |
| G05B 2219/34372 | . . . | Inability to process, execute assigned task within allocated time interval                 |
| G05B 2219/34373 | . . . | Actuator overloading   |
| G05B 2219/34374 | . . . | False alarm states   |
| G05B 2219/34375 | . . . | Generate interrupt after a certain number of position, counter pulses                      |
| G05B 2219/34376 | . . . | Management nc programs, files  |
| G05B 2219/34377 | . . . | Selection out of several databases according to workpiece or conditions                    |
| G05B 2219/34378 | . . . | Erase plural programs in a single operation  |
| G05B 2219/34379 | . . . | Job management   |
| G05B 2219/34381 | . . . | Multitasking   |
| G05B 2219/34382 | . . . | Preemptive multitasking, cpu decides upon priority scheme, which task to start             |
| G05B 2219/34383 | . . . | Dynamic preemptive, special event register manages time slices for applications            |
| G05B 2219/34384 | . . . | Execute next block after predetermined time  |
| G05B 2219/34385 | . . . | Execute next block if largest axis distance is reached                                     |
| G05B 2219/34386 | . . . | Advance program without M function completion signal                                       |
| G05B 2219/34387 | . . . | Delay command as function of speed   |
| G05B 2219/34388 | . . . | Detect correct moment, position, advanced, delayed, then next command                      |
| G05B 2219/34389 | . . . | After rough plunge grinding, initiate backoff grinding as function of delay wheel position |
| G05B 2219/34391 | . . . | Synchronize axis movement and tool action, delay action, simulation inertia                |
| G05B 2219/34392 | . . . | Stop program on detection of undefined variable, symbol, enter definition, continue        |
| G05B 2219/34393 | . . . | Stop program if needed workpiece, tool or data lacks, misses                               |

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| G05B 2219/34394 | . . . | Execute a certain number of program blocks and stop                               |
| G05B 2219/34395 | . . . | Synchronize between panel and control   |
| G05B 2219/34396 | . . . | Control different groups of functions, commands simultaneously, synchronized      |
| G05B 2219/34397 | . . . | Synchronize manipulators and machine by using a reference clock for all           |
| G05B 2219/34398 | . . . | Channel stops and waits for marker until other channel puts that marker           |
| G05B 2219/34399 | . . . | Switch between synchronous and asynchronous mode of controllers                   |
| G05B 2219/34401 | . . . | Synchronize position controller drive with interpolator                           |
| G05B 2219/34402 | . . . | Synchronize programs for machines, processes, tasks, if one stops other also      |
| G05B 2219/34403 | . . . | RTI real time, kernel, processing   |
| G05B 2219/34404 | . . . | Allocate storage, memory in each processor for a copy of needed data              |
| G05B 2219/34405 | . . . | Switch register banks, each storing process states, for quick real time execution |
| G05B 2219/34406 | . . . | Effect of computer, communication delay in real time control                      |
| G05B 2219/34407 | . . . | Calculate elapsed time, store in counter, start task when time elapsed            |
| G05B 2219/34408 | . . . | Design real time control system   |
| G05B 2219/34409 | . . . | RNOS real time networked operating system   |
| G05B 2219/34411 | . . . | Handling time critical and time non critical program sequences                    |
| G05B 2219/34412 | . . . | Mark some sequences of time non critical sequences as locked, non interruptable   |
| G05B 2219/34413 | . . . | Add time stamp to command message   |
| G05B 2219/34414 | . . . | Maximize utilisation workstation  |
| G05B 2219/34415 | . . . | Execute urgent jobs quickly   |
| G05B 2219/34416 | . . . | Examine, analyse sensor data for co-exclusion sets, memorize, correlate actions   |
| G05B 2219/34417 | . . . | Multiprocessor scheduling   |
| G05B 2219/34418 | . . . | Scheduler for sequential control, task planning, control sequence                 |
| G05B 2219/34419 | . . . | Structure of control system   |
| G05B 2219/34421 | . . . | Termination for each device, enables easy insertion, connection or disconnection  |
| G05B 2219/34422 | . . . | SBC single board computer   |
| G05B 2219/34423 | . . . | Optical isolation, galvanic isolation   |
| G05B 2219/34424 | . . . | Data flow architecture  |
| G05B 2219/34425 | . . . | Same microprocessor for programming and for machine control                       |
| G05B 2219/34426 | . . . | Same hardware, servo controller for different control modes                       |
| G05B 2219/34427 | . . . | Diagnostic, monitoring incorporated in controller                                 |
| G05B 2219/34428 | . . . | LSI   |
| G05B 2219/34429 | . . . | Servo controller near main cpu but remote from servomotor, integrated in cnc      |
| G05B 2219/34431 | . . . | Main uninterruptable servo loop processor and interruptable servo event processor |

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| G05B 2219/34432 | . . . | Speed and current control integrated into nc control system   |
| G05B 2219/34433 | . . . | Multitask processor controls real time processor via communication memory                               |
| G05B 2219/34434 | . . . | Separate power controller for drive, servodrive, one per axis, connected to cnc                         |
| G05B 2219/34435 | . . . | Position encoder and motor connection in one interface between motor and microprocessor                 |
| G05B 2219/34436 | . . . | Interface circuit build into connector, dongle  |
| G05B 2219/34437 | . . . | Parallel processing of functions, each layer has own sample rate  |
| G05B 2219/34438 | . . . | Panel connected to nc by means of switch matrixes   |
| G05B 2219/34439 | . . . | One cable between controller and amplifier, two between amplifier and motor                             |
| G05B 2219/34441 | . . . | Common communication interface for panel and remote I-O   |
| G05B 2219/34442 | . . . | Control unit serves also to match drive motor to power supply   |
| G05B 2219/34443 | . . . | Sensors and actuator integrated into tool   |
| G05B 2219/34444 | . . . | Web control system, with intelligent control components each with web server                            |
| G05B 2219/34445 | . . . | Several power modules for same actuator, motor  |
| G05B 2219/34446 | . . . | No change of operation mode when slave axis is out of synchronisation                                   |
| G05B 2219/34447 | . . . | A microprocessor for programming and a microprocessor for control execution of program                  |
| G05B 2219/34448 | . . . | Integrated servo control circuit fixed to housing, remote from cpu                                      |
| G05B 2219/34449 | . . . | Fault tolerant control, task from one microprocessor can be done by other                               |
| G05B 2219/34451 | . . . | False alarm states evaluation, treshold to verify correctness alarm                                     |
| G05B 2219/34452 | . . . | Synchronize control with pulse, if loss, excess, error, then stop                                       |
| G05B 2219/34453 | . . . | Stop spreading, propagation failure through system, inhibit drivers defect boards                       |
| G05B 2219/34454 | . . . | Check functioning controller, cpu or program  |
| G05B 2219/34455 | . . . | Different parameters are evaluated to indicate different faults   |
| G05B 2219/34456 | . . . | Authorize control of machine, robot if control panel has been connected                                 |
| G05B 2219/34457 | . . . | Emit alarm signal   |
| G05B 2219/34458 | . . . | Inhibit start or related control switches if path boundary is outside limits                            |
| G05B 2219/34459 | . . . | Plausibility check on connection of module, control unit to machine                                     |
| G05B 2219/34461 | . . . | Inhibit access to area if dangerous, cover taken off  |
| G05B 2219/34462 | . . . | Interlock, stop motor if microprocessor starts interrupt, because no watchdog pulse from microprocessor |
| G05B 2219/34463 | . . . | Alarm canceled automatically when program corrected   |
| G05B 2219/34464 | . . . | Adaptive treshold, level for alarm, eliminate false alarm   |
| G05B 2219/34465 | . . . | Safety, control of correct operation, abnormal states   |
| G05B 2219/34466 | . . . | Bad circuits, watchdog, alarm, indication   |
| G05B 2219/34467 | . . . | Try again program   |
| G05B 2219/34468 | . . . | Check memory by storing beforehand complement of expected result  |



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| G05B 2219/34469 | . . . | Normally messages over network, if failure, messages from operator over I-O          |
| G05B 2219/34471 | . . . | Program memory is inhibited, not accessible as long as power fails                   |
| G05B 2219/34472 | . . . | Configure alterable memory as read only, to avoid erasing                            |
| G05B 2219/34473 | . . . | Inhibit control until control lever is first set to neutral position                 |
| G05B 2219/34474 | . . . | Sense voltage drop of system, shut down servo  |
| G05B 2219/34475 | . . . | Detect abnormality of control system without inverted model, using input command     |
| G05B 2219/34476 | . . . | Local control predicts next command data from past stored data if host control fails |
| G05B 2219/34477 | . . . | Fault prediction, analyzing signal trends  |
| G05B 2219/34478 | . . . | Urgent safety signals treated with hardware; others with software                    |
| G05B 2219/34479 | . . . | Flush enclosure of circuit with air, keep clean air over pressure                    |
| G05B 2219/34481 | . . . | EFC explosion free control, intrinsically safe                                       |
| G05B 2219/34482 | . . . | Redundancy, processors watch each other for correctness                              |
| G05B 2219/34483 | . . . | Monitor absolute position independently by two processors, if out of range           |
| G05B 2219/34484 | . . . | Use dual channels  |
| G05B 2219/34485 | . . . | Same functioncode, program is fully used in normal and abnormal case                 |
| G05B 2219/34486 | . . . | Monitor axis movement, speed, independently by two processors, if out of range       |
| G05B 2219/34487 | . . . | Redundant diagnostic controllers watch redundant process controllers                 |
| G05B 2219/34488 | . . . | One computer, controller replaces other, backup computer                             |
| G05B 2219/34489 | . . . | Watchdog with adaptive timeout as function of speed of motor                         |
| G05B 2219/34491 | . . . | Count certain number of faults before delivering alarm or stop                       |
| G05B 2219/34492 | . . . | Time out, decide only after a lapse, period of time                                  |
| G05B 2219/34493 | . . . | Supervision, display diagnostic, use or select between different stored screen       |
| G05B 2219/34494 | . . . | Display machining time and real time clock to control machining time                 |
| G05B 2219/35    | . .   | Nc in input of data, input till input file format                                    |
| G05B 2219/35001 | . . . | Data input, data handling, programming, monitoring of nc                             |
| G05B 2219/35002 | . . . | Parametric machine control, direct control from cad data, no nc data                 |
| G05B 2219/35003 | . . . | Kad kam knowledge aided design, knowledge aided manufacturing                        |
| G05B 2219/35004 | . . . | Mechanical design and electronic design integrated                                   |
| G05B 2219/35005 | . . . | Sheet metal cad  |
| G05B 2219/35006 | . . . | Object oriented design   |
| G05B 2219/35007 | . . . | Cad makes template of tool as function of spindle, machine tool and set on spindle   |
| G05B 2219/35008 | . . . | Www cad, world wide design and manufacturing   |
| G05B 2219/35009 | . . . | Dynamic simulation   |
| G05B 2219/35011 | . . . | Use of spreadsheet   |
| G05B 2219/35012 | . . . | Cad cam  |



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|-----------------|-------|--|
| G05B 2219/35013 | . . . | Define workpiece, dimension from characteristics, strength, performance                |
| G05B 2219/35014 | . . . | From design, calculate additional parameters, for strength                             |
| G05B 2219/35015 | . . . | Calculate production compensation, heat shrinkage, overetching                         |
| G05B 2219/35016 | . . . | Analyse model, decide on number of sections to take                                    |
| G05B 2219/35017 | . . . | Finite elements analysis, finite elements method FEM                                   |
| G05B 2219/35018 | . . . | Determining bending die radius from part data, estimated radius and calculation        |
| G05B 2219/35019 | . . . | From product constraints select optimum process out of plurality of DTM means          |
| G05B 2219/35021 | . . . | Identify object characteristics, elasticity, density, hardness and select material     |
| G05B 2219/35022 | . . . | Calculate gear dimensions, tooth surfaces for optimum contact                          |
| G05B 2219/35023 | . . . | Constraint based modeling, keep relationships between elements                         |
| G05B 2219/35024 | . . . | Incremental constraint solving, constraints are handled in sequence                    |
| G05B 2219/35025 | . . . | Design and manufacture jig   |
| G05B 2219/35026 | . . . | Design of machine tool, of cnc machine   |
| G05B 2219/35027 | . . . | Design for assembly DFA, ease of object assembly                                       |
| G05B 2219/35028 | . . . | Adapt design as function of manufacturing merits, features, for manufacturing, DFM     |
| G05B 2219/35029 | . . . | Design of modular control system   |
| G05B 2219/35031 | . . . | Redesign, use former design  |
| G05B 2219/35032 | . . . | Check correctness, violation of design, rule check                                     |
| G05B 2219/35033 | . . . | Reliability by design, error free object   |
| G05B 2219/35034 | . . . | Adapt design to customer feedback  |
| G05B 2219/35035 | . . . | Design gear, tooth surfaces  |
| G05B 2219/35036 | . . . | Correct model by comparing 3-D measured data of modified workpiece with original model |
| G05B 2219/35037 | . . . | Use medial axis transformation to decompose a domain, limits combinations              |
| G05B 2219/35038 | . . . | Combine, superpose model, foot data with style data                                    |
| G05B 2219/35039 | . . . | Model for analysis of workpiece displacement due to clamping, fixture                  |
| G05B 2219/35041 | . . . | Genetic algorithm for selforganizing designs   |
| G05B 2219/35042 | . . . | Add finishing allowances to a cutter path  |
| G05B 2219/35043 | . . . | Tool, fixture design   |
| G05B 2219/35044 | . . . | Tool, design of tool, mold, die tooling  |
| G05B 2219/35045 | . . . | Design tool for minimal tool change  |
| G05B 2219/35046 | . . . | Design tool to minimize manufacturing, machining time                                  |
| G05B 2219/35047 | . . . | Design tools in pairs, to be used together   |
| G05B 2219/35048 | . . . | Recognition of punch shapes provided in die component catalogue                        |
| G05B 2219/35049 | . . . | BCL binary cutter location, rs494 standard CL format                                   |
| G05B 2219/35051 | . . . | Data exchange between cad systems, cad and cam   |
| G05B 2219/35052 | . . . | High level language conversion program, DXF format to nc format                        |

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| G05B 2219/35053 | . . . | IGES initial graphics exchange specification  |
| G05B 2219/35054 | . . . | STEP or PDES, standard for exchange of product data, form or surface data                   |
| G05B 2219/35055 | . . . | Data modeling language  |
| G05B 2219/35056 | . . . | Manual entry of source, destination, data, format to be used for transfer                   |
| G05B 2219/35057 | . . . | Create also operation data concerning operating device                                      |
| G05B 2219/35058 | . . . | Block cyclus time, time to prepare a block of data to be sent to machine                    |
| G05B 2219/35059 | . . . | Convert pcb design data to control data for surface mounting machine                        |
| G05B 2219/35061 | . . . | From cad make drawing with text for dimensions, scan it and read dimensions                 |
| G05B 2219/35062 | . . . | Derive mating, complementary, mirror part from computer model data                          |
| G05B 2219/35063 | . . . | Geometrical transformation of image   |
| G05B 2219/35064 | . . . | Transform sketch by replacing free curves with mathematical curves, two display             |
| G05B 2219/35065 | . . . | Undo part of design   |
| G05B 2219/35066 | . . . | Modify design, modify shape, stretch, scale, add, delete                                    |
| G05B 2219/35067 | . . . | Parametric function, group of lines, curves, change one, all change                         |
| G05B 2219/35068 | . . . | Command files, subroutines for drawing  |
| G05B 2219/35069 | . . . | Derive missing surface from mirror part of computer model                                   |
| G05B 2219/35071 | . . . | Drawing function, rotate designed figure, rotation  |
| G05B 2219/35072 | . . . | Scale, zoom a designed figure   |
| G05B 2219/35073 | . . . | Copy, duplicate a designed figure   |
| G05B 2219/35074 | . . . | Display object, recognition of geometric forms  |
| G05B 2219/35075 | . . . | Display picture of scanned object together with picture of cad object, combine              |
| G05B 2219/35076 | . . . | Display from bottom or top side, adjust drawing lines, visible or not                       |
| G05B 2219/35077 | . . . | Display part and patterns to be machined on part, make selection                            |
| G05B 2219/35078 | . . . | Do not load non necessary or obstructive parts of drawing, remove from screen               |
| G05B 2219/35079 | . . . | Features, functions like special relationship, assembly locations                           |
| G05B 2219/35081 | . . . | Product design and process machining planning concurrently, machining as function of design |
| G05B 2219/35082 | . . . | Product, feature based modeling, geometric and engineering info                             |
| G05B 2219/35083 | . . . | Parametric design, parameters for geometric design and for process planning                 |
| G05B 2219/35084 | . . . | Geometric feature extraction, concave and convex regions, object recognition                |
| G05B 2219/35085 | . . . | Incremental feature recognition, extraction, changes are added as new features              |
| G05B 2219/35086 | . . . | Machining feature extraction , geometry and machining parameters                            |
| G05B 2219/35087 | . . . | Hole extraction for sheet metal   |
| G05B 2219/35088 | . . . | Using graph grammars to describe parts  |

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| G05B 2219/35089 | . . . | Feature definition language  |
| G05B 2219/35091 | . . . | Feature conversion, from design to process features or else                        |
| G05B 2219/35092 | . . . | MBM modular boundary model, FFC face to face composition model                     |
| G05B 2219/35093 | . . . | Feature is stad single tool approach direction, or mtad multiple tool approach     |
| G05B 2219/35094 | . . . | Object oriented feature finder   |
| G05B 2219/35095 | . . . | Features library   |
| G05B 2219/35096 | . . . | Kind of feature, rotational parts with machining features and relation             |
| G05B 2219/35097 | . . . | Generation of cutter path, offset curve  |
| G05B 2219/35098 | . . . | Automatic coarse, rough and finish cutting path generation                         |
| G05B 2219/35099 | . . . | Generation of cutter path for only a designated part of surface                    |
| G05B 2219/35101 | . . . | CC cutter contact path   |
| G05B 2219/35102 | . . . | Isoparametric, contact points at intersection of parameter lines on surface        |
| G05B 2219/35103 | . . . | CI cartesian method, apt style, cutter tangent, parallel to drive planes           |
| G05B 2219/35104 | . . . | Steepest directed tree approach intelligent cutter path planning                   |
| G05B 2219/35105 | . . . | Polyhedral machining, cutter moved between centroids of adjacent surface triangles |
| G05B 2219/35106 | . . . | Contour map, cutter moved along contour lines, terraces of part surface            |
| G05B 2219/35107 | . . . | Generate planar section toolpath   |
| G05B 2219/35108 | . . . | Generate offset tool moving path in restrained curved plane                        |
| G05B 2219/35109 | . . . | Clean up region, volume left uncut by too large tool pass after finishing          |
| G05B 2219/35111 | . . . | Automatically search for clean up regions, generate clean up tool pass             |
| G05B 2219/35112 | . . . | Define object with spline, convert to raster, mosaic of points to make object      |
| G05B 2219/35113 | . . . | Generation of compound, composite surface  |
| G05B 2219/35114 | . . . | Generation of connection between two or more surfaces                              |
| G05B 2219/35115 | . . . | Project 3-D surface on 2-D plane, define grid in plane                             |
| G05B 2219/35116 | . . . | RFS rotation free surfaces, needs c x y z axis, non axis symmetrical surfaces      |
| G05B 2219/35117 | . . . | Define surface by elements, meshes   |
| G05B 2219/35118 | . . . | Generate intersection of offset surfaces   |
| G05B 2219/35119 | . . . | Combine different forms, shapes  |
| G05B 2219/35121 | . . . | Generate connection between two paths  |
| G05B 2219/35122 | . . . | Generate random paths along a raster path  |
| G05B 2219/35123 | . . . | Calculate volume of object   |
| G05B 2219/35124 | . . . | Calculate center of gravity of object  |
| G05B 2219/35125 | . . . | Surface with changing cone angle, different upper and lower surface shape          |
| G05B 2219/35126 | . . . | Bezier or Ferguson surface   |
| G05B 2219/35127 | . . . | Visibility maps, tool sees all points of interest on workpiece                     |
| G05B 2219/35128 | . . . | Propeller blade  |

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| G05B 2219/35129 | . . . | Generate composite surface by a single polynomial calculation                                |
| G05B 2219/35131 | . . . | Generate polynomial surface  |
| G05B 2219/35132 | . . . | Generate path as function of precision and surface finish of each portion                    |
| G05B 2219/35133 | . . . | B-spline surface fitting   |
| G05B 2219/35134 | . . . | 3-D cad-cam  |
| G05B 2219/35135 | . . . | Predict surface machining precision  |
| G05B 2219/35136 | . . . | Determine offset using closed ball expansion, 2-D square, 3-D cubic approximation            |
| G05B 2219/35137 | . . . | Create part generic, derive from known part or combination of parts                          |
| G05B 2219/35138 | . . . | Superpose part of 3-D model on a straight, curved wall                                       |
| G05B 2219/35139 | . . . | Define surface by cyclides, circular sections with variable radius                           |
| G05B 2219/35141 | . . . | Specify side of zone, line, circle for allowed region  |
| G05B 2219/35142 | . . . | Generate tile patterns, mosaic   |
| G05B 2219/35143 | . . . | Reconstruct free form surfaces   |
| G05B 2219/35144 | . . . | Egosphere: spherical shell 2-5-D around robot, objects are projected on it                   |
| G05B 2219/35145 | . . . | Voxel map, 3-D grid map  |
| G05B 2219/35146 | . . . | Enter data, calculate 3-D curve or surface, sculptured surface, okisurf                      |
| G05B 2219/35147 | . . . | Generation of nice looking composite surface   |
| G05B 2219/35148 | . . . | Geometric modeling for swept volume of moving solids   |
| G05B 2219/35149 | . . . | Generate model with haptic interface, virtual sculpting                                      |
| G05B 2219/35151 | . . . | Modeling geometric, generation or forming of curved surface                                  |
| G05B 2219/35152 | . . . | Part coding, description from 3-D cad database   |
| G05B 2219/35153 | . . . | Group and retrieve similar designs from cad data   |
| G05B 2219/35154 | . . . | Convert 2-D workpiece in rectilinear polygon, simplified skeleton                            |
| G05B 2219/35155 | . . . | From parts catalog, database, define part relationships, product definitions, specifications |
| G05B 2219/35156 | . . . | Group technology, identify and group similar parts, tools and machines                       |
| G05B 2219/35157 | . . . | Machinability, producibility, reject nc program if tool motion not possible                  |
| G05B 2219/35158 | . . . | Calculation of contact point of tool on surface, curve                                       |
| G05B 2219/35159 | . . . | With nominal blank and model in memory define tool path and machine workpiece                |
| G05B 2219/35161 | . . . | Determine orientation of workpiece   |
| G05B 2219/35162 | . . . | Determine workpiece placement, nesting in blank, optimize, minimize loss material            |
| G05B 2219/35163 | . . . | Generation of inverse offset surface, tool center on surface, tip shows offset               |
| G05B 2219/35164 | . . . | Reverse engineering, camera and probe to inspect workpiece and machine are the same ones     |
| G05B 2219/35165 | . . . | Automatic cutter selection   |
| G05B 2219/35166 | . . . | Virtual boundary method to plan coarse and then fine machining                               |
| G05B 2219/35167 | . . . | Automatic toolpath generation and tool selection   |
| G05B 2219/35168 | . . . | Automatic selection of machining conditions, optimum cutting conditions                      |

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| G05B 2219/35169 | . . . | Automatic generation of set up data as function of form to be machined, kind of operation              |
| G05B 2219/35171 | . . . | Automatic selection of machining conditions as function of controlled machine                          |
| G05B 2219/35172 | . . . | Lookup tables for technology, machining parameters   |
| G05B 2219/35173 | . . . | Automatic selection of machine type  |
| G05B 2219/35174 | . . . | Decide if blank has to be measured beforehand  |
| G05B 2219/35175 | . . . | Select machining parameters with fuzzy logic   |
| G05B 2219/35176 | . . . | Constraint, machining constraint, process type like only milling possible                              |
| G05B 2219/35177 | . . . | Power constraint for horizontal and vertical cutting forces  |
| G05B 2219/35178 | . . . | Machining parameter constraint, feed, speed, dimension of part   |
| G05B 2219/35179 | . . . | Tolerance constraints as function of process capability and manufacturing costs                        |
| G05B 2219/35181 | . . . | Machining condition constraints, coolant, chip removal, previous forming                               |
| G05B 2219/35182 | . . . | Scallop hull generation and its offset, interference free offset                                       |
| G05B 2219/35183 | . . . | Maximizing side step, constant CUSP, scallop height, smaller CL datafile for minimizing machining time |
| G05B 2219/35184 | . . . | Variable step over, from toolpath to toolpath  |
| G05B 2219/35185 | . . . | Select optimum tool radius   |
| G05B 2219/35186 | . . . | Variable step forward on same toolpath   |
| G05B 2219/35187 | . . . | Surface ridges, cusps, scallops, distance of tool traverses as function of curvature                   |
| G05B 2219/35188 | . . . | Project workpiece and sheet on screen, position layout to be cut, store contour                        |
| G05B 2219/35189 | . . . | Manufacturing function, derive gripper position on workpiece from cad data                             |
| G05B 2219/35191 | . . . | Project workpiece and gripper, control relative movement, store result                                 |
| G05B 2219/35192 | . . . | From design derive sequence of bending so that bending is possible                                     |
| G05B 2219/35193 | . . . | Manufacturability  |
| G05B 2219/35194 | . . . | From workpiece data derive tool data   |
| G05B 2219/35195 | . . . | Design mosaic, cut tiles, paint tiles and pack mosaic  |
| G05B 2219/35196 | . . . | From workpiece data derive assembly tool data  |
| G05B 2219/35197 | . . . | Assemblability   |
| G05B 2219/35198 | . . . | Combine component electronic catalog, cdrom with cad data to generate nc program                       |
| G05B 2219/35199 | . . . | Processability   |
| G05B 2219/35201 | . . . | Use cad data to test function of designed part, design for test DFT                                    |
| G05B 2219/35202 | . . . | Macroplanning, setup fixture cafp, library machine tables, sequence                                    |
| G05B 2219/35203 | . . . | Parametric modelling, variant programming, process planning  |
| G05B 2219/35204 | . . . | Planning, generic process planning   |
| G05B 2219/35205 | . . . | Planning of toolstages, comprising selection tools, position and motion                                |
| G05B 2219/35206 | . . . | Microplanning, specific machining operations and parameters  |

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| G05B 2219/35207 | . . . | Design agent selects planning agent, which selects fabrication agent                         |
| G05B 2219/35208 | . . . | Object oriented planning   |
| G05B 2219/35209 | . . . | Modifying, adding machining features to elementary cad-parts as function of their assembling |
| G05B 2219/35211 | . . . | Using a search tree  |
| G05B 2219/35212 | . . . | Estimating a cost associated with each operation, amount of time, target cost                |
| G05B 2219/35213 | . . . | Minimize number of setups  |
| G05B 2219/35214 | . . . | Setup planning , number of them, machines needed, part orientation, order                    |
| G05B 2219/35215 | . . . | Generate optimal nc program variant as function of cost, time, surface, energy               |
| G05B 2219/35216 | . . . | Program, generate nc program, code from cad data   |
| G05B 2219/35217 | . . . | Cagd computer aided geometric design, sbgd scanning based geometric design                   |
| G05B 2219/35218 | . . . | From cad data derive fixture configuration and assembly program                              |
| G05B 2219/35219 | . . . | From cad data derive cutting, stacking, sorting program                                      |
| G05B 2219/35221 | . . . | Generate cutter path as function of speed, acceleration condition selected by operator       |
| G05B 2219/35222 | . . . | From cad derive data points for endball mill, grinder, then radius compensation              |
| G05B 2219/35223 | . . . | Tolerance, consider tolerance in design, design for assembly                                 |
| G05B 2219/35224 | . . . | Kinematic tolerance analysis, variation in kinematic function as function of tolerance       |
| G05B 2219/35225 | . . . | Tolerance in setup planning  |
| G05B 2219/35226 | . . . | Analysis of tolerance propagation  |
| G05B 2219/35227 | . . . | Use FMEA failure modes and effects analysis in tolerance assignment design                   |
| G05B 2219/35228 | . . . | Automated tolerance chain generation   |
| G05B 2219/35229 | . . . | Code   |
| G05B 2219/35231 | . . . | Biquinary code, 2-of-7 symbols   |
| G05B 2219/35232 | . . . | Bcd  |
| G05B 2219/35233 | . . . | Octal  |
| G05B 2219/35234 | . . . | First column has 1-2-4, second column has 8-16-32  |
| G05B 2219/35235 | . . . | Decimal to binary  |
| G05B 2219/35236 | . . . | Excess-code  |
| G05B 2219/35237 | . . . | Under four is 0xxx, over four is 1xxx  |
| G05B 2219/35238 | . . . | Gray-code  |
| G05B 2219/35239 | . . . | Ternary code   |
| G05B 2219/35241 | . . . | End, stop code of program  |
| G05B 2219/35242 | . . . | To enable manual operation on detection of inserted code                                     |
| G05B 2219/35243 | . . . | Inserted code calls parallel execution of another program, synchronize                       |



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| G05B 2219/35244 | . . . | Select in corner different program according to inner, outer machining                |
| G05B 2219/35245 | . . . | Expansion of control words, code of standard language to increase functionality       |
| G05B 2219/35246 | . . . | Data handling for auxilliary functions as function of setting of switch, block delete |
| G05B 2219/35247 | . . . | Mode selection between two machining modes, laser beam and laser shutter control      |
| G05B 2219/35248 | . . . | Pallet exchange code to get mating nc program   |
| G05B 2219/35249 | . . . | In corner change cutting command to piercing command, to keep angle point intact      |
| G05B 2219/35251 | . . . | Several M codes sent to several machines simultaneously                               |
| G05B 2219/35252 | . . . | Function, machine codes G, M  |
| G05B 2219/35253 | . . . | To stop program until a cycle start key is pressed                                    |
| G05B 2219/35254 | . . . | GPF, G preparatory functions, G111 indicate switch to polar, absolute to reference    |
| G05B 2219/35255 | . . . | G112 switch to polar, relative to last polar coordinate                               |
| G05B 2219/35256 | . . . | Assign a macro to a key   |
| G05B 2219/35257 | . . . | Macro, assign a name to macro   |
| G05B 2219/35258 | . . . | A named macro can be called from a program, a key, a menu                             |
| G05B 2219/35259 | . . . | Divide program in machining division blocks, and name them                            |
| G05B 2219/35261 | . . . | Use of mathematical expression, functional equation                                   |
| G05B 2219/35262 | . . . | Macro instruction, canned cycles, subroutines, subprogram                             |
| G05B 2219/35263 | . . . | Using variables, parameters in program, macro, parametrized instruction               |
| G05B 2219/35264 | . . . | Reread same data  |
| G05B 2219/35265 | . . . | Check time differences of command signals   |
| G05B 2219/35266 | . . . | On error display code, message for recovery from fault                                |
| G05B 2219/35267 | . . . | Compare ram data to rom data, verify correctness, validity data, tolerance            |
| G05B 2219/35268 | . . . | Detection of presence of rom cassette or similar, if coupled to internal memory       |
| G05B 2219/35269 | . . . | Checking data, parity, diagnostic   |
| G05B 2219/35271 | . . . | Checking electronics  |
| G05B 2219/35272 | . . . | Watchdog, count or integrate number of data errors before alarm                       |
| G05B 2219/35273 | . . . | Sensor to detect functioning of signal conditioning elements                          |
| G05B 2219/35274 | . . . | Parity  |
| G05B 2219/35275 | . . . | Excess in error   |
| G05B 2219/35276 | . . . | Two identical tapes   |
| G05B 2219/35277 | . . . | Double reader   |
| G05B 2219/35278 | . . . | Checksum CRC  |
| G05B 2219/35279 | . . . | Ignoring invalid program  |
| G05B 2219/35281 | . . . | Detect overlap of program, if new data is entered before old is handled, stop         |



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| G05B 2219/35282 | . . . | Verify if loaded program into memory or stored into tape, cassette is correct    |
| G05B 2219/35283 | . . . | Plausibility check for function, program, inhibit dangerous, unallowed program   |
| G05B 2219/35284 | . . . | Programmed speed automatically limited to min and max transmission range speed   |
| G05B 2219/35285 | . . . | Plausibility check for data, within permissible range                            |
| G05B 2219/35286 | . . . | Run tape without machining, tape proving, dry run, test run                      |
| G05B 2219/35287 | . . . | Verify, check program by drawing, display part, testpiece                        |
| G05B 2219/35288 | . . . | Verification of instructions on tape, direct or by comparing with reference      |
| G05B 2219/35289 | . . . | Display machining state and corresponding control program                        |
| G05B 2219/35291 | . . . | Record history, log, journal, audit of machine operation                         |
| G05B 2219/35292 | . . . | By making, plotting a drawing  |
| G05B 2219/35293 | . . . | Execute program and check block of data, on interrupt display block              |
| G05B 2219/35294 | . . . | Display concentric circles   |
| G05B 2219/35295 | . . . | Stop test run, correct instruction or block, restart test run                    |
| G05B 2219/35296 | . . . | Inhibit operation if part shape not compatible with raw material shape           |
| G05B 2219/35297 | . . . | Convert program to voice output to check program                                 |
| G05B 2219/35298 | . . . | Print screen display   |
| G05B 2219/35299 | . . . | Verify if generalised data block has all words required                          |
| G05B 2219/35301 | . . . | On error, push button to reverse execution mode of block, stop, correct          |
| G05B 2219/35302 | . . . | Set and store command code together with display colour, detected on execution   |
| G05B 2219/35303 | . . . | Dry run, compare simulated output with desired finished profile, alarm, inhibit  |
| G05B 2219/35304 | . . . | Real time analysis, check of program, just before machining                      |
| G05B 2219/35305 | . . . | Before machining, verify if all different machining start points are correct     |
| G05B 2219/35306 | . . . | Interference of all tools of turret, or part of tool base with chuck, workpiece  |
| G05B 2219/35307 | . . . | Print out of program on paper, on screen   |
| G05B 2219/35308 | . . . | Update simulator with actual machine, control parameters before start simulation |
| G05B 2219/35309 | . . . | Actual execution times acquired during machining used in simulation              |
| G05B 2219/35311 | . . . | Remote simulation of machining program   |
| G05B 2219/35312 | . . . | Display working state, process   |
| G05B 2219/35313 | . . . | Display, validate tool path for boundary, surface interference                   |
| G05B 2219/35314 | . . . | Display workpiece and machine, chuck, jig, clamp, tool                           |
| G05B 2219/35315 | . . . | Projection, two, three section views   |
| G05B 2219/35316 | . . . | Interference checking between tool , machine, part, chuck, machining range       |
| G05B 2219/35317 | . . . | Display tool shape, to select tool for program, or for interference              |
| G05B 2219/35318 | . . . | 3-D display of workpiece, workspace, tool track                                  |

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|-----------------|-------|---|
| G05B 2219/35319 | . . . | Show alternatively static and dynamic locus, during static update of dynamic                            |
| G05B 2219/35321 | . . . | Display only tool locus, dynamic  |
| G05B 2219/35322 | . . . | Display dynamic tool locus from entered start point to present position                                 |
| G05B 2219/35323 | . . . | Point to two points on tool locus, calculate and display value  |
| G05B 2219/35324 | . . . | Two, more pictures separated on screen, display   |
| G05B 2219/35325 | . . . | Display of locus with possible correction of machining  |
| G05B 2219/35326 | . . . | Scale image automatically to display whole tool locus or indicated area                                 |
| G05B 2219/35327 | . . . | Display tool locus together with correlated machining parameter, load motor                             |
| G05B 2219/35328 | . . . | Shift view as function of shift of tool with respect to workpiece                                       |
| G05B 2219/35329 | . . . | Display entire image within an enlarged image   |
| G05B 2219/35331 | . . . | Display only machined part  |
| G05B 2219/35332 | . . . | Use solid and wire frame plotting to display tool locus, workpiece                                      |
| G05B 2219/35333 | . . . | Display raw material, blank, tool locus, workpiece, alarm if error                                      |
| G05B 2219/35334 | . . . | Display entire part and zoom of detail  |
| G05B 2219/35335 | . . . | Update display image only if tool advanced over a defined distance                                      |
| G05B 2219/35336 | . . . | Display locus and corresponding actual block  |
| G05B 2219/35337 | . . . | Program has instruction to display specific information   |
| G05B 2219/35338 | . . . | Display virtual tool, locus, part to check possibility of execution next block                          |
| G05B 2219/35339 | . . . | A mark for present position of tool, a mark for end point of block, colour                              |
| G05B 2219/35341 | . . . | Display finishing, finishing margin, work, tool and chuck shape, different colours                      |
| G05B 2219/35342 | . . . | Set colour change for a block, display locus for that block in different colour                         |
| G05B 2219/35343 | . . . | Display path and coating thickness and painting time  |
| G05B 2219/35344 | . . . | Display part, programmed locus and not yet machined, uncompleted portions of part                       |
| G05B 2219/35345 | . . . | Display entry of high level program together with corresponding nc program                              |
| G05B 2219/35346 | . . . | VMMC: virtual machining measuring cell simulate machining process with modeled errors, error prediction |
| G05B 2219/35347 | . . . | Replace tool by light emitter, operator checks light path on workpiece                                  |
| G05B 2219/35348 | . . . | Different colour, texture as function of distance, direction between tool and workpiece                 |
| G05B 2219/35349 | . . . | Display part, programmed locus and tool path, trajet, dynamic locus                                     |
| G05B 2219/35351 | . . . | While machining probe model, sense drawing by same program, stop if deviation                           |
| G05B 2219/35352 | . . . | By making a testpiece   |
| G05B 2219/35353 | . . . | While machining compare real path with simulated, command path, contour display                         |
| G05B 2219/35354 | . . . | Polar coordinates, turntable  |

- G05B 2219/35355 . . . Generate at jump a fictive instruction equal to sum of previous instructions
- G05B 2219/35356 . . . Data handling
- G05B 2219/35357 . . . Setup data, includes scale, range, type, selected together with part program
- G05B 2219/35358 . . . If a pattern contains another pattern, separate data to avoid overlap
- G05B 2219/35359 . . . Discriminate between setup data and machining data
- G05B 2219/35361 . . . Discriminate between data for servocontrol directly and nc processing data
- G05B 2219/35362 . . . Group similar operations, to select correction, compensation values
- G05B 2219/35363 . . . Generate data on component arrangement
- G05B 2219/35364 . . . Merge normal nc program with manual entered monitoring, diagnostic criteria
- G05B 2219/35365 . . . Configure buffer dynamically, store two 3-D blocks or one 6-D block
- G05B 2219/35366 . . . Fill buffer dynamically, track read out and write in addresses, fifo
- G05B 2219/35367 . . . Only read buffer, advance tape while machining with data from read buffer
- G05B 2219/35368 . . . Read and work buffer, machine while read in, no switching between buffers
- G05B 2219/35369 . . . Read and work buffer, machine while read in, buffers switched alternative
- G05B 2219/35371 . . . Data from read instead of work buffer, load data directly to work buffer
- G05B 2219/35372 . . . Store variable block, word length into memory
- G05B 2219/35373 . . . Data storage, buffer
- G05B 2219/35374 . . . First memory for independent axis, second memory for synchronized axis
- G05B 2219/35375 . . . Store command data into latch, buffer synchronized to clock
- G05B 2219/35376 . . . Input program, analyze, store to buffer ready to control nc, no further data handling
- G05B 2219/35377 . . . Check for end of block
- G05B 2219/35378 . . . Detect if reference data is not changing anymore to decide a still stand, stop
- G05B 2219/35379 . . . Conversion, normalize
- G05B 2219/35381 . . . Convert in real time input peripheral data to processor data, output data format
- G05B 2219/35382 . . . Distribution
- G05B 2219/35383 . . . Input serial or parallel
- G05B 2219/35384 . . . Serial data handling
- G05B 2219/35385 . . . Decode several blocks at the same time, as a single block, simultaneous, parallel
- G05B 2219/35386 . . . Look ahead processing of plural block data from buffer
- G05B 2219/35387 . . . Transfer measured data first to fastest controller, processor then to slower
- G05B 2219/35388 . . . Processors in parallel, second, third handle rest old block while first starts new block

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| G05B 2219/35389 | . . . | Different block length to select between panel and remote I-O                       |
| G05B 2219/35391 | . . . | Sort, order entered data hierarchical   |
| G05B 2219/35392 | . . . | Set switches, load, cancel data for different axis, spindles simultaneous           |
| G05B 2219/35393 | . . . | Coordinate selection switch   |
| G05B 2219/35394 | . . . | A separate processor for block, span  |
| G05B 2219/35395 | . . . | Memory, ram table with waveform, no need to be loaded by nc program, quicker        |
| G05B 2219/35396 | . . . | Table of contour for cyclic machining, only data for one cycle, derive other        |
| G05B 2219/35397 | . . . | Cross bar switch  |
| G05B 2219/35398 | . . . | Machining, change parameters as function of machining type                          |
| G05B 2219/35399 | . . . | Split part program in elementary machining steps, executable by a single tool       |
| G05B 2219/35401 | . . . | Tool edge, tool shape, dead corner because of tool shape                            |
| G05B 2219/35402 | . . . | Calculate allowable machining capability from cutting conditions                    |
| G05B 2219/35403 | . . . | Calculate midline of tapelike contour, as reference line for stitching              |
| G05B 2219/35404 | . . . | Divide scanned pattern in several closed area, store as intermediate data           |
| G05B 2219/35405 | . . . | Prepare seam data for each pattern size as function of scale and intermediate data  |
| G05B 2219/35406 | . . . | Decompose axis movement, group components, interpolate separately, superpose pulses |
| G05B 2219/35407 | . . . | Position data, calculate data to project characters along curve                     |
| G05B 2219/35408 | . . . | Calculate new position data from actual data to compensate for contour error        |
| G05B 2219/35409 | . . . | DPC direct programming at the console   |
| G05B 2219/35411 | . . . | Clamp detachable teaching box magnetically on housing                               |
| G05B 2219/35412 | . . . | Special interface for manual input to pc  |
| G05B 2219/35413 | . . . | Manual device is automatically recognised and its interface selected                |
| G05B 2219/35414 | . . . | Remote instruction to operate machine tool  |
| G05B 2219/35415 | . . . | 3-D three dimension, space input, spaceball   |
| G05B 2219/35416 | . . . | 3-D joystick  |
| G05B 2219/35417 | . . . | Handle, joystick connected to n+1 wires for n degrees of freedom                    |
| G05B 2219/35418 | . . . | Bird, free flying hand controller, receives signals from transmitters in space      |
| G05B 2219/35419 | . . . | Four and more-DOF hand controller, joystick, manipulandum                           |
| G05B 2219/35421 | . . . | 3-D matrix to input a 3-D surface, position displaced elements read by computer     |
| G05B 2219/35422 | . . . | Unit freely movable in space, detect its position, orientation by triangulation     |
| G05B 2219/35423 | . . . | 6-DOF force reflective hand controller frhc   |
| G05B 2219/35424 | . . . | 16-DOF glove attached to 6-DOF hand controller, superposition                       |
| G05B 2219/35425 | . . . | 18-DOF glove with fifteen load detectors on each finger, eighty one in total        |

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| G05B 2219/35426 | . . . | Prepare, enter next program during execution of actual program, machining                    |
| G05B 2219/35427 | . . . | User controls machine with eye motion, activates icons on display                            |
| G05B 2219/35428 | . . . | Block selection, search  |
| G05B 2219/35429 | . . . | Enter code number directly for function, no use of function keys                             |
| G05B 2219/35431 | . . . | Interactive  |
| G05B 2219/35432 | . . . | Format guide to guide user during input of data  |
| G05B 2219/35433 | . . . | During execution, display asks for parameters, operator answers, machine again               |
| G05B 2219/35434 | . . . | Enter part geometry and manually control path free, directly, real time, cutting             |
| G05B 2219/35435 | . . . | Display, if needed, tolerance memo data at place where real data must be input               |
| G05B 2219/35436 | . . . | Means, manual input, input reference, hand wheel   |
| G05B 2219/35437 | . . . | Decimal  |
| G05B 2219/35438 | . . . | Joystick   |
| G05B 2219/35439 | . . . | Keys or buttons  |
| G05B 2219/35441 | . . . | Production design metaphore, tool, operation like input system                               |
| G05B 2219/35442 | . . . | Hand wheel turns resolver to control movement slide  |
| G05B 2219/35443 | . . . | Portable drill, screw driver to set position of axis instead of handwheel                    |
| G05B 2219/35444 | . . . | Gesture interface, controlled machine observes operator, executes commands                   |
| G05B 2219/35445 | . . . | Joystick for coarse and handwheel for fine movement  |
| G05B 2219/35446 | . . . | Earprotection, earphone  |
| G05B 2219/35447 | . . . | Potentiometer  |
| G05B 2219/35448 | . . . | Datasuit, arm sleeve, actor, operator wears datasuit and generates motion                    |
| G05B 2219/35449 | . . . | Joystick and buttons for menu and function selection, scrolling, +sign and -sign             |
| G05B 2219/35451 | . . . | Mouse with additional wheel, switches for position control                                   |
| G05B 2219/35452 | . . . | Two axis foot pedal  |
| G05B 2219/35453 | . . . | Voice announcement, oral, speech input   |
| G05B 2219/35454 | . . . | Switch between joystick and pedal control  |
| G05B 2219/35455 | . . . | Foot pedal   |
| G05B 2219/35456 | . . . | Disk segments connected to different inputs of microprocessor, represent different positions |
| G05B 2219/35457 | . . . | Joystick for coarse, rotary encoder for fine movement  |
| G05B 2219/35458 | . . . | Control command embedded in video, audio stream, signal                                      |
| G05B 2219/35459 | . . . | Knob, handle, handwheel delivers pulses, electronic handwheel, digipot                       |
| G05B 2219/35461 | . . . | Digitizing, menu tablet, pencil  |
| G05B 2219/35462 | . . . | Mouse  |
| G05B 2219/35463 | . . . | Trackball  |

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| G05B 2219/35464 | . . . | Glove , movement of fingers   |
| G05B 2219/35465 | . . . | Hand wheel  |
| G05B 2219/35466 | . . . | Select with mouse button coarse or fine movement control                          |
| G05B 2219/35467 | . . . | Select between control modes, jog, freeform, grid, corner, locate, contour, slot  |
| G05B 2219/35468 | . . . | Select between teaching, regulate position and direct control of position         |
| G05B 2219/35469 | . . . | Select with button specified picture, interrupt addresses selection table         |
| G05B 2219/35471 | . . . | Select between run and step command mode, step forward, reverse                   |
| G05B 2219/35472 | . . . | Mode selection  |
| G05B 2219/35473 | . . . | Input limit values of speed, position, acceleration or force                      |
| G05B 2219/35474 | . . . | Enter fuzzy command, instruction, like move closer                                |
| G05B 2219/35475 | . . . | Set tolerance values  |
| G05B 2219/35476 | . . . | Switch from auto to manual if operator moves feedback detector, to set parameter  |
| G05B 2219/35477 | . . . | Accelerate input data, exponent as function of pressure, time, turning speed      |
| G05B 2219/35478 | . . . | Set flexibility of axis in working coordinates, to move real axis manually easily |
| G05B 2219/35479 | . . . | Set values, speed of machine as function of force, pressure, duration on key      |
| G05B 2219/35481 | . . . | Display, panel  |
| G05B 2219/35482 | . . . | Eyephone, head-mounted 2-D or 3-D display, also voice and other control           |
| G05B 2219/35483 | . . . | Synoptic display for work shape during machining                                  |
| G05B 2219/35484 | . . . | Use two image memories, update second memory while display first memory           |
| G05B 2219/35485 | . . . | Library of images, pictures, select and modify each, compose them                 |
| G05B 2219/35486 | . . . | Use of two cursors on screen  |
| G05B 2219/35487 | . . . | Display and voice output incorporated in safety helmet of operator                |
| G05B 2219/35488 | . . . | Graphical user interface, labview   |
| G05B 2219/35489 | . . . | Discriminate, different colour, highlight between two states                      |
| G05B 2219/35491 | . . . | Workpiece data display, position, height  |
| G05B 2219/35492 | . . . | Display needed workpiece, tool or data to continue execution of program           |
| G05B 2219/35493 | . . . | Display workpiece and tool data together  |
| G05B 2219/35494 | . . . | Online documentation, manual, procedures, operator, user guidance, assistance     |
| G05B 2219/35495 | . . . | Messages to operator in multimedia, voice and image and text                      |
| G05B 2219/35496 | . . . | Display cursor in changing colour to indicate that object can be selected         |
| G05B 2219/35497 | . . . | Use colour tone, hue to indicate amount of processed quantity                     |
| G05B 2219/35498 | . . . | Synoptic display of available, selectable control modules with their functions    |
| G05B 2219/35499 | . . . | Model of process, machine and parameters  |



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| G05B 2219/35501 | . . . | Colour display  |
| G05B 2219/35502 | . . . | Display picture, image of place of error  |
| G05B 2219/35503 | . . . | Eye tracking associated with head mounted display to detect eye position                  |
| G05B 2219/35504 | . . . | Multilingual communication, messages in different languages                               |
| G05B 2219/35505 | . . . | Display two windows, one with nc-data, other with general application data                |
| G05B 2219/35506 | . . . | Camera images overlayed with graphics, model  |
| G05B 2219/35507 | . . . | Spider, radar, parallel axes, multivariate plot   |
| G05B 2219/35508 | . . . | Operator chooses among different GUI formats  |
| G05B 2219/35509 | . . . | Double large character on screen  |
| G05B 2219/35511 | . . . | Cursor on screen  |
| G05B 2219/35512 | . . . | Display entered, measured values with bargraph  |
| G05B 2219/35513 | . . . | Setting tool condition, tool set in tool exchanger, present or not                        |
| G05B 2219/35514 | . . . | Display tool data   |
| G05B 2219/35515 | . . . | Workpiece set condition, workpiece present or not   |
| G05B 2219/35516 | . . . | Three linear movements in a single plane for three actuators                              |
| G05B 2219/35517 | . . . | Use same data, program for workpieces with different length, but same profile             |
| G05B 2219/35518 | . . . | Superposition data, three memories for 2-D projection and z profile and surface structure |
| G05B 2219/35519 | . . . | Machining data and tool data  |
| G05B 2219/35521 | . . . | Machining and parts on workpiece arrangement data, machine each, then cut out             |
| G05B 2219/35522 | . . . | Database for standard machining data and for personal machining data                      |
| G05B 2219/35523 | . . . | Data one bit better than measurement, rest accumulated in memory                          |
| G05B 2219/35524 | . . . | Approach data and machining data  |
| G05B 2219/35525 | . . . | Use same data for different operations, coarse and fine, cutting and grinding             |
| G05B 2219/35526 | . . . | Number of workpieces to be machined, cut  |
| G05B 2219/35527 | . . . | Range of number of workpieces to be machined, cut   |
| G05B 2219/35528 | . . . | Create machining conditions database by analyzing actual machining nc program             |
| G05B 2219/35529 | . . . | Monitoring current machining, store information in database as a new working case         |
| G05B 2219/35531 | . . . | Operator inputs manually evaluation of current machining                                  |
| G05B 2219/35532 | . . . | Comment, work directive, message to operator and control signals together                 |
| G05B 2219/35533 | . . . | Use, input 2-D data, sectional profile to machine 3-D surface                             |
| G05B 2219/35534 | . . . | Conversion input data   |
| G05B 2219/35535 | . . . | Decimal to binary   |
| G05B 2219/35536 | . . . | Digital to analog   |
| G05B 2219/35537 | . . . | Bcd to phase  |



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| G05B 2219/35538 | . . . | Bcd to decimal  |
| G05B 2219/35539 | . . . | Gray to frequency   |
| G05B 2219/35541 | . . . | Bcd to 5-2-1-1-code   |
| G05B 2219/35542 | . . . | Bcd to binary   |
| G05B 2219/35543 | . . . | Cartesian to polar and vice versa   |
| G05B 2219/35544 | . . . | Convert male to female form, die to stamp form                                      |
| G05B 2219/35545 | . . . | Serial to parallel conversion   |
| G05B 2219/35546 | . . . | Convert input data to execution data  |
| G05B 2219/35547 | . . . | 1-to-8-bit conversion   |
| G05B 2219/35548 | . . . | 1-to-16-bit conversion  |
| G05B 2219/35549 | . . . | Convert buffer content to executable data in case of short execution time           |
| G05B 2219/35551 | . . . | Convert and select between EIA and ISO code   |
| G05B 2219/35552 | . . . | ISO and EIA code detected by difference of parity bit                               |
| G05B 2219/35553 | . . . | Convert ISO or EIA code to internal or standard code                                |
| G05B 2219/35554 | . . . | Mirror, other conversions   |
| G05B 2219/35555 | . . . | Turn figure over 90-degrees or 180-degrees, convert data for new state              |
| G05B 2219/35556 | . . . | Conversion inch to metric   |
| G05B 2219/35557 | . . . | Workpiece related data to axis related data   |
| G05B 2219/35558 | . . . | Convert speed value into two signals sin, cos representing position                 |
| G05B 2219/35559 | . . . | Convert 15-bit image into 20-bit image  |
| G05B 2219/35561 | . . . | Analog to digital   |
| G05B 2219/35562 | . . . | Radius to diameter  |
| G05B 2219/35563 | . . . | Use of conversion tables  |
| G05B 2219/35564 | . . . | High speed data processor between host and nc for direct conversion of data         |
| G05B 2219/35565 | . . . | Communications adapter converts program to machine or controls directly machine     |
| G05B 2219/35566 | . . . | Use of only delta x values, no absolute values                                      |
| G05B 2219/35567 | . . . | Each block contains connection, index to other blocks, to form patterns             |
| G05B 2219/35568 | . . . | Array structure corresponding to display format                                     |
| G05B 2219/35569 | . . . | Single block format indicates change of speed at start and end                      |
| G05B 2219/35571 | . . . | Table with constant speed and corresponding distance for each segment               |
| G05B 2219/35572 | . . . | Data contains header and type of data   |
| G05B 2219/35573 | . . . | Header has code to select proper load program                                       |
| G05B 2219/35574 | . . . | Header with information for display position  |
| G05B 2219/35575 | . . . | Part program contains movement and condition statements                             |
| G05B 2219/35576 | . . . | Data divided in blocks to be covered by small movement, to origin by large movement |
| G05B 2219/35577 | . . . | Delta x, delta v and delta t  |
| G05B 2219/35578 | . . . | Gerber, hp format to drive plotter or similar xy device                             |
| G05B 2219/35579 | . . . | Store motion parameters as function of encoder position                             |

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| G05B 2219/35581 | . . . | Position data for module and position data within module                                  |
| G05B 2219/35582 | . . . | Control format in browser, use of xml and xslt  |
| G05B 2219/35583 | . . . | Difference between signals and sign of difference are the controlling signals             |
| G05B 2219/35584 | . . . | Link geometry, workpiece data with machining data, select region                          |
| G05B 2219/35585 | . . . | Motion command profile  |
| G05B 2219/35586 | . . . | Position, time and slope, tangent of curve  |
| G05B 2219/35587 | . . . | Store curves with packed code, indicating bezier curve parameters                         |
| G05B 2219/35588 | . . . | Pack, compress data efficiently in memory   |
| G05B 2219/36    | . .   | Nc in input of data, input key till input tape  |
| G05B 2219/36001 | . . . | File format, initial graphics exchange specification, iges standard                       |
| G05B 2219/36002 | . . . | Dimensional measurement interface specification dmis standard                             |
| G05B 2219/36003 | . . . | Start key, switch to start performing program   |
| G05B 2219/36004 | . . . | Program mask depends on physical position of panel  |
| G05B 2219/36005 | . . . | Same knob, different functions, turn for position, push and turn for speed                |
| G05B 2219/36006 | . . . | A key delivers a series of key codes  |
| G05B 2219/36007 | . . . | Special keys, automatic switch over x or y to numerical values                            |
| G05B 2219/36008 | . . . | Illuminated, lighting up keys, build in led, display, show sequence data entry            |
| G05B 2219/36009 | . . . | Keys with variable control code, multifunction keys                                       |
| G05B 2219/36011 | . . . | Page key, go to next or previous page   |
| G05B 2219/36012 | . . . | Percentage keys, input percentage values  |
| G05B 2219/36013 | . . . | Up-down keys for calling sequentially functions, parameters                               |
| G05B 2219/36014 | . . . | Overlay to indicate function of key   |
| G05B 2219/36015 | . . . | Display areas, fields on screen correspond to position of keys on panel, matrix           |
| G05B 2219/36016 | . . . | Unified language for machines and translation to each                                     |
| G05B 2219/36017 | . . . | Graphic assisted robot programming, display projection of surface                         |
| G05B 2219/36018 | . . . | Language for dimensional measuring, inspection  |
| G05B 2219/36019 | . . . | Using interpreted descriptive commands giving G-codes                                     |
| G05B 2219/36021 | . . . | Switch high level and assembly, machine language as function of capacity memory and speed |
| G05B 2219/36022 | . . . | Switch between machining language for execution and high level for editing                |
| G05B 2219/36023 | . . . | Attribute programming   |
| G05B 2219/36024 | . . . | State language  |
| G05B 2219/36025 | . . . | Link, connect icons together to form program  |
| G05B 2219/36026 | . . . | Combine general high level language and specialised plc language                          |
| G05B 2219/36027 | . . . | Decompiler, translate machine code to hll, reverse processing, easy modification          |
| G05B 2219/36028 | . . . | C++   |
| G05B 2219/36029 | . . . | Basic   |

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|-----------------|-------|---|
| G05B 2219/36031 | . . . | Programming in assembler, machine or high level language                              |
| G05B 2219/36032 | . . . | Script, interpreted language  |
| G05B 2219/36033 | . . . | High level graphics language, gks   |
| G05B 2219/36034 | . . . | APT   |
| G05B 2219/36035 | . . . | Special language, task programming, oop object oriented programming                   |
| G05B 2219/36036 | . . . | Motion, graphical motion control language gmcl  |
| G05B 2219/36037 | . . . | Application programming interface associates component code with driver function      |
| G05B 2219/36038 | . . . | Ladder program for plc, using functions and motion data                               |
| G05B 2219/36039 | . . . | Learning task dynamics, process   |
| G05B 2219/36041 | . . . | Edit program step by step   |
| G05B 2219/36042 | . . . | Point to defect, faulty instruction or locus, call up corresponding command block     |
| G05B 2219/36043 | . . . | Correction or modification of program   |
| G05B 2219/36044 | . . . | Program modified after breakage, crash, jamming                                       |
| G05B 2219/36045 | . . . | Skip of program blocks, jump over certain blocks                                      |
| G05B 2219/36046 | . . . | Adapt, modify program as function of configuration of machine                         |
| G05B 2219/36047 | . . . | Edit program, change or not header, starting code, output new program with header     |
| G05B 2219/36048 | . . . | Verify, probe workpiece, if position deviation edit, modify program                   |
| G05B 2219/36049 | . . . | Relational geometry, change one element, rest of part is adjusted according           |
| G05B 2219/36051 | . . . | Store history of modified file, back-up, update, using different file extensions      |
| G05B 2219/36052 | . . . | Tape tuning with expert system, correction of tape as function of measured parameters |
| G05B 2219/36053 | . . . | Adapt, modify program in real time as function of workpiece configuration             |
| G05B 2219/36054 | . . . | Modify offset for whole sections collectively, different offsets for sections         |
| G05B 2219/36055 | . . . | Separate, temporary memory or special storage region for corrections only             |
| G05B 2219/36056 | . . . | Modify program, machining order in real time , during operation, dynamically          |
| G05B 2219/36057 | . . . | Select center of pattern for placement of new scaled pattern                          |
| G05B 2219/36058 | . . . | Modify workpiece part program without changing approach program                       |
| G05B 2219/36059 | . . . | Modify approach program as function of changed part program                           |
| G05B 2219/36061 | . . . | Storage, memory area to store history data for previous corrections, editable         |
| G05B 2219/36062 | . . . | Verify if editing, modifying program is suitable for connected controller             |
| G05B 2219/36063 | . . . | During machining, compare simulated with detected profile, correct, modify program    |
| G05B 2219/36064 | . . . | Modify data by using the four rules of arithmetic such as +sign, -sign, xsign, :sign  |
| G05B 2219/36065 | . . . | Modify data by entering a compensation rate value                                     |

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| G05B 2219/36066 | . . . | Collectively modify data instead of each in particular                              |
| G05B 2219/36067 | . . . | Altering working order of program blocks  |
| G05B 2219/36068 | . . . | Change program at allowed point of time or program step                             |
| G05B 2219/36069 | . . . | Display, on machining error, display error message and correct program              |
| G05B 2219/36071 | . . . | Simulate on screen, if operation value out of limits, edit program                  |
| G05B 2219/36072 | . . . | Select pattern, input modification of tolerance                                     |
| G05B 2219/36073 | . . . | Display original and modified part in different colour, highlight, shading, filling |
| G05B 2219/36074 | . . . | Display part, select, mark element and edit corresponding block                     |
| G05B 2219/36075 | . . . | Set certain command codes, discriminate codes and display in different colour       |
| G05B 2219/36076 | . . . | Select icon and display corresponding instructions                                  |
| G05B 2219/36077 | . . . | Display and select, modify shape, pattern on screen                                 |
| G05B 2219/36078 | . . . | Insert, read in new command instruction to modify fixed program                     |
| G05B 2219/36079 | . . . | Replace faulty instructions and execute only that portion of the program            |
| G05B 2219/36081 | . . . | Merge, mix original program with taught program                                     |
| G05B 2219/36082 | . . . | Delete a block by overwriting block with delete control character                   |
| G05B 2219/36083 | . . . | Insert a block by using insert control character pointing to address in memory      |
| G05B 2219/36084 | . . . | Amend, modify program by inserting wait and wait dismiss command                    |
| G05B 2219/36085 | . . . | Replace faulty instructions from rom, tape by instructions from ram, error setting  |
| G05B 2219/36086 | . . . | Select, modify machining, cutting conditions  |
| G05B 2219/36087 | . . . | Edit, modify program for position errors, moving path, use conversion matrix        |
| G05B 2219/36088 | . . . | Machining parameters, override  |
| G05B 2219/36089 | . . . | Machining parameters, modification during operation                                 |
| G05B 2219/36091 | . . . | Modification, override as function of conditions, distance                          |
| G05B 2219/36092 | . . . | Override limit contour  |
| G05B 2219/36093 | . . . | Lookup table with override for each pattern, tool path                              |
| G05B 2219/36094 | . . . | Inhibit or permit override by separate manual switch                                |
| G05B 2219/36095 | . . . | Inhibit or permit override by program instruction                                   |
| G05B 2219/36096 | . . . | Override program by selecting another font, size for letters                        |
| G05B 2219/36097 | . . . | Override program to scale workpiece   |
| G05B 2219/36098 | . . . | Override program to execute a certain number of same blocks, repeat pattern         |
| G05B 2219/36099 | . . . | Stop machine and correct position manually  |
| G05B 2219/36101 | . . . | During machining keep override log, history, journal, kind of record playback       |
| G05B 2219/36102 | . . . | Display override log and nc instructions, select nc block to modify permanent       |

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| G05B 2219/36103 | . . . | Adapt, update machining parameters automatically as function of state of processing   |
| G05B 2219/36104 | . . . | IC card   |
| G05B 2219/36105 | . . . | Cd rom  |
| G05B 2219/36106 | . . . | Cassette  |
| G05B 2219/36107 | . . . | Bubble memory   |
| G05B 2219/36108 | . . . | Eprom, earom, eerom   |
| G05B 2219/36109 | . . . | Flash memory  |
| G05B 2219/36111 | . . . | Local memory instead of tape, or combined   |
| G05B 2219/36112 | . . . | Floppy disk, diskette   |
| G05B 2219/36113 | . . . | Rom   |
| G05B 2219/36114 | . . . | Eprom, prom   |
| G05B 2219/36115 | . . . | Card  |
| G05B 2219/36116 | . . . | Harddisk  |
| G05B 2219/36117 | . . . | Magnetic tape cassette  |
| G05B 2219/36118 | . . . | Adapt interactive dialog, help to experience, short cut menu                          |
| G05B 2219/36119 | . . . | Mouse with buttons to assist operator with selection of menu instead of pointing      |
| G05B 2219/36121 | . . . | Tree oriented menu, go to root, scroll up down, select mode                           |
| G05B 2219/36122 | . . . | Operator menu with submenu for each item  |
| G05B 2219/36123 | . . . | Store statistical history of selected menus, recall for quick data entry              |
| G05B 2219/36124 | . . . | Screen with certain display menu called by pointer, number                            |
| G05B 2219/36125 | . . . | Select out of library, beforehand only functions needed for part program              |
| G05B 2219/36126 | . . . | Programmable, configurable function keys, execute a programmed sequence               |
| G05B 2219/36127 | . . . | Menu, help menu for operator, messages  |
| G05B 2219/36128 | . . . | Function menu, switches, keys replaced by menu  |
| G05B 2219/36129 | . . . | Menu keys, function of keys soft defined  |
| G05B 2219/36131 | . . . | Cyclic selection of functions or values by pushing a single key                       |
| G05B 2219/36132 | . . . | Selection of menu with lightpen on screen, display                                    |
| G05B 2219/36133 | . . . | MMI, HMI: man machine interface, communication  |
| G05B 2219/36134 | . . . | Osf-motif standard  |
| G05B 2219/36135 | . . . | Link between sequence, motion or process and diagnostic control                       |
| G05B 2219/36136 | . . . | User configurable graphics selected as function of kind of machining, display builder |
| G05B 2219/36137 | . . . | Configuration of display device, operator panel                                       |
| G05B 2219/36138 | . . . | Configuration of operator panel, using os-2 modular programs, masks                   |
| G05B 2219/36139 | . . . | Edit templates for screen display, and use of keyboard                                |
| G05B 2219/36141 | . . . | Configuration with visual basic extension   |
| G05B 2219/36142 | . . . | Using window display, selection of function calls in a window                         |
| G05B 2219/36143 | . . . | Use of icon to represent a function, part of program                                  |

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| G05B 2219/36144 | . . . | Display of not allowed function in a different way, light                          |
| G05B 2219/36145 | . . . | In case of alarm a window is maximised automatically                               |
| G05B 2219/36146 | . . . | Group windows into coherent sets to facilitate a task                              |
| G05B 2219/36147 | . . . | Limit number of windows displayed simultaneously                                   |
| G05B 2219/36148 | . . . | Main process, alarm window takes priority, always on top, safe view                |
| G05B 2219/36149 | . . . | Window, X window   |
| G05B 2219/36151 | . . . | Display is a TV  |
| G05B 2219/36152 | . . . | Panel  |
| G05B 2219/36153 | . . . | Two, several consoles, displays, panels, two different input, joystick             |
| G05B 2219/36154 | . . . | Two displays, for part shape and for corresponding instructions, block             |
| G05B 2219/36155 | . . . | Plc switches functions of panel when changing kind of machining                    |
| G05B 2219/36156 | . . . | Keyboard as a drawer   |
| G05B 2219/36157 | . . . | Pendant control box for handwheel control, mounted on controlled axis              |
| G05B 2219/36158 | . . . | Panel for disabled, scanned sequentially   |
| G05B 2219/36159 | . . . | Detachable or portable programming unit, display, pc, pda                          |
| G05B 2219/36161 | . . . | Common program panel for nc, pic, switch display diagnostic or part                |
| G05B 2219/36162 | . . . | Pendant control box  |
| G05B 2219/36163 | . . . | Local as well as remote control panel  |
| G05B 2219/36164 | . . . | Common CRT for two input devices   |
| G05B 2219/36165 | . . . | Common program panel for host and cnc, at cnc place, for data from host, cnc       |
| G05B 2219/36166 | . . . | Several panels can be selected by rotation, limited space needed                   |
| G05B 2219/36167 | . . . | Use camera of handheld device, pda, pendant, head mounted display                  |
| G05B 2219/36168 | . . . | Touchscreen  |
| G05B 2219/36169 | . . . | Remote, host controlled, operated manual data input, keyboard                      |
| G05B 2219/36171 | . . . | Edit velocity, motion profile, graphic plot of speed as function of time, position |
| G05B 2219/36172 | . . . | Select block, item, highlight, colour this block with respect to rest              |
| G05B 2219/36173 | . . . | Combine record play back, hand wheel with normal cnc programming, software         |
| G05B 2219/36174 | . . . | Program divided into modules   |
| G05B 2219/36175 | . . . | Capture image of part, create automatically geometry, sequence of machining        |
| G05B 2219/36176 | . . . | Edit servo control parameters  |
| G05B 2219/36177 | . . . | Select block and display graphic representation associated with block type         |
| G05B 2219/36178 | . . . | Derive finishing allowance, tolerance from shape and work information              |
| G05B 2219/36179 | . . . | Combine nc programming with cad and order system                                   |
| G05B 2219/36181 | . . . | Input part data, dimensions, without graphical representation of part              |
| G05B 2219/36182 | . . . | First block contour then parameter input   |
| G05B 2219/36183 | . . . | Offline teaching is sound assisted   |



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| G05B 2219/36184 | . . . | Record actions of human expert, teach by showing                                   |
| G05B 2219/36185 | . . . | Application, for cylindrical groove shape  |
| G05B 2219/36186 | . . . | Programming languages for lathe, mill or general use mixed                         |
| G05B 2219/36187 | . . . | End shape data input for end surface configuration                                 |
| G05B 2219/36188 | . . . | Deep drilling cycle  |
| G05B 2219/36189 | . . . | Wheel dressing program   |
| G05B 2219/36191 | . . . | Prepare rough, coarse machining program  |
| G05B 2219/36192 | . . . | End facing   |
| G05B 2219/36193 | . . . | Semi finish and finish machining   |
| G05B 2219/36194 | . . . | Taper angle machining  |
| G05B 2219/36195 | . . . | Assembly, mount of electronic parts onto board                                     |
| G05B 2219/36196 | . . . | Grinding cycle   |
| G05B 2219/36197 | . . . | Non circular workpiece, radius and angle input                                     |
| G05B 2219/36198 | . . . | Gear, thread cutting   |
| G05B 2219/36199 | . . . | Laser cutting  |
| G05B 2219/36201 | . . . | Hole machining   |
| G05B 2219/36202 | . . . | Freeform surfaces  |
| G05B 2219/36203 | . . . | Bending of workpiece, also for long slender workpiece                              |
| G05B 2219/36204 | . . . | Lathe, turning   |
| G05B 2219/36205 | . . . | For aspheric non symmetrical mirrors   |
| G05B 2219/36206 | . . . | Embroidery   |
| G05B 2219/36207 | . . . | Involute curve, compressor   |
| G05B 2219/36208 | . . . | Roll grinding  |
| G05B 2219/36209 | . . . | Specify hole shape pattern for boring and store in hole file                       |
| G05B 2219/36211 | . . . | Using different cutter sizes, largest as possible for minimizing machining time    |
| G05B 2219/36212 | . . . | Using generic virtual pocket, having virtual boundary, arbitrarily shaped          |
| G05B 2219/36213 | . . . | Grouping of decomposed volumes with similar features                               |
| G05B 2219/36214 | . . . | Pocket machining, area clearance, contained cutting, axis milling                  |
| G05B 2219/36215 | . . . | Insert automatically program sequence, for corner execution, avoid machining error |
| G05B 2219/36216 | . . . | Replace entered position data with previous if difference less than tolerance      |
| G05B 2219/36217 | . . . | Commands trigger programming functions   |
| G05B 2219/36218 | . . . | Reuse stored data as programming data after confirmation                           |
| G05B 2219/36219 | . . . | Calculate machining information, like time, surface to be machined from program    |
| G05B 2219/36221 | . . . | Entry of chamfer, beveling, rounding of corner shape                               |
| G05B 2219/36222 | . . . | Indicate entered element on top, next element below, after input, update top       |
| G05B 2219/36223 | . . . | Enter machining conditions, determine automatically machining data                 |



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| G05B 2219/36224 | . . . | Enter machining and positioning elements, derive order of execution in real time                         |
| G05B 2219/36225 | . . . | Select and insert program from library, select case, variant   |
| G05B 2219/36226 | . . . | Global selection of grid or circle of points by number, distance, angle                                  |
| G05B 2219/36227 | . . . | Assist operator to calculate unknown points, contours  |
| G05B 2219/36228 | . . . | Combine two programs to obtain new shifted positions and new processing data                             |
| G05B 2219/36229 | . . . | Generate missed line when last end point is different from next start point                              |
| G05B 2219/36231 | . . . | Translate, convert machine independent to machine dependent program                                      |
| G05B 2219/36232 | . . . | Before machining, convert, adapt program to specific possibilities of machine                            |
| G05B 2219/36233 | . . . | Convert program so that it can be executed in reverse order  |
| G05B 2219/36234 | . . . | Convert program for a 2-axis machine into program for 4-axis machine                                     |
| G05B 2219/36235 | . . . | Convert grinding machine oriented language to nc machine oriented  |
| G05B 2219/36236 | . . . | Convert character, ascii, text code to internal code and vice versa                                      |
| G05B 2219/36237 | . . . | Prepare nc program for selected, distinct nc machines  |
| G05B 2219/36238 | . . . | Derive marking from punching program, secondary from principal program                                   |
| G05B 2219/36239 | . . . | Determine automatic, manual machining of workpiece as function of specific possibilities of machine tool |
| G05B 2219/36241 | . . . | Convert, translate milling to laser machining program  |
| G05B 2219/36242 | . . . | Convert program for different machines with different M-code, G-code, header                             |
| G05B 2219/36243 | . . . | Convert source, high level code to machine, object code  |
| G05B 2219/36244 | . . . | Means, use of tables, correlating functions to instructions  |
| G05B 2219/36245 | . . . | Use of tables to store order of execution of functions   |
| G05B 2219/36246 | . . . | Comments, messages displayed with program instructions, explain process                                  |
| G05B 2219/36247 | . . . | Remarks, comments as hierarchical structure, indented, corresponds to instructions                       |
| G05B 2219/36248 | . . . | Generate automatically machining, stitching points from scanned contour                                  |
| G05B 2219/36249 | . . . | Generate automatically a balance program for workpiece, dynamic balance                                  |
| G05B 2219/36251 | . . . | Superpose scanned or finished object image on workpiece model for best fitting                           |
| G05B 2219/36252 | . . . | Generate machining program based on a simulation to optimize a machine parameter                         |
| G05B 2219/36253 | . . . | Generate machining program from previous test run  |
| G05B 2219/36254 | . . . | Generate machining program from history of similar tools   |
| G05B 2219/36255 | . . . | Machining condition, parameter is workpiece conicity, inclination between surfaces                       |
| G05B 2219/36256 | . . . | Define upper lower limit of reciprocating machining, chopping  |
| G05B 2219/36257 | . . . | Indicate region and kind of machining on shape of part   |

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| G05B 2219/36258 | . . . | Machining planning, indicate kind of operation   |
| G05B 2219/36259 | . . . | Indicate primary and secondary operations on shape, deliver nc data for each               |
| G05B 2219/36261 | . . . | Program with subroutines for machining process   |
| G05B 2219/36262 | . . . | Input workpiece mounting position, setup   |
| G05B 2219/36263 | . . . | Select cutting direction   |
| G05B 2219/36264 | . . . | Program movement from first to second machining area                                       |
| G05B 2219/36265 | . . . | Set machining start point from tool, machining data avoiding interference                  |
| G05B 2219/36266 | . . . | Tool path editor, for offset, multi-passes   |
| G05B 2219/36267 | . . . | Process planning editor  |
| G05B 2219/36268 | . . . | From blank and finished entered shape, derive machining features                           |
| G05B 2219/36269 | . . . | Separate machining data as function of dependance or independance of material              |
| G05B 2219/36271 | . . . | Enter, edit workpiece data   |
| G05B 2219/36272 | . . . | Enter start position, program number for each workpiece                                    |
| G05B 2219/36273 | . . . | Use general and tool data to select available tool and machining operation                 |
| G05B 2219/36274 | . . . | Automatic calculation cutting conditions, but operator can enter them also                 |
| G05B 2219/36275 | . . . | Select automatically transmission ratio as function of programmed speed                    |
| G05B 2219/36276 | . . . | Program virtual, logical tools, select tool from tables                                    |
| G05B 2219/36277 | . . . | Flexible fixturing, clamp workpiece, mark clamp regions and store them                     |
| G05B 2219/36278 | . . . | Topological classification of forming, machining process                                   |
| G05B 2219/36279 | . . . | Machining parameter is strategy for making corners   |
| G05B 2219/36281 | . . . | Machining parameter is technology: surface roughness, corner, contour tolerance            |
| G05B 2219/36282 | . . . | Divide complex sculptured surface into smaller, easier to machine areas                    |
| G05B 2219/36283 | . . . | Select, enter machining, cutting conditions, material file, tool file                      |
| G05B 2219/36284 | . . . | Use of database for machining parameters, material, cutting method, tools                  |
| G05B 2219/36285 | . . . | Display symbol pattern for kind of machining performed                                     |
| G05B 2219/36286 | . . . | Show shape of workpiece, point to coordinates to enter machining parameters                |
| G05B 2219/36287 | . . . | Selection of speed as function of tool diameter  |
| G05B 2219/36288 | . . . | Select machining method, parameters as function of dimensions of workpiece                 |
| G05B 2219/36289 | . . . | Cutting, machining conditions by optimisation of time, cost, accuracy                      |
| G05B 2219/36291 | . . . | Cutting, machining conditions by empirical equation, like tool life                        |
| G05B 2219/36292 | . . . | Method to drill, machine based on ratio bore depth, diameter, select tools                 |
| G05B 2219/36293 | . . . | Set feed and speed for specified tool, workpiece as function of ratio cutting force, speed |
| G05B 2219/36294 | . . . | Stored coefficients, standard cutting conditions, calculate for entered material           |

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| G05B 2219/36295 | . . . | Select optimum process for manufacturing articles with longer life                       |
| G05B 2219/36296 | . . . | Order, select, determine, change machining sequence, order                               |
| G05B 2219/36297 | . . . | Machining plan, indicate order of machining as function of presence of operator          |
| G05B 2219/36298 | . . . | Enter, change order of different programs to be executed                                 |
| G05B 2219/36299 | . . . | Generate sequences of operations starting from finished product, end with raw            |
| G05B 2219/36301 | . . . | Optimisation of sequence of operations   |
| G05B 2219/36302 | . . . | Determine several machining processes and order as function of available tools           |
| G05B 2219/36303 | . . . | Determine several machining processes and order as function of number of mountable tools |
| G05B 2219/36304 | . . . | Divide into several machining processes, divide each also in several sub processes       |
| G05B 2219/36305 | . . . | Table, correlation tool type and machining category, process                             |
| G05B 2219/36306 | . . . | Table correlation different turrets, slides and possible simultaneous operations         |
| G05B 2219/36307 | . . . | Table with workpiece features and corresponding machining parameters, methods            |
| G05B 2219/36308 | . . . | Table for cutting conditions   |
| G05B 2219/36309 | . . . | Program has different modules, each with own load program                                |
| G05B 2219/36311 | . . . | Machining mode selection, pocket, grooving, raster, area, profile                        |
| G05B 2219/36312 | . . . | Enter shape with cursor, joystick directions up, down, left , right, slash               |
| G05B 2219/36313 | . . . | If elements cannot be combined, show error   |
| G05B 2219/36314 | . . . | Superpose and combine shapes   |
| G05B 2219/36315 | . . . | Library for shapes of tool holders, fixtures, chucks                                     |
| G05B 2219/36316 | . . . | Define profile from elements, show only selectable elements                              |
| G05B 2219/36317 | . . . | Input symbol for element, search in library and display                                  |
| G05B 2219/36318 | . . . | Enter start, begin and stop, end point   |
| G05B 2219/36319 | . . . | Simplify display, calculation of shapes by deleting holes, grooves                       |
| G05B 2219/36321 | . . . | Program only shape, add approach path and machining conditions automatically             |
| G05B 2219/36322 | . . . | Program shape interactively and tool change position manually by teaching                |
| G05B 2219/36323 | . . . | Shape is alphabetical character  |
| G05B 2219/36324 | . . . | Scan drawing, sketch of part, enter on screen coordinates, lines, circles                |
| G05B 2219/36325 | . . . | Enter shape with mouse, tablet, enter on screen coordinates, lines, circles              |
| G05B 2219/36326 | . . . | Define blank, part, area   |
| G05B 2219/36327 | . . . | Define shape of part   |
| G05B 2219/36328 | . . . | Display closed shape   |
| G05B 2219/36329 | . . . | Display path on cylinder by developing cylinder into a plane                             |
| G05B 2219/36331 | . . . | Display block with cursor or highlight actual contour element                            |

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| G05B 2219/36332 | . . . | Display different faces of work in different colour                             |
| G05B 2219/36333 | . . . | Selection from standard forms, shapes, partprograms, enter value for variable   |
| G05B 2219/36334 | . . . | Select a shape, select a point or line and enter data                           |
| G05B 2219/36335 | . . . | Select and show already defined lines, circles to define from them new element  |
| G05B 2219/36336 | . . . | Select a shape and use it to create a similar shape                             |
| G05B 2219/36337 | . . . | Select similar shape and derive motion defining sentences from original shape   |
| G05B 2219/36338 | . . . | Create program for parallel, simultaneous operated slides, timing               |
| G05B 2219/36339 | . . . | Time necessary for one slide equals time for second slide                       |
| G05B 2219/36341 | . . . | Prepare program to control multiple slides at the same time                     |
| G05B 2219/36342 | . . . | Tool path processing, sequence to cut paths                                     |
| G05B 2219/36343 | . . . | Select machining method as function of selected tool                            |
| G05B 2219/36344 | . . . | Display different tools in different colours                                    |
| G05B 2219/36345 | . . . | Prepare program for minimal idle strokes with multitool turret                  |
| G05B 2219/36346 | . . . | Display feed quantity and cutting speed as function of material to help user    |
| G05B 2219/36347 | . . . | Select tool if tool life duration is sufficient for operation                   |
| G05B 2219/36348 | . . . | Enter, edit tool, cutter data   |
| G05B 2219/36349 | . . . | Compensation part program with form of tool, in memory                          |
| G05B 2219/36351 | . . . | Display tool shapes to select tool and enter tool dimensions                    |
| G05B 2219/36352 | . . . | Select tool as function of part shape, number of grooves and groove width       |
| G05B 2219/36353 | . . . | Display different offset surfaces in different colours to select right tool     |
| G05B 2219/36354 | . . . | Select from table with machining type and corresponding tools                   |
| G05B 2219/36355 | . . . | Select tool with fuzzy logic  |
| G05B 2219/36356 | . . . | Select tool as function of collision avoidance                                  |
| G05B 2219/36357 | . . . | Tool line up, select right order of tool, optimal tool order loading, tool file |
| G05B 2219/36358 | . . . | Use of cd rom with catalog of tools   |
| G05B 2219/36359 | . . . | As function of tool location  |
| G05B 2219/36361 | . . . | Tool change time, program for optimal tool change time                          |
| G05B 2219/36362 | . . . | Tool change time as function of location in tool magazine, index                |
| G05B 2219/36363 | . . . | Tool change time as function of cutter trajectory, spindle and slide times      |
| G05B 2219/36364 | . . . | Tool change time as function of tool switch time, to replace tool with another  |
| G05B 2219/36365 | . . . | Program so that minimal tool changes are needed                                 |
| G05B 2219/36366 | . . . | Data, read in, distribution   |
| G05B 2219/36367 | . . . | A tape reader for each axis   |
| G05B 2219/36368 | . . . | Tape reader   |
| G05B 2219/36369 | . . . | Measuring object, spectacle glass, to derive position data                      |
| G05B 2219/36371 | . . . | Barcode reader  |

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| G05B 2219/36372 | . . . | Light, magnetic pen   |
| G05B 2219/36373 | . . . | Common tape reader for two controllers  |
| G05B 2219/36374 | . . . | Dual, multiple tape reader  |
| G05B 2219/36375 | . . . | Combination of two devices, floppy disk and tape reader                           |
| G05B 2219/36376 | . . . | Read out of memory synchronized with machine driven axis                          |
| G05B 2219/36377 | . . . | Read of several jobs  |
| G05B 2219/36378 | . . . | Either from tape or other source, using same electronics                          |
| G05B 2219/36379 | . . . | Read in   |
| G05B 2219/36381 | . . . | Timing, synchronization, start of reader  |
| G05B 2219/36382 | . . . | Speed of read in of data as function of available power for driving servo, safety |
| G05B 2219/36383 | . . . | Manual input combined with input from computer or tape                            |
| G05B 2219/36384 | . . . | Load machining program and workpiece delivery program together                    |
| G05B 2219/36385 | . . . | Transfer, load data from rom, bubble memory into ram                              |
| G05B 2219/36386 | . . . | Bootstrap loader  |
| G05B 2219/36387 | . . . | Interface between reader and nc   |
| G05B 2219/36388 | . . . | Simulate reader to input data direct to nc, behind tape reader BTR                |
| G05B 2219/36389 | . . . | Switch between input from internal manual thumbwheel and external input           |
| G05B 2219/36391 | . . . | Keep subsystem stopped while load of program                                      |
| G05B 2219/36392 | . . . | Rewrite data if power loss, check flag area, marked at start, end of writing      |
| G05B 2219/36393 | . . . | Variable read in speed, from max to zero, controls execution speed of program     |
| G05B 2219/36394 | . . . | Read in data from connected pc instead of nc control panel                        |
| G05B 2219/36395 | . . . | Load local computer program from host, data transfer ram to rom , BTR             |
| G05B 2219/36396 | . . . | Load also function code needed to execute part program, compact controller        |
| G05B 2219/36397 | . . . | Read reference data only after certain delay, to be sure data will not change     |
| G05B 2219/36398 | . . . | Read of handwritten text  |
| G05B 2219/36399 | . . . | On excess error or on release joystick stop movement, dead man, shut off motors   |
| G05B 2219/36401 | . . . | Record play back, teach position and record it then play back                     |
| G05B 2219/36402 | . . . | Use rope, wire, cable, chain to record position and for playback                  |
| G05B 2219/36403 | . . . | Incremental detector of position deviation attached to tool for correction        |
| G05B 2219/36404 | . . . | Adapt taught position as function of deviation 3-D, 2-D position workpiece        |
| G05B 2219/36405 | . . . | Adjust path by detecting path, line with a photosensor                            |
| G05B 2219/36406 | . . . | Use a spring or gas pressure to keep tool on desired path                         |
| G05B 2219/36407 | . . . | Follow path with probe, store deviations for correction during normal operation   |

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| G05B 2219/36408 | . . . | During machining, store begin and end of region not finished during first pass  |
| G05B 2219/36409 | . . . | Geometric adaptation by sensing force on surface of workpiece, object   |
| G05B 2219/36411 | . . . | By coarse model of robot to modify commands, learned by feedforward controller  |
| G05B 2219/36412 | . . . | Fine, autonomous movement of end effector by using camera   |
| G05B 2219/36413 | . . . | Adapt playback as function of hardness material, time comparison to reach start point   |
| G05B 2219/36414 | . . . | Compare image detected path with stored reference, difference corrects position   |
| G05B 2219/36415 | . . . | Adjust path and attitude tool by detecting path, line with a photosensor, laser   |
| G05B 2219/36416 | . . . | Adapt taught position as function of deviation 3-D, 2-D position of end effector, tool  |
| G05B 2219/36417 | . . . | Programmed coarse position, fine position by alignment, follow line, path adaptive  |
| G05B 2219/36418 | . . . | Modify trajectory by operator gesture, gesture force sensed by end effector   |
| G05B 2219/36419 | . . . | Compare modified, corrected path with stored reference, difference too large alarm  |
| G05B 2219/36421 | . . . | Assist in correction of position to form a circle or line   |
| G05B 2219/36422 | . . . | During teaching shut off, disable motor to move arm easy  |
| G05B 2219/36423 | . . . | During teaching release brake or decouple clutch from motor   |
| G05B 2219/36424 | . . . | Balance mechanically arm to be moved  |
| G05B 2219/36425 | . . . | Move manually, touch surface, record position   |
| G05B 2219/36426 | . . . | Pilot lamp on end effector to guide operator  |
| G05B 2219/36427 | . . . | Jog feed to a command position, if close enough robot takes over positioning  |
| G05B 2219/36428 | . . . | During teaching set torque instruction for motor to zero  |
| G05B 2219/36429 | . . . | Power assisted positioning  |
| G05B 2219/36431 | . . . | Tv camera in place of tool, on display operator marks points, crosshair   |
| G05B 2219/36432 | . . . | By putting some constraints on some DOF, move within limited volumes, areas, planes, limits motion in x, y or z planes, virtual reality constraints |
| G05B 2219/36433 | . . . | Position assisted teaching  |
| G05B 2219/36434 | . . . | During teaching direct control signal to power servo for quick response   |
| G05B 2219/36435 | . . . | Electromyographical, myoelectric control signal   |
| G05B 2219/36436 | . . . | Arm follows movement of handheld device, camera detects, analyses motion  |
| G05B 2219/36437 | . . . | Follow coarse programmed surface, detect contact feeler or no force, record point   |
| G05B 2219/36438 | . . . | Manually selection of points on surface to select area to scan automatically  |
| G05B 2219/36439 | . . . | Guide arm in path by slaving arm to projected path, beam riding   |
| G05B 2219/36441 | . . . | Follow contour, line with sensor and record points  |



- G05B 2219/36442 . . . Automatically teaching, teach by showing
- G05B 2219/36443 . . . Auto follow coarse contour, operator can correct contour before recording
- G05B 2219/36444 . . . Contour, teach contour of sawblade
- G05B 2219/36445 . . . Mode selection between large displacement and precision work
- G05B 2219/36446 . . . Keep tool stationary, move workpiece
- G05B 2219/36447 . . . Project light on path to be followed, keep also distance constant
- G05B 2219/36448 . . . Teaching, consider workpoint on workpiece temporarily as tip of end effector
- G05B 2219/36449 . . . During teaching use standard subroutines, assemble them to macro sequences
- G05B 2219/36451 . . . Handheld toollike probe, work instructor, lightweighted, connected to recorder
- G05B 2219/36452 . . . Touch points with handheld probe, camera detects position and orientation probe
- G05B 2219/36453 . . . Handheld tool like probe
- G05B 2219/36454 . . . Master slave, director agent, operator replication
- G05B 2219/36455 . . . Sensor, tactile feedback, operator feels forces of tool on workpiece
- G05B 2219/36456 . . . Learning tool holding dynamics
- G05B 2219/36457 . . . During teaching, force set point is automatically adapted to circumstances
- G05B 2219/36458 . . . Teach only some points, for playback interpolation between points
- G05B 2219/36459 . . . offline program for plural robots, send data to corresponding robots
- G05B 2219/36461 . . . Teach for each next similar fixture, piece only some reference points
- G05B 2219/36462 . . . Minimize teach time, compress data, many points in curve, few in line
- G05B 2219/36463 . . . Manual switch to drive motor to wanted position, store, memorize position
- G05B 2219/36464 . . . Position, teach, store extreme, full open, closed positions
- G05B 2219/36465 . . . Teach and store also intermediate, between full open and closed positions, areas
- G05B 2219/36466 . . . Teach motion profile in both directions, between full closed and open position
- G05B 2219/36467 . . . Teach and store time needed from open to closed and closed to open position
- G05B 2219/36468 . . . Teach and store intermediate stop position in moving route to avoid collision
- G05B 2219/36469 . . . Separate axis movement with higher acceleration replaces simultaneous movement
- G05B 2219/36471 . . . Recording speed different from playback speed
- G05B 2219/36472 . . . During teaching low servo power, during playback high servo power
- G05B 2219/36473 . . . Prohibit teaching if force, speed, acceleration of end effector is out of safe range
- G05B 2219/36474 . . . Prohibit normal manipulator control during teaching
- G05B 2219/36475 . . . When operator near robot, local pendant is enabled otherwise select local remote



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| G05B 2219/36476 | . . . | Record points if sufficient difference with previous position exists  |
| G05B 2219/36477 | . . . | Timing record position according to pulses coding wheel   |
| G05B 2219/36478 | . . . | Record on predetermined time, read in position, measured data   |
| G05B 2219/36479 | . . . | Record position on trigger of touch probe   |
| G05B 2219/36481 | . . . | Record at predetermined distances, read in position, measured data  |
| G05B 2219/36482 | . . . | Recording of position and of command instructions   |
| G05B 2219/36483 | . . . | Recording mechanical properties, tonal quality by force detection   |
| G05B 2219/36484 | . . . | Each taught point has a correlated amount of shift data, independently modified                               |
| G05B 2219/36485 | . . . | Memorize open and closed state, motion parameters at each start up  |
| G05B 2219/36486 | . . . | Memorize workpiece deviations as function of angle, compensate, extra feed                                    |
| G05B 2219/36487 | . . . | Record position, motion and sound   |
| G05B 2219/36488 | . . . | Record motion and emotion, mimics   |
| G05B 2219/36489 | . . . | Position and force  |
| G05B 2219/36491 | . . . | Contour of workpiece where other workpiece is to be installed   |
| G05B 2219/36492 | . . . | Record position and orientation, posture of probe, tool   |
| G05B 2219/36493 | . . . | Position of stillstand if no reverse and acceleration only, data compression                                  |
| G05B 2219/36494 | . . . | Record position and inclination of tool, wrist  |
| G05B 2219/36495 | . . . | Recording position and other parameters, current, tool diameter, voltage                                      |
| G05B 2219/36496 | . . . | Memorize open, closed state of hand and corresponding motion parameters such as open, close and move, no move |
| G05B 2219/36497 | . . . | Select program, main and secondary program  |
| G05B 2219/36498 | . . . | Main and secondary program for repeating same operations  |
| G05B 2219/36499 | . . . | Part program, workpiece, geometry and environment , machining dependant, combine                              |
| G05B 2219/36501 | . . . | For each contour a tape, a program  |
| G05B 2219/36502 | . . . | Ram for variable servo data, rom for fixed servo routine  |
| G05B 2219/36503 | . . . | Adapt program to real coordinates, software orientation   |
| G05B 2219/36504 | . . . | Adapt program to real coordinates, shape, dimension of tool, offset path                                      |
| G05B 2219/36505 | . . . | Compare stored conditions to actual, adapt program  |
| G05B 2219/36506 | . . . | Store in Rom and Ram  |
| G05B 2219/36507 | . . . | Select program or execute command, control instructions as function of axis position                          |
| G05B 2219/36508 | . . . | Each pallet, workpiece, tool holder, selects corresponding tape reader, program                               |
| G05B 2219/36509 | . . . | Select as function of shape, dimension of workpiece   |
| G05B 2219/36511 | . . . | Select by a detector  |
| G05B 2219/36512 | . . . | Select by a selector, dip switch  |
| G05B 2219/36513 | . . . | Select out of a plurality of programs, patterns   |
| G05B 2219/36514 | . . . | Select by force, height or other detection  |

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| G05B 2219/36515 | . . . | As function of material or pattern direction, nerves of wood for optimal cutting |
| G05B 2219/36516 | . . . | Select acceleration deceleration profile as function of kind of machine          |
| G05B 2219/36517 | . . . | Selecting nc program points to mated manipulator, robot program                  |
| G05B 2219/36518 | . . . | Selection of calibration program as function of parameter to be calibrated       |
| G05B 2219/36519 | . . . | After sporadic change of program, return to program in use before                |
| G05B 2219/36521 | . . . | Select by combination of detected force, acceleration, speed, work rate          |
| G05B 2219/36522 | . . . | Select program using a management, workpiece number                              |
| G05B 2219/36523 | . . . | Select with code on workpiece, fixture, clamp, object                            |
| G05B 2219/36524 | . . . | Selection of Rom and ram   |
| G05B 2219/36525 | . . . | On bad data block, reverse motion, correct and execute block                     |
| G05B 2219/36526 | . . . | Regenerate, hold reference previous block for bad actual value, block            |
| G05B 2219/36527 | . . . | Separate input for machine data from operator and for program from programmer    |
| G05B 2219/36528 | . . . | Interlock, inhibit nc control while transferring data from host                  |
| G05B 2219/36529 | . . . | Warn, alert, notify operator to confirm a preset override value, command         |
| G05B 2219/36531 | . . . | Inhibit, ignore or postpone new command if previous is still in execution        |
| G05B 2219/36532 | . . . | Detect overflow of buffer  |
| G05B 2219/36533 | . . . | Writing critical contour data as a whole, inhibit read out during writing        |
| G05B 2219/36534 | . . . | Manual input overrides automatic control   |
| G05B 2219/36535 | . . . | Check if instruction is executable, if not message to operator                   |
| G05B 2219/36536 | . . . | Inhibit, forbid, prevent execution of program if no tool or workpiece data       |
| G05B 2219/36537 | . . . | On error acoustic signal   |
| G05B 2219/36538 | . . . | Different tunes, melodies, voice patterns for different error indication         |
| G05B 2219/36539 | . . . | Different colours for program and machine error, failure display                 |
| G05B 2219/36541 | . . . | Operation command stored in register, on completion also in other register       |
| G05B 2219/36542 | . . . | Cryptography, encrypt, access, authorize with key, code, password                |
| G05B 2219/36543 | . . . | Input a standard value automatically on power up or after power loss             |
| G05B 2219/36544 | . . . | Inhibiting manual control while under automatic, other control vice versa        |
| G05B 2219/36545 | . . . | Safety, save data at power loss  |
| G05B 2219/36546 | . . . | Memory protection, protected fields  |
| G05B 2219/36547 | . . . | Use binary code to avoid program tampering                                       |
| G05B 2219/36548 | . . . | Save data if trigger signal received   |
| G05B 2219/36549 | . . . | Regenerate faulty program block from previous and next block                     |
| G05B 2219/36551 | . . . | Inhibiting control after detecting data error                                    |
| G05B 2219/36552 | . . . | Inhibiting simultaneous input from local and remote keyboard                     |
| G05B 2219/36553 | . . . | Track, channel on tape for each direction of movement                            |
| G05B 2219/36554 | . . . | Copy modified, corrected program to another tape, keep original intact           |
| G05B 2219/36555 | . . . | Two tapes, programs one for position data, one for commands                      |
| G05B 2219/36556 | . . . | Compare, check original tape with converted, copy tape                           |

- G05B 2219/36557 . . . Copy entered program in memory to tape
- G05B 2219/36558 . . . Forward and backward reading of tape, reverse execution program
- G05B 2219/36559 . . . Copy one tape to another, transfer program from tape to tape, back-up
- G05B 2219/36561 . . . Tape, band
- G05B 2219/36562 . . . One tape, copy feeler controls several machines
- G05B 2219/36563 . . . Two tapes
- G05B 2219/36564 . . . Position of hole in tape corresponds with position of hole on workpiece
- G05B 2219/36565 . . . Cartesian and polar data mixed
- G05B 2219/36566 . . . Mix polar data with cartesian data
- G05B 2219/36567 . . . On tape also commands for equipment attached to machine
- G05B 2219/36568 . . . Control data is sequence of position, axis indication, time delay for speed
- G05B 2219/36569 . . . Enter, punch only different, changed data, same not repeated in next block
- G05B 2219/36571 . . . Coarse and fine dimensions
- G05B 2219/36572 . . . Macro data or coarse dimension on tape
- G05B 2219/36573 . . . X, y, z and tooloffset values or direction values
- G05B 2219/36574 . . . Absolute x or delta x values
- G05B 2219/36575 . . . On tape reference and command signals
- G05B 2219/36576 . . . Relative phase of signals is variable
- G05B 2219/36577 . . . Signals have a position dependant frequency
- G05B 2219/36578 . . . Tracks for x, two for delta x, one for sign, three for y
- G05B 2219/36579 . . . Only true dimension is recorded, no tool offset
- G05B 2219/36581 . . . X, Y, Vx, Vy
- G05B 2219/36582 . . . Special order
- G05B 2219/36583 . . . Each punched hole is one pulse, increment
- G05B 2219/36584 . . . X, Y, Z and tool offset or corrections
- G05B 2219/36585 . . . Speed and acceleration, rate of change of speed
- G05B 2219/36586 . . . Word address format
- G05B 2219/36587 . . . Binary format
- G05B 2219/36588 . . . Endless loop
- G05B 2219/36589 . . . Making control tape
- G05B 2219/36591 . . . Tape moves synchronized with machine driven axis
- G05B 2219/36592 . . . Each track controls an axis
- G05B 2219/37 . . . Measurements
- G05B 2219/37001 . . . Measuring problems
- G05B 2219/37002 . . . Absence, detect absence, presence or correct position of workpiece
- G05B 2219/37003 . . . Detect if no workpiece in holder
- G05B 2219/37004 . . . Detect absence of tool
- G05B 2219/37005 . . . Absence of tool accessories, material, like nails, staples, glue
- G05B 2219/37006 . . . Measuring bars

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| G05B 2219/37007 | . . . | Join bars or cylinders binary  |
| G05B 2219/37008 | . . . | Calibration of measuring system, probe, sensor   |
| G05B 2219/37009 | . . . | Calibration of vision system, camera, adapt light level                                |
| G05B 2219/37011 | . . . | Set absolute marks on disk as exact position or address to position memory             |
| G05B 2219/37012 | . . . | Adjust angular position of transducer  |
| G05B 2219/37013 | . . . | Faulty number of total scale increments corrected evenly over scale                    |
| G05B 2219/37014 | . . . | Use of calibration bar, bar with cams  |
| G05B 2219/37015 | . . . | Adaptive online camera, vision calibration   |
| G05B 2219/37016 | . . . | Calibrate dc offset, measure offset and maintain fixed level                           |
| G05B 2219/37017 | . . . | Calibration of vision system, set correct attitude of sensor to workpiece              |
| G05B 2219/37018 | . . . | Make measuring scale machine tool  |
| G05B 2219/37019 | . . . | Position detection integrated in actuator, lvdt integrated linear actuator             |
| G05B 2219/37021 | . . . | Robot controls position of touch probe   |
| G05B 2219/37022 | . . . | Detector, measuring device incorporated within workpiece holder                        |
| G05B 2219/37023 | . . . | Step motor used as measuring device and as drive motor                                 |
| G05B 2219/37024 | . . . | Measure single value, parameter with two detectors                                     |
| G05B 2219/37025 | . . . | Retract, swing out of the way, measuring device during normal machining for protection |
| G05B 2219/37026 | . . . | Adjust sensor radially   |
| G05B 2219/37027 | . . . | Sensor integrated with tool or machine   |
| G05B 2219/37028 | . . . | Detail, extended range, discrimination, switch from one range to other                 |
| G05B 2219/37029 | . . . | Power supply position detector in common with drive motor                              |
| G05B 2219/37031 | . . . | Lvdt for x and y in a plane, center lines intersect at locating point                  |
| G05B 2219/37032 | . . . | Generate vibrations, ultrasound  |
| G05B 2219/37033 | . . . | Energy saving by powering feedback device, potentiometer only during measuring         |
| G05B 2219/37034 | . . . | Actuator coil is also used as measuring coil   |
| G05B 2219/37035 | . . . | Sensor in air gap of drive, detect directly speed or position                          |
| G05B 2219/37036 | . . . | Position normally, stop, measure position tool with second independent sensor          |
| G05B 2219/37037 | . . . | Remeasure workpiece regularly for deformation  |
| G05B 2219/37038 | . . . | Protection cover over measuring device, probe, feeler opened when measuring            |
| G05B 2219/37039 | . . . | Digitize position with flexible feeler, correction of position as function of flexion  |
| G05B 2219/37041 | . . . | Digitize, electric wires form grid on surface  |
| G05B 2219/37042 | . . . | Photographic, picture on film, photogrammetry  |
| G05B 2219/37043 | . . . | Touch probe, store position of touch point on surface                                  |
| G05B 2219/37044 | . . . | Ultrasound transmitters on surface, touch probe detects ultrasound, triangulation      |

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| G05B 2219/37045 | . . . | Probe detects electromagnetic fields from grid, antenna like digitizing tablet              |
| G05B 2219/37046 | . . . | Use simultaneous several pairs of stereo cameras, synchronized                              |
| G05B 2219/37047 | . . . | After digitizing, edit graphically data   |
| G05B 2219/37048 | . . . | Split beam, stripe projection on object, lines detected with cameras                        |
| G05B 2219/37049 | . . . | First a rasterscan, then align workpiece as function of height average, scan again          |
| G05B 2219/37051 | . . . | First coarse measurement, around each point a fine measurement of surface                   |
| G05B 2219/37052 | . . . | Sense surface, mean value used as reference surface   |
| G05B 2219/37053 | . . . | Optical triangulation   |
| G05B 2219/37054 | . . . | Digitize every grid point of a raster   |
| G05B 2219/37055 | . . . | Project stripes having a regular sine wave  |
| G05B 2219/37056 | . . . | Mark point to be digitized graphically on screen  |
| G05B 2219/37057 | . . . | Several feelers, probes touch model in rasterpoints   |
| G05B 2219/37058 | . . . | Digitize not only position but also colour  |
| G05B 2219/37059 | . . . | Probe connected to three pair of wires of which the length is measured                      |
| G05B 2219/37061 | . . . | Use matrix of optical sensors to detect form, edges of object                               |
| G05B 2219/37062 | . . . | Regulated scanning, the head deflection is controlled by a regulation circuit               |
| G05B 2219/37063 | . . . | Controlled scanning, the head is moved along a given path                                   |
| G05B 2219/37064 | . . . | After digitizing, reconstruct surface by interpolating the initial mesh points              |
| G05B 2219/37065 | . . . | Map of stiffness, compliance of object  |
| G05B 2219/37066 | . . . | Image from object together with references on background                                    |
| G05B 2219/37067 | . . . | Calibrate work surface, reference markings on object, work surface                          |
| G05B 2219/37068 | . . . | Setting reference coordinate frame  |
| G05B 2219/37069 | . . . | Calibrate probe, imitated tool, repeated measurements for different orientations            |
| G05B 2219/37071 | . . . | Measurement program is created, executed on object data , no real object, no CMM is present |
| G05B 2219/37072 | . . . | Surface covered with grid of electric wires, of coloured tape on object                     |
| G05B 2219/37073 | . . . | Workpiece surface covered with shielding coating, against disturbing fields                 |
| G05B 2219/37074 | . . . | Projection device, monitor, track tool, workpiece form, process on display                  |
| G05B 2219/37075 | . . . | Print out of document measured results or record on tape                                    |
| G05B 2219/37076 | . . . | Display load on tool, motor graphically on screen   |
| G05B 2219/37077 | . . . | Relative movement   |
| G05B 2219/37078 | . . . | Display machining, processing parameters with curves, pictograms                            |
| G05B 2219/37079 | . . . | Display probing result on drawing taken from cad data                                       |
| G05B 2219/37081 | . . . | Display machining parameters  |
| G05B 2219/37082 | . . . | Indicate, point region on path, locus, display path and machining parameters                |

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| G05B 2219/37083 | . . . | Switch display from normal mode to inspection mode, to monitor conditions  |
| G05B 2219/37084 | . . . | Display tool parameters  |
| G05B 2219/37085 | . . . | Display in real time of state variables of control system                  |
| G05B 2219/37086 | . . . | Display real, measured machining load                                      |
| G05B 2219/37087 | . . . | Cutting forces   |
| G05B 2219/37088 | . . . | Indicate service condition, status   |
| G05B 2219/37089 | . . . | Speed error  |
| G05B 2219/37091 | . . . | Motion and force   |
| G05B 2219/37092 | . . . | Display position actual and or target                                      |
| G05B 2219/37093 | . . . | Display speed  |
| G05B 2219/37094 | . . . | Hall sensor  |
| G05B 2219/37095 | . . . | Digital handheld device with data interface                                |
| G05B 2219/37096 | . . . | Invar scale, low temperature coefficient                                   |
| G05B 2219/37097 | . . . | Marker on workpiece to detect reference position                           |
| G05B 2219/37098 | . . . | X y scale plate instead of two ruler scale, two dimensional scale          |
| G05B 2219/37099 | . . . | One detector for coarse and fine target location, variable resolution      |
| G05B 2219/37101 | . . . | Vector gauge, telescopic ballbar   |
| G05B 2219/37102 | . . . | Single detector for whole range, both x and y axis                         |
| G05B 2219/37103 | . . . | Limit, proximity switch  |
| G05B 2219/37104 | . . . | Absolute encoder   |
| G05B 2219/37105 | . . . | Soft limit, store limits in counters, use content of counters as limit     |
| G05B 2219/37106 | . . . | Inductive, differential transformer, pins                                  |
| G05B 2219/37107 | . . . | Acupin   |
| G05B 2219/37108 | . . . | Rasters, grid on xy-plane  |
| G05B 2219/37109 | . . . | Photoelectric scanned raster, rule and photocell, microscope               |
| G05B 2219/37111 | . . . | Rule and photocell, microscope   |
| G05B 2219/37112 | . . . | Several scales with one device   |
| G05B 2219/37113 | . . . | Psd position sensitive detector, light spot on surface gives x, y position |
| G05B 2219/37114 | . . . | Precision screw  |
| G05B 2219/37115 | . . . | Photogrammetric position detection   |
| G05B 2219/37116 | . . . | Shape sensor leads tool, in front of tool                                  |
| G05B 2219/37117 | . . . | Optical sensor, delivers analog signal as function of displacement         |
| G05B 2219/37118 | . . . | Inductive, coil moves over conical, tapered core                           |
| G05B 2219/37119 | . . . | Atomic force probe   |
| G05B 2219/37121 | . . . | Linear transducer  |
| G05B 2219/37122 | . . . | Signal analyser  |
| G05B 2219/37123 | . . . | Extensible ball bar with potentiometer, lvdv                               |
| G05B 2219/37124 | . . . | Magnetic sensor  |



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| G05B 2219/37125 | . . . | Photosensor, as contactless analog position sensor, signal as function of position |
| G05B 2219/37126 | . . . | Wire, tape around cylinder measures displacement, string encoder                   |
| G05B 2219/37127 | . . . | Spm scanning probe microscopy, stm scanning tunneling microscopy                   |
| G05B 2219/37128 | . . . | Tool itself emits vibrations to be detected to build an image of surface           |
| G05B 2219/37129 | . . . | Mark, engrave workpiece at specific surface point for measurement, calibration     |
| G05B 2219/37131 | . . . | Moire pattern, diffraction grating, fringe   |
| G05B 2219/37132 | . . . | Polyhedral prism   |
| G05B 2219/37133 | . . . | Linear, rotary variable differential transformer, lvdt, rvdtd                      |
| G05B 2219/37134 | . . . | Gyroscope  |
| G05B 2219/37135 | . . . | Two counters receiving pulses from two encoders, one for speed, one for position   |
| G05B 2219/37136 | . . . | Control resolution of encoder  |
| G05B 2219/37137 | . . . | Encoder combined with barcode label, reader  |
| G05B 2219/37138 | . . . | Encoder and gear and absolute coder, give together absolute position of rotation   |
| G05B 2219/37139 | . . . | Sampling output of encoder at precisely defined intervals                          |
| G05B 2219/37141 | . . . | Programmable divider for counter as buffer for microprocessor, read on interrupt   |
| G05B 2219/37142 | . . . | Center position between two pulses, in the middle of a bit                         |
| G05B 2219/37143 | . . . | Divide feedback pulses to make feedback independent from resolution encoder        |
| G05B 2219/37144 | . . . | Delay marker to synchronize motions  |
| G05B 2219/37145 | . . . | Multiturn fine counter counts total pulses, index counter counts turns             |
| G05B 2219/37146 | . . . | Second counter reset to zero on marker, to detect counting errors                  |
| G05B 2219/37147 | . . . | Sampling rate low during power loss  |
| G05B 2219/37148 | . . . | Switch between rise, fall of pulses of one phase and of both phases, coarse fine   |
| G05B 2219/37149 | . . . | Multiplexer to send encoder and rotor pole position to same output lines           |
| G05B 2219/37151 | . . . | Handling encoder signal, compensation for light variation, stray light             |
| G05B 2219/37152 | . . . | Combination 00-01-10-11, previous, actual pulses, or two series of pulses, and rom |
| G05B 2219/37153 | . . . | Encoder delivers only one channel of pulses, using only one detector               |
| G05B 2219/37154 | . . . | Encoder and absolute position counter  |
| G05B 2219/37155 | . . . | Encoder and delta position counter   |
| G05B 2219/37156 | . . . | Pulse derived from belt driving drum   |
| G05B 2219/37157 | . . . | Pulses derived from brake disk having north and south poles                        |
| G05B 2219/37158 | . . . | Pulse derived from perforated belt along track                                     |
| G05B 2219/37159 | . . . | Source of pulse, pulse derived from gear, plate teeth                              |
| G05B 2219/37161 | . . . | Motor rotor has a normal magnetised ring and a second ring, magnetic decoder       |



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| G05B 2219/37162 | . . . | Marker, reflector mounted on chuck, workpiece holder                                |
| G05B 2219/37163 | . . . | Marker derived from phase of motor  |
| G05B 2219/37164 | . . . | Pulse derived from encoder built into ball bearing                                  |
| G05B 2219/37165 | . . . | Derive pulse from commutation position, build into brushless motor                  |
| G05B 2219/37166 | . . . | Rotating magnets shunt motor over resistance, cause current variations              |
| G05B 2219/37167 | . . . | Count number of periods of voltage supply   |
| G05B 2219/37168 | . . . | Inductive sensor senses fluctuations, spikes in motor current                       |
| G05B 2219/37169 | . . . | Derive incremental pulse from motor current deviation                               |
| G05B 2219/37171 | . . . | Commutation brushes, sensors deliver increment                                      |
| G05B 2219/37172 | . . . | Encoder with hall effect and reed relays, and decoder gives absolute position       |
| G05B 2219/37173 | . . . | Encapsulate electronics of encoder in resin, electronics and encoder integrated     |
| G05B 2219/37174 | . . . | Encoder with infrared   |
| G05B 2219/37175 | . . . | Normal encoder, disk for pulses, incremental  |
| G05B 2219/37176 | . . . | Disk emits phase shifted pulses, special convertor                                  |
| G05B 2219/37177 | . . . | Linear encoder  |
| G05B 2219/37178 | . . . | Magnetic marks on screw   |
| G05B 2219/37179 | . . . | Coarse encoder combined with fine grid ccd detector                                 |
| G05B 2219/37181 | . . . | Encoder delivers sinusoidal signals   |
| G05B 2219/37182 | . . . | Slit plate encoder  |
| G05B 2219/37183 | . . . | Marker or index or coded information as well as position pulses                     |
| G05B 2219/37184 | . . . | Hall generator cooperates with magnetic ring, gives signal with dc offset           |
| G05B 2219/37185 | . . . | Magnetic ring and sensor  |
| G05B 2219/37186 | . . . | Camera reads large number of marks, derive frequency of dark-light                  |
| G05B 2219/37187 | . . . | Disk with magnetic, inductive sensors   |
| G05B 2219/37188 | . . . | Encoder pulses reset high resolution clock, get position from counting clock pulses |
| G05B 2219/37189 | . . . | Camera with image processing emulates encoder output                                |
| G05B 2219/37191 | . . . | General problems for standing waves, torque, surface inspection                     |
| G05B 2219/37192 | . . . | Problems  |
| G05B 2219/37193 | . . . | Multicoordinate measuring system, machine, cmm                                      |
| G05B 2219/37194 | . . . | Probe work, calculate shape independent of position, orientation, best fit          |
| G05B 2219/37195 | . . . | Measuring dimension independent from accuracy of nc, machine tool                   |
| G05B 2219/37196 | . . . | Measuring station, flexible, integrated cmm   |
| G05B 2219/37197 | . . . | From measured data derive form, roundness, orientation, parallel, straightness      |
| G05B 2219/37198 | . . . | Machine as measuring station, use tool or probe, in process incycle                 |
| G05B 2219/37199 | . . . | Hole location   |
| G05B 2219/37201 | . . . | Measuring several points at the same time   |

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| G05B 2219/37202 | . | . | . | Footprint, probe piece on machine, then on cmm to avoid errors of machine |
| G05B 2219/37203 | . | . | . | Compensate probed values as function of reference plane of fixture, clamp |
| G05B 2219/37204 | . | . | . | Move synchronously associated sensor elements independently at both sides |
| G05B 2219/37205 | . | . | . | Compare measured, vision data with computer model, cad data               |
| G05B 2219/37206 | . | . | . | Inspection of surface   |
| G05B 2219/37207 | . | . | . | Verify, probe, workpiece  |
| G05B 2219/37208 | . | . | . | Vision, visual inspection of workpiece                                    |
| G05B 2219/37209 | . | . | . | Estimate life of gear, drive  |
| G05B 2219/37211 | . | . | . | Measure temperature, compensate cmm program for temperature               |
| G05B 2219/37212 | . | . | . | Visual inspection of workpiece and tool                                   |
| G05B 2219/37213 | . | . | . | Inhibit measuring if one of the joints is near endstop                    |
| G05B 2219/37214 | . | . | . | Detect failed machine component, machine performance degradation          |
| G05B 2219/37215 | . | . | . | Inspect application of solder paste, glue to workpiece                    |
| G05B 2219/37216 | . | . | . | Inspect component placement   |
| G05B 2219/37217 | . | . | . | Inspect solder joint, machined part, workpiece, welding result            |
| G05B 2219/37218 | . | . | . | Compensate for offset due to probe diameter, detect exact contact point   |
| G05B 2219/37219 | . | . | . | Predict next probed point from previous probed points                     |
| G05B 2219/37221 | . | . | . | Probe fixture to know datum points  |
| G05B 2219/37222 | . | . | . | Probe workpiece for correct setup   |
| G05B 2219/37223 | . | . | . | Identify minimum number of appropriate measuring points                   |
| G05B 2219/37224 | . | . | . | Inspect wafer   |
| G05B 2219/37225 | . | . | . | Tool holder, measure forces in chuck, tool holder                         |
| G05B 2219/37226 | . | . | . | Monitor condition of spindle, tool holder, transmit to nc controller      |
| G05B 2219/37227 | . | . | . | Probing tool for its geometry   |
| G05B 2219/37228 | . | . | . | Tool inspection, condition, dull tool                                     |
| G05B 2219/37229 | . | . | . | Test quality tool by measuring time needed for machining                  |
| G05B 2219/37231 | . | . | . | Tool used as touch probe, sensor  |
| G05B 2219/37232 | . | . | . | Wear, breakage detection derived from tailstock, headstock or rest        |
| G05B 2219/37233 | . | . | . | Breakage, wear of rotating tool with multitident saw, mill, drill         |
| G05B 2219/37234 | . | . | . | Monitor tool before, after and during machining                           |
| G05B 2219/37235 | . | . | . | Detect bad tool by relative movement of tool with respect to tool holder  |
| G05B 2219/37236 | . | . | . | Tool serves, acts also as measuring device                                |
| G05B 2219/37237 | . | . | . | Tool collision, interference  |
| G05B 2219/37238 | . | . | . | Missing tool  |
| G05B 2219/37239 | . | . | . | Plastic deformation of tool   |
| G05B 2219/37241 | . | . | . | Displacement of tool, miss inserted                                       |
| G05B 2219/37242 | . | . | . | Tool signature, compare pattern with detected signal                      |

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| G05B 2219/37243 | . . . | Tool breakage by comparing tool image, length before and after machining  |
| G05B 2219/37244 | . . . | Detect tool breakage already in tool magazine                             |
| G05B 2219/37245 | . . . | Breakage tool, failure  |
| G05B 2219/37246 | . . . | Compare estimated torques of different axis with reference for breakage   |
| G05B 2219/37247 | . . . | By electrical contact, disappears when breakage                           |
| G05B 2219/37248 | . . . | By monitoring changes in capacitive circuit                               |
| G05B 2219/37249 | . . . | Correction coefficient of life time as function of kind of machining      |
| G05B 2219/37251 | . . . | Selfcorrecting, counter for tool life adapts correction                   |
| G05B 2219/37252 | . . . | Life of tool, service life, decay, wear estimation                        |
| G05B 2219/37253 | . . . | Fail estimation as function of lapsed time of use                         |
| G05B 2219/37254 | . . . | Estimate wear of subsystem of machine with measures from other subsystems |
| G05B 2219/37255 | . . . | Using fuzzy logic techniques  |
| G05B 2219/37256 | . . . | Wear, tool wear   |
| G05B 2219/37257 | . . . | Crater wear of tool   |
| G05B 2219/37258 | . . . | Calculate wear from workpiece and tool material, machining operations     |
| G05B 2219/37259 | . . . | Resolver for coarse, photo cell for fine position on grid crossing        |
| G05B 2219/37261 | . . . | Encoder and potentiometer to detect fault measurement                     |
| G05B 2219/37262 | . . . | Mixing pins and fine positioning  |
| G05B 2219/37263 | . . . | Absolute and incremental encoder, detector combined                       |
| G05B 2219/37264 | . . . | Cam for absolute positions, encoder for incremental position              |
| G05B 2219/37265 | . . . | Rotary potentiometer and incremental counter for each maximum             |
| G05B 2219/37266 | . . . | Infrared  |
| G05B 2219/37267 | . . . | Thermocouple  |
| G05B 2219/37268 | . . . | Tool workpiece junction, thermoelectric interface                         |
| G05B 2219/37269 | . . . | Ultrasonic, ultrasound, sonar   |
| G05B 2219/37271 | . . . | Using standing waves  |
| G05B 2219/37272 | . . . | Capacitive  |
| G05B 2219/37273 | . . . | Wheatstone bridge   |
| G05B 2219/37274 | . . . | Strain gauge  |
| G05B 2219/37275 | . . . | Laser , interferometer  |
| G05B 2219/37276 | . . . | Position changes frequency  |
| G05B 2219/37277 | . . . | Inductive proximity sensor  |
| G05B 2219/37278 | . . . | Optical waveguide, fiberoptic sensor                                      |
| G05B 2219/37279 | . . . | Fiber optic proximity sensor  |
| G05B 2219/37281 | . . . | Laser range finder  |
| G05B 2219/37282 | . . . | Current transformator   |
| G05B 2219/37283 | . . . | Photoelectric sensor  |
| G05B 2219/37284 | . . . | Capacitive 3-D proximity sensor   |

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| G05B 2219/37285 | . . . | Load, current taken by motor  |
| G05B 2219/37286 | . . . | Photoelectric sensor with reflection, emits and receives modulated light          |
| G05B 2219/37287 | . . . | Fiber optic interferometer  |
| G05B 2219/37288 | . . . | Tracking lasers follow object, reflection gives 3-D position                      |
| G05B 2219/37289 | . . . | Inductive   |
| G05B 2219/37291 | . . . | Electro acoustic  |
| G05B 2219/37292 | . . . | Eddy current  |
| G05B 2219/37293 | . . . | Magnetostrictive effect on ferrous rod, ultrasonic wave, time delay measured      |
| G05B 2219/37294 | . . . | Coarse digitized position combined with fine digitized analog position signal     |
| G05B 2219/37295 | . . . | Measure workpiece while machining other workpiece                                 |
| G05B 2219/37296 | . . . | Electronic graduation, scale expansion, interpolation                             |
| G05B 2219/37297 | . . . | Two measurements, on driving motor and on slide or on both sides of motor         |
| G05B 2219/37298 | . . . | Two measurements, position of slide and position of tool                          |
| G05B 2219/37299 | . . . | Measure same parameter from three different space directions                      |
| G05B 2219/37301 | . . . | Two measurements, speed with tachometer and speed with encoder                    |
| G05B 2219/37302 | . . . | Measure tool length, workpiece configuration without stopping movement            |
| G05B 2219/37303 | . . . | Two measurements, speed of motor and speed of load                                |
| G05B 2219/37304 | . . . | Combined position measurement, encoder and separate laser, two different sensors  |
| G05B 2219/37305 | . . . | Drive step motor with pulses, at stop with dc current to avoid emi when measuring |
| G05B 2219/37306 | . . . | Two sensors and two scales for same measurement of relative movement between x y  |
| G05B 2219/37307 | . . . | Detector in line, in plane of tool to avoid parallax                              |
| G05B 2219/37308 | . . . | Measure workpiece relieved from stress, redrawn, disengaged tool                  |
| G05B 2219/37309 | . . . | Selecting a desired sensor structure  |
| G05B 2219/37311 | . . . | Derive speed from current, use of lookup table                                    |
| G05B 2219/37312 | . . . | Derive speed from motor current   |
| G05B 2219/37313 | . . . | Derive speed from position  |
| G05B 2219/37314 | . . . | Derive position from speed  |
| G05B 2219/37315 | . . . | High speed and low speed signals are derived in a different way                   |
| G05B 2219/37316 | . . . | Derive speed from two phased position signals, with high range and resolution     |
| G05B 2219/37317 | . . . | Derive position from current, voltage, back electromotive force bemf              |
| G05B 2219/37318 | . . . | Derive speed from back electromotive force, bemf                                  |
| G05B 2219/37319 | . . . | Derive acceleration, force, torque from current                                   |
| G05B 2219/37321 | . . . | Derive acceleration from net driving force  |
| G05B 2219/37322 | . . . | Derive position from frequency power supply                                       |
| G05B 2219/37323 | . . . | Derive acceleration from position or speed  |

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| G05B 2219/37324 | . . . | Derive position, speed from acceleration                                      |
| G05B 2219/37325 | . . . | Multisensor integration, fusion, redundant                                    |
| G05B 2219/37326 | . . . | Automatic configuration of multisensor, adaptive, active sensing              |
| G05B 2219/37327 | . . . | Select lookup table corresponding to sensor                                   |
| G05B 2219/37328 | . . . | Decentralised data fusion   |
| G05B 2219/37329 | . . . | Far away and near by sensor groups  |
| G05B 2219/37331 | . . . | Sensor fusion using extended kalman filter                                    |
| G05B 2219/37332 | . . . | Detect power of noise source using sound and visual sensors                   |
| G05B 2219/37333 | . . . | Position of control valve and position of controlled actuator                 |
| G05B 2219/37334 | . . . | Diameter of tool with teeth   |
| G05B 2219/37335 | . . . | Diameter tool   |
| G05B 2219/37336 | . . . | Cutting, machining time   |
| G05B 2219/37337 | . . . | Noise, acoustic emission, sound   |
| G05B 2219/37338 | . . . | Magnetic or electric property of tool to control feed                         |
| G05B 2219/37339 | . . . | Eccentricity, cylindricity, circularity                                       |
| G05B 2219/37341 | . . . | Sectional distortion of machining face of workpiece                           |
| G05B 2219/37342 | . . . | Overload of motor, tool   |
| G05B 2219/37343 | . . . | Load, vectorial components of load  |
| G05B 2219/37344 | . . . | Torque, thrust, twist, machining force measurement                            |
| G05B 2219/37345 | . . . | Dimension of workpiece, diameter  |
| G05B 2219/37346 | . . . | Cutting, chip quality   |
| G05B 2219/37347 | . . . | Speed, velocity   |
| G05B 2219/37348 | . . . | Power, wattmeter voltage times current  |
| G05B 2219/37349 | . . . | Unbalance of tool or tool holder  |
| G05B 2219/37351 | . . . | Detect vibration, ultrasound  |
| G05B 2219/37352 | . . . | Frequency   |
| G05B 2219/37353 | . . . | Amplitude   |
| G05B 2219/37354 | . . . | Powerfactor, phase between voltage and current                                |
| G05B 2219/37355 | . . . | Cutting, milling, machining force   |
| G05B 2219/37356 | . . . | Torsion, twist  |
| G05B 2219/37357 | . . . | Force, pressure, weight or deflection   |
| G05B 2219/37358 | . . . | Depth of cut  |
| G05B 2219/37359 | . . . | Contour, to sense corners, edges of surface                                   |
| G05B 2219/37361 | . . . | acoustic feedback, for speed, if speed very low hearing is better than seeing |
| G05B 2219/37362 | . . . | Hardness  |
| G05B 2219/37363 | . . . | Texture   |
| G05B 2219/37364 | . . . | Thermal conductivity  |
| G05B 2219/37365 | . . . | Surface shape, gradient   |
| G05B 2219/37366 | . . . | Colour, surface colour  |

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| G05B 2219/37367 | . . . | Grinding rate   |
| G05B 2219/37368 | . . . | Displacement perpendicular to probe movement  |
| G05B 2219/37369 | . . . | Measure tool length and diameter together with single sensor                          |
| G05B 2219/37371 | . . . | Flow  |
| G05B 2219/37372 | . . . | Position and speed  |
| G05B 2219/37373 | . . . | Friction  |
| G05B 2219/37374 | . . . | Deflection  |
| G05B 2219/37375 | . . . | Climate, temperature and humidity   |
| G05B 2219/37376 | . . . | Inclination, gradient of machine base   |
| G05B 2219/37377 | . . . | Roundness of workpiece  |
| G05B 2219/37378 | . . . | Balance of workpiece from vibration sensor and angle sensor                           |
| G05B 2219/37379 | . . . | Profile, diameter along workpiece   |
| G05B 2219/37381 | . . . | Force in steady rest  |
| G05B 2219/37382 | . . . | Voltage over or short circuit between tool and workpiece                              |
| G05B 2219/37383 | . . . | Tool length   |
| G05B 2219/37384 | . . . | Change of actuator current  |
| G05B 2219/37385 | . . . | Peripheral speed  |
| G05B 2219/37386 | . . . | Lateral movement of tool  |
| G05B 2219/37387 | . . . | Nanometer position  |
| G05B 2219/37388 | . . . | Acceleration or deceleration, inertial measurement                                    |
| G05B 2219/37389 | . . . | Magnetic flux   |
| G05B 2219/37391 | . . . | Null, initial load, no load torque detection or other parameter at no load            |
| G05B 2219/37392 | . . . | Motion  |
| G05B 2219/37393 | . . . | acoustic feedback varies as function of positional error                              |
| G05B 2219/37394 | . . . | Measuring diameter of workpieces with longitudinal grooves                            |
| G05B 2219/37395 | . . . | Detection sparks during machining   |
| G05B 2219/37396 | . . . | Tactile feedback, operator feels reaction, force reflection                           |
| G05B 2219/37397 | . . . | Measuring gap between tool and workpiece  |
| G05B 2219/37398 | . . . | Thickness   |
| G05B 2219/37399 | . . . | Pressure  |
| G05B 2219/37401 | . . . | Differential pressure   |
| G05B 2219/37402 | . . . | Flatness, roughness of surface  |
| G05B 2219/37403 | . . . | Bending, springback angle   |
| G05B 2219/37404 | . . . | Orientation of workpiece or tool, surface sensor                                      |
| G05B 2219/37405 | . . . | Contact detection between workpiece and tool, probe, feeler                           |
| G05B 2219/37406 | . . . | Detect position of detector contact point relative to reference on tool slide         |
| G05B 2219/37407 | . . . | Detect position of detector contact point relative to reference on tool               |
| G05B 2219/37408 | . . . | Combination of contact and contactless detection to avoid tool contact with workpiece |
| G05B 2219/37409 | . . . | Measure different pressure of fluid flow on contacting surface                        |

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| G05B 2219/37411 | . . . | Measure contact from force and velocity detection                                 |
| G05B 2219/37412 | . . . | acoustical detection of contact   |
| G05B 2219/37413 | . . . | By conductivity, short circuit between tool, probe and metallic surface           |
| G05B 2219/37414 | . . . | By microswitch  |
| G05B 2219/37415 | . . . | By cutting light beam   |
| G05B 2219/37416 | . . . | By measuring phase shift between voltage and current of feedmotor                 |
| G05B 2219/37417 | . . . | By linear varying electrical signal   |
| G05B 2219/37418 | . . . | By capacitive means   |
| G05B 2219/37419 | . . . | Measuring rotation of non driven axis after being touched by driven axis          |
| G05B 2219/37421 | . . . | Measure braking, slower rotation of driven axis, tool upon contact                |
| G05B 2219/37422 | . . . | Distance and attitude detector  |
| G05B 2219/37423 | . . . | Distance, gap between tool and surface sensor                                     |
| G05B 2219/37424 | . . . | Calculate distance from known inner diameter of coil, bobbin and detected image   |
| G05B 2219/37425 | . . . | Distance, range   |
| G05B 2219/37426 | . . . | Detected with infrared sensor   |
| G05B 2219/37427 | . . . | Detected with thermocouple  |
| G05B 2219/37428 | . . . | Temperature of tool   |
| G05B 2219/37429 | . . . | Temperature of motor  |
| G05B 2219/37431 | . . . | Temperature   |
| G05B 2219/37432 | . . . | Detected by accelerometer, piezo electric   |
| G05B 2219/37433 | . . . | Detected by acoustic emission, microphone   |
| G05B 2219/37434 | . . . | Measuring vibration of machine or workpiece or tool                               |
| G05B 2219/37435 | . . . | Vibration of machine  |
| G05B 2219/37436 | . . . | Prediction of displacement, relative or absolute, motion                          |
| G05B 2219/37437 | . . . | Prediction of cutting force with flexible ball end milling model                  |
| G05B 2219/37438 | . . . | Prediction of machining error with flexible ball end milling model                |
| G05B 2219/37439 | . . . | Computer assisted inspection, cad interactive with manual commands                |
| G05B 2219/37441 | . . . | Use nc machining program, cad data for measuring, inspection                      |
| G05B 2219/37442 | . . . | Cad and cap for cmm   |
| G05B 2219/37443 | . . . | Program cmm, coordinate measuring machine, use cad data                           |
| G05B 2219/37444 | . . . | Program cmm by using a stylus to detect points on a real workpiece                |
| G05B 2219/37445 | . . . | Load teaching program from file server, enter teaching data at pendant            |
| G05B 2219/37446 | . . . | Select measuring program together with control parameters                         |
| G05B 2219/37447 | . . . | Path planning using ann, for measurement task pattern, optimal path, dummy points |
| G05B 2219/37448 | . . . | Inspection process planner  |
| G05B 2219/37449 | . . . | Inspection path planner   |
| G05B 2219/37451 | . . . | Plan sensor placement for optimal inspection                                      |
| G05B 2219/37452 | . . . | Generate nc program from metrology program, defining cmm probe path               |



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| G05B 2219/37453 | . . . | Simulate measuring program, graphical interactive generation of program          |
| G05B 2219/37454 | . . . | Interactive, enter also tolerance  |
| G05B 2219/37455 | . . . | After entering one measuring cycle, display in separate window instruction list  |
| G05B 2219/37456 | . . . | Program proposes measuring points  |
| G05B 2219/37457 | . . . | On machine, on workpiece   |
| G05B 2219/37458 | . . . | Reference on machine, on workpiece and on tool                                   |
| G05B 2219/37459 | . . . | Reference on workpiece, moving workpiece moves reference point                   |
| G05B 2219/37461 | . . . | Two rotary potentiometers, only one used, switch over to other on ambiguity      |
| G05B 2219/37462 | . . . | Resistor, potentiometers   |
| G05B 2219/37463 | . . . | Tapped resistors, not continuous   |
| G05B 2219/37464 | . . . | Potentiometer with dual wiper  |
| G05B 2219/37465 | . . . | Magnetic resistor  |
| G05B 2219/37466 | . . . | Dual potentiometers with sin and cos output                                      |
| G05B 2219/37467 | . . . | Continuous rotary potentiometer, no end  |
| G05B 2219/37468 | . . . | Magnetic resistor sensors used as incremental encoder                            |
| G05B 2219/37469 | . . . | Two, more slides use resolver with common secondary, different primary frequency |
| G05B 2219/37471 | . . . | Resolver, synchro  |
| G05B 2219/37472 | . . . | Synchro  |
| G05B 2219/37473 | . . . | Resolver   |
| G05B 2219/37474 | . . . | Resolver with several phases   |
| G05B 2219/37475 | . . . | Resolver emits two redundant signals for safety                                  |
| G05B 2219/37476 | . . . | Single resolver for speed, rotor and absolute position, IMAS                     |
| G05B 2219/37477 | . . . | Inductosyn   |
| G05B 2219/37478 | . . . | Excitation of resolver by pulses instead of continuous wave, to save energy      |
| G05B 2219/37479 | . . . | Excitation as function of speed of rotor, to get always stable detection waves   |
| G05B 2219/37481 | . . . | Sampling rate for output of resolver as function of pulse rate of excitation     |
| G05B 2219/37482 | . . . | Control amplitude of excitation of resolver                                      |
| G05B 2219/37483 | . . . | Synchronize resolver reference frequency with clock of position control          |
| G05B 2219/37484 | . . . | Differential resolver  |
| G05B 2219/37485 | . . . | Phaseshift to reference counted  |
| G05B 2219/37486 | . . . | Resolver emits pulses at zerocrossings, counter                                  |
| G05B 2219/37487 | . . . | Counter combined with angle to digital convertor                                 |
| G05B 2219/37488 | . . . | Angle to digital conversion  |
| G05B 2219/37489 | . . . | Emit binary code at quadrant 00+01+10+11, count pulse for 11-to-000 and 00-to-11 |
| G05B 2219/37491 | . . . | Compensate non linearity of transducer by lookup table                           |
| G05B 2219/37492 | . . . | Store measured value in memory, to be used afterwards                            |

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| G05B 2219/37493 | . . . | Use of different frequency band pass filters to separate different signals         |
| G05B 2219/37494 | . . . | Intelligent sensor, data handling incorporated in sensor                           |
| G05B 2219/37495 | . . . | Correction of measured value as function of given, reference surface               |
| G05B 2219/37496 | . . . | Root mean square   |
| G05B 2219/37497 | . . . | Summing, integration of signal   |
| G05B 2219/37498 | . . . | Variable amplification, gain for detected signal, select correct level range       |
| G05B 2219/37499 | . . . | Determine cumulative deviation, difference   |
| G05B 2219/37501 | . . . | Delay detected signal avoids transients, start up noise                            |
| G05B 2219/37502 | . . . | Input signal converted to logarithmic value  |
| G05B 2219/37503 | . . . | Set integrator of acceleration detector to zero at velocity zero, avoids drift     |
| G05B 2219/37504 | . . . | Differential use of sensors, to double precision                                   |
| G05B 2219/37505 | . . . | Debounce contact signal from absolute reference position cam                       |
| G05B 2219/37506 | . . . | Correction of position error   |
| G05B 2219/37507 | . . . | Spectral density analysis  |
| G05B 2219/37508 | . . . | Cross correlation  |
| G05B 2219/37509 | . . . | Intelligent sensor, incorporation temperature compensation                         |
| G05B 2219/37511 | . . . | Select and process only those detected signals needed for a certain purpose        |
| G05B 2219/37512 | . . . | Correction for detection delay   |
| G05B 2219/37513 | . . . | Convert time domain signal to frequency domain signal                              |
| G05B 2219/37514 | . . . | Detect normality, novelty in time series for online monitoring                     |
| G05B 2219/37515 | . . . | Error separation, eliminate eccentricity   |
| G05B 2219/37516 | . . . | Combine results, opinions of multiple but same sensors, fuzzy logic                |
| G05B 2219/37517 | . . . | Compensation of position for vibration of probe, calibration x-y lookup table      |
| G05B 2219/37518 | . . . | Prediction, estimation of machining parameters from cutting data                   |
| G05B 2219/37519 | . . . | From machining parameters classify different fault cases                           |
| G05B 2219/37521 | . . . | Ann to map sensor signals to decision signals                                      |
| G05B 2219/37522 | . . . | Determine validity of measured signals   |
| G05B 2219/37523 | . . . | Reduce noise by combination of digital filter and estimator                        |
| G05B 2219/37524 | . . . | Sampling of forces and signal analysis are triggered as function of rotation angle |
| G05B 2219/37525 | . . . | Mean, average values, statistical derived values                                   |
| G05B 2219/37526 | . . . | Determine time or position to take a measurement                                   |
| G05B 2219/37527 | . . . | Frequency filtering and amplitude qualification                                    |
| G05B 2219/37528 | . . . | Separate force signal into static and dynamic component                            |
| G05B 2219/37529 | . . . | Synchronous demodulation   |
| G05B 2219/37531 | . . . | Superpose modulated measuring signal on servo command reference                    |
| G05B 2219/37532 | . . . | Synchronized data acquisition  |
| G05B 2219/37533 | . . . | Real time processing of data acquisition, monitoring                               |
| G05B 2219/37534 | . . . | Frequency analysis   |

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| G05B 2219/37535 | . . . | Signal processing, ratio of signals against fluctuation of signals                     |
| G05B 2219/37536 | . . . | Rate of change, derivative   |
| G05B 2219/37537 | . . . | Virtual sensor   |
| G05B 2219/37538 | . . . | Window for signal, to detect signal at peak or zero values                             |
| G05B 2219/37539 | . . . | Read values twice, for correctness   |
| G05B 2219/37541 | . . . | Switch off measuring, control system during test of encoder, resolver                  |
| G05B 2219/37542 | . . . | Curve fitting measured points, predict, extrapolate dimension in time                  |
| G05B 2219/37543 | . . . | Set, compare to maximum, peak, minimum value   |
| G05B 2219/37544 | . . . | Compare detected signal to several references to derive several control actions        |
| G05B 2219/37545 | . . . | References to be compared vary with evolution of measured signals, auto-calibrate      |
| G05B 2219/37546 | . . . | Compare two positions measured with different methods, alarm if difference too high    |
| G05B 2219/37547 | . . . | Ignore position information from detector during invalid intervals                     |
| G05B 2219/37548 | . . . | Avoid false motion condition, jitter, compare three recent values with possible values |
| G05B 2219/37549 | . . . | Limit switch protected against overload  |
| G05B 2219/37551 | . . . | Select for each detector type corresponding signal processor                           |
| G05B 2219/37552 | . . . | Detect loss of correct excitation moment of step motor, correct excitation             |
| G05B 2219/37553 | . . . | Two cameras one for coarse scanning, other for fine scanning                           |
| G05B 2219/37554 | . . . | Two camera, or tiltable camera to detect different surfaces of the object              |
| G05B 2219/37555 | . . . | Camera detects orientation, position workpiece, points of workpiece                    |
| G05B 2219/37556 | . . . | Camera detects fictive contour of workpiece, by reflection                             |
| G05B 2219/37557 | . . . | Camera for coarse, acoustic array for fine vision                                      |
| G05B 2219/37558 | . . . | Optical sensor, scanner  |
| G05B 2219/37559 | . . . | Camera, vision of tool, compute tool center, detect tool wear                          |
| G05B 2219/37561 | . . . | Move camera until image corresponds to stored image of same workpiece                  |
| G05B 2219/37562 | . . . | Scan mark at certain angle, to avoid glare noise                                       |
| G05B 2219/37563 | . . . | Ccd, tv camera   |
| G05B 2219/37564 | . . . | Center of camera vision aligned with axis of drill                                     |
| G05B 2219/37565 | . . . | Camera to detect precisely, crosshair, positions on workpiece by operator              |
| G05B 2219/37566 | . . . | Explore autonomous, explore surface until useful measurement possible                  |
| G05B 2219/37567 | . . . | 3-D vision, stereo vision, with two cameras  |
| G05B 2219/37568 | . . . | 3-D spectacles, glasses, left and right synchronised with images on screen             |
| G05B 2219/37569 | . . . | Radiography in x and y, x-ray images   |
| G05B 2219/37571 | . . . | Camera detecting reflected light from laser  |
| G05B 2219/37572 | . . . | Camera, tv, vision   |
| G05B 2219/37573 | . . . | In-cycle, insitu, during machining workpiece is measured continuously                  |
| G05B 2219/37574 | . . . | In-process, in cycle, machine part, measure part, machine same part                    |

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| G05B 2219/37575 | . . . | Pre-process, measure workpiece before machining                              |
| G05B 2219/37576 | . . . | Post-process, measure workpiece after machining, use results for new or same |
| G05B 2219/37577 | . . . | In-process and post-process measurement combined                             |
| G05B 2219/37578 | . . . | Compare images of workpiece before and after machining                       |
| G05B 2219/37579 | . . . | Run away measured value by differentiating measured signal, rate of change   |
| G05B 2219/37581 | . . . | Measuring errors   |
| G05B 2219/37582 | . . . | Position, angle of workpiece surface   |
| G05B 2219/37583 | . . . | Detect separation, cutting, penetration, piercing, break through material    |
| G05B 2219/37584 | . . . | Deformation of machined material   |
| G05B 2219/37585 | . . . | Start, begin and end, halt, stop of machining                                |
| G05B 2219/37586 | . . . | Detect, discriminate cutting or non cutting machining state                  |
| G05B 2219/37587 | . . . | Count number of machining cycles, frequency use of tool                      |
| G05B 2219/37588 | . . . | Detect swarf, building up of swarf   |
| G05B 2219/37589 | . . . | Measure drift of servo during positioning, not disturbing actual position    |
| G05B 2219/37591 | . . . | Plant characteristics  |
| G05B 2219/37592 | . . . | Detect machine, workpiece noise by operator with headphone, directional      |
| G05B 2219/37593 | . . . | Measure correct setting of workpiece   |
| G05B 2219/37594 | . . . | Detect discharge state between electrode and workpiece                       |
| G05B 2219/37595 | . . . | Detect if drill bit is in peck cycle   |
| G05B 2219/37596 | . . . | Surface layer to be machined away, lowest point, minimum material to be cut  |
| G05B 2219/37597 | . . . | Spectrum analyser  |
| G05B 2219/37598 | . . . | Chip length  |
| G05B 2219/37599 | . . . | Presence of metal  |
| G05B 2219/37601 | . . . | Count number of times tool is overloaded, derived from mean and limit        |
| G05B 2219/37602 | . . . | Material removal rate  |
| G05B 2219/37603 | . . . | System time constant   |
| G05B 2219/37604 | . . . | Hysteresis of actuator, servo  |
| G05B 2219/37605 | . . . | Accuracy, repeatability of machine, robot                                    |
| G05B 2219/37606 | . . . | Thread form, parameters  |
| G05B 2219/37607 | . . . | Circular form  |
| G05B 2219/37608 | . . . | Center and diameter of hole, wafer, object                                   |
| G05B 2219/37609 | . . . | Over-travel  |
| G05B 2219/37611 | . . . | Relative movement between tool and workpiece carriage                        |
| G05B 2219/37612 | . . . | Transfer function, kinematic identification, parameter estimation, response  |
| G05B 2219/37613 | . . . | Cutter axis tilt of end mill   |
| G05B 2219/37614 | . . . | Number of workpieces, counter  |

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| G05B 2219/37615 | . . . | Dead time, between detecting finished workpieces and feedback measured value    |
| G05B 2219/37616 | . . . | Use same monitoring tools to monitor tool and workpiece                         |
| G05B 2219/37617 | . . . | Tolerance of form, shape or position  |
| G05B 2219/37618 | . . . | Observe, monitor position, posture of tool                                      |
| G05B 2219/37619 | . . . | Characteristics of machine, deviation of movement, gauge,                       |
| G05B 2219/37621 | . . . | Inertia, mass of rotating, moving tool, workpiece, element                      |
| G05B 2219/37622 | . . . | Detect collision, blocking, stall by change, lag in position                    |
| G05B 2219/37623 | . . . | Detect collision, blocking by use of integrated load between two limits         |
| G05B 2219/37624 | . . . | Detect collision, blocking by measuring change of velocity or torque            |
| G05B 2219/37625 | . . . | By measuring changing forces in a time window                                   |
| G05B 2219/37626 | . . . | By measuring changing forces in different position zones                        |
| G05B 2219/37627 | . . . | Measure elapsed time needed for positioning                                     |
| G05B 2219/37628 | . . . | Use of special detector the output of which changes if object detected          |
| G05B 2219/37629 | . . . | Detect sudden change of direction due to collision                              |
| G05B 2219/37631 | . . . | Means detecting object in forbidden zone  |
| G05B 2219/37632 | . . . | By measuring current, load of motor   |
| G05B 2219/37633 | . . . | Output modulated signal on detection of blocking instead of flat signal         |
| G05B 2219/37634 | . . . | By measuring vibration  |
| G05B 2219/39    | . .   | Robotics, robotics to robotics hand   |
| G05B 2219/39001 | . . . | Robot, manipulator control  |
| G05B 2219/39002 | . . . | Move tip of arm on straight line  |
| G05B 2219/39003 | . . . | Move end effector on ellipse, circle, sphere                                    |
| G05B 2219/39004 | . . . | Assisted by automatic control system for certain functions                      |
| G05B 2219/39005 | . . . | Feedback for stability of manipulator, felt as force reflection                 |
| G05B 2219/39006 | . . . | Move end effector in a plane, describing a raster, meander                      |
| G05B 2219/39007 | . . . | Calibrate by switching links to mirror position, tip remains on reference point |
| G05B 2219/39008 | . . . | Fixed camera detects reference pattern held by end effector                     |
| G05B 2219/39009 | . . . | Using fixture with potentiometer, wire to end effector, estimate length of wire |
| G05B 2219/39011 | . . . | Fixed camera detects deviation end effector from reference on workpiece, object |
| G05B 2219/39012 | . . . | Calibrate arm during scanning operation for identification of object            |
| G05B 2219/39013 | . . . | Locate movable manipulator relative to object, compare to stored gridpoints     |
| G05B 2219/39014 | . . . | Match virtual world with real world   |
| G05B 2219/39015 | . . . | With different manipulator configurations, contact known sphere, ballbar        |
| G05B 2219/39016 | . . . | Simultaneous calibration of manipulator and camera                              |
| G05B 2219/39017 | . . . | Forward calibration, find actual pose world space for given joint configuration |

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| G05B 2219/39018 | . . . | Inverse calibration, find exact joint angles for given location in world space      |
| G05B 2219/39019 | . . . | Calibration by cmm coordinate measuring machine over a certain volume               |
| G05B 2219/39021 | . . . | With probe, touch reference positions   |
| G05B 2219/39022 | . . . | Transform between measuring and manipulator coordinate system                       |
| G05B 2219/39023 | . . . | Shut off, disable motor and rotate arm to reference pin                             |
| G05B 2219/39024 | . . . | Calibration of manipulator  |
| G05B 2219/39025 | . . . | Spheric tool interrupts transmitted calibration beam, in different configurations   |
| G05B 2219/39026 | . . . | Calibration of manipulator while tool is mounted                                    |
| G05B 2219/39027 | . . . | Calibrate only some links, part of dofs, lock some links, ref pins on links         |
| G05B 2219/39028 | . . . | Relative to base calibrated 6-DOF device, cmm connected between wrist and base      |
| G05B 2219/39029 | . . . | Verify if calibration position is a correct, by comparing with range in rom         |
| G05B 2219/39031 | . . . | Use of model for robot and for measuring device                                     |
| G05B 2219/39032 | . . . | Touch probe senses constraint known plane, derive kinematic calibration             |
| G05B 2219/39033 | . . . | Laser tracking of end effector, measure orientation of rotatable mirror             |
| G05B 2219/39034 | . . . | Use of telescopic ballbar   |
| G05B 2219/39035 | . . . | Screw axis measurement, each joint moved in circle, cpa circle point analysis       |
| G05B 2219/39036 | . . . | Screw axis measurement, jacobian estimation from wrist and joint torques, no motion |
| G05B 2219/39037 | . . . | Screw axis measurement, jacobian estimation from end effector and joint speeds      |
| G05B 2219/39038 | . . . | Determine position of two cameras by using a common reference grid                  |
| G05B 2219/39039 | . . . | Two cameras detect same reference on workpiece to define its position in space      |
| G05B 2219/39041 | . . . | Calibrate only for end position   |
| G05B 2219/39042 | . . . | Interchange robot and reference pattern, measure by camera at same location         |
| G05B 2219/39043 | . . . | Self calibration using ANN to map robot poses to the commands, only distortions     |
| G05B 2219/39044 | . . . | Estimate error model from error at different attitudes and points                   |
| G05B 2219/39045 | . . . | Camera on end effector detects reference pattern                                    |
| G05B 2219/39046 | . . . | Compare image of plate on robot with reference, move till coincidence, camera       |
| G05B 2219/39047 | . . . | Calibration plate mounted on robot, plate comprises sensors for measuring target    |
| G05B 2219/39048 | . . . | Closed loop kinematic self calibration, grip part of robot with hand                |
| G05B 2219/39049 | . . . | Calibration cooperating manipulators, closed kinematic chain by bolting             |
| G05B 2219/39051 | . . . | Calibration cooperating manipulators, closed kinematic chain by alignment           |
| G05B 2219/39052 | . . . | Self calibration of parallel manipulators   |



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| G05B 2219/39053 | . . . | Probe, camera on hand scans many points on own robot body, no extra jig            |
| G05B 2219/39054 | . . . | From teached different attitudes for same point calculate tool tip position        |
| G05B 2219/39055 | . . . | Correction of end effector attachment, calculated from model and real position     |
| G05B 2219/39056 | . . . | On line relative position error and orientation error calibration                  |
| G05B 2219/39057 | . . . | Hand eye calibration, eye, camera on hand, end effector                            |
| G05B 2219/39058 | . . . | Sensor, calibration of sensor, potentiometer                                       |
| G05B 2219/39059 | . . . | Sensor adaptation for robots by software   |
| G05B 2219/39061 | . . . | Calculation direct dynamics  |
| G05B 2219/39062 | . . . | Calculate, jacobian matrix estimator   |
| G05B 2219/39063 | . . . | Quick calculation of coordinates by using precalculated, stored matrixes, inverses |
| G05B 2219/39064 | . . . | Learn kinematics by ann mapping, map spatial directions to joint rotations         |
| G05B 2219/39065 | . . . | Calculate workspace for end effector, manipulator                                  |
| G05B 2219/39066 | . . . | Two stage inverse kinematics algorithm, first inner joint variables, then outer    |
| G05B 2219/39067 | . . . | Calculate max load a manipulator can repeatedly lift                               |
| G05B 2219/39068 | . . . | Time needed to execute an instruction  |
| G05B 2219/39069 | . . . | Inverse kinematics by arm splitting, divide six link arm into two three link arms  |
| G05B 2219/39071 | . . . | Solve inverse kinematics by ann learning nonlinear mappings, consider smoothness   |
| G05B 2219/39072 | . . . | Solve inverse kinematics by linear hopfield network                                |
| G05B 2219/39073 | . . . | Solve inverse kinematics by fuzzy algorithm  |
| G05B 2219/39074 | . . . | By formal substitution of two consecutive joints by a spherical joint              |
| G05B 2219/39075 | . . . | Solve inverse kinematics by error back propagation ebp                             |
| G05B 2219/39076 | . . . | Learn by function division, change only one variable at a time, combine shapes     |
| G05B 2219/39077 | . . . | Solve inverse geometric model by iteration, no matrixes inversion                  |
| G05B 2219/39078 | . . . | Divide workspace in sectors, lookup table for sector joint angle                   |
| G05B 2219/39079 | . . . | Solve inverse differential kinematics in closed, feedback loop, iterate            |
| G05B 2219/39081 | . . . | Inexact solution for orientation or other DOF with relation to type of task        |
| G05B 2219/39082 | . . . | Collision, real time collision avoidance   |
| G05B 2219/39083 | . . . | Robot interference, between two robot arms   |
| G05B 2219/39084 | . . . | Parts handling, during assembly  |
| G05B 2219/39085 | . . . | Use of two dimensional maps and feedback of external and joint sensors             |
| G05B 2219/39086 | . . . | Reduce impact effect by impact configuration of redundant manipulator              |
| G05B 2219/39087 | . . . | Artificial field potential algorithm, force repulsion from obstacle                |
| G05B 2219/39088 | . . . | Inhibit movement in one axis if collision danger                                   |
| G05B 2219/39089 | . . . | On collision, lead arm around obstacle manually                                    |
| G05B 2219/39091 | . . . | Avoid collision with moving obstacles  |



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| G05B 2219/39092 | . . . | Treat interference in hardware, circuit and also in software                     |
| G05B 2219/39093 | . . . | On collision, ann, bam, learns path on line, used next time for same command     |
| G05B 2219/39094 | . . . | Interference checking between robot and fixture                                  |
| G05B 2219/39095 | . . . | Use neural geometric modeler, overlapping spheres                                |
| G05B 2219/39096 | . . . | Self-collision, internal collision, collision between links of one robot         |
| G05B 2219/39097 | . . . | Estimate own stop, brake time, then verify if in safe distance                   |
| G05B 2219/39098 | . . . | Estimate stop, brake distance in predef time, then verify if in safe distance    |
| G05B 2219/39099 | . . . | Interlocks inserted in movement process if necessary to avoid collision          |
| G05B 2219/39101 | . . . | Cooperation with one or more rotating workpiece holders, manipulators            |
| G05B 2219/39102 | . . . | Manipulator cooperating with conveyor  |
| G05B 2219/39103 | . . . | Multicooperating sensing modules   |
| G05B 2219/39104 | . . . | Manipulator control orders conveyor to stop, to visualize, pick up               |
| G05B 2219/39105 | . . . | Manipulator cooperates with moving machine, like press brake                     |
| G05B 2219/39106 | . . . | Conveyor, pick up article, object from conveyor, bring to test unit, place it    |
| G05B 2219/39107 | . . . | Pick up article, object, measure, test it during motion path, place it           |
| G05B 2219/39108 | . . . | Regrasp object as function of impact   |
| G05B 2219/39109 | . . . | Dual arm, multiarm manipulation, object handled in cooperation                   |
| G05B 2219/39111 | . . . | Use of flexibility or free joint in manipulator to avoid large forces            |
| G05B 2219/39112 | . . . | Force, load distribution   |
| G05B 2219/39113 | . . . | Select grasp pattern based on motion oriented coordinability                     |
| G05B 2219/39114 | . . . | Hand eye cooperation, active camera on first arm follows movement of second arm  |
| G05B 2219/39115 | . . . | Optimal hold and moving force, torque  |
| G05B 2219/39116 | . . . | Constraint object handled in cooperation   |
| G05B 2219/39117 | . . . | Task distribution between involved manipulators                                  |
| G05B 2219/39118 | . . . | Cooperation between manipulator and vehicle with manipulator                     |
| G05B 2219/39119 | . . . | Path constraint handling of object   |
| G05B 2219/39121 | . . . | Two manipulators operate on same object  |
| G05B 2219/39122 | . . . | Follower, slave mirrors leader, master   |
| G05B 2219/39123 | . . . | Manipulate, handle flexible object   |
| G05B 2219/39124 | . . . | Grasp common rigid object, no movement end effectors relative to object          |
| G05B 2219/39125 | . . . | Task is grasp object with movable parts, like pliers                             |
| G05B 2219/39126 | . . . | Manipulate very large objects, not possible to grasp, open palm and use of links |
| G05B 2219/39127 | . . . | Roll object on base by link control  |
| G05B 2219/39128 | . . . | Grasp tool with two manipulators, rigidity, and use tool                         |
| G05B 2219/39129 | . . . | One manipulator holds one piece, other inserts, screws other piece, dexterity    |
| G05B 2219/39131 | . . . | Each of the manipulators holds one of the pieces to be welded together           |

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| G05B 2219/39132 | . . . | Robot welds, operates on moving workpiece, moved by other robot                              |
| G05B 2219/39133 | . . . | Convert taught program for fixed workpiece to program for moving workpiece                   |
| G05B 2219/39134 | . . . | Teach point, move workpiece, follow point with tip, place tip on next point                  |
| G05B 2219/39135 | . . . | For multiple manipulators operating at same time, avoid collision                            |
| G05B 2219/39136 | . . . | Teach each manipulator independently or dependently from each other                          |
| G05B 2219/39137 | . . . | Manual teaching, set next point when tool touches other tool, workpiece                      |
| G05B 2219/39138 | . . . | Calculate path of robots from path of point on gripped object                                |
| G05B 2219/39139 | . . . | Produce program of slave from path of master and desired relative position                   |
| G05B 2219/39141 | . . . | Slave program has no taught positions, receives position from master, convert from master    |
| G05B 2219/39142 | . . . | Moving time between positions in slave program coordinated online with master                |
| G05B 2219/39143 | . . . | One program in robot controller for both robot and machine, press, mold                      |
| G05B 2219/39144 | . . . | Scale moving time of all robots, machines to match slowest, no waiting                       |
| G05B 2219/39145 | . . . | Slave path is the same as master path and superposed desired relative movement               |
| G05B 2219/39146 | . . . | Swarm, multiagent, distributed multitask fusion, cooperation multi robots                    |
| G05B 2219/39147 | . . . | Group transport, transfer object, ant problem  |
| G05B 2219/39148 | . . . | To push or pull on objects, boxes  |
| G05B 2219/39149 | . . . | To assemble two objects, objects manipulation  |
| G05B 2219/39151 | . . . | Use intention inference, observe behaviour of other robots for their intention               |
| G05B 2219/39152 | . . . | Basic behaviour, avoid, follow, aggregate, disperse, home, wander, grasp, drop               |
| G05B 2219/39153 | . . . | Human supervisory control of swarm   |
| G05B 2219/39154 | . . . | Each robot can pick up an information carrier, read and write it, exchange it                |
| G05B 2219/39155 | . . . | Motion skill, relate sensor data to certain situation and motion                             |
| G05B 2219/39156 | . . . | To machine together workpiece, desktop flexible manufacturing                                |
| G05B 2219/39157 | . . . | Collectively grasping object to be transported   |
| G05B 2219/39158 | . . . | Configuration description language, to define behaviour of system                            |
| G05B 2219/39159 | . . . | Task modelling   |
| G05B 2219/39161 | . . . | Search, grip object and bring to a home area, gather object, object placement                |
| G05B 2219/39162 | . . . | Learn social rules, greedy robots become non-greedy, adapt to other robots                   |
| G05B 2219/39163 | . . . | Formation control, robots form a rigid formation, fixed relationship                         |
| G05B 2219/39164 | . . . | Embodied evolution, evolutionary robots with basic ann learn by interactions with each other |
| G05B 2219/39165 | . . . | Evolution, best performing control strategy is transmitted to other robots                   |

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| G05B 2219/39166 | . . . | Coordinate activity by sending pheromone messages between robots, no central control |
| G05B 2219/39167 | . . . | Resources scheduling and balancing   |
| G05B 2219/39168 | . . . | Multiple robots searching an object  |
| G05B 2219/39169 | . . . | Redundant communication channels with central control                                |
| G05B 2219/39171 | . . . | Vehicle moves towards arm if stretched arm, away from it if folded, singular point   |
| G05B 2219/39172 | . . . | Vehicle, coordination between manipulator arm and its moving vehicle                 |
| G05B 2219/39173 | . . . | Dynamic interaction between vehicle and manipulator                                  |
| G05B 2219/39174 | . . . | Add DOFs of mobility to DOFs of manipulator to add user defined tasks to motion      |
| G05B 2219/39175 | . . . | Cooperation between fixed manipulator and manipulator on vehicle                     |
| G05B 2219/39176 | . . . | Compensation deflection arm  |
| G05B 2219/39177 | . . . | Compensation position working point as function of inclination tool, hand            |
| G05B 2219/39178 | . . . | Compensation inertia arms  |
| G05B 2219/39179 | . . . | Of movement after lock stop by small movement against load, stop again               |
| G05B 2219/39181 | . . . | Compensation of coulomb friction in joint  |
| G05B 2219/39182 | . . . | Compensation for base, floor deformation   |
| G05B 2219/39183 | . . . | Compliance compensation  |
| G05B 2219/39184 | . . . | Forward compensation in robot world space, inverse in joint space                    |
| G05B 2219/39185 | . . . | ANN as compensator   |
| G05B 2219/39186 | . . . | Flexible joint   |
| G05B 2219/39187 | . . . | Coriolis and centripetal compensation  |
| G05B 2219/39188 | . . . | Torque compensation  |
| G05B 2219/39189 | . . . | Compensate for dead weight of tool as function of inclination tool                   |
| G05B 2219/39191 | . . . | Compensation for errors in mechanical components                                     |
| G05B 2219/39192 | . . . | Compensate thermal effects, expansion of links                                       |
| G05B 2219/39193 | . . . | Compensate movement before lock stop, by small movement against load, gravity        |
| G05B 2219/39194 | . . . | Compensation gravity   |
| G05B 2219/39195 | . . . | Control, avoid oscillation, vibration due to low rigidity                            |
| G05B 2219/39196 | . . . | Use of passive joint, no actuator but brake, brake on or off                         |
| G05B 2219/39197 | . . . | Passive compliance, no input of force reference, mechanical resilience, spring       |
| G05B 2219/39198 | . . . | Manipulator used as workpiece handler and for machining operation                    |
| G05B 2219/39199 | . . . | Active vibration absorber  |
| G05B 2219/39201 | . . . | Control of joint stiffness   |
| G05B 2219/39202 | . . . | Invariant inertia, constant inertia matrix independent of joint positions            |
| G05B 2219/39203 | . . . | Fuzzy petrinet controller  |
| G05B 2219/39204 | . . . | Petrinet controller  |
| G05B 2219/39205 | . . . | Markov model   |

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| G05B 2219/39206 | . . . | Joint space position control   |
| G05B 2219/39207 | . . . | Manipulator is passive, gives operator only feedback of what is currently done   |
| G05B 2219/39208 | . . . | Robot is active, realizes planned trajectory by itself   |
| G05B 2219/39209 | . . . | Switch over from free space motion to constraint motion  |
| G05B 2219/39211 | . . . | If operator on platform moves in certain direction, arm will follow  |
| G05B 2219/39212 | . . . | Select between autonomous or teleoperation control   |
| G05B 2219/39213 | . . . | Distributed tasks, space motion, contact, kinematic conditioning tasks   |
| G05B 2219/39214 | . . . | Compensate tracking error by using model, polynomial network   |
| G05B 2219/39215 | . . . | Adaptive control with stabilizing compensation   |
| G05B 2219/39216 | . . . | Motion scaling   |
| G05B 2219/39217 | . . . | Keep constant orientation of handled object while moving manipulator   |
| G05B 2219/39218 | . . . | Force tracking   |
| G05B 2219/39219 | . . . | Trajectory tracking  |
| G05B 2219/39221 | . . . | Control angular position of joint by length of linear actuator   |
| G05B 2219/39222 | . . . | Disturbance rejection, suppression   |
| G05B 2219/39223 | . . . | Resonance ratio control, between arm and motor   |
| G05B 2219/39224 | . . . | Jacobian transpose control of force vector in configuration and cartesian space  |
| G05B 2219/39225 | . . . | Rmfc resolved motion force control, apply known acceleration to payload mass   |
| G05B 2219/39226 | . . . | Operational space formulation, project model into cartesian coordinates  |
| G05B 2219/39227 | . . . | Configuration control, generate end effector forces to compensate dynamics   |
| G05B 2219/39228 | . . . | Computed torque method and H-compensation  |
| G05B 2219/39229 | . . . | Linear parameterization of robot dynamics  |
| G05B 2219/39231 | . . . | Parameterization of inertia, coriolis and centrifugal matrix   |
| G05B 2219/39232 | . . . | Fuzzy adaptation of sliding mode controller  |
| G05B 2219/39233 | . . . | Adaptive switching of multiple models, same model but different initial estimates, different robot model for different areas |
| G05B 2219/39234 | . . . | Constraint accelerated feedback, distance dependant sampling rate  |
| G05B 2219/39235 | . . . | Track surface without knowing surface geometry   |
| G05B 2219/39236 | . . . | Hybrid integrator back-stepping control, cascaded motor and manipulator subsystems   |
| G05B 2219/39237 | . . . | Torque disturbance control   |
| G05B 2219/39238 | . . . | Trajectory feedforward and feedback to input ann, output a control function  |
| G05B 2219/39239 | . . . | Control additional actuator in each flexible link  |
| G05B 2219/39241 | . . . | Force and vibration control  |
| G05B 2219/39242 | . . . | Velocity blending, change in a certain time from first to second velocity  |
| G05B 2219/39243 | . . . | Adaptive trajectory tracking   |
| G05B 2219/39244 | . . . | Generic motion control operations, primitive skills each for special task  |

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| G05B 2219/39245 | . . . | Computed torque fuzzy controller   |
| G05B 2219/39246 | . . . | Control position and orientation of handled object                                     |
| G05B 2219/39247 | . . . | Control speed, acceleration as function of load and rate of fatigue                    |
| G05B 2219/39248 | . . . | Visual servoing combined with inertial measurements                                    |
| G05B 2219/39249 | . . . | Computed torque controller combined with ann compensating switch type controller       |
| G05B 2219/39251 | . . . | Autonomous distributed control, joint and link is a subsystem, communication intensive |
| G05B 2219/39252 | . . . | Autonomous distributed control, task distributed into each subsystem, task space       |
| G05B 2219/39253 | . . . | Virtual arm, has end effector on any joint of real manipulator                         |
| G05B 2219/39254 | . . . | Behaviour controller, robot have feelings, learns behaviour                            |
| G05B 2219/39255 | . . . | Penalty invariance:distribute disturbance equally over all joints, nodes               |
| G05B 2219/39256 | . . . | Task space controller  |
| G05B 2219/39257 | . . . | Switch from task space to joint space controller when close to singularity             |
| G05B 2219/39258 | . . . | Three objective attitude control   |
| G05B 2219/39259 | . . . | GPS to control robotic arm   |
| G05B 2219/39261 | . . . | Calculate driving torque from dynamic model, computed torque method variant            |
| G05B 2219/39262 | . . . | Position joint to minimize energy in previous joints, equilibrium point, attractor     |
| G05B 2219/39263 | . . . | Normal and overload operation modes, robot speed or torque higher than nominal         |
| G05B 2219/39264 | . . . | Torque control using hardware designed for position control                            |
| G05B 2219/39265 | . . . | Cutting force disturbances compensated by accelerating a mass within tool head         |
| G05B 2219/39266 | . . . | Algorithm for control  |
| G05B 2219/39267 | . . . | Uncertainty estimation by the bounds   |
| G05B 2219/39268 | . . . | Layer perceptron, drive torque from state variables                                    |
| G05B 2219/39269 | . . . | Neural adaptation followed by fuzzy correction   |
| G05B 2219/39271 | . . . | Ann artificial neural network, ffw-nn, feedforward neural network                      |
| G05B 2219/39272 | . . . | Course by expert rule based system to correct fine fuzzy system                        |
| G05B 2219/39273 | . . . | Neural oscillator  |
| G05B 2219/39274 | . . . | CMAC cerebellar model articulation controller network                                  |
| G05B 2219/39275 | . . . | Ann in parallel to known dynamics model to correct for unknown dynamics                |
| G05B 2219/39276 | . . . | FFW and PD and ANN for compensation position error                                     |
| G05B 2219/39277 | . . . | Segmented tree ANN   |
| G05B 2219/39278 | . . . | Ann with pd in parallel, pd corrects response of ANN                                   |
| G05B 2219/39279 | . . . | Ann parallel with p controller   |
| G05B 2219/39281 | . . . | Ann for compensation torque  |

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| G05B 2219/39282 | . . . | FFW ann for torque command, adapt as function of speed and detected speed                |
| G05B 2219/39283 | . . . | Ffw ann to compensate torque or speed  |
| G05B 2219/39284 | . . . | NSC neural servo controller  |
| G05B 2219/39285 | . . . | From database find strategy and select corresponding neural servo controller             |
| G05B 2219/39286 | . . . | Forward inverse, dynamics model, relaxation neural network model firm                    |
| G05B 2219/39287 | . . . | Position and speed error to fuzzy input, output corrected by ann as function of position |
| G05B 2219/39288 | . . . | Track control with ann   |
| G05B 2219/39289 | . . . | Adaptive ann controller  |
| G05B 2219/39291 | . . . | Fuzzy neural for adaptive force control  |
| G05B 2219/39292 | . . . | Neural brain based controller based on simplified model of vertebrate nervous system     |
| G05B 2219/39293 | . . . | Ann parallel to pd, learn inverse dynamics and feedforward of torque signal              |
| G05B 2219/39294 | . . . | Learn inverse dynamics, ffw decomposed ann adapted by pid                                |
| G05B 2219/39295 | . . . | Learn position correction values to be added to reference values                         |
| G05B 2219/39296 | . . . | Learn inverse and forward model together   |
| G05B 2219/39297 | . . . | First learn inverse model, then fine tune with ffw error learning                        |
| G05B 2219/39298 | . . . | Trajectory learning  |
| G05B 2219/39299 | . . . | Learn forward dynamics   |
| G05B 2219/39301 | . . . | Learn feedforward control  |
| G05B 2219/39302 | . . . | Backpropagation end effector location error through the link equations                   |
| G05B 2219/39303 | . . . | Feedback error learn inverse dynamics, felc use position reference and error             |
| G05B 2219/39304 | . . . | Feedback error learn inverse dynamics, use actual position and error                     |
| G05B 2219/39305 | . . . | Learn, detect kinematic constraints in a plane from displacement and force               |
| G05B 2219/39306 | . . . | Three networks, data to cartesian, cartesian to joint angle, joint angle to control      |
| G05B 2219/39307 | . . . | Multiple ann, trajectory control net and force control net                               |
| G05B 2219/39308 | . . . | Position control net, pcn combined with velocity control net, vcn                        |
| G05B 2219/39309 | . . . | Inverse dynamic network combined with time scaling network for trajectory plan           |
| G05B 2219/39311 | . . . | Multilayer, MNN, four layer perceptron, sigmoidal neural network                         |
| G05B 2219/39312 | . . . | Double neural network for tracking, slave microprocessor for servo control               |
| G05B 2219/39313 | . . . | Ann for joint control, ann for trajectory optimization                                   |
| G05B 2219/39314 | . . . | Ann for identification, ann for convergence, ann for tracking control                    |
| G05B 2219/39315 | . . . | Art ann classifier and input selector, bam ann to retrieve collision free path           |
| G05B 2219/39316 | . . . | Two ann, second ann trained with calibration data to learn error first ann               |

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| G05B 2219/39317 | . . . | Adapt weights MNN online, MNN as feedforward, maps inputs to joint torques           |
| G05B 2219/39318 | . . . | Position loop ann and velocity loop ann and force loop ann                           |
| G05B 2219/39319 | . . . | Force control, force as reference, active compliance                                 |
| G05B 2219/39321 | . . . | Force control as function of position of tool  |
| G05B 2219/39322 | . . . | Force and position control   |
| G05B 2219/39323 | . . . | Force and motion control   |
| G05B 2219/39324 | . . . | Force as function of distance from boundary, border of grinding area                 |
| G05B 2219/39325 | . . . | External force control, additional loop comparing forces corrects position           |
| G05B 2219/39326 | . . . | Model compensates positions as function of position to compensate force deformations |
| G05B 2219/39327 | . . . | Fuzzy adaptive force control   |
| G05B 2219/39328 | . . . | Fuzzy pi force control   |
| G05B 2219/39329 | . . . | Adaptive force and position control  |
| G05B 2219/39331 | . . . | Switch between position and force control by fuzzy logic                             |
| G05B 2219/39332 | . . . | Adaptive force control   |
| G05B 2219/39333 | . . . | Fuzzy adaptive force and position control, hybrid                                    |
| G05B 2219/39334 | . . . | Fuzzy reinforcement compliance control   |
| G05B 2219/39335 | . . . | Independent joint control, decentralised   |
| G05B 2219/39336 | . . . | Pd controller combined with disturbance rejection at joint                           |
| G05B 2219/39337 | . . . | Pd controller combined with joint energy based controller                            |
| G05B 2219/39338 | . . . | Impedance control, also mechanical   |
| G05B 2219/39339 | . . . | Admittance control, admittance is tip speed-force                                    |
| G05B 2219/39341 | . . . | Sliding mode based impedance control   |
| G05B 2219/39342 | . . . | Adaptive impedance control   |
| G05B 2219/39343 | . . . | Force based impedance control  |
| G05B 2219/39344 | . . . | Cooperative impedance control, between fingers or arms                               |
| G05B 2219/39345 | . . . | Active compliance control, control tension of spring with dc motor                   |
| G05B 2219/39346 | . . . | Workspace impedance control  |
| G05B 2219/39347 | . . . | Joint space impedance control  |
| G05B 2219/39348 | . . . | Generalized impedance control  |
| G05B 2219/39349 | . . . | RCC remote center compliance device inserted between wrist and gripper               |
| G05B 2219/39351 | . . . | Compensation ann for uncertain trajectory in impedance control                       |
| G05B 2219/39352 | . . . | Feedback error learning, ffw ann compensates torque, feedback from pd to ann         |
| G05B 2219/39353 | . . . | Joint space observer   |
| G05B 2219/39354 | . . . | Operation, work space observer   |
| G05B 2219/39355 | . . . | Observer, disturbance observer   |
| G05B 2219/39356 | . . . | Fuzzy logic velocity observer, to estimate velocity in joints                        |
| G05B 2219/39357 | . . . | Execute motion of path in minimum of time  |



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| G05B 2219/39358 | . . . | Time optimal control along path for singular points, having velocity constraints           |
| G05B 2219/39359 | . . . | Tracking path, priority control for component perpendicular to path                        |
| G05B 2219/39361 | . . . | Minimize time-energy cost  |
| G05B 2219/39362 | . . . | Adapt path of gripping point as function of position of cooperating machine                |
| G05B 2219/39363 | . . . | Track circular path on inclined surface  |
| G05B 2219/39364 | . . . | Path, correction of path in function of load   |
| G05B 2219/39365 | . . . | By using a cue, part of a stimulus to prompt an adapted reaction pattern                   |
| G05B 2219/39366 | . . . | SMC sensory motor coordination   |
| G05B 2219/39367 | . . . | Using a motion map, association between visual position and joint position                 |
| G05B 2219/39368 | . . . | Sensorimotor command layer, between task space and sensor, motor space                     |
| G05B 2219/39369 | . . . | Host and robot controller and vision processing  |
| G05B 2219/39371 | . . . | Host and robot controller  |
| G05B 2219/39372 | . . . | Expert rule based system to correct parameters impedance controller                        |
| G05B 2219/39373 | . . . | Fuzzy for planning, fuzzy neural for adaptive force control                                |
| G05B 2219/39374 | . . . | Fwd and ann combined to compensate torque  |
| G05B 2219/39375 | . . . | MMI to path planner to servo controller  |
| G05B 2219/39376 | . . . | Hierarchical, learning, recognition and skill level and adaptation servo level             |
| G05B 2219/39377 | . . . | Task level supervisor and planner, organizer and execution and path tracking               |
| G05B 2219/39378 | . . . | Control panel separated from power control of articulations                                |
| G05B 2219/39379 | . . . | Open architecture such as nasrem, ngc, dicam, saridis, chimera, gisc, utap, nomad, robline |
| G05B 2219/39381 | . . . | Map task, application to behaviour, force tracking, singularity to motion to actuator      |
| G05B 2219/39382 | . . . | Level, organization and coordination or distribution of tasks and execution level          |
| G05B 2219/39383 | . . . | Supervisor communicates with several ion control agents                                    |
| G05B 2219/39384 | . . . | Control unit near robot, control and teaching panel in safe zone                           |
| G05B 2219/39385 | . . . | Hybrid control system with neural brain based controller and classical ctrlr               |
| G05B 2219/39386 | . . . | Cell configuration, selection and connection of cell combinations                          |
| G05B 2219/39387 | . . . | Reflex control, follow movement, track face, work, hand, visual servoing                   |
| G05B 2219/39388 | . . . | Visual compliance, xy constraint is 2-D image, z position controlled                       |
| G05B 2219/39389 | . . . | Laparoscopic surgery, camera on center of operated part, view around, scale                |
| G05B 2219/39391 | . . . | Visual servoing, track end effector with camera image feedback                             |
| G05B 2219/39392 | . . . | Dynamic pyramiding, change vision field to small area if high tracking speed, zoom         |

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| G05B 2219/39393 | . | . | . | Camera detects projected image, compare with reference image, position end effector                                       |
| G05B 2219/39394 | . | . | . | Compensate hand position with camera detected deviation, new end effector attitude  |
| G05B 2219/39395 | . | . | . | Expectation based visual servoing, use of model   |
| G05B 2219/39396 | . | . | . | Manipulator action on screen depends from displayed position on screen  |
| G05B 2219/39397 | . | . | . | Map image error directly to robot movement, position with relation to world, base not needed, image based visual servoing |
| G05B 2219/39398 | . | . | . | Convert hand to tool coordinates, derive transform matrix   |
| G05B 2219/39399 | . | . | . | Convert position of old, teach to new, changed, actual tool by transform matrix   |
| G05B 2219/39401 | . | . | . | Machine tool coordinates to manipulator coordinates   |
| G05B 2219/39402 | . | . | . | Transfer matrix for moving object and robot to absolute space, motion independent   |
| G05B 2219/39403 | . | . | . | Method, axial rotation of tool to make tool and base coordinates parallel   |
| G05B 2219/39404 | . | . | . | Design of manipulator   |
| G05B 2219/39405 | . | . | . | Develop inverse model of system with ann  |
| G05B 2219/39406 | . | . | . | Obtain optimal parameters of model of system  |
| G05B 2219/39407 | . | . | . | Power metrics, energy efficiency  |
| G05B 2219/39408 | . | . | . | Integrated structure and control design   |
| G05B 2219/39409 | . | . | . | Design of gripper, hand   |
| G05B 2219/39411 | . | . | . | Effect of scaling drive arms  |
| G05B 2219/39412 | . | . | . | Diagnostic of robot, estimation of parameters   |
| G05B 2219/39413 | . | . | . | Robot self diagnostics  |
| G05B 2219/39414 | . | . | . | 7-DOF   |
| G05B 2219/39415 | . | . | . | Hyper redundant, infinite number of DOFs  |
| G05B 2219/39416 | . | . | . | 12-DOF  |
| G05B 2219/39417 | . | . | . | 6-DOF   |
| G05B 2219/39418 | . | . | . | 3-DOF   |
| G05B 2219/39419 | . | . | . | 4-DOF   |
| G05B 2219/39421 | . | . | . | DOF is degree of freedom, 2-DOF   |
| G05B 2219/39422 | . | . | . | 7-DOF for arm and 6-DOF for end effector  |
| G05B 2219/39423 | . | . | . | 5-DOF   |
| G05B 2219/39424 | . | . | . | 16-DOF  |
| G05B 2219/39425 | . | . | . | 9-DOF   |
| G05B 2219/39426 | . | . | . | 10-DOF  |
| G05B 2219/39427 | . | . | . | Panel on arm, hand of robot, controlled axis  |
| G05B 2219/39428 | . | . | . | Panel with special keys for robot programming, like gripper, hand, wrist  |
| G05B 2219/39429 | . | . | . | Using graphic kinematic perspective entered and represented by keys   |
| G05B 2219/39431 | . | . | . | Keys represent function of gripper, open, close   |
| G05B 2219/39432 | . | . | . | Direct robot control, click on mouse on variety of display command buttons  |

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| G05B 2219/39433 | . . . | Enter a move file, robot will follow a series of instructions                    |
| G05B 2219/39434 | . . . | Each function key of pc corresponds to a motor, jog each motor                   |
| G05B 2219/39435 | . . . | Free movable unit has push buttons for other than position, orientation control  |
| G05B 2219/39436 | . . . | Joystick mimics manipulator to provide spatial correspondance                    |
| G05B 2219/39437 | . . . | Joystick with additional handle for wrist and gripper control                    |
| G05B 2219/39438 | . . . | Direct programming at the console  |
| G05B 2219/39439 | . . . | Joystick, handle, lever controls manipulator directly, manually by operator      |
| G05B 2219/39441 | . . . | Voice command, camera detects object, grasp, move                                |
| G05B 2219/39442 | . . . | Set manual a coordinate system by jog feed operation                             |
| G05B 2219/39443 | . . . | Portable, adapted to handpalm, with joystick, function keys, display             |
| G05B 2219/39444 | . . . | Display of position, of shape of robot and tool                                  |
| G05B 2219/39445 | . . . | Select between jog modes, user, robot coordinates, tool, system feed, joint feed |
| G05B 2219/39446 | . . . | Display of manipulator and workpiece and jog directions                          |
| G05B 2219/39447 | . . . | Dead man switch  |
| G05B 2219/39448 | . . . | Same teach pendant connects to many robot controllers over network               |
| G05B 2219/39449 | . . . | Pendant, pda displaying camera images overlayed with graphics, augmented reality |
| G05B 2219/39451 | . . . | Augmented reality for robot programming  |
| G05B 2219/39452 | . . . | Select with mouse button a coordinate plane for micromanipulation                |
| G05B 2219/39453 | . . . | Select program as function of location of mobile manipulator                     |
| G05B 2219/39454 | . . . | Rubber actuator, two muscle drive, one for extension other for traction          |
| G05B 2219/39455 | . . . | Flexible microactuator, fluidic controlled fibre reinforced rubber, three tubes  |
| G05B 2219/39456 | . . . | Direct drive   |
| G05B 2219/39457 | . . . | Tendon drive   |
| G05B 2219/39458 | . . . | Vehicle levitated, arm pushes to position vehicle                                |
| G05B 2219/39459 | . . . | Finger actuator, ac motor and harmonic gear and encoder                          |
| G05B 2219/39461 | . . . | Rotate arm in one direction, forearm in other direction but double speed         |
| G05B 2219/39462 | . . . | Pneumatic actuator, imitates human muscle  |
| G05B 2219/39463 | . . . | Exercise treatment end effector, dexter cube with various switches for tasks     |
| G05B 2219/39464 | . . . | Estimation of human hand impedance in multijoint arm movements                   |
| G05B 2219/39465 | . . . | Two fingers each with 2-DOF  |
| G05B 2219/39466 | . . . | Hand, gripper, end effector of manipulator                                       |
| G05B 2219/39467 | . . . | Select hand as function of geometric form of hand                                |
| G05B 2219/39468 | . . . | Changeable hand, tool, code carrier, detector                                    |
| G05B 2219/39469 | . . . | Grip flexible, deformable plate, object and manipulate it                        |
| G05B 2219/39471 | . . . | Push workpiece in order to grip it correctly                                     |
| G05B 2219/39472 | . . . | Braced manipulator, for fine positioning hand is resting on table                |

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| G05B 2219/39473 | . . . | Autonomous grasping, find, approach, grasp object, sensory motor coordination  |
| G05B 2219/39474 | . . . | Coordination of reaching and grasping  |
| G05B 2219/39475 | . . . | Grasp slightly, rotate object between two fingers by action of gravity         |
| G05B 2219/39476 | . . . | Orient hand relative to object   |
| G05B 2219/39477 | . . . | Finger tracks moving light spot on object                                      |
| G05B 2219/39478 | . . . | Control force and posture of hand  |
| G05B 2219/39479 | . . . | Grip, release again to put object in correct position in tray, regrip and move |
| G05B 2219/39481 | . . . | Control distance finger from center, radius                                    |
| G05B 2219/39482 | . . . | Control position of center of grip   |
| G05B 2219/39483 | . . . | Control angle of rotation  |
| G05B 2219/39484 | . . . | Locate, reach and grasp, visual guided grasping                                |
| G05B 2219/39485 | . . . | Lift workpiece with two fingers, then grasp it with two additional fingers     |
| G05B 2219/39486 | . . . | Fingered hand, multifingered hand  |
| G05B 2219/39487 | . . . | Parallel jaws, two fingered hand   |
| G05B 2219/39488 | . . . | Each finger gets 1-DOF, one more movement, translation or rotation             |
| G05B 2219/39489 | . . . | Soft fingertip, electro rheological controlled fluid                           |
| G05B 2219/39491 | . . . | Each finger controlled by a controller   |
| G05B 2219/39492 | . . . | Finger impedance control   |
| G05B 2219/39493 | . . . | Passive compliant finger, array of resilient rods in tip                       |
| G05B 2219/39494 | . . . | Each finger has 4-DOF  |
| G05B 2219/39495 | . . . | Active electromechanical compliance for each finger                            |
| G05B 2219/39496 | . . . | 3-Fingered hand  |
| G05B 2219/39497 | . . . | Each finger can be controlled independently                                    |
| G05B 2219/39498 | . . . | Each finger has force torque sensor in tip of finger                           |
| G05B 2219/39499 | . . . | 4-Fingers with each 6-DOF  |
| G05B 2219/39501 | . . . | 5-Fingers with each 4-DOF  |
| G05B 2219/39502 | . . . | 4-Fingers with each 3-DOF  |
| G05B 2219/39503 | . . . | 4-Fingers with each 4-DOF  |
| G05B 2219/39504 | . . . | Grip object in gravity center  |
| G05B 2219/39505 | . . . | Control of gripping, grasping, contacting force, force distribution            |
| G05B 2219/39506 | . . . | Grip flexible wire at fixed base, move gripper to top of wire and grip         |
| G05B 2219/39507 | . . . | Control of slip motion   |
| G05B 2219/39508 | . . . | Reorientation of object, orient, regrasp object                                |
| G05B 2219/39509 | . . . | Gripping, grasping, links embrace, encircle, envelop object to grasp           |
| G05B 2219/39511 | . . . | Reorient, rotate object in hand between fingers by action of fingers           |
| G05B 2219/39512 | . . . | Whole hand manipulation, use of fingertips and hand surface                    |
| G05B 2219/39513 | . . . | Tip prehension grasp, grasp with tip of fingers                                |
| G05B 2219/39514 | . . . | Stability of grasped objects   |

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| G05B 2219/39515 | . | . | . | Grapple object, grip in compliant mode, self alignment of fingers and object      |
| G05B 2219/39516 | . | . | . | Push align object against wall, detect each time distance from grip point to wall |
| G05B 2219/39517 | . | . | . | Control orientation and position of object in hand, roll between plates           |
| G05B 2219/39518 | . | . | . | Rolling contact between fingers, robot arms and object                            |
| G05B 2219/39519 | . | . | . | Concurrent grasp, all forces converge in one point                                |
| G05B 2219/39521 | . | . | . | Pencil grasp, forces act in two points, along line of intersection of two planes  |
| G05B 2219/39522 | . | . | . | Regulus grasp, forces do not intersect at all                                     |
| G05B 2219/39523 | . | . | . | Set holding force as function of dimension, weight, shape, hardness, surface      |
| G05B 2219/39524 | . | . | . | Power grasp, between thumb and four fingers, acting as a virtual middle finger    |
| G05B 2219/39525 | . | . | . | Lateral grasp, between thumb and four fingers, acting as virtual index finger     |
| G05B 2219/39526 | . | . | . | Three fingers used, thumb, index, middle finger for lateral precision             |
| G05B 2219/39527 | . | . | . | Workpiece detector, sensor mounted in, near hand, gripper                         |
| G05B 2219/39528 | . | . | . | Measuring, gripping force sensor build into hand                                  |
| G05B 2219/39529 | . | . | . | Force, torque sensor in wrist, end effector                                       |
| G05B 2219/39531 | . | . | . | Several different sensors integrated into hand                                    |
| G05B 2219/39532 | . | . | . | Gripping force sensor build into finger   |
| G05B 2219/39533 | . | . | . | Measure grasping posture and pressure distribution                                |
| G05B 2219/39534 | . | . | . | By positioning fingers, dimension of object can be measured                       |
| G05B 2219/39535 | . | . | . | Measuring, test unit build into hand, end effector                                |
| G05B 2219/39536 | . | . | . | Planning of hand motion, grasping   |
| G05B 2219/39537 | . | . | . | First slide object on table in order to be able to grasp it, grasp it             |
| G05B 2219/39538 | . | . | . | Rotate object with one or more fingers, while sliding on table                    |
| G05B 2219/39539 | . | . | . | Plan hand shape   |
| G05B 2219/39541 | . | . | . | Place fingers to reorient object while grasping                                   |
| G05B 2219/39542 | . | . | . | Plan grasp points, grip matrix and initial grasp force                            |
| G05B 2219/39543 | . | . | . | Recognize object and plan hand shapes in grasping movements                       |
| G05B 2219/39544 | . | . | . | Fuzzy dynamic programming, generate trajectory of finger during tracking          |
| G05B 2219/39545 | . | . | . | Trajectory generation for smoothly grasping moving object                         |
| G05B 2219/39546 | . | . | . | Map human grasps to manipulator grasps  |
| G05B 2219/39547 | . | . | . | Program, plan gripping force, range and speed                                     |
| G05B 2219/39548 | . | . | . | Enter interactively parameter for gripper, then teach movement                    |
| G05B 2219/39549 | . | . | . | Structure, hand has connector for power supply and control signals                |
| G05B 2219/39551 | . | . | . | Pivoting gripper, so part takes always vertical orientation                       |
| G05B 2219/39552 | . | . | . | Stewart platform hand, parallel structured hand                                   |
| G05B 2219/39553 | . | . | . | Dual gripper, two heads to pick up different objects                              |
| G05B 2219/39554 | . | . | . | Gripper is formed by flexible tube, embraces object like a finger                 |

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| G05B 2219/39555 | . . . | Revolver with several grippers, hands  |
| G05B 2219/39556 | . . . | Control system build into hand itself  |
| G05B 2219/39557 | . . . | Vacuum gripper using mask with pattern corresponding to workpiece to be lifted       |
| G05B 2219/39558 | . . . | Vacuum hand has selective gripper area   |
| G05B 2219/39559 | . . . | Polyvalent gripper, to grip, assemble, manipulate                                    |
| G05B 2219/39561 | . . . | Gripper with build in positioning device to align handled object                     |
| G05B 2219/39562 | . . . | Dual end effector, one as tool, the other as workhandler, revolver                   |
| G05B 2219/39563 | . . . | Hand has a center pin to pick up coils   |
| G05B 2219/39564 | . . . | Spoon and fork, fork slides back if food delivered in mouth                          |
| G05B 2219/39565 | . . . | Two fingered microhand, each finger is a parallel, stewart platform                  |
| G05B 2219/39566 | . . . | Transparent gripper, object can always be seen by camera                             |
| G05B 2219/39567 | . . . | Use electromagnetic attraction to bring robot hand in contact with workpiece         |
| G05B 2219/39568 | . . . | Extract, insert objects by controlling fingers, dexterous                            |
| G05B 2219/39569 | . . . | Twirl baton, rotate cylinder through center perpendicular to length                  |
| G05B 2219/39571 | . . . | Grip, grasp non rigid material, piece of cloth                                       |
| G05B 2219/39572 | . . . | Task, tool manipulation  |
| G05B 2219/39573 | . . . | Tool guidance along path   |
| G05B 2219/39574 | . . . | Passive compliant hand, wrist  |
| G05B 2219/39575 | . . . | Wrist, flexible wrist  |
| G05B 2219/39576 | . . . | Magnetically levitated wrist   |
| G05B 2219/39577 | . . . | Active electromechanical compliance for wrist  |
| G05B 2219/39578 | . . . | Axis wrist   |
| G05B 2219/40    | . .   | Robotics, robotics mapping to robotics vision  |
| G05B 2219/40001 | . . . | Laser color indicates type of machining  |
| G05B 2219/40002 | . . . | Camera, robot follows direction movement of operator head, helmet, headstick         |
| G05B 2219/40003 | . . . | Move end effector so that image center is shifted to desired position                |
| G05B 2219/40004 | . . . | Window function, only a specific region is analyzed                                  |
| G05B 2219/40005 | . . . | Vision, analyse image at one station during manipulation at next station             |
| G05B 2219/40006 | . . . | Placing, palletize, un palletize, paper roll placing, box stacking                   |
| G05B 2219/40007 | . . . | Optimize sequence of pick and place operations upon arrival of workpiece on conveyor |
| G05B 2219/40008 | . . . | Place a box, block in a corner   |
| G05B 2219/40009 | . . . | Remove and replace machine part, module  |
| G05B 2219/40011 | . . . | Lay down, laying non rigid material, handle flat textile material                    |
| G05B 2219/40012 | . . . | Pick and place by chain of three manipulators, handling part to each other           |
| G05B 2219/40013 | . . . | Kitting, place parts from belt into tray, place tray on conveyor belt                |
| G05B 2219/40014 | . . . | Gripping workpiece to place it in another place                                      |



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| G05B 2219/40015 | . . . | Soccer playing   |
| G05B 2219/40016 | . . . | Kick a ball, leg and foot movement simulator                                       |
| G05B 2219/40017 | . . . | Hockey playing, puck and paddle  |
| G05B 2219/40018 | . . . | Ball in cup  |
| G05B 2219/40019 | . . . | Placing and assembly, throw object correctly on table                              |
| G05B 2219/40021 | . . . | Batting, to redirect a projectile  |
| G05B 2219/40022 | . . . | Snatching, dynamic pick, effector contacts object, moves with object               |
| G05B 2219/40023 | . . . | Dynamic closure, remain contact by acceleration forces                             |
| G05B 2219/40024 | . . . | Catching   |
| G05B 2219/40025 | . . . | Dynamic manipulation, throwing   |
| G05B 2219/40026 | . . . | Juggling, tennis playing, throw and catch  |
| G05B 2219/40027 | . . . | Preying, object capture, interception, mouse-buster                                |
| G05B 2219/40028 | . . . | Insert flexible rod, beam into hole  |
| G05B 2219/40029 | . . . | Mount elastic ring on a cylinder   |
| G05B 2219/40031 | . . . | Dual peg in hole   |
| G05B 2219/40032 | . . . | Peg and hole insertion, mating and joining, remote center compliance               |
| G05B 2219/40033 | . . . | Assembly, micro assembly   |
| G05B 2219/40034 | . . . | Disassembly, for recycling   |
| G05B 2219/40035 | . . . | Shake grasped parts for dropping excess entangled parts back into pin              |
| G05B 2219/40036 | . . . | Transport plates or sheets between two locations without motion inversion          |
| G05B 2219/40037 | . . . | No incomplete containers allowed to exit on output conveyor                        |
| G05B 2219/40038 | . . . | Black list, exclude operation on workpiece when not possible, collision, error     |
| G05B 2219/40039 | . . . | Robot mounted or sliding inside vehicle, on assembly line or for test, service     |
| G05B 2219/40041 | . . . | Robot operates panel like car radio by pushing, turning buttons, knobs             |
| G05B 2219/40042 | . . . | Control tilting angle of surface carried by robot                                  |
| G05B 2219/40043 | . . . | Move object without swinging, no pendulum or swing motion at stop point            |
| G05B 2219/40044 | . . . | Unfold flexible material   |
| G05B 2219/40045 | . . . | Fill bucket, if hard rock, follow contour rock                                     |
| G05B 2219/40046 | . . . | Fill bucket with sand, move horizontally, if resistance move up, move horizontally |
| G05B 2219/40047 | . . . | Machine overhanging sculptured surfaces  |
| G05B 2219/40048 | . . . | Transport bar by two mobile robots on wavy road                                    |
| G05B 2219/40049 | . . . | Cut material with scissors   |
| G05B 2219/40051 | . . . | Manipulate flexible material fixed with one end to a wall                          |
| G05B 2219/40052 | . . . | Deform, bend flexible material   |
| G05B 2219/40053 | . . . | Pick 3-D object from pile of objects   |
| G05B 2219/40054 | . . . | Supply sheet to bending machine  |
| G05B 2219/40055 | . . . | Wire stripping   |



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| G05B 2219/40056 | . . . | Slide an edge over an edge   |
| G05B 2219/40057 | . . . | Contour tracking, edge following   |
| G05B 2219/40058 | . . . | Align box, block with a surface  |
| G05B 2219/40059 | . . . | Mount, couple and demount, decouple exchangeable mechanical modules                  |
| G05B 2219/40061 | . . . | Disconnect cable   |
| G05B 2219/40062 | . . . | Door opening   |
| G05B 2219/40063 | . . . | Transport dish pile and dispense material in each dish of pile                       |
| G05B 2219/40064 | . . . | Pierce, penetrate soft tissue  |
| G05B 2219/40065 | . . . | Approach, touch and then push object   |
| G05B 2219/40066 | . . . | Stack and align identical layers, laminates, electronic substrate layers             |
| G05B 2219/40067 | . . . | Stack irregular packages   |
| G05B 2219/40068 | . . . | Collective, group transport  |
| G05B 2219/40069 | . . . | Flattening, sweeping non rigid material, take out wrinkles                           |
| G05B 2219/40071 | . . . | Relative positioning, grinding and polishing against rotating belt                   |
| G05B 2219/40072 | . . . | Exert a screwing motion  |
| G05B 2219/40073 | . . . | Carry container with liquid, compensate liquid vibration, swinging effect            |
| G05B 2219/40074 | . . . | Move tip of arm or carried object on surface, wall, constraint                       |
| G05B 2219/40075 | . . . | Turn crank, handle, link around fixed point  |
| G05B 2219/40076 | . . . | Fold flexible plate, non rigid material  |
| G05B 2219/40077 | . . . | Posicast, inverted pendulum, acrobat, balance rod                                    |
| G05B 2219/40078 | . . . | Sort objects, workpieces   |
| G05B 2219/40079 | . . . | Grasp parts from first bin, put them in reverse order in second bin                  |
| G05B 2219/40081 | . . . | Grasp part, object through hole in wall  |
| G05B 2219/40082 | . . . | Docking, align object on end effector with target                                    |
| G05B 2219/40083 | . . . | Pick up pen and robot hand writing   |
| G05B 2219/40084 | . . . | Posicast, inverted pendulum, acrobat, balance rod, control unactuated joint, dof     |
| G05B 2219/40085 | . . . | Point with tip always to same remote target point                                    |
| G05B 2219/40086 | . . . | Slide, tumble, pivot object on surface with fingers of manipulator, graspless        |
| G05B 2219/40087 | . . . | Align hand on workpiece to pick up workpiece, peg and hole                           |
| G05B 2219/40088 | . . . | Task is push, slide box  |
| G05B 2219/40089 | . . . | Tele-programming, transmit task as a program, plus extra info needed by robot        |
| G05B 2219/40091 | . . . | Tele-programming by graphical simulation   |
| G05B 2219/40092 | . . . | Tele-programming by direct instruction on new object, using vision and force sensors |
| G05B 2219/40093 | . . . | Use known task for similar, like object, inform system of that likeness              |
| G05B 2219/40094 | . . . | By changing knowledge base directly  |
| G05B 2219/40095 | . . . | Modify tasks due to modular tooling, other fixture configuration, environment        |

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| G05B 2219/40096 | . . . | Modify tasks due to use of different manipulator                                    |
| G05B 2219/40097 | . . . | Select stations with mouse to create process steps                                  |
| G05B 2219/40098 | . . . | Show grid locations with symbols of workstations                                    |
| G05B 2219/40099 | . . . | Graphical user interface for robotics, visual robot user interface                  |
| G05B 2219/40101 | . . . | Generate concurrent tasks   |
| G05B 2219/40102 | . . . | Tasks are classified in types of unit motions                                       |
| G05B 2219/40103 | . . . | Show object with laser pointer, give oral command for action on, with object        |
| G05B 2219/40104 | . . . | Reactive planner, user is integral component of planner, interactive                |
| G05B 2219/40105 | . . . | Oop task planning, use three knowledge bases, world-, domain- for vision, plan base |
| G05B 2219/40106 | . . . | Feedback of online failures to offline learned knowledge base                       |
| G05B 2219/40107 | . . . | Offline task learning knowledge base, static planner controls dynamic online        |
| G05B 2219/40108 | . . . | Generating possible sequence of steps as function of timing and conflicts           |
| G05B 2219/40109 | . . . | Consider each part to be assembled as an agent, behaving autonomously               |
| G05B 2219/40111 | . . . | For assembly  |
| G05B 2219/40112 | . . . | Using graph grammars and fuzzy logic  |
| G05B 2219/40113 | . . . | Task planning   |
| G05B 2219/40114 | . . . | From vision detected initial and user given final state, generate tasks             |
| G05B 2219/40115 | . . . | Translate goal to task program, use of expert system                                |
| G05B 2219/40116 | . . . | Learn by operator observation, symbiosis, show, watch                               |
| G05B 2219/40117 | . . . | Virtual mechanism, like slider to constraint movement in task space                 |
| G05B 2219/40118 | . . . | Task oriented virtual tool, developed for task, assists operator in task            |
| G05B 2219/40119 | . . . | Virtual internal model, derive from forces on object, motion of end effector        |
| G05B 2219/40121 | . . . | Trajectory planning in virtual space  |
| G05B 2219/40122 | . . . | Manipulate virtual object, for trajectory planning of real object, haptic display   |
| G05B 2219/40123 | . . . | Indicate, select features on display, remote manipulator will execute               |
| G05B 2219/40124 | . . . | During manipulator motion, sensor feedback to adapt model in memory                 |
| G05B 2219/40125 | . . . | Overlay real time stereo image of object on existing, stored memory image argos     |
| G05B 2219/40126 | . . . | Virtual landmarks, reference points for operator                                    |
| G05B 2219/40127 | . . . | Virtual tape measure, indicate distance between end effector and destination        |
| G05B 2219/40128 | . . . | Virtual tether, line on display connects end effector to destination point          |
| G05B 2219/40129 | . . . | Virtual graphic 3-D pointer, manipulator commands real manipulator                  |
| G05B 2219/40131 | . . . | Virtual reality control, programming of manipulator                                 |
| G05B 2219/40132 | . . . | Haptic joystick with force feedback based on accelerometer included in joystick     |
| G05B 2219/40133 | . . . | Force sensation of slave converted to movement of chair for operator                |

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| G05B 2219/40134 | . . . | Force sensation of slave converted to vibration for operator                        |
| G05B 2219/40135 | . . . | Slave force converted to shape display, actuated by fingers, surface is force image |
| G05B 2219/40136 | . . . | Stereo audio and vision   |
| G05B 2219/40137 | . . . | Force sensation feedback from simulated tool  |
| G05B 2219/40138 | . . . | Scaled feedback of forces from slave to master and master to slave                  |
| G05B 2219/40139 | . . . | Force from slave converted to a digital display like fingers and object             |
| G05B 2219/40141 | . . . | Pain sensation feedback, impinge air on, squeeze, vibrate, stimulate fingers        |
| G05B 2219/40142 | . . . | Temperature sensation, thermal feedback to operator fingers                         |
| G05B 2219/40143 | . . . | Slip, texture sensation feedback, by vibration stimulation of fingers               |
| G05B 2219/40144 | . . . | Force sensation feedback from slave   |
| G05B 2219/40145 | . . . | Force sensation of slave converted to audio signal for operator                     |
| G05B 2219/40146 | . . . | Telepresence, teletaction, sensor feedback from slave to operator                   |
| G05B 2219/40147 | . . . | Variable time delay, through internet   |
| G05B 2219/40148 | . . . | Predict locally machining forces from model to control remote machine               |
| G05B 2219/40149 | . . . | Local intelligence for global planning, remote intelligence for tuning              |
| G05B 2219/40151 | . . . | Time delay, problems caused by time delay between local and remote                  |
| G05B 2219/40152 | . . . | Deictic, using a sign language, point finger to reach, close hand to grasp          |
| G05B 2219/40153 | . . . | Teleassistance, operator assists, controls autonomous robot                         |
| G05B 2219/40154 | . . . | Moving of objects   |
| G05B 2219/40155 | . . . | Purpose is grasping objects   |
| G05B 2219/40156 | . . . | Input work program as well as timing schedule                                       |
| G05B 2219/40157 | . . . | Planning, event based planning, operator changes plans during execution             |
| G05B 2219/40158 | . . . | Correlate actual image at angle with image presented to operator without angle      |
| G05B 2219/40159 | . . . | Between operator and sensor a world modeler, local intelligence                     |
| G05B 2219/40161 | . . . | Visual display of machining, operation, remote viewing                              |
| G05B 2219/40162 | . . . | Sound display of machining operation  |
| G05B 2219/40163 | . . . | Measuring, predictive information feedback to operator                              |
| G05B 2219/40164 | . . . | Fault recovery from task execution errors   |
| G05B 2219/40165 | . . . | Sensor data to display depends on robot status                                      |
| G05B 2219/40166 | . . . | Surface display, virtual object translated into real surface, movable rods          |
| G05B 2219/40167 | . . . | Switch between simulated display of remote site, and actual display                 |
| G05B 2219/40168 | . . . | Simulated display of remote site, driven by operator interaction                    |
| G05B 2219/40169 | . . . | Display of actual situation at the remote site                                      |
| G05B 2219/40171 | . . . | Set a common coordinate system for all remotely controlled robots                   |
| G05B 2219/40172 | . . . | Stop command transmission if no feedback signal received at remote site             |
| G05B 2219/40173 | . . . | Stop robot if no command received within interval                                   |
| G05B 2219/40174 | . . . | Robot teleoperation through internet  |

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|-----------------|-------|---|
| G05B 2219/40175 | . . . | Inclination, tilt of operator seat, chair serves as control command, like handle  |
| G05B 2219/40176 | . . . | Encode operator actions into symbolic commands for transmission to remote         |
| G05B 2219/40177 | . . . | Nano manipulation   |
| G05B 2219/40178 | . . . | Distributed top, resource availability in network                                 |
| G05B 2219/40179 | . . . | Design of controller  |
| G05B 2219/40181 | . . . | Operator can fine position in small area, free, but if contact, force feedback    |
| G05B 2219/40182 | . . . | Master has different configuration than slave manipulator                         |
| G05B 2219/40183 | . . . | Tele-machining  |
| G05B 2219/40184 | . . . | Compliant teleoperation, operator controls motion, system controls contact, force |
| G05B 2219/40185 | . . . | Decoupled coarse fine motion coordination   |
| G05B 2219/40186 | . . . | Reachability control, permits slave to reach commanded position                   |
| G05B 2219/40187 | . . . | Indexed position control, master controls only small part of slave space          |
| G05B 2219/40188 | . . . | Position control with scaling, master small movement, slave large movement        |
| G05B 2219/40189 | . . . | Modes, coarse by rate controller, fine by position controller                     |
| G05B 2219/40191 | . . . | Autonomous manipulation, computer assists operator during manipulation            |
| G05B 2219/40192 | . . . | Control modes, velocity for coarse, position for fine, hand for gripper           |
| G05B 2219/40193 | . . . | Micro manipulation  |
| G05B 2219/40194 | . . . | Force reflective, impedance shaping tele operation                                |
| G05B 2219/40195 | . . . | Tele-operation, computer assisted manual operation                                |
| G05B 2219/40196 | . . . | Projecting light on floor to delimit danger zone around robot                     |
| G05B 2219/40197 | . . . | Suppress, execute command depending on physical position of control panel         |
| G05B 2219/40198 | . . . | Contact with human allowed if under pain tolerance limit                          |
| G05B 2219/40199 | . . . | Soft material covers links, arms for shock and pain attenuation                   |
| G05B 2219/40201 | . . . | Detect contact, collision with human  |
| G05B 2219/40202 | . . . | Human robot coexistence   |
| G05B 2219/40203 | . . . | Detect position of operator, create non material barrier to protect operator      |
| G05B 2219/40204 | . . . | Each fault condition has a different recovery procedure                           |
| G05B 2219/40205 | . . . | Multiple arm systems  |
| G05B 2219/40206 | . . . | Redundant serial manipulators, kinematic fault tolerance                          |
| G05B 2219/40207 | . . . | Parallel structured modules, more joints than DOF                                 |
| G05B 2219/40208 | . . . | Dual redundant actuators  |
| G05B 2219/40209 | . . . | If speed is important processors execute each different code, otherwise same code |
| G05B 2219/40211 | . . . | Fault tolerant, if one joint, actuator fails, others take over, reconfiguration   |
| G05B 2219/40212 | . . . | Two-way clutch for joint, prevents movement in unallowable direction              |

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|-----------------|-------|---|
| G05B 2219/40213 | . . . | Record history, log of instructions sent from task planner to path planner                |
| G05B 2219/40214 | . . . | Command rejection module  |
| G05B 2219/40215 | . . . | Limit link kinetic energy to amount another element can dissipate upon impact             |
| G05B 2219/40216 | . . . | Record image of working robot; display to detect errors                                   |
| G05B 2219/40217 | . . . | Individual emergency stop lines for each part of system                                   |
| G05B 2219/40218 | . . . | Check conditions before allowing unlocking of joint brake                                 |
| G05B 2219/40219 | . . . | Detect contact, proximity of other manipulators   |
| G05B 2219/40221 | . . . | Individual and common power cutoff switch for several robots                              |
| G05B 2219/40222 | . . . | Lock arm if somebody is looking into the hand   |
| G05B 2219/40223 | . . . | If insertion force to high, alarm, stop for operator assistance                           |
| G05B 2219/40224 | . . . | If robot gets a return signal, go to initial condition position                           |
| G05B 2219/40225 | . . . | During start up, control robot with low speed, after a while gradually higher             |
| G05B 2219/40226 | . . . | Input control signals to control system and to model, compare their outputs               |
| G05B 2219/40227 | . . . | If one access robot fails, other pushes it out of the way                                 |
| G05B 2219/40228 | . . . | If deviation of compliant tool is too large, stop and alarm                               |
| G05B 2219/40229 | . . . | Analytical redundancy, use available functional redundancy of model                       |
| G05B 2219/40231 | . . . | Safety, dual clutched freewheel for joint, if error no movement possible                  |
| G05B 2219/40232 | . . . | Lock mechanical arm if servo, cpu error, other arms remain free                           |
| G05B 2219/40233 | . . . | Portable robot  |
| G05B 2219/40234 | . . . | Snake arm, flexi-digit robotic manipulator, a hand at each end                            |
| G05B 2219/40235 | . . . | Parallel robot, structure   |
| G05B 2219/40236 | . . . | With opposing actuators on same joint, agonist, flexor, muscle                            |
| G05B 2219/40237 | . . . | Bus for communication with sensors  |
| G05B 2219/40238 | . . . | Dual arm robot, one picks up one part from conveyor as other places other part in machine |
| G05B 2219/40239 | . . . | Common control box for several robot control boards and additional control boards         |
| G05B 2219/40241 | . . . | Underactuated robot, has less actuators than number of DOF                                |
| G05B 2219/40242 | . . . | End effector with motor to provide a yaw, roll and pitch motion                           |
| G05B 2219/40243 | . . . | Global positioning robot  |
| G05B 2219/40244 | . . . | Walking manipulator with integrated stewart, parallel arm                                 |
| G05B 2219/40245 | . . . | Gripper on crawling device, smaller than two cm   |
| G05B 2219/40246 | . . . | 6-DOF 3-ppsp parallel manipulator   |
| G05B 2219/40247 | . . . | Series manipulator mounted on parallel manipulator  |
| G05B 2219/40248 | . . . | Manipulator on slide  |
| G05B 2219/40249 | . . . | Whole arm manipulator, grip object not with end effector but with all links               |
| G05B 2219/40251 | . . . | Ghdrs generalized high dimensional robotic system, virtual decomposition                  |
| G05B 2219/40252 | . . . | Robot on track, rail moves only back and forth  |

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|-----------------|-------|--|
| G05B 2219/40253 | . . . | Soft arm robot, light, rubber, very compliant                                      |
| G05B 2219/40254 | . . . | Serial to parallel, branching manipulator, one macro and several parallel arms     |
| G05B 2219/40255 | . . . | End effector attached to cable for gravity balance suspension                      |
| G05B 2219/40256 | . . . | Large, heavy manipulator   |
| G05B 2219/40257 | . . . | Flexible macro manipulator with rigid attached micro manipulator                   |
| G05B 2219/40258 | . . . | Robot can be fixed in orientation and height to ground, plurality of such points   |
| G05B 2219/40259 | . . . | Set friction in each joint to optimal value  |
| G05B 2219/40261 | . . . | Self reproducing, replicating fabrication machine, tools, structure, info for this |
| G05B 2219/40262 | . . . | Two link arm with a free, attached to base, and an active joint between links      |
| G05B 2219/40263 | . . . | Dual use mobile detachable manipulator   |
| G05B 2219/40264 | . . . | Human like, type robot arm   |
| G05B 2219/40265 | . . . | Use of inflatable links, can easily be folded, compressed air for stiffness        |
| G05B 2219/40266 | . . . | Resonant manipulator, springs cooperate with latches, motor only for lost energy   |
| G05B 2219/40267 | . . . | Parallel manipulator, end effector connected to at least two independent links     |
| G05B 2219/40268 | . . . | Master attached to tip of macro manipulator, controls slave micro manipulator      |
| G05B 2219/40269 | . . . | Naturally compliant robot arm  |
| G05B 2219/40271 | . . . | Underwater, submarine movable manipulator  |
| G05B 2219/40272 | . . . | Manipulator on slide, track  |
| G05B 2219/40273 | . . . | Wire manipulator, crane type manipulator with three wires                          |
| G05B 2219/40274 | . . . | Cebot segments are mobile manipulators, connected by manipulator arm self          |
| G05B 2219/40275 | . . . | Manipulator mounted on satellite, space manipulator                                |
| G05B 2219/40276 | . . . | Aqua robot manipulator   |
| G05B 2219/40277 | . . . | Hybrid, connect parallel manipulators in series, Stewart truss                     |
| G05B 2219/40278 | . . . | Compact, foldable manipulator  |
| G05B 2219/40279 | . . . | Flexible arm, link   |
| G05B 2219/40281 | . . . | Closed kinematic loop, chain mechanisms, closed linkage systems                    |
| G05B 2219/40282 | . . . | Vehicle supports manipulator and other controlled devices                          |
| G05B 2219/40283 | . . . | Reservoir with additional material on vehicle with manipulator                     |
| G05B 2219/40284 | . . . | Toolrack on vehicle with manipulator, toolchanger                                  |
| G05B 2219/40285 | . . . | Variable geometry manipulator, camlock   |
| G05B 2219/40286 | . . . | End effector with offset arm, to carry hose to feed material                       |
| G05B 2219/40287 | . . . | Workpiece manipulator and tool manipulator cooperate                               |
| G05B 2219/40288 | . . . | Integrate sensor, actuator units into a virtual manipulator                        |
| G05B 2219/40289 | . . . | Scara for coarse movement, xy table for fine movement                              |



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|-----------------|-------|---|
| G05B 2219/40291 | . . . | Instead of two links, two eccentrically rotating disks for full circle working    |
| G05B 2219/40292 | . . . | Manipulator is positioned by a crane to cover a large workpiece, extended range   |
| G05B 2219/40293 | . . . | Gantry, portal  |
| G05B 2219/40294 | . . . | Portable robot can be fixed, attached to different workplaces, stations           |
| G05B 2219/40295 | . . . | Sensors at the elbow to detect obstacles  |
| G05B 2219/40296 | . . . | Second arm can be attached to first arm, modular                                  |
| G05B 2219/40297 | . . . | Macro manipulator and micro hand, distributed positioning                         |
| G05B 2219/40298 | . . . | Manipulator on vehicle, wheels, mobile  |
| G05B 2219/40299 | . . . | Holonic, made of similar modules, truss manipulator                               |
| G05B 2219/40301 | . . . | Scara, selective compliance assembly robot arm, links, arms in a plane            |
| G05B 2219/40302 | . . . | Dynamically reconfigurable robot, adapt structure to tasks, cellular robot, cebot |
| G05B 2219/40303 | . . . | Arm somersaults over grid, place one hand on grid point, release other hand       |
| G05B 2219/40304 | . . . | Modular structure   |
| G05B 2219/40305 | . . . | Exoskeleton, human robot interaction, extenders                                   |
| G05B 2219/40306 | . . . | Two or more independent robots  |
| G05B 2219/40307 | . . . | Two, dual arm robot, arm used synchronously, or each separately, asynchronously   |
| G05B 2219/40308 | . . . | Machine, conveyor model in library contains coop robot path                       |
| G05B 2219/40309 | . . . | Simulation of human hand motion   |
| G05B 2219/40311 | . . . | Real time simulation  |
| G05B 2219/40312 | . . . | OOP object oriented programming for simulation                                    |
| G05B 2219/40313 | . . . | Graphic motion simulation for ergonomic analysis                                  |
| G05B 2219/40314 | . . . | Simulation of program locally before remote operation                             |
| G05B 2219/40315 | . . . | Simulation with boundary graphs   |
| G05B 2219/40316 | . . . | Simulation of human-like robot joint, restricted 3-D motion                       |
| G05B 2219/40317 | . . . | For collision avoidance and detection   |
| G05B 2219/40318 | . . . | Simulation of reaction force and moment, force simulation                         |
| G05B 2219/40319 | . . . | Simulate contact of object and obstacle, reduce to pairs with only one contact    |
| G05B 2219/40321 | . . . | Simulation of human arm trajectories  |
| G05B 2219/40322 | . . . | Simulation with des, discrete event system  |
| G05B 2219/40323 | . . . | Modeling robot environment for sensor based robot system                          |
| G05B 2219/40324 | . . . | Simulation, modeling of muscle, musculoskeletal dynamical system                  |
| G05B 2219/40325 | . . . | Learn inverse kinematic model by variation, perturbation                          |
| G05B 2219/40326 | . . . | Singular value decomposition  |
| G05B 2219/40327 | . . . | Calculation, inverse kinematics solution using damped least squares method        |
| G05B 2219/40328 | . . . | If joint near singularity, restore angle to start values, adapt other joints      |



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|-----------------|-------|---|
| G05B 2219/40329 | . . . | Semi-singularity, movement in one direction not possible, in opposite direction is possible |
| G05B 2219/40331 | . . . | Joint angle change constraint, singularity between elbow up and down                        |
| G05B 2219/40332 | . . . | Identify degenerated directions, eliminate velocity component in that direction             |
| G05B 2219/40333 | . . . | Singularity, at least one movement not possible, kinematic redundancy                       |
| G05B 2219/40334 | . . . | By fuzzy logic supervisor   |
| G05B 2219/40335 | . . . | By probability distribution functions pdf   |
| G05B 2219/40336 | . . . | Optimize multiple constraints or subtasks   |
| G05B 2219/40337 | . . . | Maximum distance criterium  |
| G05B 2219/40338 | . . . | Task priority redundancy  |
| G05B 2219/40339 | . . . | Avoid collision   |
| G05B 2219/40341 | . . . | Minimize energy   |
| G05B 2219/40342 | . . . | Minimize sum of gravitational torques of some joints  |
| G05B 2219/40343 | . . . | Optimize local torque   |
| G05B 2219/40344 | . . . | Configuration index, control, limits of joint movement                                      |
| G05B 2219/40345 | . . . | Minor measure   |
| G05B 2219/40346 | . . . | Compatibility index   |
| G05B 2219/40347 | . . . | Optimize manipulator velocity ratio function  |
| G05B 2219/40348 | . . . | Optimize condition number   |
| G05B 2219/40349 | . . . | Optimize manipulability measure function  |
| G05B 2219/40351 | . . . | Cooperation of hand arm, break down into two subsystems                                     |
| G05B 2219/40352 | . . . | Combination of priority, basic task, tip position, and task for link movement               |
| G05B 2219/40353 | . . . | Split robot into two virtual robot, origin of second equals tip of first                    |
| G05B 2219/40354 | . . . | Singularity detection   |
| G05B 2219/40355 | . . . | Geometric, task independent   |
| G05B 2219/40356 | . . . | Kinetic energy, content and distribution  |
| G05B 2219/40357 | . . . | Compliance, design and operational issues   |
| G05B 2219/40358 | . . . | Inertial, from dynamic models   |
| G05B 2219/40359 | . . . | Constraint, physical limitations  |
| G05B 2219/40361 | . . . | Category of performance criteria  |
| G05B 2219/40362 | . . . | Elbow high or low, avoid obstacle collision with redundancy control                         |
| G05B 2219/40363 | . . . | Two independent paths planned, interpolations for same robot, e.g. wrist and TCP            |
| G05B 2219/40364 | . . . | Position of robot platform as additional task   |
| G05B 2219/40365 | . . . | Configuration control, select other tasks by configuration of link positions                |
| G05B 2219/40366 | . . . | Elbow reaches its target position before the end effector                                   |
| G05B 2219/40367 | . . . | Redundant manipulator   |
| G05B 2219/40368 | . . . | Multipoint impedance control, redundant manipulator can touch several obstacles             |

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|-----------------|-------|---|
| G05B 2219/40369 | . . . | Generate all possible arm postures associated with end effector position                |
| G05B 2219/40371 | . . . | Control trajectory to avoid joint limit as well as obstacle collision                   |
| G05B 2219/40372 | . . . | Control end effector impedance  |
| G05B 2219/40373 | . . . | Control of trajectory in case of a limb, joint disturbance, failure                     |
| G05B 2219/40374 | . . . | Control trajectory in case of distortion of visual input                                |
| G05B 2219/40375 | . . . | Control trajectory in case of changed tool length                                       |
| G05B 2219/40376 | . . . | Moving center of mass and end effector for dynamic task of lifting heavy weight         |
| G05B 2219/40377 | . . . | Impact force on stationary end effector, move center of mass, no reaction to base       |
| G05B 2219/40378 | . . . | Keep center of mass fixed, no counterweight, no reaction on base                        |
| G05B 2219/40379 | . . . | Manipulability  |
| G05B 2219/40381 | . . . | Control trajectory in case of joint limit, clamping of joint                            |
| G05B 2219/40382 | . . . | Limit allowable area where robot can be taught  |
| G05B 2219/40383 | . . . | Correction, modification program by detection type workpiece                            |
| G05B 2219/40384 | . . . | Optimize taught path by data acquisition followed by genetic algorithm                  |
| G05B 2219/40385 | . . . | Compare offline taught point with online taught point, modify rest as function of error |
| G05B 2219/40386 | . . . | Search around taught point until operation has succes, correct program                  |
| G05B 2219/40387 | . . . | Modify without repeating teaching operation   |
| G05B 2219/40388 | . . . | Two channels between robot and teaching panel, rs232c and video                         |
| G05B 2219/40389 | . . . | Use robot control language also to write non robotic user, application programs         |
| G05B 2219/40391 | . . . | Human to robot skill transfer   |
| G05B 2219/40392 | . . . | Programming, visual robot programming language  |
| G05B 2219/40393 | . . . | Learn natural high level command, associate its template with a plan, sequence          |
| G05B 2219/40394 | . . . | Combine offline with online information to generate robot actions                       |
| G05B 2219/40395 | . . . | Compose movement with primitive movement segments from database                         |
| G05B 2219/40396 | . . . | Intermediate code for robots, bridge, conversion to controller                          |
| G05B 2219/40397 | . . . | Programming language for robots, universal, user oriented                               |
| G05B 2219/40398 | . . . | Opto-electronic follow-up of movement of head, eyelids, finger to control robot         |
| G05B 2219/40399 | . . . | Selection of master-slave operation mode  |
| G05B 2219/40401 | . . . | Convert workspace of master to workspace of slave                                       |
| G05B 2219/40402 | . . . | Control button on master for quick movement, for fine slow movement                     |
| G05B 2219/40403 | . . . | Master for walk through, slave uses data for motion control and simulation              |
| G05B 2219/40404 | . . . | Separate master controls macro and micro slave manipulator                              |
| G05B 2219/40405 | . . . | Master slave position control   |
| G05B 2219/40406 | . . . | Master slave rate control   |
| G05B 2219/40407 | . . . | Master slave, master is replica of slave  |

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|-----------------|-------|---|
| G05B 2219/40408 | . . . | Intention learning  |
| G05B 2219/40409 | . . . | Robot brings object near operator, operator places object in correct position                     |
| G05B 2219/40411 | . . . | Robot assists human in non-industrial environment like home or office                             |
| G05B 2219/40412 | . . . | Sensor knowledge command fusion network, data and feature and action and constraint               |
| G05B 2219/40413 | . . . | Robot has multisensors surrounding operator, to understand intention of operator                  |
| G05B 2219/40414 | . . . | Man robot interface, exchange of information between operator and robot                           |
| G05B 2219/40415 | . . . | Semi active robot, cobot, guides surgeon, operator to planned trajectory , constraint             |
| G05B 2219/40416 | . . . | Planning for variable length tool, laser beam as tool   |
| G05B 2219/40417 | . . . | For cooperating manipulators  |
| G05B 2219/40418 | . . . | Presurgical planning, on screen indicate regions to be operated on                                |
| G05B 2219/40419 | . . . | Task, motion planning of objects in contact, task level programming, not robot level              |
| G05B 2219/40421 | . . . | Motion planning for manipulator handling sheet metal profiles                                     |
| G05B 2219/40422 | . . . | Force controlled velocity motion planning, adaptive   |
| G05B 2219/40423 | . . . | Map task space to sensor space  |
| G05B 2219/40424 | . . . | Online motion planning, in real time, use vision to detect workspace changes                      |
| G05B 2219/40425 | . . . | Sensing, vision based motion planning   |
| G05B 2219/40426 | . . . | Adaptive trajectory planning as function of force on end effector, bucket                         |
| G05B 2219/40427 | . . . | Integrate sensing and action in planning  |
| G05B 2219/40428 | . . . | Using rapidly exploring random trees algorithm RRT-algorithm                                      |
| G05B 2219/40429 | . . . | Stochastic, probabilistic generation of intermediate points                                       |
| G05B 2219/40431 | . . . | Grid of preoptimised paths as function of target position, choose closest, fine adapt             |
| G05B 2219/40432 | . . . | Pass states by weighted transitions   |
| G05B 2219/40433 | . . . | Distributed, trajectory planning for each virtual arm   |
| G05B 2219/40434 | . . . | Decompose in motion planning for swarm of robots and motion planning for object to be transported |
| G05B 2219/40435 | . . . | Extract minimum number of via points from a trajectory  |
| G05B 2219/40436 | . . . | Distributed search of attainable positions, parallel computed                                     |
| G05B 2219/40437 | . . . | Local, directly search robot workspace  |
| G05B 2219/40438 | . . . | Global, compute free configuration space, connectivity graph is then searched                     |
| G05B 2219/40439 | . . . | Feasible map algorithm  |
| G05B 2219/40441 | . . . | Probabilistic backprojection  |
| G05B 2219/40442 | . . . | Voxel map, 3-D grid map   |
| G05B 2219/40443 | . . . | Conditional and iterative planning  |
| G05B 2219/40444 | . . . | Hierarchical planning, in levels  |

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| G05B 2219/40445 | . . . | Decompose n-dimension with n-links into smaller m-dimension with m-1-links         |
| G05B 2219/40446 | . . . | Graph based  |
| G05B 2219/40447 | . . . | Bitmap based   |
| G05B 2219/40448 | . . . | Preprocess nodes with arm configurations, c-space and planning by connecting nodes |
| G05B 2219/40449 | . . . | Continuous, smooth robot motion  |
| G05B 2219/40451 | . . . | Closest, nearest arm, robot executes task, minimum travel time                     |
| G05B 2219/40452 | . . . | Evaluation function derived from skilled, experimented operator data               |
| G05B 2219/40453 | . . . | Maximum torque for each axis   |
| G05B 2219/40454 | . . . | Max velocity, acceleration limit for workpiece and arm jerk rate as constraints    |
| G05B 2219/40455 | . . . | Proximity of obstacles   |
| G05B 2219/40456 | . . . | End effector orientation error   |
| G05B 2219/40457 | . . . | End effector position error  |
| G05B 2219/40458 | . . . | Grid adaptive optimization   |
| G05B 2219/40459 | . . . | Minimum torque change model  |
| G05B 2219/40461 | . . . | Plan for even distribution of motor load of joints                                 |
| G05B 2219/40462 | . . . | Constant consumed energy, regenerate acceleration energy during deceleration       |
| G05B 2219/40463 | . . . | Shortest distance in time, or metric, time optimal                                 |
| G05B 2219/40464 | . . . | Minimum relative velocities  |
| G05B 2219/40465 | . . . | Criteria is lowest cost function, minimum work path                                |
| G05B 2219/40466 | . . . | Plan for minimum time trajectory, at least one joint maximum torque                |
| G05B 2219/40467 | . . . | Virtual springs, impedance method  |
| G05B 2219/40468 | . . . | Using polytree intersection method   |
| G05B 2219/40469 | . . . | Using fuzzy logic performance, distances are fuzzy, very close to very far         |
| G05B 2219/40471 | . . . | Using gradient method  |
| G05B 2219/40472 | . . . | Using exact cell decomposition   |
| G05B 2219/40473 | . . . | Using genetic algorithm GA   |
| G05B 2219/40474 | . . . | Using potential fields   |
| G05B 2219/40475 | . . . | In presence of moving obstacles, dynamic environment                               |
| G05B 2219/40476 | . . . | Collision, planning for collision free path  |
| G05B 2219/40477 | . . . | Plan path independent from obstacles, then correction for obstacles                |
| G05B 2219/40478 | . . . | Graphic display of work area of robot, forbidden, permitted zone                   |
| G05B 2219/40479 | . . . | Use graphic display, layout of robot path, obstacles to indicate interference      |
| G05B 2219/40481 | . . . | Search pattern according to type of assembly to be performed                       |
| G05B 2219/40482 | . . . | Before assembly arrange parts  |
| G05B 2219/40483 | . . . | Find possible contacts   |
| G05B 2219/40484 | . . . | Using several tethered motors, attached to powersupply cable, move over surface    |

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| G05B 2219/40485 | . . . | Generate goal regions in presence of uncertainty, interference                          |
| G05B 2219/40486 | . . . | If physical limitation, execute regrasping steps  |
| G05B 2219/40487 | . . . | Sensing to task planning to assembly execution, integration, automatic                  |
| G05B 2219/40488 | . . . | Coarse and fine motion planning combined  |
| G05B 2219/40489 | . . . | Assembly, polyhedra in contact  |
| G05B 2219/40491 | . . . | Gravity stable assembly, upper part cannot fall apart                                   |
| G05B 2219/40492 | . . . | Model manipulator by spheres for collision avoidance                                    |
| G05B 2219/40493 | . . . | Task to parameter designer, adapts parameters of impedance model as function of sensors |
| G05B 2219/40494 | . . . | Neural network for object trajectory prediction, fuzzy for robot path                   |
| G05B 2219/40495 | . . . | Inverse kinematics model controls trajectory planning and servo system                  |
| G05B 2219/40496 | . . . | Hierarchical, learning, recognition level controls adaptation, servo level              |
| G05B 2219/40497 | . . . | Collision monitor controls planner in real time to replan if collision                  |
| G05B 2219/40498 | . . . | Architecture, integration of planner and motion controller                              |
| G05B 2219/40499 | . . . | Reinforcement learning algorithm  |
| G05B 2219/40501 | . . . | Using sub goal method of options for semi optimal path planning                         |
| G05B 2219/40502 | . . . | Configuration metrics   |
| G05B 2219/40503 | . . . | Input design parameters of workpiece into path, trajectory planner                      |
| G05B 2219/40504 | . . . | Simultaneous trajectory and camera planning   |
| G05B 2219/40505 | . . . | Adaptive posture planning as function of large forces                                   |
| G05B 2219/40506 | . . . | Self motion topology knowledge, configuration mapping                                   |
| G05B 2219/40507 | . . . | Distributed planning, offline trajectory, online motion, avoid collision                |
| G05B 2219/40508 | . . . | Fuzzy identification of motion plans executed by operator                               |
| G05B 2219/40509 | . . . | Piano moving model  |
| G05B 2219/40511 | . . . | Trajectory optimization, coarse for arm, medium for wrist, fine for finger              |
| G05B 2219/40512 | . . . | Real time path planning, trajectory generation  |
| G05B 2219/40513 | . . . | Planning of vehicle and of its manipulator arm  |
| G05B 2219/40514 | . . . | Computed robot optimized configurations to train ann, output path in real time          |
| G05B 2219/40515 | . . . | Integration of simulation and planning  |
| G05B 2219/40516 | . . . | Replanning  |
| G05B 2219/40517 | . . . | Constraint motion planning, variational dynamic programming                             |
| G05B 2219/40518 | . . . | Motion and task planning  |
| G05B 2219/40519 | . . . | Motion, trajectory planning   |
| G05B 2219/40521 | . . . | Alternative, allowable path substitution if arm movements not possible                  |
| G05B 2219/40522 | . . . | Display of workpiece, workspace, locus of robot tip in different planes, xy xz yz       |
| G05B 2219/40523 | . . . | Path motion planning, path in space followed by tip of robot                            |
| G05B 2219/40524 | . . . | Replace link, joint, structure by stewart platform to model flexibility                 |
| G05B 2219/40525 | . . . | Modeling only part of links or modules  |
| G05B 2219/40526 | . . . | Modeling of links for each possible error or only certain error                         |

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| G05B 2219/40527 | . . . | Modeling, identification of link parameters                                     |
| G05B 2219/40528 | . . . | Ann for learning robot contact surface shape                                    |
| G05B 2219/40529 | . . . | Neural network based on distance between patterns                               |
| G05B 2219/40531 | . . . | Ann for voice recognition   |
| G05B 2219/40532 | . . . | Ann for vision processing   |
| G05B 2219/40533 | . . . | Generate derivative, change of vibration error                                  |
| G05B 2219/40534 | . . . | Generate derivative, change of position error                                   |
| G05B 2219/40535 | . . . | Selective perception, retain only information needed for special task           |
| G05B 2219/40536 | . . . | Signal processing for sensors   |
| G05B 2219/40537 | . . . | Detect if robot has picked up more than one piece from bin; interlocked parts   |
| G05B 2219/40538 | . . . | Barcode reader to detect position   |
| G05B 2219/40539 | . . . | Edge detection from tactile information   |
| G05B 2219/40541 | . . . | Identification of contact formation, state from several force measurements      |
| G05B 2219/40542 | . . . | Object dimension  |
| G05B 2219/40543 | . . . | Identification and location, position of components, objects                    |
| G05B 2219/40544 | . . . | Detect proximity of object  |
| G05B 2219/40545 | . . . | Relative position of wrist with respect to end effector spatial configuration   |
| G05B 2219/40546 | . . . | Motion of object  |
| G05B 2219/40547 | . . . | End effector position using accelerometers in tip                               |
| G05B 2219/40548 | . . . | Compare measured distances to obstacle with model of environment                |
| G05B 2219/40549 | . . . | Acceleration of end effector  |
| G05B 2219/40551 | . . . | Friction estimation for grasp   |
| G05B 2219/40552 | . . . | Joint limit   |
| G05B 2219/40553 | . . . | Haptic object recognition   |
| G05B 2219/40554 | . . . | Object recognition to track object on conveyor                                  |
| G05B 2219/40555 | . . . | Orientation and distance  |
| G05B 2219/40556 | . . . | Multisensor to detect contact errors in assembly                                |
| G05B 2219/40557 | . . . | Tracking a tool, compute 3-D position relative to camera                        |
| G05B 2219/40558 | . . . | Derive hand position angle from sensed process variable, like waveform          |
| G05B 2219/40559 | . . . | Collision between hand and workpiece, operator                                  |
| G05B 2219/40561 | . . . | Contactpoint between sensor surface and the normal, geometric probing           |
| G05B 2219/40562 | . . . | Position and orientation of end effector, teach probe, track them               |
| G05B 2219/40563 | . . . | Object detection  |
| G05B 2219/40564 | . . . | Recognize shape, contour of object, extract position and orientation            |
| G05B 2219/40565 | . . . | Detect features of object, not position or orientation                          |
| G05B 2219/40566 | . . . | Measuring, determine axis of revolution surface by tactile sensing, orientation |
| G05B 2219/40567 | . . . | Purpose, workpiece slip sensing   |
| G05B 2219/40568 | . . . | Position and force and skin acceleration and stress rate sensors                |



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| G05B 2219/40569 | . . . | Force and tactile and proximity sensor   |
| G05B 2219/40571 | . . . | Camera, vision combined with force sensor  |
| G05B 2219/40572 | . . . | Camera combined with position sensor   |
| G05B 2219/40573 | . . . | Isee integrated sensor, end effector, camera, proximity, gas, temperature, force     |
| G05B 2219/40574 | . . . | Laserscanner combined with tactile sensors   |
| G05B 2219/40575 | . . . | Camera combined with tactile sensors, for 3-D  |
| G05B 2219/40576 | . . . | Multisensory object recognition, surface reconstruction                              |
| G05B 2219/40577 | . . . | Multisensor object recognition   |
| G05B 2219/40578 | . . . | Impedance, mechanical impedance measurement  |
| G05B 2219/40579 | . . . | Mechanical impedance, from motor current and estimated velocity                      |
| G05B 2219/40581 | . . . | Touch sensing, arc sensing   |
| G05B 2219/40582 | . . . | Force sensor in robot fixture, base  |
| G05B 2219/40583 | . . . | Detect relative position or orientation between gripper and currently handled object |
| G05B 2219/40584 | . . . | Camera, non-contact sensor mounted on wrist, indep from gripper                      |
| G05B 2219/40585 | . . . | Chemical, biological sensors   |
| G05B 2219/40586 | . . . | 6-DOF force sensor   |
| G05B 2219/40587 | . . . | Measure force indirectly by using deviation in position                              |
| G05B 2219/40588 | . . . | Three laser scanners project beam on photodiodes on end effector                     |
| G05B 2219/40589 | . . . | Recognize shape, contour of tool   |
| G05B 2219/40591 | . . . | At least three cameras, for tracking, general overview and underview                 |
| G05B 2219/40592 | . . . | Two virtual infrared range sensors   |
| G05B 2219/40593 | . . . | Push object and hold, detect moved distance  |
| G05B 2219/40594 | . . . | Two range sensors for recognizing 3-D objects  |
| G05B 2219/40595 | . . . | Camera to monitor deviation of each joint, due to bending of link                    |
| G05B 2219/40596 | . . . | Encoder in each joint  |
| G05B 2219/40597 | . . . | Measure, calculate angular momentum, gyro of rotating body at end effector           |
| G05B 2219/40598 | . . . | Measure velocity, speed of end effector  |
| G05B 2219/40599 | . . . | Force, torque sensor integrated in joint   |
| G05B 2219/40601 | . . . | Reference sensors  |
| G05B 2219/40602 | . . . | Robot control test platform  |
| G05B 2219/40603 | . . . | Infrared stimulated ultrasonic button on end effector, two fixed receivers           |
| G05B 2219/40604 | . . . | Two camera, global vision camera, end effector neighbourhood vision camera           |
| G05B 2219/40605 | . . . | Two cameras, each on a different end effector to measure relative position           |
| G05B 2219/40606 | . . . | Force, torque sensor in finger   |
| G05B 2219/40607 | . . . | Fixed camera to observe workspace, object, workpiece, global                         |
| G05B 2219/40608 | . . . | Camera rotates around end effector, no calibration needed                            |



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| G05B 2219/40609 | . . . | Camera to monitor end effector as well as object to be handled                        |
| G05B 2219/40611 | . . . | Camera to monitor endpoint, end effector position                                     |
| G05B 2219/40612 | . . . | 6-DOF ultrasonic or infrared external measurement                                     |
| G05B 2219/40613 | . . . | Camera, laser scanner on end effector, hand eye manipulator, local                    |
| G05B 2219/40614 | . . . | Whole arm proximity sensor WHAP   |
| G05B 2219/40615 | . . . | Integrate sensor placement, configuration with vision tracking                        |
| G05B 2219/40616 | . . . | Sensor planning, sensor configuration, parameters as function of task                 |
| G05B 2219/40617 | . . . | Agile eye, control position of camera, active vision, pan-tilt camera, follow object  |
| G05B 2219/40618 | . . . | Measure gripping force offline, calibrate gripper for gripping force                  |
| G05B 2219/40619 | . . . | Haptic, combination of tactile and proprioceptive sensing                             |
| G05B 2219/40621 | . . . | Triangulation sensor  |
| G05B 2219/40622 | . . . | Detect orientation of workpiece during movement of end effector                       |
| G05B 2219/40623 | . . . | Track position of end effector by laser beam  |
| G05B 2219/40624 | . . . | Optical beam area sensor  |
| G05B 2219/40625 | . . . | Tactile sensor  |
| G05B 2219/40626 | . . . | Proprioceptive, detect relative link position, form object from hand contact          |
| G05B 2219/40627 | . . . | Tactile image sensor, matrix, array of tactile elements, tixels                       |
| G05B 2219/40628 | . . . | Progressive constraints   |
| G05B 2219/40629 | . . . | Manipulation planning, consider manipulation task, path, grasping                     |
| G05B 2219/41    | . .   | Servomotor, servo controller till figures   |
| G05B 2219/41001 | . . . | Servo problems  |
| G05B 2219/41002 | . . . | Servo amplifier   |
| G05B 2219/41003 | . . . | Control power amplifier with data on data bus   |
| G05B 2219/41004 | . . . | Selection gain according to selection of speed or positioning mode                    |
| G05B 2219/41005 | . . . | Update servo gain not for each microprocessor cycle, but after a certain displacement |
| G05B 2219/41006 | . . . | Change gain as function of speed and position   |
| G05B 2219/41007 | . . . | Select gain as function of gear ratio   |
| G05B 2219/41008 | . . . | Speed gain high, position gain low in speed mode and inverse in position mode         |
| G05B 2219/41009 | . . . | Sum output of amplifiers with different gains   |
| G05B 2219/41011 | . . . | Adapt gain as function of followup error, model can be used                           |
| G05B 2219/41012 | . . . | Adjust feedforward gain   |
| G05B 2219/41013 | . . . | Lower gain in high frequency region   |
| G05B 2219/41014 | . . . | Cubic raise of gain until friction overcome, then linear raise                        |
| G05B 2219/41015 | . . . | Adjust position and speed gain of different axis                                      |
| G05B 2219/41016 | . . . | Adjust gain to maintain operating bandwidth for guaranteed servo performance          |
| G05B 2219/41017 | . . . | High gain in narrow band of frequencies centered around frequency of rotation         |

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| G05B 2219/41018 | . . . | High gain for motor control during acceleration, low during deceleration         |
| G05B 2219/41019 | . . . | Measure time needed from first to second speed, to adapt gain to aging condition |
| G05B 2219/41021 | . . . | Variable gain  |
| G05B 2219/41022 | . . . | Small gain for small movements, large gain for large movements                   |
| G05B 2219/41023 | . . . | Large pd gain initially switched to smaller pd gain afterwards                   |
| G05B 2219/41024 | . . . | High gain for low command speed, torque or position error equals or near zero    |
| G05B 2219/41025 | . . . | Detect oscillation, unstability of servo and change gain to stabilize again      |
| G05B 2219/41026 | . . . | Change gain as function of speed   |
| G05B 2219/41027 | . . . | Control signal exponentially to error  |
| G05B 2219/41028 | . . . | Select gain with memory, rom table   |
| G05B 2219/41029 | . . . | Adjust gain as function of position error and position                           |
| G05B 2219/41031 | . . . | Raise gain at zero speed until position error or speed is zero, then normal gain |
| G05B 2219/41032 | . . . | Backlash   |
| G05B 2219/41033 | . . . | Constant counter torque  |
| G05B 2219/41034 | . . . | Two motors driven in opposite direction to take up backlash                      |
| G05B 2219/41035 | . . . | Voltage injection  |
| G05B 2219/41036 | . . . | Position error in memory, lookup table for correction actual position            |
| G05B 2219/41037 | . . . | With computer  |
| G05B 2219/41038 | . . . | Compensation pulses  |
| G05B 2219/41039 | . . . | Change compensation slowly, gradually, smooth error with filter                  |
| G05B 2219/41041 | . . . | Compensation pulses as function of direction movement                            |
| G05B 2219/41042 | . . . | Switch between rapid, quick feed and cut, slow workspeed feed backlash           |
| G05B 2219/41043 | . . . | Memory table with motor current and corresponding correction for lost motion     |
| G05B 2219/41044 | . . . | For several transducers a table, select table as function of transducer          |
| G05B 2219/41045 | . . . | For several modes and feed speeds, a table, registers for several backlash       |
| G05B 2219/41046 | . . . | Ffw compensation using adaptive inverse backlash model                           |
| G05B 2219/41047 | . . . | Recirculating ballnut, ballscrew, preloaded bearing                              |
| G05B 2219/41048 | . . . | Relieve backlash by stepping back a little and verify position                   |
| G05B 2219/41049 | . . . | Block position pulses until movement detected, automatic compensation            |
| G05B 2219/41051 | . . . | Detect end of lost motion by detecting changing current                          |
| G05B 2219/41052 | . . . | By detecting change of velocity  |
| G05B 2219/41053 | . . . | How to integrate position error, add to speed loop                               |
| G05B 2219/41054 | . . . | Using neural network techniques  |
| G05B 2219/41055 | . . . | Kind of compensation such as pitch error compensation                            |
| G05B 2219/41056 | . . . | Compensation for changing stiffness, deformation of workpiece                    |
| G05B 2219/41057 | . . . | Stiffness, deformation of slide, drive   |

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| G05B 2219/41058 | . . . | For deformation of screw   |
| G05B 2219/41059 | . . . | Play in gear, screw backlash, lost motion  |
| G05B 2219/41061 | . . . | Backlash for linear deviations   |
| G05B 2219/41062 | . . . | Compensation for two, three axis at the same time, crosscoupling                   |
| G05B 2219/41063 | . . . | Lineary distributing pitch error over interpolated distance, add pulses, smoothing |
| G05B 2219/41064 | . . . | Reference screw, simulation axis, electronic simulated axis                        |
| G05B 2219/41065 | . . . | Resolver or inductosyn correction  |
| G05B 2219/41066 | . . . | Keep nut at constant distance from screw   |
| G05B 2219/41067 | . . . | Correction screw   |
| G05B 2219/41068 | . . . | Measuring and feedback   |
| G05B 2219/41069 | . . . | With cam   |
| G05B 2219/41071 | . . . | Backlash for non orthogonal axis   |
| G05B 2219/41072 | . . . | Cam transmits movement to resolver   |
| G05B 2219/41073 | . . . | Tuning potentiometers and programming them   |
| G05B 2219/41074 | . . . | Learn, calibrate at start for indetermined position, drive until movement          |
| G05B 2219/41075 | . . . | Calibrate at start if new screw or slide has been installed, new lookup table      |
| G05B 2219/41076 | . . . | For each replacement of a movable part, reload pitch error correction              |
| G05B 2219/41077 | . . . | Self tuning, test run, detect, compute optimal backlash, deformation compensation  |
| G05B 2219/41078 | . . . | Backlash acceleration compensation when inversing, reversing direction             |
| G05B 2219/41079 | . . . | Cross coupled backlash for two other axis on reversing third axis                  |
| G05B 2219/41081 | . . . | Approach position from same direction  |
| G05B 2219/41082 | . . . | Timer, speed integration to control duration of backlash correction                |
| G05B 2219/41083 | . . . | Upon reversing direction, lower, change gain                                       |
| G05B 2219/41084 | . . . | Compensation speed axis with changing, reversing direction, quadrant circle        |
| G05B 2219/41085 | . . . | Compensation pulses on inversion of direction of rotation, movement                |
| G05B 2219/41086 | . . . | Bang bang control  |
| G05B 2219/41087 | . . . | Determine switch point   |
| G05B 2219/41088 | . . . | If error too large, switch over to signal identification and servo correction      |
| G05B 2219/41089 | . . . | Align, calibrate control so that one pulse or signal represents certain movement   |
| G05B 2219/41091 | . . . | Alignment, zeroing, nulling, set parallel to axis                                  |
| G05B 2219/41092 | . . . | References, calibration positions for correction of value position counter         |
| G05B 2219/41093 | . . . | By injection of sinusoidal signal, superposed on reference                         |
| G05B 2219/41094 | . . . | Removable interferometer, store exact position, needed drive current, temperature  |
| G05B 2219/41095 | . . . | References, calibration positions to adapt gain of servo                           |
| G05B 2219/41096 | . . . | For several positions store dead zone in memory                                    |
| G05B 2219/41097 | . . . | Align stepping motor with driven valve   |

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| G05B 2219/41098 | . . . | Automatic recalibration   |
| G05B 2219/41099 | . . . | Calibration by going to two extremes, limits, counting pulses, storing values                     |
| G05B 2219/41101 | . . . | Stop, halt step, ac motor on certain excitation phase, after sensing a reference                  |
| G05B 2219/41102 | . . . | Analog comparator   |
| G05B 2219/41103 | . . . | One comparator for both speed and position feedback   |
| G05B 2219/41104 | . . . | Start fine position after coarse position stopped   |
| G05B 2219/41105 | . . . | Coarse fine   |
| G05B 2219/41106 | . . . | Coarse fine take over, transition, switch over  |
| G05B 2219/41107 | . . . | Coarse by hydraulic cylinder, fine by step motor superposed on piston                             |
| G05B 2219/41108 | . . . | Controlled parameter such as gas mass flow rate   |
| G05B 2219/41109 | . . . | Drilling rate, feed rate  |
| G05B 2219/41111 | . . . | Vertical position and orientation with respect to vertical  |
| G05B 2219/41112 | . . . | Control parameter such as motor controlled by a torque signal                                     |
| G05B 2219/41113 | . . . | Compensation for path radius  |
| G05B 2219/41114 | . . . | Compensation for gravity, counter balance gravity   |
| G05B 2219/41115 | . . . | Compensation periodical disturbance, like chatter, non-circular workpiece                         |
| G05B 2219/41116 | . . . | Compensation for instability  |
| G05B 2219/41117 | . . . | Cancel vibration during positioning of slide  |
| G05B 2219/41118 | . . . | Drift-compensation for servo, anti-hunt   |
| G05B 2219/41119 | . . . | Servo error compensation  |
| G05B 2219/41121 | . . . | Eliminating oscillations, hunting motor, actuator   |
| G05B 2219/41122 | . . . | Mechanical vibrations in servo, antihunt also safety, stray pulses, jitter                        |
| G05B 2219/41123 | . . . | Correction inertia of servo   |
| G05B 2219/41124 | . . . | Nonlinear compensation  |
| G05B 2219/41125 | . . . | Compensate position as function of phase lag of drive motor                                       |
| G05B 2219/41126 | . . . | Compensation for current ripple of drive or transducer  |
| G05B 2219/41127 | . . . | Compensation for temperature variations of servo  |
| G05B 2219/41128 | . . . | Compensate vibration beam, gantry, feedback of speed of non driven end                            |
| G05B 2219/41129 | . . . | Force compensation for non linearity of system  |
| G05B 2219/41131 | . . . | Enter manually a compensation, correction for a better positioning                                |
| G05B 2219/41132 | . . . | Motor ripple compensation   |
| G05B 2219/41133 | . . . | Compensation non linear transfer function   |
| G05B 2219/41134 | . . . | Ann compensates output of pd controller   |
| G05B 2219/41135 | . . . | Avoid stray pulses, jitter, use two d-flipflops, or integrate pulse duration                      |
| G05B 2219/41136 | . . . | Compensation of position for slip of ac motor   |
| G05B 2219/41137 | . . . | Torque compensation for levitation effect of motor  |
| G05B 2219/41138 | . . . | Torque compensation   |
| G05B 2219/41139 | . . . | Compensate dynamic deflection of slide, calculated with position, speed, torque deflection values |

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| G05B 2219/41141 | . . . | Position error compensation as function of speed to compensate detection delay               |
| G05B 2219/41142 | . . . | Compensation of servocontrol signals as function of changing supply voltage                  |
| G05B 2219/41143 | . . . | Compensation of dynamic characteristic of actuator   |
| G05B 2219/41144 | . . . | Element used such as low pass filter to cut resonance at non needed regions                  |
| G05B 2219/41145 | . . . | Digital filter for compensation of servo loop  |
| G05B 2219/41146 | . . . | Kalman filter  |
| G05B 2219/41147 | . . . | Exponential filter   |
| G05B 2219/41148 | . . . | Model, from position, speed, acceleration derive compensation                                |
| G05B 2219/41149 | . . . | Zero phase filter  |
| G05B 2219/41151 | . . . | Finite impulse response filter   |
| G05B 2219/41152 | . . . | Adaptive filter  |
| G05B 2219/41153 | . . . | Infinite impulse response filter   |
| G05B 2219/41154 | . . . | Friction, compensation for friction  |
| G05B 2219/41155 | . . . | During reversing, inverting rotation, movement   |
| G05B 2219/41156 | . . . | Injection of vibration anti-stick, against static friction, dither, stiction                 |
| G05B 2219/41157 | . . . | Compensation as function of speed and acceleration   |
| G05B 2219/41158 | . . . | Use of pwm signal against friction   |
| G05B 2219/41159 | . . . | Two step command, reference and dead zone value forward, then dead zone reverse              |
| G05B 2219/41161 | . . . | Adaptive friction compensation   |
| G05B 2219/41162 | . . . | Large gain at start to overcome friction, then low gain                                      |
| G05B 2219/41163 | . . . | Adapt gain to friction, weight, inertia  |
| G05B 2219/41164 | . . . | How to compensate, for example by injecting compensation signal in comparator of normal loop |
| G05B 2219/41165 | . . . | Compensation corrected by second servo independent from main servo                           |
| G05B 2219/41166 | . . . | Adaptive filter frequency as function of oscillation, rigidity, inertia load                 |
| G05B 2219/41167 | . . . | Control path independent of load   |
| G05B 2219/41168 | . . . | Compensate position error by shifting projected image electronically                         |
| G05B 2219/41169 | . . . | Parallel compensation  |
| G05B 2219/41171 | . . . | Different compensation for left and right movement   |
| G05B 2219/41172 | . . . | Adapt coefficients of compensator to bring system into phase margin                          |
| G05B 2219/41173 | . . . | Delay of compensation output signal as function of sampling and computation time             |
| G05B 2219/41174 | . . . | Compensator in feedback loop   |
| G05B 2219/41175 | . . . | Derivative compensation for speed loop, added or subtracted to speed reference               |
| G05B 2219/41176 | . . . | Compensation control, position error with data from lookup memory                            |
| G05B 2219/41177 | . . . | Repetitive control, adaptive, previous error during actual positioning                       |
| G05B 2219/41178 | . . . | Serial precompensation   |

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| G05B 2219/41179 | . . . | PI precompensation for speed loop  |
| G05B 2219/41181 | . . . | PID precompensation for position loop  |
| G05B 2219/41182 | . . . | PI precompensation for position loop   |
| G05B 2219/41183 | . . . | Compensation of lag during standstill  |
| G05B 2219/41184 | . . . | Compensation of lag during constant speed movement                                     |
| G05B 2219/41185 | . . . | Send reference data in inverse order to model, filter to get inverted phase            |
| G05B 2219/41186 | . . . | Lag  |
| G05B 2219/41187 | . . . | Inverse, reciprocal filter, transfer function, reduce lag in contouring                |
| G05B 2219/41188 | . . . | Compensate position error between two different axis as function of type of transducer |
| G05B 2219/41189 | . . . | Several axis, compensation for load for several axis at the same time                  |
| G05B 2219/41191 | . . . | Cancel vibration by positioning two slides, opposite acceleration                      |
| G05B 2219/41192 | . . . | Compensation for different response times, delay of axis                               |
| G05B 2219/41193 | . . . | Active damping of tool vibrations by cross coupling                                    |
| G05B 2219/41194 | . . . | Axis error, one axis is corrected on other axis  |
| G05B 2219/41195 | . . . | Cross coupled feedback, position change one axis effects control of other              |
| G05B 2219/41196 | . . . | Adaptive prefiltering  |
| G05B 2219/41197 | . . . | Adaptive postfiltering   |
| G05B 2219/41198 | . . . | Fuzzy precompensation of pid, pd   |
| G05B 2219/41199 | . . . | Feedforward compensation of pid  |
| G05B 2219/41201 | . . . | Fuzzy compensation of statecontroller  |
| G05B 2219/41202 | . . . | Structure, compensation circuit after comparator in loop                               |
| G05B 2219/41203 | . . . | Lead-phase compensation, lag-phase compensation servo                                  |
| G05B 2219/41204 | . . . | Compensation circuit for input, reference, before comparator                           |
| G05B 2219/41205 | . . . | Compensation circuit in speed feedback loop  |
| G05B 2219/41206 | . . . | Lookup table, memory with certain relationships  |
| G05B 2219/41207 | . . . | Lookup table with position command, deviation and correction value                     |
| G05B 2219/41208 | . . . | Lookup table for load, motor torque as function of actual position error               |
| G05B 2219/41209 | . . . | Lookup table with compensation as function of reference and feedback value             |
| G05B 2219/41211 | . . . | For surface deviations from reference surface  |
| G05B 2219/41212 | . . . | Gains for pid compensator as function of xy position                                   |
| G05B 2219/41213 | . . . | Lookup table for load, motor torque as function of actual position                     |
| G05B 2219/41214 | . . . | Lookup table for current as function of actual position                                |
| G05B 2219/41215 | . . . | Lookup table for speed as function of actual position error                            |
| G05B 2219/41216 | . . . | Two lookup tables, for forward and reverse movement                                    |
| G05B 2219/41217 | . . . | Command preshape, guidance, reference for better dynamic response, forcing feedforward |
| G05B 2219/41218 | . . . | Posicast, break reference into two parts, better settling time                         |
| G05B 2219/41219 | . . . | To compensate path, track error, calculate, use compensated reference                  |
| G05B 2219/41221 | . . . | Fuzzy shaping  |



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|-----------------|-------|---|
| G05B 2219/41222 | . . . | Modified command filtering  |
| G05B 2219/41223 | . . . | Ann shaping, objective position, trajectory is shaped by ann                            |
| G05B 2219/41224 | . . . | Shaping a bang-bang input   |
| G05B 2219/41225 | . . . | Profile generator for reference and for feedforward torque                              |
| G05B 2219/41226 | . . . | Zero vibration and zero derivative input shaper ZVD                                     |
| G05B 2219/41227 | . . . | Extra insensitive input shaper, some vibration allowed                                  |
| G05B 2219/41228 | . . . | Frequency of commutation updates depends on motor speed                                 |
| G05B 2219/41229 | . . . | Adding a vibration, noise signal to reference signal of position, speed or acceleration |
| G05B 2219/41231 | . . . | Using impulse shaping filter  |
| G05B 2219/41232 | . . . | Notch filter  |
| G05B 2219/41233 | . . . | Feedforward simulation filter, with model   |
| G05B 2219/41234 | . . . | Design, modeling of position controller   |
| G05B 2219/41235 | . . . | Design, modeling of motion controller   |
| G05B 2219/41236 | . . . | Use of sfc sequential function charts for specification                                 |
| G05B 2219/41237 | . . . | Use of petrinets for verification, simulation   |
| G05B 2219/41238 | . . . | Design with control bandwidth beyond lowest natural frequency                           |
| G05B 2219/41239 | . . . | Lyapunov direct controller design   |
| G05B 2219/41241 | . . . | Anti-coincidence, synchronizer  |
| G05B 2219/41242 | . . . | Pulse height modulation PHM   |
| G05B 2219/41243 | . . . | Prevent, detect overflow of counter   |
| G05B 2219/41244 | . . . | Dead band, zone   |
| G05B 2219/41245 | . . . | Discrimination of direction   |
| G05B 2219/41246 | . . . | Modulate command according to hysteresis so that ideal curve is followed                |
| G05B 2219/41247 | . . . | Servo lock  |
| G05B 2219/41248 | . . . | Adapting characteristics of servo   |
| G05B 2219/41249 | . . . | Several slides along one axis   |
| G05B 2219/41251 | . . . | Servo with spring, resilient, elastic element, twist                                    |
| G05B 2219/41252 | . . . | Avoid housing vibration, slide and auxiliary slide controlled with opposite phase       |
| G05B 2219/41253 | . . . | From measured signature, select in database corresponding servo valve type              |
| G05B 2219/41254 | . . . | Avoid cumulative measuring, calculation errors, sum remainder                           |
| G05B 2219/41255 | . . . | Mode switch, select independent or dependent control of axis                            |
| G05B 2219/41256 | . . . | Chattering control  |
| G05B 2219/41257 | . . . | Display of gain   |
| G05B 2219/41258 | . . . | Single position detector for plural motors driving a single load                        |
| G05B 2219/41259 | . . . | Coupling, clutch  |
| G05B 2219/41261 | . . . | Flexible coupling between carriage, slide and actuator, motor                           |
| G05B 2219/41262 | . . . | Binary summing of motions, by stacking or using levers                                  |



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|-----------------|---|---|---|---|
| G05B 2219/41263 | . | . | . | Switch control mode of spindle drive as function of contouring, spindle orientation   |
| G05B 2219/41264 | . | . | . | Driven by two motors  |
| G05B 2219/41265 | . | . | . | To avoid backlash   |
| G05B 2219/41266 | . | . | . | Coupling, clutch and brake unit   |
| G05B 2219/41267 | . | . | . | Servo loop with stepping motor, see figure SE-twelve                                  |
| G05B 2219/41268 | . | . | . | Two cascade slides controlled in opposite direction to avoid local wear               |
| G05B 2219/41269 | . | . | . | Ballscrew and ball spline nut driven synchronously or independently                   |
| G05B 2219/41271 | . | . | . | Drive in two directions   |
| G05B 2219/41272 | . | . | . | Driven by two steppermotors with different resonance frequency                        |
| G05B 2219/41273 | . | . | . | Hydraulic   |
| G05B 2219/41274 | . | . | . | Flywheel as power buffer  |
| G05B 2219/41275 | . | . | . | Two axis, x y motors controlled simultaneous, no contouring, quick move at 45-degrees |
| G05B 2219/41276 | . | . | . | Displacement as function of width, amplitude pulse to motor                           |
| G05B 2219/41277 | . | . | . | Separation of position drive controller and motor amplifiers                          |
| G05B 2219/41278 | . | . | . | Two current amplifiers, pumps for each direction of displacement, pushpull            |
| G05B 2219/41279 | . | . | . | Brake   |
| G05B 2219/41281 | . | . | . | Hydraulic actuated brake  |
| G05B 2219/41282 | . | . | . | Magnetic brake  |
| G05B 2219/41283 | . | . | . | Brake force does not load index axis, better positioning                              |
| G05B 2219/41284 | . | . | . | Brake by applying dc to ac motor  |
| G05B 2219/41285 | . | . | . | Dynamic brake of ac, dc motor   |
| G05B 2219/41286 | . | . | . | Brake motor before reversing motor  |
| G05B 2219/41287 | . | . | . | Mechanical self braking   |
| G05B 2219/41288 | . | . | . | Two brakes, one on motor axis, other on drive axis                                    |
| G05B 2219/41289 | . | . | . | Motor direction controlled by relays  |
| G05B 2219/41291 | . | . | . | Before switching relay, series semiconductor diminishes current to zero               |
| G05B 2219/41292 | . | . | . | H-bridge, diagonal pairs of semiconductors  |
| G05B 2219/41293 | . | . | . | Inverter, dc-to-ac  |
| G05B 2219/41294 | . | . | . | Dc-to-ac converter  |
| G05B 2219/41295 | . | . | . | Ac-to-ac converter frequency controlled   |
| G05B 2219/41296 | . | . | . | Two data lines; one for drive controllers, other to communicate with central unit     |
| G05B 2219/41297 | . | . | . | For cancelling magnetic field leakage generated by e.g. voice coil motor              |
| G05B 2219/41298 | . | . | . | Stepping motor and control valve and power cylinder and mechanical feedback           |
| G05B 2219/41299 | . | . | . | Pneumatic drive, pressure controlled bellow extension                                 |
| G05B 2219/41301 | . | . | . | Pilot valve, linear fluid control valve and power cylinder                            |
| G05B 2219/41302 | . | . | . | On off fluid valve and power cylinder   |

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| G05B 2219/41303 | . . . | Flow rate valve controls speed   |
| G05B 2219/41304 | . . . | Pneumatic  |
| G05B 2219/41305 | . . . | Bypass fluid flow, block it from motor   |
| G05B 2219/41306 | . . . | Control valve with counteracting control pulses                                  |
| G05B 2219/41307 | . . . | Motor drives hydraulic pump in direction needed for power cylinder               |
| G05B 2219/41308 | . . . | Bellow formed by for linear actuators, each pressure controlled by motor         |
| G05B 2219/41309 | . . . | Hydraulic or pneumatic drive   |
| G05B 2219/41311 | . . . | Pilot valve with feedback of position  |
| G05B 2219/41312 | . . . | Metering piston between switch to fluid supply and switch to power cylinder      |
| G05B 2219/41313 | . . . | Electro rheological fluid actuator   |
| G05B 2219/41314 | . . . | Electro rheological valve controls cylinder                                      |
| G05B 2219/41315 | . . . | Feedback of position of pilot valve and of power cylinder                        |
| G05B 2219/41316 | . . . | Piezo valve  |
| G05B 2219/41317 | . . . | Stepping motor and control valve and power cylinder                              |
| G05B 2219/41318 | . . . | Electro hydraulic drive, electric motor drives hydraulic actuator                |
| G05B 2219/41319 | . . . | Ac, induction motor  |
| G05B 2219/41321 | . . . | Brushless dc motor   |
| G05B 2219/41322 | . . . | Vector, field oriented controlled motor  |
| G05B 2219/41323 | . . . | Permanent magnetic synchronous actuator, motor                                   |
| G05B 2219/41324 | . . . | Modular servo drive, simo drive  |
| G05B 2219/41325 | . . . | Linear electric actuator for position combined with pneumatic actuator for force |
| G05B 2219/41326 | . . . | Step motor   |
| G05B 2219/41327 | . . . | Linear induction motor   |
| G05B 2219/41328 | . . . | Direct motor drive   |
| G05B 2219/41329 | . . . | Dc motor   |
| G05B 2219/41331 | . . . | Galvano driver   |
| G05B 2219/41332 | . . . | Electromagnet driven core, position of core controlled                           |
| G05B 2219/41333 | . . . | Non linear solenoid actuator   |
| G05B 2219/41334 | . . . | Electrostatic levitator  |
| G05B 2219/41335 | . . . | Reluctance motor   |
| G05B 2219/41336 | . . . | Voltage and frequency controlled ac motor  |
| G05B 2219/41337 | . . . | Linear drive motor , voice coil  |
| G05B 2219/41338 | . . . | High torque, low inertia motor, printed circuit motor                            |
| G05B 2219/41339 | . . . | Using, switch reluctance or asynchronous motor in, to stepping mode motor        |
| G05B 2219/41341 | . . . | Ultrasonic motor   |
| G05B 2219/41342 | . . . | Shape memory metal actuator  |
| G05B 2219/41343 | . . . | Magnetostrictive motor   |
| G05B 2219/41344 | . . . | Piezo, electrostrictive linear drive   |

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| G05B 2219/41345 | . . . | Micropositioner   |
| G05B 2219/41346 | . . . | Micropositioner in x, y and theta   |
| G05B 2219/41347 | . . . | Piezo cycloid motor   |
| G05B 2219/41348 | . . . | Hydraulic pressure block  |
| G05B 2219/41349 | . . . | 6-Dof combined magnetic fluidic floating motion stage 100-micrometer cube range         |
| G05B 2219/41351 | . . . | Piezo impact force, rapid extension of small mass moves object a bit                    |
| G05B 2219/41352 | . . . | Alternative clamping dilation of piezo, caterpillar motion, inchworm                    |
| G05B 2219/41353 | . . . | Optical piezo electric element, light converted in movement                             |
| G05B 2219/41354 | . . . | Magnetic, thermal, bimetal peltier effect displacement, positioning                     |
| G05B 2219/41355 | . . . | Electro magnetic coil actuator , voice coil   |
| G05B 2219/41356 | . . . | Variable speed transmission, Van Doorne, Reeves   |
| G05B 2219/41357 | . . . | Belt  |
| G05B 2219/41358 | . . . | Transmission, variable gear ratio   |
| G05B 2219/41359 | . . . | Gearbox   |
| G05B 2219/41361 | . . . | Differential  |
| G05B 2219/41362 | . . . | Registration, display of servo error  |
| G05B 2219/41363 | . . . | Excess in error, error too large, follow up error                                       |
| G05B 2219/41364 | . . . | Excess in error for speed, follow up error for speed                                    |
| G05B 2219/41365 | . . . | Servo error converted to frequency  |
| G05B 2219/41366 | . . . | Linearization of embedded position signals  |
| G05B 2219/41367 | . . . | Estimator, state observer, space state controller                                       |
| G05B 2219/41368 | . . . | Disturbance observer, inject disturbance, adapt controller to resulting effect          |
| G05B 2219/41369 | . . . | Two estimators  |
| G05B 2219/41371 | . . . | Force estimation using velocity observer  |
| G05B 2219/41372 | . . . | Force estimator using disturbance estimator observer                                    |
| G05B 2219/41373 | . . . | Observe position and driving signal, estimate disturbance and speed                     |
| G05B 2219/41374 | . . . | Observe position and driving signal, predict, estimate disturbance signal               |
| G05B 2219/41375 | . . . | Observe speed and select torque as function of position reference, to compensate torque |
| G05B 2219/41376 | . . . | Tool wear, flank and crater, estimation from cutting force                              |
| G05B 2219/41377 | . . . | Estimate cutting torque in real time  |
| G05B 2219/41378 | . . . | Estimate torque as function of speed, voltage and current                               |
| G05B 2219/41379 | . . . | Estimate torque from command torque and measured speed                                  |
| G05B 2219/41381 | . . . | Torque disturbance observer to estimate inertia   |
| G05B 2219/41382 | . . . | Observe position from encoder, estimate speed with ann                                  |
| G05B 2219/41383 | . . . | Observe current, voltage, derive position   |
| G05B 2219/41384 | . . . | Force estimation using position observer  |
| G05B 2219/41385 | . . . | Observe position from encoder, estimate speed, position with kalman filter              |

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| G05B 2219/41386 | . . . | System identifier adapts coefficients tables for state and observer controller           |
| G05B 2219/41387 | . . . | Observe reference torque, position and feedback position, estimate contact force         |
| G05B 2219/41388 | . . . | Observe input torque and feedback position, estimate reaction torque                     |
| G05B 2219/41389 | . . . | Estimate torque from command torque and feedback acceleration                            |
| G05B 2219/41391 | . . . | Flux observer, flux estimated from current and voltage                                   |
| G05B 2219/41392 | . . . | Observer for each axis, link, freedom, gives greater speed                               |
| G05B 2219/41393 | . . . | Synchronize observer with pulse from encoder   |
| G05B 2219/41394 | . . . | Estimate speed and position error from motor current, torque                             |
| G05B 2219/41395 | . . . | Observe actual position to estimate compensation torque                                  |
| G05B 2219/41396 | . . . | Estimate acceleration from three phase current values                                    |
| G05B 2219/41397 | . . . | Estimate voltage control signal as function of voltage control signal and position error |
| G05B 2219/41398 | . . . | Estimate twist between motor and load, observe motor position and speed                  |
| G05B 2219/41399 | . . . | Reduced order estimator  |
| G05B 2219/41401 | . . . | Estimate position from max and min speeds in open loop                                   |
| G05B 2219/41402 | . . . | Observe speed and driving signal, estimate speed   |
| G05B 2219/41403 | . . . | Machine deformation estimator as function of commanded position                          |
| G05B 2219/41404 | . . . | Hysteresis, bang bang feedback of velocity   |
| G05B 2219/41405 | . . . | Inverse kinematic, dynamic   |
| G05B 2219/41406 | . . . | LQR linear quadratic regulator to calculate gain for several known variables             |
| G05B 2219/41407 | . . . | Master changes resistor, slave restores value in order to follow master                  |
| G05B 2219/41408 | . . . | Control of jerk, change of acceleration  |
| G05B 2219/41409 | . . . | Update position feedback during speed control  |
| G05B 2219/41411 | . . . | Avoid integrator wind-up, saturation actuator by dead zone feedback for integral         |
| G05B 2219/41412 | . . . | Bandwidth of velocity loop is just below natural frequency of drive support              |
| G05B 2219/41413 | . . . | Forward kinematics   |
| G05B 2219/41414 | . . . | Time delay control, estimate non linear dynamics, correct with time delayed input        |
| G05B 2219/41415 | . . . | Lookup table for nonlinear function synthesis  |
| G05B 2219/41416 | . . . | Feedback signal is doubled, reference signal is doubled plus one                         |
| G05B 2219/41417 | . . . | Correction signal is different as function of sign of error                              |
| G05B 2219/41418 | . . . | Select feedback signal between detected position of motor and of driven load             |
| G05B 2219/41419 | . . . | Resolution of feedback of incremental position decreases with velocity speed             |
| G05B 2219/41421 | . . . | Eliminate, diminish delay in feedback speed  |
| G05B 2219/41422 | . . . | Correction stored position while motor, power off, drive - encoder not connected         |

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| G05B 2219/41423 | . . . | Noise filter as function of rate of displacement, speed, for stabilisation                             |
| G05B 2219/41424 | . . . | Select a controller as function of large or small error  |
| G05B 2219/41425 | . . . | Feedforward of acceleration  |
| G05B 2219/41426 | . . . | Feedforward of torque  |
| G05B 2219/41427 | . . . | Feedforward of position  |
| G05B 2219/41428 | . . . | Feedforward of position and speed  |
| G05B 2219/41429 | . . . | Mean value of previous feedforward values  |
| G05B 2219/41431 | . . . | Delay position command as function of calculation time for feedforward, or order of system             |
| G05B 2219/41432 | . . . | Feedforward of current   |
| G05B 2219/41433 | . . . | Advance feedforward as function of delay rising torque, for large acceleration changes                 |
| G05B 2219/41434 | . . . | Feedforward FFW  |
| G05B 2219/41435 | . . . | Adapt coefficients, parameters of feedforward  |
| G05B 2219/41436 | . . . | Feedforward of speed and acceleration  |
| G05B 2219/41437 | . . . | Feedforward of speed   |
| G05B 2219/41438 | . . . | Feedforward of speed only during deceleration  |
| G05B 2219/41439 | . . . | Position error ffw for compensation of speed   |
| G05B 2219/41441 | . . . | Position reference ffw for compensation speed reference and speed error                                |
| G05B 2219/41442 | . . . | Position reference ffw for compensation speed reference  |
| G05B 2219/41443 | . . . | Position reference ffw for compensation of position  |
| G05B 2219/41444 | . . . | Speed reference ffw for compensation of speed error  |
| G05B 2219/41445 | . . . | Ffw of position and speed error to compensate torque   |
| G05B 2219/41446 | . . . | Position reference acceleration ffw for torque compensation  |
| G05B 2219/41447 | . . . | Position generates force ffw combined with position error  |
| G05B 2219/41448 | . . . | Ffw friction compensation for speed error, derived from position reference                             |
| G05B 2219/41449 | . . . | Speed reference and derived position ffw to compensate delay of position control                       |
| G05B 2219/41451 | . . . | Ffw tracking controller  |
| G05B 2219/41452 | . . . | Position reference ffw for speed error compensation  |
| G05B 2219/41453 | . . . | Inverse, feedforward controller is inverse of closed loop system                                       |
| G05B 2219/41454 | . . . | Zero phase error tracking controller zpec  |
| G05B 2219/41455 | . . . | Servo loop with absolute digital comparator, see figure SE-one   |
| G05B 2219/41456 | . . . | Servo loop with switch between difference of counter OR absolute digital comparator, see figure SE-two |
| G05B 2219/41457 | . . . | Superposition of movement  |
| G05B 2219/41458 | . . . | Servo loop with phase counter and phase discriminator, see figure SE-four                              |
| G05B 2219/41459 | . . . | Time counter and phase discriminator   |
| G05B 2219/41461 | . . . | Phase counter and phase discriminator, phase locked motion   |
| G05B 2219/41462 | . . . | Servo loop with position and reference counter, see figure SE-seven                                    |

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| G05B 2219/41463 | . . . | Servo loop with angle comparator and angle comparator predictor, see figure SE-eight |
| G05B 2219/41464 | . . . | Servo loop with position decoder, see figure SE-nine                                 |
| G05B 2219/41465 | . . . | Servo loop with phase comparator, see figure SE-ten                                  |
| G05B 2219/41466 | . . . | Servo loop with oscillator, see figure SE-eleven                                     |
| G05B 2219/41467 | . . . | Servo loop with coincidence detector, see figure SE-thirteen                         |
| G05B 2219/41468 | . . . | Servo loop with adder, see figure SE-fourteen  |
| G05B 2219/41469 | . . . | Servo loop with counter, see figure SE-fifteen                                       |
| G05B 2219/41471 | . . . | Servo loop with u-down counter, see figure SE-sixteen                                |
| G05B 2219/41472 | . . . | Servo loop with position error indicates speed step value                            |
| G05B 2219/41473 | . . . | Servo loop with position and speed loop, problems of speed loop                      |
| G05B 2219/41474 | . . . | Servo loop with absolute digital position sensor                                     |
| G05B 2219/41475 | . . . | Servo loop with absolute digital position sensor for continuous path control         |
| G05B 2219/41476 | . . . | Servo loop with analog position sensor   |
| G05B 2219/41477 | . . . | Servo loop with analog position sensor for continuous path control                   |
| G05B 2219/41478 | . . . | Servo loop with combination of analog and digital sensor                             |
| G05B 2219/41479 | . . . | Servo loop with position loop  |
| G05B 2219/41481 | . . . | Divide command, block in subcommands, subblocks                                      |
| G05B 2219/42    | . .   | Servomotor, servo controller kind till VSS   |
| G05B 2219/42001 | . . . | Statistical process control spc  |
| G05B 2219/42002 | . . . | Proportional   |
| G05B 2219/42003 | . . . | Three point, hysteresis comparator, controller                                       |
| G05B 2219/42004 | . . . | PD proportional derivative   |
| G05B 2219/42005 | . . . | Disturbance decoupling, rejection, suppression                                       |
| G05B 2219/42006 | . . . | Digital event dynamic system control   |
| G05B 2219/42007 | . . . | Nonlinear PD   |
| G05B 2219/42008 | . . . | P regulator for position loop  |
| G05B 2219/42009 | . . . | I regulator for speed loop   |
| G05B 2219/42011 | . . . | PI regulator for speed loop  |
| G05B 2219/42012 | . . . | H-infinite controller  |
| G05B 2219/42013 | . . . | Two pd controllers, one for coarse, one for fine motion                              |
| G05B 2219/42014 | . . . | Pseudo derivative control with feedforward of gain                                   |
| G05B 2219/42015 | . . . | P integrator, look at past periodic errors, fading memory, repetitive controller     |
| G05B 2219/42016 | . . . | Dynamic impedance control, load does not influence speed, force, position            |
| G05B 2219/42017 | . . . | Mimo controller with many inputs and outputs   |
| G05B 2219/42018 | . . . | Pid learning controller, gains adapted as function of previous error                 |
| G05B 2219/42019 | . . . | Pi for position controller   |
| G05B 2219/42021 | . . . | Pi for current loop  |

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| G05B 2219/42022 | . . . | Three point, hysteresis controller with variable hysteresis as function of error |
| G05B 2219/42023 | . . . | Non linear pi  |
| G05B 2219/42024 | . . . | Stage controller, zpec and fuzzy smc and compensation controller                 |
| G05B 2219/42025 | . . . | Pidaf, pid with acceleration and friction compensation                           |
| G05B 2219/42026 | . . . | Pi position controller and fuzzy logic speed controller                          |
| G05B 2219/42027 | . . . | Flsps frequency locked steeping position control servo                           |
| G05B 2219/42028 | . . . | Five point, hysteresis controller  |
| G05B 2219/42029 | . . . | Crone controller, fractional or fractal or non integer order robust controller   |
| G05B 2219/42031 | . . . | All denominator model, the model form is expanded in denominator taylor series   |
| G05B 2219/42032 | . . . | Differential feedback pd   |
| G05B 2219/42033 | . . . | Kind of servo controller   |
| G05B 2219/42034 | . . . | Pi regulator   |
| G05B 2219/42035 | . . . | I regulator  |
| G05B 2219/42036 | . . . | Adaptive control, adaptive nonlinear control                                     |
| G05B 2219/42037 | . . . | Adaptive pi  |
| G05B 2219/42038 | . . . | Real time adaptive control   |
| G05B 2219/42039 | . . . | Select servo parameter set from table for fixed linear working points            |
| G05B 2219/42041 | . . . | Adaptive pd  |
| G05B 2219/42042 | . . . | Adaptive robust controller   |
| G05B 2219/42043 | . . . | Adapt regulator as function of its output  |
| G05B 2219/42044 | . . . | Adapt model as function of difference between real and calculated position       |
| G05B 2219/42045 | . . . | Ann, error to pd, output pd to plant and also sets weights in ann                |
| G05B 2219/42046 | . . . | Fuzzy pd controller, with position and velocity inputs                           |
| G05B 2219/42047 | . . . | Pid like fuzzy controller with position and velocity inputs                      |
| G05B 2219/42048 | . . . | Fuzzy pi control   |
| G05B 2219/42049 | . . . | Fuzzy p  |
| G05B 2219/42051 | . . . | Fuzzy position controller  |
| G05B 2219/42052 | . . . | Fuzzy pi and d control   |
| G05B 2219/42053 | . . . | Dynamic fuzzy position controller  |
| G05B 2219/42054 | . . . | Loop, p control for position loop  |
| G05B 2219/42055 | . . . | Pi control for speed   |
| G05B 2219/42056 | . . . | Pi current controller  |
| G05B 2219/42057 | . . . | Predictive fuzzy controller  |
| G05B 2219/42058 | . . . | General predictive controller GPC  |
| G05B 2219/42059 | . . . | Delta gpc, using derivative in time, predict over finite horizon                 |
| G05B 2219/42061 | . . . | Stochastic predictive controller spc   |
| G05B 2219/42062 | . . . | Position and speed and current   |
| G05B 2219/42063 | . . . | Position and speed and current and force, moment, torque                         |



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| G05B 2219/42064 | . . . | Position, speed and acceleration  |
| G05B 2219/42065 | . . . | Feedforward combined with pid feedback  |
| G05B 2219/42066 | . . . | Position and speed and acceleration and current feedback                            |
| G05B 2219/42067 | . . . | Position and current  |
| G05B 2219/42068 | . . . | Quasi smc, smc combined with other regulators                                       |
| G05B 2219/42069 | . . . | Observer combined with pd and zero phase error tracking ffw controller              |
| G05B 2219/42071 | . . . | Two clocks for each of the two loops  |
| G05B 2219/42072 | . . . | Position feedback and speed feedforward, speed from data of tape                    |
| G05B 2219/42073 | . . . | Position and speed feedback, speed derived from position reference                  |
| G05B 2219/42074 | . . . | Position feedback and speed feedback, speed measured with tachometer                |
| G05B 2219/42075 | . . . | Two position loops  |
| G05B 2219/42076 | . . . | Hybrid, digital control sets reference, coefficients for quick analog, pid, control |
| G05B 2219/42077 | . . . | Position, speed or current, combined with vibration feedback                        |
| G05B 2219/42078 | . . . | Observer combined with pd   |
| G05B 2219/42079 | . . . | P position loop, fuzzy speed loop   |
| G05B 2219/42081 | . . . | Fuzzy position controller and smc for motor voltage control                         |
| G05B 2219/42082 | . . . | Force control in one axis, velocity control in other axis                           |
| G05B 2219/42083 | . . . | Position, speed and force feedback  |
| G05B 2219/42084 | . . . | Hybrid, analog loop, reference compensated by digital loop                          |
| G05B 2219/42085 | . . . | Error between reference model and controller compensated with fuzzy controller      |
| G05B 2219/42086 | . . . | Position, speed and deflection feedback   |
| G05B 2219/42087 | . . . | Speed and force loop  |
| G05B 2219/42088 | . . . | I parallel to non linear controller   |
| G05B 2219/42089 | . . . | Quick but coarse loop and slow but fine loop, dexterity                             |
| G05B 2219/42091 | . . . | Loop combinations, add a second loop, cascade control                               |
| G05B 2219/42092 | . . . | Position and force control loop together  |
| G05B 2219/42093 | . . . | Position and current, torque control loop   |
| G05B 2219/42094 | . . . | Speed then pressure or force loop   |
| G05B 2219/42095 | . . . | First closed loop, then open loop   |
| G05B 2219/42096 | . . . | Add, subtract i part of speed feedback as function of sign speed error              |
| G05B 2219/42097 | . . . | Dual mode servo, slow and precise, quick and coarse movement                        |
| G05B 2219/42098 | . . . | First open, then closed loop to correct setpoint of open loop                       |
| G05B 2219/42099 | . . . | Slow coarse loop followed by fine quick loop  |
| G05B 2219/42101 | . . . | Coarse position with microprocessor, fine with hardware centering, tracking         |
| G05B 2219/42102 | . . . | Coarse 8-bit positioning in closed loop, fine 10-bit in open loop                   |
| G05B 2219/42103 | . . . | Switch from pi, if large error to disturbance mode control if small error           |
| G05B 2219/42104 | . . . | Loop switch, speed loop then position loop, mode switch                             |

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| G05B 2219/42105 | . . . | Switch from pid to bang-bang to energy dissipation as function of speed, error               |
| G05B 2219/42106 | . . . | Speed regulation starts only in braking range, less processor time needed                    |
| G05B 2219/42107 | . . . | Always position loop, first open loop for speed, then also closed loop speed                 |
| G05B 2219/42108 | . . . | Open loop for positioning, closed loop for calibration                                       |
| G05B 2219/42109 | . . . | Coarse is speed loop, fine is position loop  |
| G05B 2219/42111 | . . . | Change from pd, if small error, to bangbang if large error                                   |
| G05B 2219/42112 | . . . | Switch between motion and stall mode, if speed is below certain value                        |
| G05B 2219/42113 | . . . | Position closed loop or open loop pressure control   |
| G05B 2219/42114 | . . . | Loop mode, dual mode incremental coarse, analog fine   |
| G05B 2219/42115 | . . . | Switch from continuous drive to pwm, near stop or out of acceleration period                 |
| G05B 2219/42116 | . . . | Switch from pid to pd or pd to pid   |
| G05B 2219/42117 | . . . | Speed mode then stepping mode  |
| G05B 2219/42118 | . . . | Breaking of control loop, closing open control loop  |
| G05B 2219/42119 | . . . | Switch between motion and stall mode if actuator voltage current below limit                 |
| G05B 2219/42121 | . . . | Switch from bang-bang control to dead beat, finite time settling control                     |
| G05B 2219/42122 | . . . | First open loop, then closed loop  |
| G05B 2219/42123 | . . . | Position loop then force, current loop   |
| G05B 2219/42124 | . . . | Change over between two controllers, transfer error signal                                   |
| G05B 2219/42125 | . . . | Switch from pi to p or to pd-controller  |
| G05B 2219/42126 | . . . | Bumpless, smooth transfer between two control modes  |
| G05B 2219/42127 | . . . | Timing, switch over on detection of marker on spindle  |
| G05B 2219/42128 | . . . | Servo characteristics, drive parameters, during test move                                    |
| G05B 2219/42129 | . . . | Teach, learn position table, model, for each reference a motor control output                |
| G05B 2219/42131 | . . . | Speed model created by entering estimated speed at references                                |
| G05B 2219/42132 | . . . | Correct, modify position table, model if detected error too large                            |
| G05B 2219/42133 | . . . | Position references as function of time, correlated speed, acceleration in memory, signature |
| G05B 2219/42134 | . . . | Fuzzy logic tuning of controller as function of error  |
| G05B 2219/42135 | . . . | Fuzzy model reference learning controller, synthesis, tune rule base automatically           |
| G05B 2219/42136 | . . . | Fuzzy feedback adapts parameters model   |
| G05B 2219/42137 | . . . | Automatic tune fuzzy controller  |
| G05B 2219/42138 | . . . | Network tunes controller   |
| G05B 2219/42139 | . . . | Tune fuzzy controller by three attributes: rise time, overshoot, settling time               |
| G05B 2219/42141 | . . . | Filter error learning  |

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| G05B 2219/42142 | . . . | Fuzzy control learning of starting friction coefficient                               |
| G05B 2219/42143 | . . . | offline optimization of fuzzy controller  |
| G05B 2219/42144 | . . . | Online tuning of fuzzy controller by ann  |
| G05B 2219/42145 | . . . | Coarse tune with genetic algorithm, fine with gradient descent, hill climbing         |
| G05B 2219/42146 | . . . | In each position, upper, lower drive current needed to move more, less, store mean    |
| G05B 2219/42147 | . . . | Tune with genetic algorithm   |
| G05B 2219/42148 | . . . | Position references as function of time, correlated noise, temperature in memory      |
| G05B 2219/42149 | . . . | During learning relation between control and controlled signal, open loop             |
| G05B 2219/42151 | . . . | Learn dynamics of servomotor system by ann  |
| G05B 2219/42152 | . . . | Learn, self, auto tuning, calibrating, environment adaptation, repetition             |
| G05B 2219/42153 | . . . | Inverse dynamics model idm, computed torque method                                    |
| G05B 2219/42154 | . . . | Model itself controlled by position and speed loop                                    |
| G05B 2219/42155 | . . . | Model   |
| G05B 2219/42156 | . . . | Forward dynamics model fdm  |
| G05B 2219/42157 | . . . | Reference model uses only output and input measurements                               |
| G05B 2219/42158 | . . . | Fuzzy model of cutting process of milling machine                                     |
| G05B 2219/42159 | . . . | ARMA, AR autoregressive for poles, MA moving average model for zeros , in combination |
| G05B 2219/42161 | . . . | One model for load, one model for motor inertia                                       |
| G05B 2219/42162 | . . . | Model reference adaptive control MRAC, correction fictive-real error, position        |
| G05B 2219/42163 | . . . | Simulator   |
| G05B 2219/42164 | . . . | Compensation of integration time of model   |
| G05B 2219/42165 | . . . | Compensation of gain of speed control circuit for model                               |
| G05B 2219/42166 | . . . | Criterion is minimum jerk   |
| G05B 2219/42167 | . . . | Minimum torque change   |
| G05B 2219/42168 | . . . | Measuring of needed force for servo   |
| G05B 2219/42169 | . . . | Decoder   |
| G05B 2219/42171 | . . . | Velocity profile, variable gain, multiplication factors, rom ram                      |
| G05B 2219/42172 | . . . | Special code  |
| G05B 2219/42173 | . . . | Acceleration deceleration   |
| G05B 2219/42174 | . . . | Memory with position profile and force limits   |
| G05B 2219/42175 | . . . | Velocity, speed points, profile and corresponding acceleration, delta v               |
| G05B 2219/42176 | . . . | Motion profile  |
| G05B 2219/42177 | . . . | Configuration memory for step motor   |
| G05B 2219/42178 | . . . | Reduce cable connection by pre-memorized positions                                    |
| G05B 2219/42179 | . . . | Normalize velocity profile, calculate real velocity from additional parameters        |
| G05B 2219/42181 | . . . | Rom contains sin and cos table to drive step motor                                    |

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| G05B 2219/42182 | . . . | Memory is Rom for servo control   |
| G05B 2219/42183 | . . . | Memory is Ram   |
| G05B 2219/42184 | . . . | Master slave with feedforward for compensation of contour error                             |
| G05B 2219/42185 | . . . | Master slave with contour controller  |
| G05B 2219/42186 | . . . | Master slave, motion proportional to axis   |
| G05B 2219/42187 | . . . | Position mirror, axis, display, back of seat as function of position of seat, other axis    |
| G05B 2219/42188 | . . . | Slave controlled as function of reference and actual position and derived speed of master   |
| G05B 2219/42189 | . . . | Motion look up table as function of cam angle   |
| G05B 2219/42191 | . . . | Adjust proportionality factor to optimize slave axis movement                               |
| G05B 2219/42192 | . . . | Each axis drive has own queue of commands, executed in synchronism                          |
| G05B 2219/42193 | . . . | Select between limit switches as function of current position and destination               |
| G05B 2219/42194 | . . . | Derive position from command speed, integrate speed   |
| G05B 2219/42195 | . . . | Position a stop, move workpiece against stop to cut stock, bar                              |
| G05B 2219/42196 | . . . | Follow dynamically contour warped surface with tool   |
| G05B 2219/42197 | . . . | Brake as function of machining load, to keep total load on tool constant, avoid oscillation |
| G05B 2219/42198 | . . . | Step motor driven by step size and step duration data                                       |
| G05B 2219/42199 | . . . | Fine position with gauge, coarse with limit switch, transducer                              |
| G05B 2219/42201 | . . . | Deriving speed from commanded position  |
| G05B 2219/42202 | . . . | Square of distance  |
| G05B 2219/42203 | . . . | Using a counter and a limit switch  |
| G05B 2219/42204 | . . . | Absolute positions  |
| G05B 2219/42205 | . . . | With potentiometer  |
| G05B 2219/42206 | . . . | Block, stop pulses in one axis, not in other axis   |
| G05B 2219/42207 | . . . | Generate points between start and end position, linear interpolation                        |
| G05B 2219/42208 | . . . | Set position of proximity switch  |
| G05B 2219/42209 | . . . | Two slides, fine and quick, coarse and slow, piggyback, multirate positioner                |
| G05B 2219/42211 | . . . | Command position by time value, proportional to total displacement                          |
| G05B 2219/42212 | . . . | Rotation over, selection of smallest, shortest angle, distance                              |
| G05B 2219/42213 | . . . | Position overshoot, axis still moves after stop   |
| G05B 2219/42214 | . . . | Near desired position, control actuator by pulse in each clock, otherwise continuously      |
| G05B 2219/42215 | . . . | Stop machine in a predetermined position  |
| G05B 2219/42216 | . . . | Changing position range, stroke, between closed and fully open                              |
| G05B 2219/42217 | . . . | Time optimal position control   |
| G05B 2219/42218 | . . . | Coarse and fine position control combined, each by ann                                      |
| G05B 2219/42219 | . . . | Slow positioning with low pass, concurrent quick with high pass part of command             |

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| G05B 2219/42221 | . . . | Control position by equilibrium between spring and actuator force                        |
| G05B 2219/42222 | . . . | Compare reflected image from object with reference image, adjust object                  |
| G05B 2219/42223 | . . . | Number and frequency of pwm signals define mean position in time                         |
| G05B 2219/42224 | . . . | Process received reference to adapt it to range of servo                                 |
| G05B 2219/42225 | . . . | Coarse and fine position control combined, added, superposed                             |
| G05B 2219/42226 | . . . | If deviation, return to desired position after a delay if within position range          |
| G05B 2219/42227 | . . . | Using incremental control actuator   |
| G05B 2219/42228 | . . . | Stop motor where torque will be maximum  |
| G05B 2219/42229 | . . . | Shut off control, system, power on detection of zero or neutral position                 |
| G05B 2219/42231 | . . . | Detent, stop lock, current through motor in stop, locked, hold, blocked position         |
| G05B 2219/42232 | . . . | Select, switch between long, extended and short range to position                        |
| G05B 2219/42233 | . . . | Pwm signal to low pass filter, compared to feedback position, if equal stop motor        |
| G05B 2219/42234 | . . . | Regression ann to map position error to pulse width                                      |
| G05B 2219/42235 | . . . | Adaptive pulsing, augment time duration until movement detected                          |
| G05B 2219/42236 | . . . | Use of a certain number of ac periods  |
| G05B 2219/42237 | . . . | Pwm pulse width modulation, pulse to position modulation ppm                             |
| G05B 2219/42238 | . . . | Control motor position with direction signal and pwm signal for position                 |
| G05B 2219/42239 | . . . | Adaptive pulsing, take into account next cycle, command                                  |
| G05B 2219/42241 | . . . | Select minimum value of two reference values   |
| G05B 2219/42242 | . . . | Reference generator for position   |
| G05B 2219/42243 | . . . | Enter velocity in reference generator, delivers position signals                         |
| G05B 2219/42244 | . . . | Enter acceleration, jerk, generator outputs acceleration, speed, position by integration |
| G05B 2219/42245 | . . . | Reference generates upper and lower range value at both sides of reference               |
| G05B 2219/42246 | . . . | Add compensation to reference value  |
| G05B 2219/42247 | . . . | Remote reference transmitted to servo  |
| G05B 2219/42248 | . . . | Command reference limited, clipped, only between upper and lower values                  |
| G05B 2219/42249 | . . . | Relative positioning   |
| G05B 2219/42251 | . . . | Control position of beam in coordination with xy slide                                   |
| G05B 2219/42252 | . . . | Position beam to keep centerline   |
| G05B 2219/42253 | . . . | Double resolution for one pulse of computer  |
| G05B 2219/42254 | . . . | Resolution one axis different from resolution other axis                                 |
| G05B 2219/42255 | . . . | Acceleration, deceleration time is a multiple of sampling time                           |
| G05B 2219/42256 | . . . | Sampling the signal  |
| G05B 2219/42257 | . . . | Sampling time in fixed relation to timer interrupt                                       |
| G05B 2219/42258 | . . . | Two sampling frequencies, for online measurements, for offline calculations              |
| G05B 2219/42259 | . . . | Variable sampling rate as function of thermal displacement                               |

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| G05B 2219/42261 | . . . | Two sampling frequencies, one for motion, one for stillstand                        |
| G05B 2219/42262 | . . . | Variable sampling rate as function of position error                                |
| G05B 2219/42263 | . . . | Different sample rates, multiple sample rates for the different loops               |
| G05B 2219/42264 | . . . | Slow down sampling if power down is detected  |
| G05B 2219/42265 | . . . | Sampling rate for sending reference values equals interpolation rate                |
| G05B 2219/42266 | . . . | Variable sampling rate, slow at low velocity  |
| G05B 2219/42267 | . . . | Stability analysis  |
| G05B 2219/42268 | . . . | Safety, excess in error   |
| G05B 2219/42269 | . . . | Inject, superpose test signal on reference, monitor functionality servo             |
| G05B 2219/42271 | . . . | Monitor parameters, conditions servo for maintenance, lubrication, repair purposes  |
| G05B 2219/42272 | . . . | Total movement is divided in several zones with different protection parameters     |
| G05B 2219/42273 | . . . | On restart, power up, overload replace reference with feedback signal, free rotate  |
| G05B 2219/42274 | . . . | On power failure keep last servoposition by cutting off air supply                  |
| G05B 2219/42275 | . . . | Alarm if working cycle fraction with values exceeding nominal exceeds threshold     |
| G05B 2219/42276 | . . . | Action, on power failure, close pilot valve entirely by return spring               |
| G05B 2219/42277 | . . . | If no position command in a period, servo to rest position, shut off power          |
| G05B 2219/42278 | . . . | If direction bad, change direction sign or phase sequence automatically             |
| G05B 2219/42279 | . . . | Allow temporary motor overload if temperature still under maximum, heat inertia     |
| G05B 2219/42281 | . . . | If estimated temperature rise of motor is too high, inhibit motor                   |
| G05B 2219/42282 | . . . | If displacement rate of actuator exceeds limit, lower it                            |
| G05B 2219/42283 | . . . | Motor only actuated if hardware and software permission and control signal together |
| G05B 2219/42284 | . . . | Stop and brake motor  |
| G05B 2219/42285 | . . . | Stop axis contour controlled  |
| G05B 2219/42286 | . . . | Speed, ramp controlled slow down of motor   |
| G05B 2219/42287 | . . . | On feedback failure, use profile stored in memory during learning                   |
| G05B 2219/42288 | . . . | Limit, stop drive current if axis obstructed, blocked, force against stop           |
| G05B 2219/42289 | . . . | Avoid overload servo motor, actuator limit servo torque                             |
| G05B 2219/42291 | . . . | Regenerate faulty feedback by last measurement after detection excess error         |
| G05B 2219/42292 | . . . | If speed detection fails, regenerate speed from position signal                     |
| G05B 2219/42293 | . . . | Regenerate faulty feedback by using previous value, substitute                      |
| G05B 2219/42294 | . . . | Software monitoring of time delay of feedback pulses, feedback failure              |
| G05B 2219/42295 | . . . | Detect augmenting torque of drive motor   |
| G05B 2219/42296 | . . . | Detect diminishing torque of drive motor, below low limit                           |
| G05B 2219/42297 | . . . | Detect phase lag of driving motor   |



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| G05B 2219/42298 | . . . | Measure backlash, time difference between point A to point B and from B to A, if too large |
| G05B 2219/42299 | . . . | Measure current during first acceleration command  |
| G05B 2219/42301 | . . . | Detect correct connection of servomotor to powersupply                                     |
| G05B 2219/42302 | . . . | Detect insufficient acceleration, diminishing speed  |
| G05B 2219/42303 | . . . | Detect no speeding up of motor   |
| G05B 2219/42304 | . . . | Load, torque threshold as function of speed  |
| G05B 2219/42305 | . . . | Detect loss of pulse step motor  |
| G05B 2219/42306 | . . . | Excess in error, compare reference with feedback   |
| G05B 2219/42307 | . . . | Compare actual feedback with predicted, simulated value to detect run away                 |
| G05B 2219/42308 | . . . | Watchdog or integrator to detect no change or excess in feedback                           |
| G05B 2219/42309 | . . . | Excess in speed  |
| G05B 2219/42311 | . . . | Store working torque profiles as function of time, position, compare with real torque      |
| G05B 2219/42312 | . . . | Compare feedback with upper and lower limit, store result as 0-1 if in tolerance           |
| G05B 2219/42313 | . . . | Excess in error for speed and different sign of position and speed feedback                |
| G05B 2219/42314 | . . . | Warning signals are send when excess in error for speed, acceleration, amplitude           |
| G05B 2219/42315 | . . . | Two, double counter to check measurement   |
| G05B 2219/42316 | . . . | Additional hardware to detect which part of feedback is defect, failed                     |
| G05B 2219/42317 | . . . | Redundant, two actuators   |
| G05B 2219/42318 | . . . | Using two, more, redundant measurements or scales to detect bad function                   |
| G05B 2219/42319 | . . . | What kind of actuator failure  |
| G05B 2219/42321 | . . . | Wrong direction or sign of measured value, eventually stop                                 |
| G05B 2219/42322 | . . . | Emit dummy pulses, detect loss of pulses, feedback failure, wire brake, short              |
| G05B 2219/42323 | . . . | Detect wire break, short circuit of feedback   |
| G05B 2219/42324 | . . . | Axis breaking, between motor and slide, table  |
| G05B 2219/42325 | . . . | Stalling of drive motor, overload  |
| G05B 2219/42326 | . . . | Protection servo for saturation of amplifier   |
| G05B 2219/42327 | . . . | Detect ballscrew wear  |
| G05B 2219/42328 | . . . | Detect bearing, clamp wear   |
| G05B 2219/42329 | . . . | Defective measurement, sensor failure  |
| G05B 2219/42331 | . . . | Bad parameter configuration for spindle, gear ratio, encoder resolution                    |
| G05B 2219/42332 | . . . | Detect failure of servo controller   |
| G05B 2219/42333 | . . . | Synchronization by opposite correction for both axis                                       |
| G05B 2219/42334 | . . . | Synchronous tracking servo for biaxial positioning tables, contouring                      |



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| G05B 2219/42335 | . . . | If one slave axis out of synchronisation, synchronise all other axes to that one   |
| G05B 2219/42336 | . . . | To synchronize axis, adapt gain of each axis as function of max, min, average gain |
| G05B 2219/42337 | . . . | Tracking control   |
| G05B 2219/42338 | . . . | Position tracking control  |
| G05B 2219/42339 | . . . | Speed tracking control   |
| G05B 2219/42341 | . . . | Force tracking control   |
| G05B 2219/42342 | . . . | Path, trajectory tracking control  |
| G05B 2219/42343 | . . . | Optimum, adaptive sliding mode controller  |
| G05B 2219/42344 | . . . | Chattering alleviation control, chattering about switching surface                 |
| G05B 2219/42345 | . . . | VSTC variable structure tracking control   |
| G05B 2219/42346 | . . . | Fuzzy sliding mode control fsmc  |
| G05B 2219/42347 | . . . | Switch to a saturation control signal if deviation from switch line is too large   |
| G05B 2219/42348 | . . . | Slimsoc sliding mode self organizing controller                                    |
| G05B 2219/42349 | . . . | Sliding mode control with perturbation estimation smcpe                            |
| G05B 2219/42351 | . . . | PIVSC proportional integral compensated vsc  |
| G05B 2219/42352 | . . . | Sliding mode controller SMC, select other gain                                     |
| G05B 2219/42353 | . . . | Variable structure system, control VSS VSC   |
| G05B 2219/43    | . .   | Speed, acceleration, deceleration control ADC                                      |
| G05B 2219/43001 | . . . | Speed, feed, infeed, acceleration, stopping problems                               |
| G05B 2219/43002 | . . . | Acceleration, deceleration for forward, backward reciprocating movement            |
| G05B 2219/43003 | . . . | Acceleration deceleration in presence of backlash, dynamic backlash                |
| G05B 2219/43004 | . . . | Decelerate to follow desired velocity  |
| G05B 2219/43005 | . . . | Corner distance variables to keep path when programmed speed changes               |
| G05B 2219/43006 | . . . | Acceleration, deceleration control   |
| G05B 2219/43007 | . . . | Acceleration from rest   |
| G05B 2219/43008 | . . . | Deceleration and stopping  |
| G05B 2219/43009 | . . . | Acceleration deceleration for each block of data, segment                          |
| G05B 2219/43011 | . . . | Shorter time by adjusting corner speed, avoid zero speed when engage corner        |
| G05B 2219/43012 | . . . | Profile is defined by series of bits, for each actuator, sensor                    |
| G05B 2219/43013 | . . . | Ramp signal from division of sum of registers                                      |
| G05B 2219/43014 | . . . | Calculate inertia ratio from full acceleration and full deceleration trial         |
| G05B 2219/43015 | . . . | Calculate square root x  |
| G05B 2219/43016 | . . . | Acceleration, deceleration as function of feed rate override                       |
| G05B 2219/43017 | . . . | Acceleration is larger than deceleration to compensate for friction                |
| G05B 2219/43018 | . . . | Compensation, correction of acceleration, deceleration time                        |
| G05B 2219/43019 | . . . | Compensate acceleration for sudden change in load, shockless                       |

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| G05B 2219/43021 | . . . | At several positions detect acceleration error, compensate for it                            |
| G05B 2219/43022 | . . . | Compensate for friction as function of position  |
| G05B 2219/43023 | . . . | Switch from acceleration to deceleration if mid stroke speed not reached                     |
| G05B 2219/43024 | . . . | Parabolic velocity profile, linear acceleration, keep energy dissipation minimal             |
| G05B 2219/43025 | . . . | Acceleration, deceleration is polynomial, derivative is zero on stop position                |
| G05B 2219/43026 | . . . | Predict deceleration start from measured characteristics and actual performance              |
| G05B 2219/43027 | . . . | Parabolic acceleration, deceleration trajectory at start, stop                               |
| G05B 2219/43028 | . . . | Switching points for trapezoidal form are stored in memory                                   |
| G05B 2219/43029 | . . . | Acceleration larger than deceleration for safe stopping at slow speed                        |
| G05B 2219/43031 | . . . | Feed speed reduction dependent on tool surface   |
| G05B 2219/43032 | . . . | Non symmetric acceleration profile   |
| G05B 2219/43033 | . . . | Sinusoidal acceleration profile  |
| G05B 2219/43034 | . . . | Form of profile, ramp, trapezoid, S-curve, exponential                                       |
| G05B 2219/43035 | . . . | Vertical start and stop phase  |
| G05B 2219/43036 | . . . | Velocity profile with given starting and stopping speed vector                               |
| G05B 2219/43037 | . . . | Position, speed as function of position is trapezoid   |
| G05B 2219/43038 | . . . | Parabolic acceleration, constant speed, parabolic deceleration as function of position       |
| G05B 2219/43039 | . . . | Time, exponential acceleration, constant speed, exponential deceleration as function of time |
| G05B 2219/43041 | . . . | Prediction, look ahead deceleration control, calculate start deceleration                    |
| G05B 2219/43042 | . . . | Convolution of speed curve with torque curve   |
| G05B 2219/43043 | . . . | Normal and maximum deceleration mode, switch as function of position deviation, error        |
| G05B 2219/43044 | . . . | Drive and brake alternative to decelerate and stop   |
| G05B 2219/43045 | . . . | Max torque, acceleration, then variable, then reverse, variable then max deceleration        |
| G05B 2219/43046 | . . . | Determine time constant from command speed and needed max acceleration torque                |
| G05B 2219/43047 | . . . | If speed below reference, small acceleration, if above, large deceleration                   |
| G05B 2219/43048 | . . . | Step change in reference, soft start , smoothing reference                                   |
| G05B 2219/43049 | . . . | Digital convolution for velocity profile, also successive convolution                        |
| G05B 2219/43051 | . . . | Translate generic motion description into acceleration profiles                              |
| G05B 2219/43052 | . . . | Set for each block time constant and speed target  |
| G05B 2219/43053 | . . . | Slow acceleration, rapid deceleration  |
| G05B 2219/43054 | . . . | Take up gear backlash during deceleration  |
| G05B 2219/43055 | . . . | Same acceleration deceleration pattern for position and velocity loop                        |
| G05B 2219/43056 | . . . | Asynchronous acceleration between slow, fast axes, rotational, linear axes                   |

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| G05B 2219/43057 | . . . | Adjust acceleration, speed until maximum allowable moment for axis                |
| G05B 2219/43058 | . . . | Limitation of acceleration, permissible, tolerable acceleration                   |
| G05B 2219/43059 | . . . | Accelerate, decelerate all axis as function of max, min, average speed axis       |
| G05B 2219/43061 | . . . | Maximum acceleration deceleration lookup table as function of distance            |
| G05B 2219/43062 | . . . | Maximum acceleration, limit   |
| G05B 2219/43063 | . . . | Acceleration deceleration as function of maximum allowable speed                  |
| G05B 2219/43064 | . . . | Brake, decelerate at least one axis at maximum                                    |
| G05B 2219/43065 | . . . | Limitation of jerk  |
| G05B 2219/43066 | . . . | Max centrifugal acceleration, especially for cmm                                  |
| G05B 2219/43067 | . . . | Reach maximum speed at zero acceleration  |
| G05B 2219/43068 | . . . | Adapt acceleration as function of load, developed heat in motor                   |
| G05B 2219/43069 | . . . | Measure acceleration, derive limit torque, adapt acceleration                     |
| G05B 2219/43071 | . . . | Open closing acceleration deceleration control                                    |
| G05B 2219/43072 | . . . | Position controlled opening profile   |
| G05B 2219/43073 | . . . | Time controlled opening profile   |
| G05B 2219/43074 | . . . | Control speed, acceleration so as to follow desired speed profile                 |
| G05B 2219/43075 | . . . | Two modes, one normal and one for obstruction by objects                          |
| G05B 2219/43076 | . . . | Switch from acceleration to constant speed as function of detected speed limit    |
| G05B 2219/43077 | . . . | Limit switch starts braking, stop, no braking, low torque movement until end      |
| G05B 2219/43078 | . . . | Near end position limit switch, brake by reversing, then slow until end limit     |
| G05B 2219/43079 | . . . | Acceleration, deceleration controlled by switches along path                      |
| G05B 2219/43081 | . . . | Set parameters of profile generator, creep distance and speed, flight time        |
| G05B 2219/43082 | . . . | Near end position limit switch, lower speed and brake                             |
| G05B 2219/43083 | . . . | Structure, step motor   |
| G05B 2219/43084 | . . . | Acceleration deceleration circuit implemented in software, algorithm              |
| G05B 2219/43085 | . . . | Acceleration-deceleration circuit before interpolator                             |
| G05B 2219/43086 | . . . | Acceleration-deceleration circuit after interpolator                              |
| G05B 2219/43087 | . . . | Stop valves to stop fluid flow of hydraulic drive cylinder                        |
| G05B 2219/43088 | . . . | Select out of plurality of acceleration profiles                                  |
| G05B 2219/43089 | . . . | Rom, ram with speed and acceleration  |
| G05B 2219/43091 | . . . | Ram with optimum motion curve   |
| G05B 2219/43092 | . . . | Torque curve, wave stored in rom, ram   |
| G05B 2219/43093 | . . . | Speed pattern, table together with timing data in ram                             |
| G05B 2219/43094 | . . . | Acceleration and deceleration together with their respective time                 |
| G05B 2219/43095 | . . . | Maximum speed and acceleration deceleration time constant as function of position |
| G05B 2219/43096 | . . . | Position, trajectory and speed stored in ram                                      |

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| G05B 2219/43097 | . . . | Table, rom, ram speed table   |
| G05B 2219/43098 | . . . | Change ADC time constant during start and end of interpolation                                |
| G05B 2219/43099 | . . . | Select acceleration deceleration time constants as function of weight, load , position        |
| G05B 2219/43101 | . . . | Change time constants acceleration, deceleration as function of feed rate override            |
| G05B 2219/43102 | . . . | Time constant acceleration, deceleration as function of machining conditions                  |
| G05B 2219/43103 | . . . | Switch adc time constants as function of type of axis, spindle feed or position axis          |
| G05B 2219/43104 | . . . | Minimize time constant based on operation program   |
| G05B 2219/43105 | . . . | ADC time constants as function of type of axis rotational or linear                           |
| G05B 2219/43106 | . . . | Time constant acceleration, deceleration as function of temperature of motor                  |
| G05B 2219/43107 | . . . | Correction acceleration and deceleration as function of speed, time constants in rom          |
| G05B 2219/43108 | . . . | Delay stop command as function of error between reference and multiple of increments          |
| G05B 2219/43109 | . . . | Adaptive stopping with correction for both directions   |
| G05B 2219/43111 | . . . | Measure time needed from first to second speed, to adapt position command                     |
| G05B 2219/43112 | . . . | Using feedforward prediction of position  |
| G05B 2219/43113 | . . . | Give stop order a certain number of motor rotations before end stop                           |
| G05B 2219/43114 | . . . | Detect position, speed or time of object between begin and end, adapt motion                  |
| G05B 2219/43115 | . . . | Adaptive stopping   |
| G05B 2219/43116 | . . . | Calculate overshoot from supply voltage change, adapt motion                                  |
| G05B 2219/43117 | . . . | Torque compensation as function of position reference, feedback of speed and position         |
| G05B 2219/43118 | . . . | Adjust position reference as function of position reference, feedback of speed and position   |
| G05B 2219/43119 | . . . | Adapt robot motion to machine speed as function of error from programmed speed                |
| G05B 2219/43121 | . . . | Axis speed as function of probing signal during probing of workpiece                          |
| G05B 2219/43122 | . . . | Adapt speed, feed as function of duration of transmission of instruction                      |
| G05B 2219/43123 | . . . | Speed of cutter as function of position of feeler, probe                                      |
| G05B 2219/43124 | . . . | Adapt speed as function of material, thickness, depth, volume, width, uniform surface quality |
| G05B 2219/43125 | . . . | Speed as function of size of chuck, diameter tool   |
| G05B 2219/43126 | . . . | Pivoting speed of workpiece as function of inverse of work, machining time needed             |
| G05B 2219/43127 | . . . | As a function of, select reference velocity as function of gear ratio                         |
| G05B 2219/43128 | . . . | Feed as function of number of press operations  |

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| G05B 2219/43129 | . . . | Speed as function of curvature, in curves, corners smaller than in straight line              |
| G05B 2219/43131 | . . . | Adapt speed as function of lag, follow up error   |
| G05B 2219/43132 | . . . | Rotation speed as function of minimum wave energy, toolwear, first learn for different speeds |
| G05B 2219/43133 | . . . | Delay movement start as function of lag, follow up error                                      |
| G05B 2219/43134 | . . . | Feed or speed as function of magnetic characteristic, code, form of tool                      |
| G05B 2219/43135 | . . . | Reduce path speed near centre of axis   |
| G05B 2219/43136 | . . . | Lower speed of indexing motor if door to turret lathe is open                                 |
| G05B 2219/43137 | . . . | Constant path speed for combined rotational and linear movement                               |
| G05B 2219/43138 | . . . | Set speed by controlling position of pulley of variable transmission                          |
| G05B 2219/43139 | . . . | VCO variable frequency oscillator or two oscillators with different frequency                 |
| G05B 2219/43141 | . . . | Surface, path, tangential speed   |
| G05B 2219/43142 | . . . | Control relative speed between two spindles   |
| G05B 2219/43143 | . . . | ADC ramp and velocities are set by potentiometers which control digital valve                 |
| G05B 2219/43144 | . . . | Accelerate one slide and decelerate other slide to keep speed constant                        |
| G05B 2219/43145 | . . . | Machine first with low spindle speed, then with high speed, avoid chatter                     |
| G05B 2219/43146 | . . . | Control of speed, velocity of movement of tool as function of power of tool                   |
| G05B 2219/43147 | . . . | Control power of tool as function of speed, velocity of movement                              |
| G05B 2219/43148 | . . . | Rapid return, retract stroke  |
| G05B 2219/43149 | . . . | Rapid approach, then slow, then pressure for clamping, bonding                                |
| G05B 2219/43151 | . . . | Rapid feed in, slow workspeed during entering material, then high work speed                  |
| G05B 2219/43152 | . . . | Feed in, transfer line, rapid traverse to work, grip speed                                    |
| G05B 2219/43153 | . . . | Control depth of feed in by timer   |
| G05B 2219/43154 | . . . | Quick feed in to workpiece without gauging, then normal feed with gauging                     |
| G05B 2219/43155 | . . . | Rapid speed for approach then slow speed for working  |
| G05B 2219/43156 | . . . | Feed rate   |
| G05B 2219/43157 | . . . | Feed rate   |
| G05B 2219/43158 | . . . | Feedrate override   |
| G05B 2219/43159 | . . . | Feedrate override only for x y, not for z or only for z and not for x y                       |
| G05B 2219/43161 | . . . | Second, independent feedrate override   |
| G05B 2219/43162 | . . . | Motion control, movement speed combined with position   |
| G05B 2219/43163 | . . . | Based on unit motions, primitive b-spline motions, time shifted and weighted                  |
| G05B 2219/43164 | . . . | Independent, uncoordinated motion control of several motors to initialise                     |
| G05B 2219/43165 | . . . | Superposition of special effects motion on normal motion                                      |
| G05B 2219/43166 | . . . | Simulation of mechanical gear   |
| G05B 2219/43167 | . . . | Distributed motion control  |

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| G05B 2219/43168 | . . . | Motion profile planning for point to point control                                |
| G05B 2219/43169 | . . . | Motor drives a mechanical cam   |
| G05B 2219/43171 | . . . | Correction servo and constant velocity motor as input to differential, sum motion |
| G05B 2219/43172 | . . . | Change velocities on the fly during a motion                                      |
| G05B 2219/43173 | . . . | Synchronize motion with scenery, sound  |
| G05B 2219/43174 | . . . | Simulating cam motion mechanism   |
| G05B 2219/43175 | . . . | Motion in several blocks, for each part in open and part in closed loop           |
| G05B 2219/43176 | . . . | Scale velocity profile  |
| G05B 2219/43177 | . . . | Single cycle positioning, start, move, stop for single rotation                   |
| G05B 2219/43178 | . . . | Filter resonance frequency from acceleration pattern, derive new speed pattern    |
| G05B 2219/43179 | . . . | Speed changes gradually from constant value to zero                               |
| G05B 2219/43181 | . . . | Reaching reference position by spiraling speed reference                          |
| G05B 2219/43182 | . . . | Speed control with feedback and as reference the programmed value                 |
| G05B 2219/43183 | . . . | Speed control, input is the reference, but no feedback                            |
| G05B 2219/43184 | . . . | From desired speed, derive delta positions during equal intervals                 |
| G05B 2219/43185 | . . . | Speed invariant motions, path accuracy independent of speed                       |
| G05B 2219/43186 | . . . | Pulses from handle, knob, hand wheel control speed                                |
| G05B 2219/43187 | . . . | Vector speed, ratio between axis, without feedback                                |
| G05B 2219/43188 | . . . | Vector speed with feedback  |
| G05B 2219/43189 | . . . | Sum of squares  |
| G05B 2219/43191 | . . . | Approximation   |
| G05B 2219/43192 | . . . | Brake while driving to obtain very low speed, step wise movement, then stop       |
| G05B 2219/43193 | . . . | Variable slope speed steps as function of position, pulse pump controller         |
| G05B 2219/43194 | . . . | Speed steps, switch over as function of position                                  |
| G05B 2219/43195 | . . . | Using a tri-phase motor and a step motor  |
| G05B 2219/43196 | . . . | Using two motors  |
| G05B 2219/43197 | . . . | Two axis at the same time   |
| G05B 2219/43198 | . . . | Coupling and step motor   |
| G05B 2219/43199 | . . . | Safety, limitation of feedrate  |
| G05B 2219/43201 | . . . | Limit speed to allowable speed for all axis                                       |
| G05B 2219/43202 | . . . | If collision danger, speed is low, slow motion                                    |
| G05B 2219/43203 | . . . | Limitation of speed, permissible, allowable, maximum speed                        |
| G05B 2219/43204 | . . . | Different, dynamic current limits as function of speed                            |
| G05B 2219/43205 | . . . | General tape speed controls speed of axis   |
| G05B 2219/43206 | . . . | Tape speed controls speed of axis   |
| G05B 2219/45    | . . . | Nc applications   |
| G05B 2219/45001 | . . . | Antenna orientation   |
| G05B 2219/45002 | . . . | To application field of control   |

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| G05B 2219/45003 | . | . | . | Harvester   |
| G05B 2219/45004 | . | . | . | Mining  |
| G05B 2219/45005 | . | . | . | Registration machine, chart recorder                        |
| G05B 2219/45006 | . | . | . | Valves  |
| G05B 2219/45007 | . | . | . | Toy   |
| G05B 2219/45008 | . | . | . | Theatre   |
| G05B 2219/45009 | . | . | . | Glassforming  |
| G05B 2219/45011 | . | . | . | To be assigned  |
| G05B 2219/45012 | . | . | . | Excavator   |
| G05B 2219/45013 | . | . | . | Spraying, coating, painting                                 |
| G05B 2219/45014 | . | . | . | Elevator, lift  |
| G05B 2219/45015 | . | . | . | Roller blind, shutter                                       |
| G05B 2219/45016 | . | . | . | Radar   |
| G05B 2219/45017 | . | . | . | Agriculture machine, tractor                                |
| G05B 2219/45018 | . | . | . | Car, auto, vehicle  |
| G05B 2219/45019 | . | . | . | Balancing wheels  |
| G05B 2219/45021 | . | . | . | Wheel mounting  |
| G05B 2219/45022 | . | . | . | Auto seat, dentist chair, roll wheel chair                  |
| G05B 2219/45023 | . | . | . | Align head lamps of car                                     |
| G05B 2219/45024 | . | . | . | Simulation car ride   |
| G05B 2219/45025 | . | . | . | Position, mount glass window, sunroof in car-body           |
| G05B 2219/45026 | . | . | . | Circuit board, pcb  |
| G05B 2219/45027 | . | . | . | Masking, project image on wafer semiconductor, photo tracer |
| G05B 2219/45028 | . | . | . | Lithography   |
| G05B 2219/45029 | . | . | . | Mount and solder parts on board                             |
| G05B 2219/45031 | . | . | . | Manufacturing semiconductor wafers                          |
| G05B 2219/45032 | . | . | . | Wafer manufacture; interlock, load-lock module              |
| G05B 2219/45033 | . | . | . | Wire bonding, wire wrap                                     |
| G05B 2219/45034 | . | . | . | Adjusting, trimming circuits on printed boards              |
| G05B 2219/45035 | . | . | . | Printed circuit boards, also holes to be drilled in a plate |
| G05B 2219/45036 | . | . | . | Waterjet cutting  |
| G05B 2219/45037 | . | . | . | Veneer cutting  |
| G05B 2219/45038 | . | . | . | Cutting plotter   |
| G05B 2219/45039 | . | . | . | Slitter, scoring  |
| G05B 2219/45041 | . | . | . | Laser cutting   |
| G05B 2219/45042 | . | . | . | Hot wire cutting, use of polystyrene or similar material    |
| G05B 2219/45043 | . | . | . | EDM machine, wire cutting                                   |
| G05B 2219/45044 | . | . | . | Cutting   |
| G05B 2219/45045 | . | . | . | Maintenance, automatic storage and retrieval system         |
| G05B 2219/45046 | . | . | . | Crane   |



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| G05B 2219/45047 | . | . | . | Sorting   |
| G05B 2219/45048 | . | . | . | Packaging   |
| G05B 2219/45049 | . | . | . | Forklift  |
| G05B 2219/45051 | . | . | . | Transfer line   |
| G05B 2219/45052 | . | . | . | Filling vehicle with material                                       |
| G05B 2219/45053 | . | . | . | Coil, bobbin handling   |
| G05B 2219/45054 | . | . | . | Handling, conveyor  |
| G05B 2219/45055 | . | . | . | Assembly  |
| G05B 2219/45056 | . | . | . | Handling cases, boxes   |
| G05B 2219/45057 | . | . | . | Storage handling for disks or material                              |
| G05B 2219/45058 | . | . | . | Grinding, polishing robot   |
| G05B 2219/45059 | . | . | . | Drilling robot  |
| G05B 2219/45061 | . | . | . | Measuring robot   |
| G05B 2219/45062 | . | . | . | Surface finishing robot   |
| G05B 2219/45063 | . | . | . | Pick and place manipulator  |
| G05B 2219/45064 | . | . | . | Assembly robot  |
| G05B 2219/45065 | . | . | . | Sealing, painting robot   |
| G05B 2219/45066 | . | . | . | Inspection robot  |
| G05B 2219/45067 | . | . | . | Assembly  |
| G05B 2219/45068 | . | . | . | Cutting robot   |
| G05B 2219/45069 | . | . | . | Computer controlled automata, doll                                  |
| G05B 2219/45071 | . | . | . | Aircraft, airplane, ship cleaning manipulator, paint stripping      |
| G05B 2219/45072 | . | . | . | Sewer cleaning manipulator  |
| G05B 2219/45073 | . | . | . | Microrobot  |
| G05B 2219/45074 | . | . | . | Edge treating robot, machine  |
| G05B 2219/45075 | . | . | . | Sewer repair  |
| G05B 2219/45076 | . | . | . | Gas, fuel refilling   |
| G05B 2219/45077 | . | . | . | Sculpturing manipulator   |
| G05B 2219/45078 | . | . | . | Window cleaning, end effector contains detection and cleaning means |
| G05B 2219/45079 | . | . | . | Stripping robot, strip pieces of garments from table                |
| G05B 2219/45081 | . | . | . | Tuning robot for amplifiers   |
| G05B 2219/45082 | . | . | . | Sanding robot, to clean surfaces                                    |
| G05B 2219/45083 | . | . | . | Manipulators, robot   |
| G05B 2219/45084 | . | . | . | Service robot   |
| G05B 2219/45085 | . | . | . | Space robot   |
| G05B 2219/45086 | . | . | . | Brick laying, masonry robot   |
| G05B 2219/45087 | . | . | . | Gymnast robot, acrobat  |
| G05B 2219/45088 | . | . | . | Riveting robot  |
| G05B 2219/45089 | . | . | . | Testing robot   |
| G05B 2219/45091 | . | . | . | Screwing robot, tighten or loose bolt                               |

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| G05B 2219/45092 | . | . | . | Analysing or chemical synthesis robot, moving samples from station to station |
| G05B 2219/45093 | . | . | . | Tacker robot, to join panels with nails, staples                              |
| G05B 2219/45094 | . | . | . | Milling robot   |
| G05B 2219/45095 | . | . | . | Office messenger  |
| G05B 2219/45096 | . | . | . | Polishing manipulator   |
| G05B 2219/45097 | . | . | . | Cable harnessing robot  |
| G05B 2219/45098 | . | . | . | Vacuum cleaning robot   |
| G05B 2219/45099 | . | . | . | Filament, tape winding robot  |
| G05B 2219/45101 | . | . | . | Hot line work robot, to handle high voltage lines                             |
| G05B 2219/45102 | . | . | . | Concrete delivering manipulator with several links                            |
| G05B 2219/45103 | . | . | . | Security, surveillance applications   |
| G05B 2219/45104 | . | . | . | Lasrobot, welding robot   |
| G05B 2219/45105 | . | . | . | Fruit picker, pruner, end effector is a platform for an operator              |
| G05B 2219/45106 | . | . | . | Used in agriculture, tree trimmer, pruner                                     |
| G05B 2219/45107 | . | . | . | Weed robot  |
| G05B 2219/45108 | . | . | . | Aid, robot for aid to, assist human disabled                                  |
| G05B 2219/45109 | . | . | . | Excercise, coordination, therapy, rehabilitation robot for disabled patients  |
| G05B 2219/45111 | . | . | . | Meal, food assistance   |
| G05B 2219/45112 | . | . | . | Arm movement aid  |
| G05B 2219/45113 | . | . | . | Animal handling, milking robot  |
| G05B 2219/45114 | . | . | . | Fisher line robot   |
| G05B 2219/45115 | . | . | . | Evisceration robot, remove intestines of animal                               |
| G05B 2219/45116 | . | . | . | Tapping human shoulder with hammer  |
| G05B 2219/45117 | . | . | . | Medical, radio surgery manipulator  |
| G05B 2219/45118 | . | . | . | Endoscopic, laparoscopic manipulator  |
| G05B 2219/45119 | . | . | . | Telesurgery with local assistant, voice communication                         |
| G05B 2219/45121 | . | . | . | Operating microscope, mounted on manipulator arm                              |
| G05B 2219/45122 | . | . | . | Laser skin treatment  |
| G05B 2219/45123 | . | . | . | Electrogoniometer, neuronavigator, medical robot used by surgeon to operate   |
| G05B 2219/45124 | . | . | . | Two spindle lathe   |
| G05B 2219/45125 | . | . | . | Four axis, spindle lathe  |
| G05B 2219/45126 | . | . | . | Riveting machine  |
| G05B 2219/45127 | . | . | . | Portable, hand drill  |
| G05B 2219/45128 | . | . | . | Nibble machines   |
| G05B 2219/45129 | . | . | . | Boring, drilling  |
| G05B 2219/45131 | . | . | . | Turret punch press  |
| G05B 2219/45132 | . | . | . | Forging press, combined with furnace  |
| G05B 2219/45133 | . | . | . | Lapping   |

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| G05B 2219/45134 | . | . | . | Marking  |
| G05B 2219/45135 | . | . | . | Welding  |
| G05B 2219/45136 | . | . | . | Turning, lathe   |
| G05B 2219/45137 | . | . | . | Punch, stamp, also with use die, mould                                     |
| G05B 2219/45138 | . | . | . | Laser welding  |
| G05B 2219/45139 | . | . | . | Laser drilling   |
| G05B 2219/45141 | . | . | . | Turret lathe   |
| G05B 2219/45142 | . | . | . | Press-line   |
| G05B 2219/45143 | . | . | . | Press-brake, bending machine   |
| G05B 2219/45144 | . | . | . | Saw  |
| G05B 2219/45145 | . | . | . | Milling  |
| G05B 2219/45146 | . | . | . | Inertia friction welding   |
| G05B 2219/45147 | . | . | . | Machining blade, airfoil   |
| G05B 2219/45148 | . | . | . | Boring   |
| G05B 2219/45149 | . | . | . | Micromachining to micrometer precision                                     |
| G05B 2219/45151 | . | . | . | Deburring  |
| G05B 2219/45152 | . | . | . | Forming workpiece by pressing tool against metal on model                  |
| G05B 2219/45153 | . | . | . | Carton forming   |
| G05B 2219/45154 | . | . | . | Forming workpiece by using thermal energy, laser forming                   |
| G05B 2219/45155 | . | . | . | Electroforming, original form is covered with metal                        |
| G05B 2219/45156 | . | . | . | Grind on lathe   |
| G05B 2219/45157 | . | . | . | Grind optical lens   |
| G05B 2219/45158 | . | . | . | Grind sawteeth   |
| G05B 2219/45159 | . | . | . | Dressing, sharpening, trueing tool   |
| G05B 2219/45161 | . | . | . | Grinding machine   |
| G05B 2219/45162 | . | . | . | Chamfer grinding   |
| G05B 2219/45163 | . | . | . | Laser erosion, take away layer of material by burning, use oxygen, engrave |
| G05B 2219/45164 | . | . | . | Laser refurbish with laser beam and metal powder                           |
| G05B 2219/45165 | . | . | . | Laser machining  |
| G05B 2219/45166 | . | . | . | Tomography   |
| G05B 2219/45167 | . | . | . | Dentist, dental manufacture  |
| G05B 2219/45168 | . | . | . | Bone prosthesis  |
| G05B 2219/45169 | . | . | . | Medical, rontgen, x ray  |
| G05B 2219/45171 | . | . | . | Surgery drill  |
| G05B 2219/45172 | . | . | . | Prosthesis   |
| G05B 2219/45173 | . | . | . | Object making, golf ball   |
| G05B 2219/45174 | . | . | . | Making panels  |
| G05B 2219/45175 | . | . | . | Glasses, spectacles  |
| G05B 2219/45176 | . | . | . | Animation for film scenes, show  |

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| G05B 2219/45177 | . | . | . | Data disk drive  |
| G05B 2219/45178 | . | . | . | Zoom, focus lens   |
| G05B 2219/45179 | . | . | . | Optical, telescope   |
| G05B 2219/45181 | . | . | . | Optical multiplexer  |
| G05B 2219/45182 | . | . | . | Microscope, micromanipulator for microscope                                    |
| G05B 2219/45183 | . | . | . | Photocopying, image scanning   |
| G05B 2219/45184 | . | . | . | Filming, photography, camera   |
| G05B 2219/45185 | . | . | . | Auto mirror  |
| G05B 2219/45186 | . | . | . | Print on workpieces  |
| G05B 2219/45187 | . | . | . | Printer  |
| G05B 2219/45188 | . | . | . | Laserjet printer   |
| G05B 2219/45189 | . | . | . | Plotter  |
| G05B 2219/45191 | . | . | . | Spinning, web spinning   |
| G05B 2219/45192 | . | . | . | Weaving  |
| G05B 2219/45193 | . | . | . | Yarn manufacturing   |
| G05B 2219/45194 | . | . | . | Lace, braid, knitting  |
| G05B 2219/45195 | . | . | . | Sewing machines  |
| G05B 2219/45196 | . | . | . | Textile, embroidery, stitching machine   |
| G05B 2219/45197 | . | . | . | Prepare and machine parts, assemble parts                                      |
| G05B 2219/45198 | . | . | . | Coiling, making springs  |
| G05B 2219/45199 | . | . | . | Polish   |
| G05B 2219/45201 | . | . | . | Crowned roll machining   |
| G05B 2219/45202 | . | . | . | Edge finishing   |
| G05B 2219/45203 | . | . | . | Screwing   |
| G05B 2219/45204 | . | . | . | Die, mould making  |
| G05B 2219/45205 | . | . | . | Assembly of woodframe  |
| G05B 2219/45206 | . | . | . | Ultrasonic drill, mill, machining  |
| G05B 2219/45207 | . | . | . | Actuator to regulate position, flow, speed, process variable                   |
| G05B 2219/45208 | . | . | . | Long, deep drill, with drill, bore diameter small relative to length, in pipes |
| G05B 2219/45209 | . | . | . | Measuring, indicating device having a needle                                   |
| G05B 2219/45211 | . | . | . | Making, assembling truss structures  |
| G05B 2219/45212 | . | . | . | Etching, engraving, sculpturing, carving                                       |
| G05B 2219/45213 | . | . | . | Integrated manufacturing system ims, transfer line, machining center           |
| G05B 2219/45214 | . | . | . | Gear cutting   |
| G05B 2219/45215 | . | . | . | Thread cutting   |
| G05B 2219/45216 | . | . | . | Tapping  |
| G05B 2219/45217 | . | . | . | Notching   |
| G05B 2219/45218 | . | . | . | Making cams, cones   |
| G05B 2219/45219 | . | . | . | Making intermeshing helical rotors, for pump, compressor                       |
| G05B 2219/45221 | . | . | . | Edm, electrical discharge machining, electroerosion, ecm, chemical             |

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| G05B 2219/45222 | . . . | Cloth making  |
| G05B 2219/45223 | . . . | Making mirror, mirror segment   |
| G05B 2219/45224 | . . . | Electrode making  |
| G05B 2219/45225 | . . . | Making impellers, propellers  |
| G05B 2219/45226 | . . . | Process control   |
| G05B 2219/45227 | . . . | Stamp making  |
| G05B 2219/45228 | . . . | Making spheres  |
| G05B 2219/45229 | . . . | Woodworking   |
| G05B 2219/45231 | . . . | Stoneworking  |
| G05B 2219/45232 | . . . | CMP chemical mechanical polishing of wafer                                |
| G05B 2219/45233 | . . . | Repairing pipelines, tubes  |
| G05B 2219/45234 | . . . | Thin flat workpiece, sheet metal machining                                |
| G05B 2219/45235 | . . . | Dispensing adhesive, solder paste, for pcb                                |
| G05B 2219/45236 | . . . | Facing, polygon working, polyhedron machining                             |
| G05B 2219/45237 | . . . | Honing machine  |
| G05B 2219/45238 | . . . | Tape, fiber, glue, material dispensing in layers, beads, filling, sealing |
| G05B 2219/45239 | . . . | Filament, coil winding  |
| G05B 2219/45241 | . . . | Coke oven   |
| G05B 2219/45242 | . . . | Door, panel, window operation, opening, closing                           |
| G05B 2219/45243 | . . . | Shoe, footwear making   |
| G05B 2219/45244 | . . . | Injection molding   |
| G05B 2219/45245 | . . . | Making key  |
| G05B 2219/45246 | . . . | Turn cylindrical workpiece, crowned                                       |
| G05B 2219/45247 | . . . | Diamond turning, tool is diamond point                                    |
| G05B 2219/45248 | . . . | Turning   |
| G05B 2219/47    | . .   | Tracing, tracking   |
| G05B 2219/4701  | . . . | Edge detector, project line, inclined camera detects discontinuity        |
| G05B 2219/4702  | . . . | Project several lines on surface, to detect discontinuity by camera       |
| G05B 2219/4703  | . . . | View whole surface before edge detection, coarse scan then fine tracking  |
| G05B 2219/4704  | . . . | Store actual edge, seam in memory before machining, compare with detected |
| G05B 2219/4705  | . . . | Detect edge during machining, welding, sewing                             |
| G05B 2219/4706  | . . . | Edge detector is incorporated into machine                                |
| G05B 2219/4707  | . . . | Trace groove always at bottom of groove                                   |
| G05B 2219/4708  | . . . | Command codes, marks along line to control operation, velocity            |
| G05B 2219/4709  | . . . | Command code in form of a sticker   |
| G05B 2219/4711  | . . . | Using a pantograph  |
| G05B 2219/4712  | . . . | Using photocell sensible to different colours                             |
| G05B 2219/4713  | . . . | Limit scanning surface by marks, stored limit, limit switches             |
| G05B 2219/4714  | . . . | Use of help paths to go to different workpiece paths to be followed       |

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| G05B 2219/4715  | . . . | Second photocell in advance of first, to control speed or other operation              |
| G05B 2219/4716  | . . . | Trace electric potential lines to control z motion                                     |
| G05B 2219/4717  | . . . | Machine 3-D model by tracing two 2-D models  |
| G05B 2219/4718  | . . . | Two mode switch over tracking as function of predetermined cmm probe angle             |
| G05B 2219/4719  | . . . | Line detector with laser beam, adjustable optical axis                                 |
| G05B 2219/49    | . .   | Nc machine tool, till multiple   |
| G05B 2219/49001 | . . . | Machine tool problems  |
| G05B 2219/49002 | . . . | Map unfolded surface on flat surface to make dies, composite objects, free form        |
| G05B 2219/49003 | . . . | Make two halves of tool, model at the same time  |
| G05B 2219/49004 | . . . | Modeling, making, manufacturing model to control machine, cmm                          |
| G05B 2219/49005 | . . . | Map 2-D pattern on 3-D   |
| G05B 2219/49006 | . . . | Nc machine makes cams, model to control, or make a copy, on other machines             |
| G05B 2219/49007 | . . . | Making, forming 3-D object, model, surface   |
| G05B 2219/49008 | . . . | Making 3-D object with model in computer memory  |
| G05B 2219/49009 | . . . | Model stored in a memory of a prototype  |
| G05B 2219/49011 | . . . | Machine 2-D slices, build 3-D model, laminated object manufacturing LOM                |
| G05B 2219/49012 | . . . | Remove material by laser beam, air, water jet to form 3-D object                       |
| G05B 2219/49013 | . . . | Deposit layers, cured by scanning laser, stereo lithography SLA, prototyping           |
| G05B 2219/49014 | . . . | Calculate number and form of 2-D slices automatically from volume on screen            |
| G05B 2219/49015 | . . . | Wire, strang laying, deposit fluid, welding, adhesive, hardening, solidification, fuse |
| G05B 2219/49016 | . . . | Combination DTM and machining, sff, sfm solid free form fabrication                    |
| G05B 2219/49017 | . . . | DTM desktop manufacturing, prototyping   |
| G05B 2219/49018 | . . . | Laser sintering of powder in layers, selective laser sintering SLS                     |
| G05B 2219/49019 | . . . | Machine 3-D slices, to build 3-D model, stratified object manufacturing SOM            |
| G05B 2219/49021 | . . . | Deposit layer, machine, mill layer, then new layer, SDM solid deposit manufacturing    |
| G05B 2219/49022 | . . . | Photo masking, mask cures whole layer at one time, add wax, mill, new layer            |
| G05B 2219/49023 | . . . | 3-D printing, layer of powder, add drops of binder in layer, new powder                |
| G05B 2219/49024 | . . . | LEM laminated engineering materials, like lom but first cut, then stack                |
| G05B 2219/49025 | . . . | By positioning plurality of rods, pins to form together a mold, maquette               |
| G05B 2219/49026 | . . . | SDM shape deposition manufacturing for multimaterial layers                            |
| G05B 2219/49027 | . . . | SALD selective area laser deposition, vapor solidifies on surface                      |
| G05B 2219/49028 | . . . | Rapid freeze prototyping, selectively deposit and rapidly freeze water layer by layer  |

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| G05B 2219/49029 | . . . | Virtual rapid prototyping, create a virtual prototype, simulate rapid prototyping process |
| G05B 2219/49031 | . . . | Project particles, laser beam to point using two, more jets, beams, ballistic particle    |
| G05B 2219/49032 | . . . | Bond layers with glue, solder, welding, brazing in LOM                                    |
| G05B 2219/49033 | . . . | Blanks or taken from roll of metal sheet  |
| G05B 2219/49034 | . . . | Changing design, use same prototype, add reinforcements where needed                      |
| G05B 2219/49035 | . . . | Reconstruct boundary volume from stack of layer contours, sections                        |
| G05B 2219/49036 | . . . | Use quality measures, build time, strength of material, surface approximation             |
| G05B 2219/49037 | . . . | Electro rheological fluid to build support for overhanging parts, particle jet            |
| G05B 2219/49038 | . . . | Support help, grid between support and prototype, separate easily                         |
| G05B 2219/49039 | . . . | Build layer of different, weaker material between support and prototype                   |
| G05B 2219/49041 | . . . | Workpiece is surrounded by softer support material during machining                       |
| G05B 2219/49042 | . . . | Remove chips from probe, tool by blowing them away  |
| G05B 2219/49043 | . . . | Control of lubrication  |
| G05B 2219/49044 | . . . | Control preload of spindle bearing  |
| G05B 2219/49045 | . . . | Relieve stress of workpiece after machining by vibration table                            |
| G05B 2219/49046 | . . . | Control flatness of deformable workpiece table  |
| G05B 2219/49047 | . . . | Remove chips by tool up down movement, pecking  |
| G05B 2219/49048 | . . . | Control of damping of vibration of machine base   |
| G05B 2219/49049 | . . . | Coolant serves as lubrication and also to take away swarf, chips                          |
| G05B 2219/49051 | . . . | Heat treatment of workpiece, tempering  |
| G05B 2219/49052 | . . . | Accessory, coolant  |
| G05B 2219/49053 | . . . | Break chips, spiral chips, interrupt momentarily in feed during two or more rotations     |
| G05B 2219/49054 | . . . | Active damping of tool vibration  |
| G05B 2219/49055 | . . . | Remove chips from probe, tool by vibration  |
| G05B 2219/49056 | . . . | Control of flow of fluid or temperature as function of speed for uniform coating          |
| G05B 2219/49057 | . . . | Controlling temperature of workpiece, tool, probe holder                                  |
| G05B 2219/49058 | . . . | Division algorithm, calculate inverse ratio of cutting process from parameters            |
| G05B 2219/49059 | . . . | Machine with constant volume in time  |
| G05B 2219/49061 | . . . | Calculate optimum operating, machining conditions and adjust, adapt them                  |
| G05B 2219/49062 | . . . | Adaptive control AC   |
| G05B 2219/49063 | . . . | Adaptive control constraint ACC   |
| G05B 2219/49064 | . . . | Fuzzy adaptive control  |
| G05B 2219/49065 | . . . | Execute learning mode first for determining adaptive control parameters                   |
| G05B 2219/49066 | . . . | Geometric adaptive control  |



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| G05B 2219/49067 | . | . | . | Find optimum between production rate and quality, number of points and speed            |
| G05B 2219/49068 | . | . | . | Minimum cost adaptive   |
| G05B 2219/49069 | . | . | . | Adaptive control optimisation ACO   |
| G05B 2219/49071 | . | . | . | Cycle time reduction  |
| G05B 2219/49072 | . | . | . | Action, withdraw, stop feed tool to prevent breakage or lower load                      |
| G05B 2219/49073 | . | . | . | Adapt machining parameters so as to keep temperature constant                           |
| G05B 2219/49074 | . | . | . | Control cutting speed   |
| G05B 2219/49075 | . | . | . | Control depth of cut  |
| G05B 2219/49076 | . | . | . | Reduce cutting speed if feed force below minimum level                                  |
| G05B 2219/49077 | . | . | . | Control of feed and spindle, cutting speed  |
| G05B 2219/49078 | . | . | . | Control of feed only  |
| G05B 2219/49079 | . | . | . | Control cutting torque, force   |
| G05B 2219/49081 | . | . | . | If obstruction, bad joint, move head aside and retry operation                          |
| G05B 2219/49082 | . | . | . | Maintain constant material removal rate   |
| G05B 2219/49083 | . | . | . | If number of feed retractions exceeds a limit, repeat same instruction block            |
| G05B 2219/49084 | . | . | . | Control roughness of surface  |
| G05B 2219/49085 | . | . | . | CMP end point analysis, measure parameters on points to detect end of polishing process |
| G05B 2219/49086 | . | . | . | Adjust feeding speed or rotational speed of main spindle when load out of range         |
| G05B 2219/49087 | . | . | . | Adjust parameter to compensate path deviation   |
| G05B 2219/49088 | . | . | . | As a function of, regulate feed as function of material, tool                           |
| G05B 2219/49089 | . | . | . | Control feed as function of detected number of tools engaging simultaneously workpiece  |
| G05B 2219/49091 | . | . | . | Control feed as function of detected diameter, cross section of workpiece               |
| G05B 2219/49092 | . | . | . | Vary, change controlled parameter as function of detected power                         |
| G05B 2219/49093 | . | . | . | Adapt cutting speed as function of depth of cutting                                     |
| G05B 2219/49094 | . | . | . | Feed as function of deviation of real from programmed position at fixed time intervals  |
| G05B 2219/49095 | . | . | . | Of rigidity of workpiece  |
| G05B 2219/49096 | . | . | . | Deviation of compliant mounted tool   |
| G05B 2219/49097 | . | . | . | Material type of each layer to be drilled, to be joined                                 |
| G05B 2219/49098 | . | . | . | As a function of machine operating speed and tool                                       |
| G05B 2219/49099 | . | . | . | Cutting force, torque   |
| G05B 2219/49101 | . | . | . | As function of tool speed   |
| G05B 2219/49102 | . | . | . | Tool temperature  |
| G05B 2219/49103 | . | . | . | Speed and feed  |
| G05B 2219/49104 | . | . | . | Chip thickness  |
| G05B 2219/49105 | . | . | . | Emitted noise of tool   |
| G05B 2219/49106 | . | . | . | Feed as function of lateral movement of saw blade                                       |

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| G05B 2219/49107 | . . . | Optimize spindle speed as function of calculated motion error                    |
| G05B 2219/49108 | . . . | Spindle speed  |
| G05B 2219/49109 | . . . | Control cutting speed as function of tool wire wear, measure diameter of wire    |
| G05B 2219/49111 | . . . | Cutting speed as function of contour, path, curve                                |
| G05B 2219/49112 | . . . | Compensation alignment of cylindrical workpiece                                  |
| G05B 2219/49113 | . . . | Align elements like hole and drill, centering tool, probe, workpiece             |
| G05B 2219/49114 | . . . | Go to coarse programmed reference, detector for fine alignment                   |
| G05B 2219/49115 | . . . | Alignment by taking into account asymmetries in signal, for small offsets        |
| G05B 2219/49116 | . . . | Align tool head with fixed line by actuating actuators along tool head slideways |
| G05B 2219/49117 | . . . | Alignment of surfaces to get them parallel                                       |
| G05B 2219/49118 | . . . | Machine end face, control C-axis and X-axis                                      |
| G05B 2219/49119 | . . . | Machine arc of circumference, as groove, cylindrical interpolation               |
| G05B 2219/49121 | . . . | C-axis for turning, fifth axis for milling                                       |
| G05B 2219/49122 | . . . | Multiclamping, to reduce dead times  |
| G05B 2219/49123 | . . . | Simulation of clamping workpiece, modeling fixture and workpiece                 |
| G05B 2219/49124 | . . . | Determine clamping position from equipment specification and machining shape     |
| G05B 2219/49125 | . . . | Open clamp if tool approaches clamp zone, close again afterwards                 |
| G05B 2219/49126 | . . . | Clamp piece to pallet using connectable power source                             |
| G05B 2219/49127 | . . . | Variable clamping force as function of movement, force on workpiece              |
| G05B 2219/49128 | . . . | Determine maximum clamping force as function of allowable displacement workpiece |
| G05B 2219/49129 | . . . | Clamps are movable along rod to desired positions                                |
| G05B 2219/49131 | . . . | High force clamping along periphery  |
| G05B 2219/49132 | . . . | Control fixed clamping force   |
| G05B 2219/49133 | . . . | Variable chuck clamping force as function of spindle speed                       |
| G05B 2219/49134 | . . . | Clamp, keep positioned slide, workpiece stationary during machining              |
| G05B 2219/49135 | . . . | Active clamping, use servo to keep in position                                   |
| G05B 2219/49136 | . . . | Vacuum pads hold workpiece during machining                                      |
| G05B 2219/49137 | . . . | Store working envelop, limit, allowed zone                                       |
| G05B 2219/49138 | . . . | Adapt working envelop, limit, allowed zone to speed of tool                      |
| G05B 2219/49139 | . . . | Alarm if outside zone  |
| G05B 2219/49141 | . . . | Detect near collision and slow, stop, inhibit movement tool                      |
| G05B 2219/49142 | . . . | Shut off power, stop if outside working zone                                     |
| G05B 2219/49143 | . . . | Obstacle, collision avoiding control, move so that no collision occurs           |
| G05B 2219/49144 | . . . | Limit movement on an axis by setting limits                                      |
| G05B 2219/49145 | . . . | Spheres replace object, check first collision for large spheres, then small      |
| G05B 2219/49146 | . . . | Tool changing registers geometry of tool to avoid collision                      |
| G05B 2219/49147 | . . . | Retract on collision with moving object, tool follows, yields to object          |

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| G05B 2219/49148 | . . . | Adapt working envelop, limit to size workpiece  |
| G05B 2219/49149 | . . . | Ball end cutter interference, caused by tool shape, overcut part surface                |
| G05B 2219/49151 | . . . | Axis related interference, remove hidden surfaces                                       |
| G05B 2219/49152 | . . . | Feedhold, stop motion if machine door is open, if operator in forbidden zone            |
| G05B 2219/49153 | . . . | Avoid collision, interference between tools moving along same axis                      |
| G05B 2219/49154 | . . . | Detect position of slide to change hover height of tool to avoid collision              |
| G05B 2219/49155 | . . . | On collision, reverse motor over certain angle, then stop to avoid bending              |
| G05B 2219/49156 | . . . | On collision, cut off motor, delay, again motor on, repeat to avoid bending             |
| G05B 2219/49157 | . . . | Limitation, collision, interference, forbidden zones, avoid obstacles                   |
| G05B 2219/49158 | . . . | On near collision reduce speed  |
| G05B 2219/49159 | . . . | Avoid pinching of persons between moving and fixed part                                 |
| G05B 2219/49161 | . . . | Near end of position, lower power or speed of motor to safe value, at end normal        |
| G05B 2219/49162 | . . . | On collision, obstruction reverse drive, accelerate, cancel inertia                     |
| G05B 2219/49163 | . . . | Stop, dwell in corner edge, allow for cooling, go on machining, better surface          |
| G05B 2219/49164 | . . . | Corner, making corner   |
| G05B 2219/49165 | . . . | Compensation relative movement between two commonly driven slides                       |
| G05B 2219/49166 | . . . | Compensation for measured deviation of tool path, as function of lenght of path         |
| G05B 2219/49167 | . . . | Execute compensation only if workhead, module is connected                              |
| G05B 2219/49168 | . . . | Compensate feed as function of measured values and manual introduced values             |
| G05B 2219/49169 | . . . | Compensation for temperature, bending of tool   |
| G05B 2219/49171 | . . . | Compensate for dressing amount  |
| G05B 2219/49172 | . . . | Compensate slide position as function of indexed workpiece spindle position error       |
| G05B 2219/49173 | . . . | Compensation for sidewise deviation of machined workpiece                               |
| G05B 2219/49174 | . . . | Compensate position by use of separate cmm  |
| G05B 2219/49175 | . . . | Compensate for errors in cmm, especially mirror errors, not flat enough                 |
| G05B 2219/49176 | . . . | Compensation of vibration of machine base due to slide movement                         |
| G05B 2219/49177 | . . . | Runout, eccentricity, unbalance of tool or workpiece                                    |
| G05B 2219/49178 | . . . | Compensation of tool position as function of square of rotating speed of spindle        |
| G05B 2219/49179 | . . . | Compensation for reluctance of axis motors causing surface ondulation                   |
| G05B 2219/49181 | . . . | Calculation, estimation, creation of error model using measured error values            |
| G05B 2219/49182 | . . . | Tapping, overshoot after reversal, elasticity compensation                              |
| G05B 2219/49183 | . . . | Compensation height of tool as function of horizontal position of spindle head, bending |
| G05B 2219/49184 | . . . | Compensation for bending of workpiece, flexible workpiece                               |

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| G05B 2219/49185 | . | . | . | Position error compensation as function of position of slide, control bearing pressure |
| G05B 2219/49186 | . | . | . | Deflection, bending of tool  |
| G05B 2219/49187 | . | . | . | Control position of steady rest to compensate bending                                  |
| G05B 2219/49188 | . | . | . | Proportional compensation from middle to end of elongated workpiece                    |
| G05B 2219/49189 | . | . | . | Bending of driven table, lag between real and commanded position                       |
| G05B 2219/49191 | . | . | . | Bending, tilt spindle in bearings to compensate for bending                            |
| G05B 2219/49192 | . | . | . | Create optical reference axis always kept parallel to reference optical block          |
| G05B 2219/49193 | . | . | . | Orthogonality of axis, deviation from 90-degree correction                             |
| G05B 2219/49194 | . | . | . | Structure error, in slide or screw   |
| G05B 2219/49195 | . | . | . | Slide, guideway, robot arm deviation   |
| G05B 2219/49196 | . | . | . | Screw  |
| G05B 2219/49197 | . | . | . | Gear   |
| G05B 2219/49198 | . | . | . | Using lookup table, map, position and corresponding quasi static error                 |
| G05B 2219/49199 | . | . | . | For non linear interpolation movement  |
| G05B 2219/49201 | . | . | . | Variable load, slide friction, irregular machine guides                                |
| G05B 2219/49202 | . | . | . | For point to point positioning   |
| G05B 2219/49203 | . | . | . | For linear movement  |
| G05B 2219/49204 | . | . | . | Control of heat to compensate for dilatation, thermal displacement                     |
| G05B 2219/49205 | . | . | . | Compensate with stored values as function of machining time                            |
| G05B 2219/49206 | . | . | . | Compensation temperature, thermal displacement, use measured temperature               |
| G05B 2219/49207 | . | . | . | Compensate thermal displacement using measured distance                                |
| G05B 2219/49208 | . | . | . | Preheat spindle by powering polyphase motor with monophasic                            |
| G05B 2219/49209 | . | . | . | Compensation by using temperature feelers on slide, base, workhead                     |
| G05B 2219/49211 | . | . | . | Compensation dilatation using calculated temperature from velocity                     |
| G05B 2219/49212 | . | . | . | Using lookup table, map, position error, temperature and position                      |
| G05B 2219/49213 | . | . | . | Active thermal preload regulation for spindle  |
| G05B 2219/49214 | . | . | . | Estimate error from heat distribution model and drive current, correct error           |
| G05B 2219/49215 | . | . | . | Regulate temperature of coolant  |
| G05B 2219/49216 | . | . | . | Control of temperature of processor  |
| G05B 2219/49217 | . | . | . | Compensation of temperature increase by the measurement                                |
| G05B 2219/49218 | . | . | . | Compensation of workpiece dilatation   |
| G05B 2219/49219 | . | . | . | Compensation temperature, thermal displacement   |
| G05B 2219/49221 | . | . | . | Control of scale   |
| G05B 2219/49222 | . | . | . | Rough cut at high speed  |
| G05B 2219/49223 | . | . | . | Remove workpiece portions left uncut, unmachined by tool with suitable shape           |
| G05B 2219/49224 | . | . | . | Identify and calculate uncut portions  |

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| G05B 2219/49225 | . . . | Adapt machining conditions as function of workpiece cutting resistance        |
| G05B 2219/49226 | . . . | Cut, up or down cutting, cutting direction right, left                        |
| G05B 2219/49227 | . . . | Cutting with trailing or leading edge of tool                                 |
| G05B 2219/49228 | . . . | Unidirectional or multidirectional cutting                                    |
| G05B 2219/49229 | . . . | Cutter, axis change over  |
| G05B 2219/49231 | . . . | Keep tool, probe at constant distance from workpiece surface                  |
| G05B 2219/49232 | . . . | Limit penetration of drill into backup material, support                      |
| G05B 2219/49233 | . . . | Machining depth relative to surface, constant depth                           |
| G05B 2219/49234 | . . . | Keep constant distance even if hole present, avoid collision tool with hole   |
| G05B 2219/49235 | . . . | Control depth as function of grey level of scanned object, map of thickness   |
| G05B 2219/49236 | . . . | Translate thickness to be removed in dwell delay, then to corresponding speed |
| G05B 2219/49237 | . . . | Depth, tool depth control   |
| G05B 2219/49238 | . . . | Surface tracking, following   |
| G05B 2219/49239 | . . . | Dimensions  |
| G05B 2219/49241 | . . . | 2-5-D lace cutting, work in xy and increment in z, repeat                     |
| G05B 2219/49242 | . . . | 4-D   |
| G05B 2219/49243 | . . . | 5-D   |
| G05B 2219/49244 | . . . | 6-D   |
| G05B 2219/49245 | . . . | 2-5-D pocket machining  |
| G05B 2219/49246 | . . . | 3-D printing, layer of powder, add drops of binder in layer, new powder       |
| G05B 2219/49247 | . . . | Dressing started after number of workpieces machined                          |
| G05B 2219/49248 | . . . | Dressing started if sparking out time to get correct surface is too long      |
| G05B 2219/49249 | . . . | Dressing as function of load of grinding wheel                                |
| G05B 2219/49251 | . . . | Dress by conductive fluid between conductive grindstone and electrode         |
| G05B 2219/49252 | . . . | Two spindle drives for common workpiece                                       |
| G05B 2219/49253 | . . . | Position in space by controlling length of two, more cables, wires            |
| G05B 2219/49254 | . . . | High speed AC, induction spindle motor  |
| G05B 2219/49255 | . . . | Gear meshing, synchronize both with relative phase, then shift                |
| G05B 2219/49256 | . . . | Epicyclic movement of tool  |
| G05B 2219/49257 | . . . | Six or more linear drives to position x y z table                             |
| G05B 2219/49258 | . . . | Two y axis to control also rotation   |
| G05B 2219/49259 | . . . | Endless belt with coupling, position tools simultaneously in both directions  |
| G05B 2219/49261 | . . . | Direct drive, without gear  |
| G05B 2219/49262 | . . . | Two drives at both sides of long tool   |
| G05B 2219/49263 | . . . | Separate, auxiliary indexing motor  |
| G05B 2219/49264 | . . . | Several x-y slides on single surface  |
| G05B 2219/49265 | . . . | X motor moves x and y axis, y motor only y axis                               |
| G05B 2219/49266 | . . . | Two xy tables, on top and below workpiece, in between a cutting wire          |

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| G05B 2219/49267 | . . . | Three linear actuators to position vertically and rotate horizontally            |
| G05B 2219/49268 | . . . | Four bar mechanism   |
| G05B 2219/49269 | . . . | Single motor for different drives , switch, change gears                         |
| G05B 2219/49271 | . . . | Air bearing slide, hydraulic, electromagnetic bearing                            |
| G05B 2219/49272 | . . . | Electromagnetic bearing also used as feed in one axis or positioning in two axis |
| G05B 2219/49273 | . . . | Switch between continuous drive and index or stop mode                           |
| G05B 2219/49274 | . . . | Four linear actuators to position x y table                                      |
| G05B 2219/49275 | . . . | Linear actuators on x y to position x y table, ballscrew drive on y to rotate    |
| G05B 2219/49276 | . . . | Floating, air, magnetic suspension xy table, sawyer motor, xenetics              |
| G05B 2219/49277 | . . . | Oscillating, swinging feed drive, for grinding                                   |
| G05B 2219/49278 | . . . | Parallel link mechanism  |
| G05B 2219/49279 | . . . | Nanometric xy table  |
| G05B 2219/49281 | . . . | X y table positioned by vibration  |
| G05B 2219/49282 | . . . | Same control for double drive or slide   |
| G05B 2219/49283 | . . . | Frictionless rolling element   |
| G05B 2219/49284 | . . . | Two cascaded slides, large range sits on small range, piggyback                  |
| G05B 2219/49285 | . . . | Linear control rotating movement kept constant                                   |
| G05B 2219/49286 | . . . | Two rotations gives cartesian coordinates, compact construction                  |
| G05B 2219/49287 | . . . | Motor drives cam for very fine linear displacement, movement                     |
| G05B 2219/49288 | . . . | Three linear actuators to position x y table                                     |
| G05B 2219/49289 | . . . | Large transmission ratio   |
| G05B 2219/49291 | . . . | Torque, moment, drive power amplifier, movement follower                         |
| G05B 2219/49292 | . . . | Harmonic gear, transmission, strain wave gear                                    |
| G05B 2219/49293 | . . . | Switch between dual, double slide or double spindle mode                         |
| G05B 2219/49294 | . . . | Motor and brake actuated together  |
| G05B 2219/49295 | . . . | Drive spindle motor at maximum, limit torque for rapid machining time            |
| G05B 2219/49296 | . . . | Identification workpiece by dimension, height, resistance value, but no code     |
| G05B 2219/49297 | . . . | Spindle identification in multispindle station                                   |
| G05B 2219/49298 | . . . | Probe identification   |
| G05B 2219/49299 | . . . | Identify workpiece and align, center workpiece at the same time                  |
| G05B 2219/49301 | . . . | Identify material to be used, select between several                             |
| G05B 2219/49302 | . . . | Part, workpiece, code, tool identification                                       |
| G05B 2219/49303 | . . . | Tool identification and tool offset, compensation data together                  |
| G05B 2219/49304 | . . . | Tool identification, code  |
| G05B 2219/49305 | . . . | Store, memory on tool with control and maintenance data                          |
| G05B 2219/49306 | . . . | Derive kind of cutter from null load   |
| G05B 2219/49307 | . . . | Learn, learn operational zone, feed, speed to avoid tool breakage                |
| G05B 2219/49308 | . . . | Fuzzy classification of tool wear states   |



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| G05B 2219/49309 | . . . | Main and secondary machining area, main spindle and satellite spindle                      |
| G05B 2219/49311 | . . . | Select machining portion of workpiece, pivoting workpiece as function of correction needed |
| G05B 2219/49312 | . . . | Fixture free machining   |
| G05B 2219/49313 | . . . | Machining about eccentric center different from rotational center of workpiece             |
| G05B 2219/49314 | . . . | Machine with oscillating workpiece, no full rotation                                       |
| G05B 2219/49315 | . . . | Machine first contour slowly, then remaining surface quickly, fast                         |
| G05B 2219/49316 | . . . | Back-off grinding, during wheel retract, by deflection workpiece, after plunge             |
| G05B 2219/49317 | . . . | Traverse grinding, move along workpiece  |
| G05B 2219/49318 | . . . | Grind and simultaneous gauging, dwell, measure and final feed without gauging              |
| G05B 2219/49319 | . . . | Centerless machining, grinding, cutting  |
| G05B 2219/49321 | . . . | Reverse movement of tool to deburr   |
| G05B 2219/49322 | . . . | Cool to solidify material before machining it  |
| G05B 2219/49323 | . . . | Machine long, slender workpiece  |
| G05B 2219/49324 | . . . | Different starting point for each machining pass, to prevent dent formation                |
| G05B 2219/49325 | . . . | Combine punching and laser machining   |
| G05B 2219/49326 | . . . | Drill on laser machine, transfer to edm for operation on hole, adjust position             |
| G05B 2219/49327 | . . . | Combine punch and marker, engraving for workpiece  |
| G05B 2219/49328 | . . . | Laser machining and milling combined   |
| G05B 2219/49329 | . . . | Combine edm and milling  |
| G05B 2219/49331 | . . . | Laser drilling followed by laser cutting   |
| G05B 2219/49332 | . . . | First saw rough contours in workpiece then mill rest                                       |
| G05B 2219/49333 | . . . | Drilling and thread cutting by same machine  |
| G05B 2219/49334 | . . . | Combine turning, milling, grinding or other in one setup                                   |
| G05B 2219/49335 | . . . | Part, workpiece, inner, internal outer, external machining                                 |
| G05B 2219/49336 | . . . | Machine two mating, matching parts, at opposite ends of spindle, simultaneously            |
| G05B 2219/49337 | . . . | Machine holes in spherical nodes   |
| G05B 2219/49338 | . . . | Micromachining, workpieces small, around 1-mm or less                                      |
| G05B 2219/49339 | . . . | Machine simultaneous left and right, mirror part   |
| G05B 2219/49341 | . . . | Manual pocket machining, multipasses   |
| G05B 2219/49342 | . . . | Select between concentric and eccentric regions of a workpiece                             |
| G05B 2219/49343 | . . . | Machining point symmetrical surfaces, revolving surfaces                                   |
| G05B 2219/49344 | . . . | Surface, 5-axis surface machining  |
| G05B 2219/49345 | . . . | Smooth and polish surface at the same time   |
| G05B 2219/49346 | . . . | 3-Axis surface machining   |
| G05B 2219/49347 | . . . | Machine cover, first scan surface on which cover is to be placed                           |



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| G05B 2219/49348 | . . . | Mill surface from underneath workpiece, easy chips, cutout material evacuation   |
| G05B 2219/49349 | . . . | Drill both sides of workpiece at the same time, under and over workpiece         |
| G05B 2219/49351 | . . . | 4-Axis surface machining   |
| G05B 2219/49352 | . . . | 7-Axis surface machining   |
| G05B 2219/49353 | . . . | Control of output power of tool, laser beam                                      |
| G05B 2219/49354 | . . . | High speed cutting   |
| G05B 2219/49355 | . . . | Machine flat surface on rotating workpiece, rotate tool inverse direction        |
| G05B 2219/49356 | . . . | Tool with constant force against workpiece during machining                      |
| G05B 2219/49357 | . . . | Tool perpendicular to surface with varying force                                 |
| G05B 2219/49358 | . . . | Facing milling, tool perpendicular to surface                                    |
| G05B 2219/49359 | . . . | Cylindrical or side milling, tool tangential to surface                          |
| G05B 2219/49361 | . . . | Workpiece and tool have each own rotation speed                                  |
| G05B 2219/49362 | . . . | Tool, probe at constant height to surface during machining                       |
| G05B 2219/49363 | . . . | Minimalize time for tool movement between different positions, holes             |
| G05B 2219/49364 | . . . | Minimize number of punch strokes   |
| G05B 2219/49365 | . . . | Minimise noncutting area, tool travel, eliminate air cutting                     |
| G05B 2219/49366 | . . . | Machine several small pieces on one sheet, break off pieces                      |
| G05B 2219/49367 | . . . | Group machines into cells to minimise intercellular travel                       |
| G05B 2219/49368 | . . . | Vision calculates errors while table already moves, result corrects movement     |
| G05B 2219/49369 | . . . | Minimize machining time by maximizing feed, speed                                |
| G05B 2219/49371 | . . . | Variable laser spot width, small for boundary, large for rest                    |
| G05B 2219/49372 | . . . | Optimize toolpath pattern for a given cutting layer, mounting sequence           |
| G05B 2219/49373 | . . . | Flying operation, while tool and workpiece have same speed                       |
| G05B 2219/49374 | . . . | Speed up each conveyor between two stations, at stations synchronize in phase    |
| G05B 2219/49375 | . . . | Minimalizing machine time, number of tool change                                 |
| G05B 2219/49376 | . . . | Select two machining types, milling or turning, complete machining with one tool |
| G05B 2219/49377 | . . . | Eliminate double cutting   |
| G05B 2219/49378 | . . . | Tool path finding, select minimal distance                                       |
| G05B 2219/49379 | . . . | Key input path, move one axis manually, other axis slave controlled by program   |
| G05B 2219/49381 | . . . | Raster, line servo, area machining, cutting, facing                              |
| G05B 2219/49382 | . . . | Movement reciprocating   |
| G05B 2219/49383 | . . . | Using pick feed with non reciprocating machining direction                       |
| G05B 2219/49384 | . . . | Control of oscillatory movement like filling a weld, weaving                     |
| G05B 2219/49385 | . . . | Using pick feed when machining a surface   |
| G05B 2219/49386 | . . . | Automatic seam, weld line, finding   |
| G05B 2219/49387 | . . . | Limiting scanning region   |

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| G05B 2219/49388 | . . . | Computer controlled movement of plotter is transferred to tool by pantograph         |
| G05B 2219/49389 | . . . | Machine alternative both sides of rib, net machining, against deformation            |
| G05B 2219/49391 | . . . | Adapt number of passes as function of tool wear                                      |
| G05B 2219/49392 | . . . | Multipasses, segmentation of cut, paraxial cutting                                   |
| G05B 2219/49393 | . . . | Machining step, fixing smallest step nibble machine, planer                          |
| G05B 2219/49394 | . . . | Stop in one point, execute other operation and return back to first point            |
| G05B 2219/49395 | . . . | Repeating same operations for other coordinates                                      |
| G05B 2219/49396 | . . . | Stepwise milling, mill by advancing larger step then retract smaller step, repeat    |
| G05B 2219/49397 | . . . | Control of dwell time  |
| G05B 2219/49398 | . . . | Repeat same operations on machined part until machining reaches its finishing        |
| G05B 2219/50    | . .   | Machine tool, machine tool null till machine tool work handling                      |
| G05B 2219/50001 | . . . | Multislides, multispindles with multitool turret for each                            |
| G05B 2219/50002 | . . . | Drill more holes simultaneously, adapt distance tools as function of detected image  |
| G05B 2219/50003 | . . . | Machine simultaneously two workpieces  |
| G05B 2219/50004 | . . . | Multitool at the same time, priority for one tool as function of machining parameter |
| G05B 2219/50005 | . . . | Multiple chuck machining, chuck position change after each partial machining         |
| G05B 2219/50006 | . . . | Two parallel spindles, bi-spindle and two tool blocks sliding on same axis           |
| G05B 2219/50007 | . . . | Multiple polishing heads, oscillating and rotating                                   |
| G05B 2219/50008 | . . . | Multiple, multi tool head, parallel machining  |
| G05B 2219/50009 | . . . | Revolver head  |
| G05B 2219/50011 | . . . | Two spindles drive single large tool, cooperation of spindles                        |
| G05B 2219/50012 | . . . | Multi slide and indexable multi workpiece spindles                                   |
| G05B 2219/50013 | . . . | Two spindles on same line, one for workpiece, other for tool, second tool on slide   |
| G05B 2219/50014 | . . . | Several, multi workpieces  |
| G05B 2219/50015 | . . . | Multi cutting, twin tools contact at same time workpiece, balance cutting            |
| G05B 2219/50016 | . . . | Turret with multiple workpiece holders, spindles, multiple fixed tools around it     |
| G05B 2219/50017 | . . . | Two programs, two slides, data second slide related to moving origin of first        |
| G05B 2219/50018 | . . . | Zero point floating  |
| G05B 2219/50019 | . . . | Zero, null offset  |
| G05B 2219/50021 | . . . | Configuration, null point on tool relative to null point on workpiece                |
| G05B 2219/50022 | . . . | Null point on tool relative to null point of toolholder, rotationcenter              |
| G05B 2219/50023 | . . . | Measure different null points, references of tool and store in memory                |
| G05B 2219/50024 | . . . | Go to reference, switches and dog to decelerate and to detect origin                 |

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| G05B 2219/50025 | . . . | Go to reference, switches and dog detect origin, combine with pulse from encoder |
| G05B 2219/50026 | . . . | Go to reference plane, cube  |
| G05B 2219/50027 | . . . | Go to workpiece surface plane and store position                                 |
| G05B 2219/50028 | . . . | Beam detects x, y deviation on surface, compensates beam of position scanner     |
| G05B 2219/50029 | . . . | Go to pivotable, rotatable reference plane                                       |
| G05B 2219/50031 | . . . | Zero setting, go to reference with gauge   |
| G05B 2219/50032 | . . . | On one axis only, derive from inclined surface offsets for other axis            |
| G05B 2219/50033 | . . . | Align tool, tip with a calibration mask  |
| G05B 2219/50034 | . . . | Set search range about origin, select between different overlapping ranges       |
| G05B 2219/50035 | . . . | Go to reference point and measure a preset force, pressure, store position       |
| G05B 2219/50036 | . . . | Find center of circular mark, groove   |
| G05B 2219/50037 | . . . | Use either upper or lower limit for home control                                 |
| G05B 2219/50038 | . . . | Go to mechanical limit with low speed, until blocking of drive                   |
| G05B 2219/50039 | . . . | Two probe, one on turret, serves also to calibrate second probe on bed           |
| G05B 2219/50041 | . . . | Measuring intensity of tool vibration  |
| G05B 2219/50042 | . . . | Return to origin, reference point, zero point, homing                            |
| G05B 2219/50043 | . . . | Near zero detection  |
| G05B 2219/50044 | . . . | For speed  |
| G05B 2219/50045 | . . . | Combined axis jogging, following programmed shape instead of single axis         |
| G05B 2219/50046 | . . . | Control of level, horizontal, inclination of workholder, slide                   |
| G05B 2219/50047 | . . . | Positioning, indexing  |
| G05B 2219/50048 | . . . | Jogging  |
| G05B 2219/50049 | . . . | Control machine as function of position, angle of workpiece                      |
| G05B 2219/50051 | . . . | Turn workpiece axis perpendicular to turn axis of lathe                          |
| G05B 2219/50052 | . . . | Orienting workpiece relative to tool   |
| G05B 2219/50053 | . . . | Machine non circular, non-round cross section, hexagonal, rectangular            |
| G05B 2219/50054 | . . . | Drill on skew surface  |
| G05B 2219/50055 | . . . | Make hollow workpiece with uniform wall thickness                                |
| G05B 2219/50056 | . . . | Profile, for operation on I-, T-profiles or other elongated profiles             |
| G05B 2219/50057 | . . . | Compensation error by probing test, machined piece, post or pre process          |
| G05B 2219/50058 | . . . | During machining, measure previous part to compensate errors                     |
| G05B 2219/50059 | . . . | Record profile error, used for next machining pass                               |
| G05B 2219/50061 | . . . | Compensation of measuring errors due to machine with footprint                   |
| G05B 2219/50062 | . . . | Measure deviation of workpiece under working conditions, machine correction      |
| G05B 2219/50063 | . . . | Probe, measure, verify workpiece, feedback measured values                       |

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| G05B 2219/50064 | . | . | . | Camera inspects workpiece for errors, correction of workpiece at desired position    |
| G05B 2219/50065 | . | . | . | Estimate trends from past measured values, correct before really out of tolerance    |
| G05B 2219/50066 | . | . | . | Fit base pattern into detected geometrical workpiece data, create whole program      |
| G05B 2219/50067 | . | . | . | Measure surface for thickness and store map in memory, machine surface               |
| G05B 2219/50068 | . | . | . | Test valve, object, store parameters, machine object to get wanted performance       |
| G05B 2219/50069 | . | . | . | Reject workpiece if not machinable, material to be machined too large                |
| G05B 2219/50071 | . | . | . | Store actual surface in memory before machining, compare with reference surface      |
| G05B 2219/50072 | . | . | . | Machine workpiece again to correct previous errors                                   |
| G05B 2219/50073 | . | . | . | Signature analysis, store forces during test, compare with real ones during assembly |
| G05B 2219/50074 | . | . | . | Purpose, workpiece measurement to control, adapt feed of tool                        |
| G05B 2219/50075 | . | . | . | To adapt, control force level at which machining will be considered as finished      |
| G05B 2219/50076 | . | . | . | To derive from state of surface, the need to change used, worn tool                  |
| G05B 2219/50077 | . | . | . | Keep position by switching over to auxiliary power supply for resolver , encoder     |
| G05B 2219/50078 | . | . | . | Single battery backup for all axis, encoders, resolvers                              |
| G05B 2219/50079 | . | . | . | Battery backup supply switched over data, signal lines, to save cable                |
| G05B 2219/50081 | . | . | . | On power loss, shut down axis using generated power from one braked axis             |
| G05B 2219/50082 | . | . | . | UPS, no break to power actuator and move into safe condition                         |
| G05B 2219/50083 | . | . | . | Power loss, measures again loss of power   |
| G05B 2219/50084 | . | . | . | Keep position, setup parameters in memory  |
| G05B 2219/50085 | . | . | . | Realignment, search reference to reestablish position                                |
| G05B 2219/50086 | . | . | . | Microprocessor   |
| G05B 2219/50087 | . | . | . | Rough, coarse and finish, fine machining   |
| G05B 2219/50088 | . | . | . | Rough and finish machining simultaneously  |
| G05B 2219/50089 | . | . | . | Finish allowance equals offset rough finish tool and bending work under rough        |
| G05B 2219/50091 | . | . | . | Rough machining  |
| G05B 2219/50092 | . | . | . | Sculptured part rough machining with the offset approach                             |
| G05B 2219/50093 | . | . | . | Sculptured rough machining with the contour map approach, make slices                |
| G05B 2219/50094 | . | . | . | Optimize number of layers to be cut for contour map approach                         |
| G05B 2219/50095 | . | . | . | On tool breakage return to a reference then follow already machined path             |
| G05B 2219/50096 | . | . | . | After interrupt, use tool path display to bring tool back on path                    |
| G05B 2219/50097 | . | . | . | After repair, dry run program until block before restart is detected                 |
| G05B 2219/50098 | . | . | . | After interrupt, interpolate with suitable startpoint different from stoppoint       |

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| G05B 2219/50099 | . . . | Before restart change jig, fixture with workpieces  |
| G05B 2219/50101 | . . . | For fine machining, select tool and offset, block and restart midway                      |
| G05B 2219/50102 | . . . | Store history of operation, after power failure, restart from history, journal            |
| G05B 2219/50103 | . . . | Restart, reverse, return along machined path, stop  |
| G05B 2219/50104 | . . . | Before restarting program, restore machine status existing at stop time                   |
| G05B 2219/50105 | . . . | Display instructions to operator on how to restart machine                                |
| G05B 2219/50106 | . . . | Before allowing restart, check that machine condition is optimal                          |
| G05B 2219/50107 | . . . | Retract tool if end of drilling is detected   |
| G05B 2219/50108 | . . . | Retract tool stepwise, same path, until safe boundary reached, then quick retract         |
| G05B 2219/50109 | . . . | Soft approach, engage, retract, escape, withdraw path for tool to workpiece               |
| G05B 2219/50111 | . . . | Retract tool along path, reengage along same path   |
| G05B 2219/50112 | . . . | Retract tool to a point   |
| G05B 2219/50113 | . . . | Short stroke, retract tool, safe distance from workpiece surface, hover height            |
| G05B 2219/50114 | . . . | Select approach path as function of zone for tool slide                                   |
| G05B 2219/50115 | . . . | Select complicated, combined approach path  |
| G05B 2219/50116 | . . . | Select approach path out of plurality   |
| G05B 2219/50117 | . . . | Select approach path as function of machining time  |
| G05B 2219/50118 | . . . | Select as function of position of tool during cycle, optimum path                         |
| G05B 2219/50119 | . . . | Select between set of paths as function of interrupt nature                               |
| G05B 2219/50121 | . . . | Machining several workpieces with one or more tools in one setup                          |
| G05B 2219/50122 | . . . | Workpiece holder, chuck jaws, fixture setup   |
| G05B 2219/50123 | . . . | Setup, automatic setup  |
| G05B 2219/50124 | . . . | Automatic new setup when new program selected   |
| G05B 2219/50125 | . . . | Configurable fixture, jig   |
| G05B 2219/50126 | . . . | Position clamp, fixture by machining head itself  |
| G05B 2219/50127 | . . . | Modular fixture, use of clamps and locators, the latter also for positioning              |
| G05B 2219/50128 | . . . | Reference free part encapsulation, fixture using molten filler and cube                   |
| G05B 2219/50129 | . . . | Setup machines as function of process model, control strategy for optimum use of machines |
| G05B 2219/50131 | . . . | Setup as function of tool position in manufacturing center                                |
| G05B 2219/50132 | . . . | Jig, fixture  |
| G05B 2219/50133 | . . . | With optical beam, tool crosses beam  |
| G05B 2219/50134 | . . . | Tool pushes reference plane, or vice versa, reverse motion until again zero               |
| G05B 2219/50135 | . . . | Tool touches box, sensor to give a contact signal   |
| G05B 2219/50136 | . . . | With sensor, potentiometer to measure relative displacement                               |
| G05B 2219/50137 | . . . | Contact in probe, touch probe to detect contact, touch trigger                            |
| G05B 2219/50138 | . . . | During setup display is red, after setup display is green colour                          |

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| G05B 2219/50139 | . . . | Calibration, setting tool after measurement on tool                              |
| G05B 2219/50141 | . . . | Setup tool, preset   |
| G05B 2219/50142 | . . . | Measure parallelism of tool with respect to plane and correct                    |
| G05B 2219/50143 | . . . | Tool set up integrated, automatically transferred into control system            |
| G05B 2219/50144 | . . . | offline setup by simulation of process, during machining, forming of other piece |
| G05B 2219/50145 | . . . | Tool setup manual, preset of the machine   |
| G05B 2219/50146 | . . . | Machine construction error compensation using ann                                |
| G05B 2219/50147 | . . . | Calibrate tool heads based on calibration of first tool head                     |
| G05B 2219/50148 | . . . | Workpiece, setup of component, workpiece   |
| G05B 2219/50149 | . . . | Find orientation workpiece which maximizes number of faces machined in one setup |
| G05B 2219/50151 | . . . | Orient, translate, align workpiece to fit position assumed in program            |
| G05B 2219/50152 | . . . | Align axis cylinder, tube with rotation axis machine                             |
| G05B 2219/50153 | . . . | Mount machining unit on workpiece, move unit on it                               |
| G05B 2219/50154 | . . . | Milling center   |
| G05B 2219/50155 | . . . | Swivel spindle head horizontally   |
| G05B 2219/50156 | . . . | Tiltable rotary table  |
| G05B 2219/50157 | . . . | Universal swivel spindle head, swivel in all directions                          |
| G05B 2219/50158 | . . . | Modular structure  |
| G05B 2219/50159 | . . . | Steady rest  |
| G05B 2219/50161 | . . . | Reverse engineering, cloning   |
| G05B 2219/50162 | . . . | Stewart platform, hexapod construction   |
| G05B 2219/50163 | . . . | Machine stations and control modules build as a unity to be connected in line    |
| G05B 2219/50164 | . . . | Select a structure to make programming of free curved surface easier             |
| G05B 2219/50165 | . . . | Axis nc machine cooperates with two axis rotary table                            |
| G05B 2219/50166 | . . . | Extended range, machine a workpiece over a long distance                         |
| G05B 2219/50167 | . . . | Adapting to copying  |
| G05B 2219/50168 | . . . | Retrofitting   |
| G05B 2219/50169 | . . . | Double stewart platform  |
| G05B 2219/50171 | . . . | Machine, machining centre, center  |
| G05B 2219/50172 | . . . | Tool holder is transparent   |
| G05B 2219/50173 | . . . | Machine tool hang and move on rail above workpiece                               |
| G05B 2219/50174 | . . . | Machine tool y-1, y-2, z, A-axis, table x, c-axis                                |
| G05B 2219/50175 | . . . | 6-Dof manipulator associated with 1-DOF workpiece holder                         |
| G05B 2219/50176 | . . . | Table, general, for machine tool   |
| G05B 2219/50177 | . . . | Protection for operator during operation, machining                              |
| G05B 2219/50178 | . . . | Clamp, brake gravity axis on power loss to clamp tool in position                |
| G05B 2219/50179 | . . . | Dynamic tolerance, limit values as function of speed, type of command            |
| G05B 2219/50181 | . . . | After stopping apply additionally a brake  |



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| G05B 2219/50182 | . . . | Skip over pieces between machining and measuring station, on tool changing        |
| G05B 2219/50183 | . . . | Detect correct clamping of workpiece, chucks grip properly workpiece              |
| G05B 2219/50184 | . . . | Stop feed if relative movement between drive and tool                             |
| G05B 2219/50185 | . . . | Monitoring, detect failures, control of efficiency of machine, tool life          |
| G05B 2219/50186 | . . . | Diagnostic of spindle bearing   |
| G05B 2219/50187 | . . . | Stop drive motor if clutch refuses, remains active, if emergency                  |
| G05B 2219/50188 | . . . | If operation, feed movement not done after maximum allowable time, emergency stop |
| G05B 2219/50189 | . . . | Compare position of slide with positioning, tape data                             |
| G05B 2219/50191 | . . . | Against noise   |
| G05B 2219/50192 | . . . | If braking fails due to controller or amplifier fault, separate delayed braking   |
| G05B 2219/50193 | . . . | Safety in general   |
| G05B 2219/50194 | . . . | Before restarting machine, enter allowable, maximum speed corresponding to tool   |
| G05B 2219/50195 | . . . | Emergency stop stops drives and spindle, stored program remains in memory         |
| G05B 2219/50196 | . . . | Monitor clutch or belt drive  |
| G05B 2219/50197 | . . . | Signature analysis, store working conditions, compare with actual                 |
| G05B 2219/50198 | . . . | Emergency stop  |
| G05B 2219/50199 | . . . | Tool, nozzle is covered for protection in home position, if needed also heated    |
| G05B 2219/50201 | . . . | Tool loses contact with workpiece, alarm if no cut through operation              |
| G05B 2219/50202 | . . . | During movement of tool towards workpiece, shut down rotation, welding gun        |
| G05B 2219/50203 | . . . | Tool, monitor condition tool  |
| G05B 2219/50204 | . . . | Tool replacement point, tool change position without damage, clearance plane      |
| G05B 2219/50205 | . . . | On tool breakage stop machine   |
| G05B 2219/50206 | . . . | Tool monitoring integrated in nc control  |
| G05B 2219/50207 | . . . | Surface finish  |
| G05B 2219/50208 | . . . | Retrace, remachine portion of path, locus to remove start discontinuities         |
| G05B 2219/50209 | . . . | Surface treatment, roughing surface   |
| G05B 2219/50211 | . . . | Finish machining, spark out, rough out  |
| G05B 2219/50212 | . . . | Giving a texture, structure to surface, like leather, wood appearance             |
| G05B 2219/50213 | . . . | Grooving of different forms or parallel to each other, grooving cycle             |
| G05B 2219/50214 | . . . | Refurbish, refinish, reprofile, recondition, restore, rebuild profile             |
| G05B 2219/50215 | . . . | Move synchronously tool and anvil at both sides of plate                          |
| G05B 2219/50216 | . . . | Synchronize speed and position of several axis, spindles                          |
| G05B 2219/50217 | . . . | Synchronize, control phase angle of two spindles by auxiliary index motor         |
| G05B 2219/50218 | . . . | Synchronize groups of axis, spindles  |



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| G05B 2219/50219 | . . . | Slave spindle is driven at half the torque of main spindle for synchronism         |
| G05B 2219/50221 | . . . | Switch speed reference from speed to position loop of both spindles to synchronize |
| G05B 2219/50222 | . . . | Stop machines, actuators until others reach common synchronization point           |
| G05B 2219/50223 | . . . | Loose synchronisation, can shift within time interval                              |
| G05B 2219/50224 | . . . | Synchronize feed and spindle speed during slow down, stopping                      |
| G05B 2219/50225 | . . . | Synchronize feed and spindle speed as function of pitch of screw, thread           |
| G05B 2219/50226 | . . . | Synchronize feed and spindle speed in forward and reverse feed                     |
| G05B 2219/50227 | . . . | Synchronize two axis by correcting for measured pitch errors                       |
| G05B 2219/50228 | . . . | Synchronize two slides, portal gantry, raising, moving                             |
| G05B 2219/50229 | . . . | Synchronize axis by simulating several virtual axis to control real axis           |
| G05B 2219/50231 | . . . | Synchronize engage, disengage groups of axis as function of position of simulate   |
| G05B 2219/50232 | . . . | Synchronize change of feed and spindle speed when overriding feed speed            |
| G05B 2219/50233 | . . . | Synchronize time-dependent with electronic cam data                                |
| G05B 2219/50234 | . . . | Synchronize two spindles, axis, electronic transmission, line shafting             |
| G05B 2219/50235 | . . . | Select tools, slides, spindles to work synchronized, independent                   |
| G05B 2219/50236 | . . . | Tool editor for actual used tools and needed next, missing, unused tools           |
| G05B 2219/50237 | . . . | Detect wear by comparing coded value on tool with real value, grind tool           |
| G05B 2219/50238 | . . . | Search empty place in changer to place tool  |
| G05B 2219/50239 | . . . | Select tool manual from tool store, with permission from NC to deblock tool        |
| G05B 2219/50241 | . . . | Chuck, gripper, spindle changer  |
| G05B 2219/50242 | . . . | Tool changer and revolver fixed on spindle   |
| G05B 2219/50243 | . . . | Small buffer tool magazine, ordered tools, filled from large magazine, change time |
| G05B 2219/50244 | . . . | Machine integrated tool cassette   |
| G05B 2219/50245 | . . . | Change tools, like laser head and drill having different driving needs             |
| G05B 2219/50246 | . . . | Workpiece exchange   |
| G05B 2219/50247 | . . . | Change to finer, more adapted tools to machine complex surface                     |
| G05B 2219/50248 | . . . | Control position of coolant nozzle as function of selected tool                    |
| G05B 2219/50249 | . . . | Tool, probe, pen changer   |
| G05B 2219/50251 | . . . | Mobile tool magazine to replace spare or rarely used tool                          |
| G05B 2219/50252 | . . . | Replace, change tool with tracer head, probe, feeler                               |
| G05B 2219/50253 | . . . | Selection tool   |
| G05B 2219/50254 | . . . | Change feeler or tool on different curvature of workpiece, model                   |
| G05B 2219/50255 | . . . | Tool selection sets speed machining, kind of cooling, other parameter              |
| G05B 2219/50256 | . . . | Orienting selected tool with respect to workpiece                                  |
| G05B 2219/50257 | . . . | Kind of revolver magazine  |
| G05B 2219/50258 | . . . | Chain magazine   |

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| G05B 2219/50259 | . . . | Flat bed magazine   |
| G05B 2219/50261 | . . . | Two tool holders to eliminate tool change time, replace and search simultaneously                 |
| G05B 2219/50262 | . . . | Change tool at minimum distance from workpiece  |
| G05B 2219/50263 | . . . | Standby tool, tool ready for next machining step, change tool while machining                     |
| G05B 2219/50264 | . . . | Change tool during positioning movement   |
| G05B 2219/50265 | . . . | If tool life over, continue machining only actual block, workability, then stop                   |
| G05B 2219/50266 | . . . | During tool change, workpiece immobile, then execute backward operation sequence                  |
| G05B 2219/50267 | . . . | Change tool and workpiece simultaneously, except if collision possible                            |
| G05B 2219/50268 | . . . | Measure diameter only if new tool has been inserted   |
| G05B 2219/50269 | . . . | Minimize tool change by selecting appropriate fixture   |
| G05B 2219/50271 | . . . | Select second tool if first tool cannot machine workpiece without moving it                       |
| G05B 2219/50272 | . . . | Change spare, used tool during machining, minimize machining time                                 |
| G05B 2219/50273 | . . . | Before motor start of spindle with new tool, detect if old tool back in storage                   |
| G05B 2219/50274 | . . . | Measure new tool inserted by operator, compare with diameter needed to accept                     |
| G05B 2219/50275 | . . . | Safety, verify correct code of chosen tool, probe   |
| G05B 2219/50276 | . . . | Detect wear or defect tool, breakage and change tool  |
| G05B 2219/50277 | . . . | Detection tool presence in tool holder, spindle before starting motor                             |
| G05B 2219/50278 | . . . | Send offset values from tool changer before machining   |
| G05B 2219/50279 | . . . | Adjust displacement amount of tracer as function of rough, finish machining                       |
| G05B 2219/50281 | . . . | Adjust tool for tool offset by using an axis parallel to feed axis                                |
| G05B 2219/50282 | . . . | Tool offset as function of cutting depth  |
| G05B 2219/50283 | . . . | Tool offset for two different diameters, smoothing  |
| G05B 2219/50284 | . . . | Tool nose correction  |
| G05B 2219/50285 | . . . | Tool geometry compensation, keep contact of tool on desired curve                                 |
| G05B 2219/50286 | . . . | Fine adjustment tool head, adjustment with respect to toolholder                                  |
| G05B 2219/50287 | . . . | Tool offset as function of diameter of saw, for begin and end point of path                       |
| G05B 2219/50288 | . . . | Compensate tool offset as function of speed, needed when tool is not mounted correctly in spindle |
| G05B 2219/50289 | . . . | Tool offset general   |
| G05B 2219/50291 | . . . | Multi-tool, several tools   |
| G05B 2219/50292 | . . . | Tool offset based on two cutter contact points, admitting some overcut                            |
| G05B 2219/50293 | . . . | Radial setting of tool  |
| G05B 2219/50294 | . . . | Tool offset length by going to a reference and recording distance                                 |
| G05B 2219/50295 | . . . | Tool offset by manual input by switches   |
| G05B 2219/50296 | . . . | Tool offset by verifying piece and registering errors   |

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| G05B 2219/50297 | . . . | Compensation of positioning error due to a-axis, b-axis tool rotation        |
| G05B 2219/50298 | . . . | Trace with feelers of different diameter, from the two loci calculate offset |
| G05B 2219/50299 | . . . | Correction data stored in memory attached to tool or tool holder             |
| G05B 2219/50301 | . . . | Correction stored on tape, together with tool identification                 |
| G05B 2219/50302 | . . . | Remachine same workpiece with same tool but diminished tool offset           |
| G05B 2219/50303 | . . . | Resolver   |
| G05B 2219/50304 | . . . | Correction from tape, file   |
| G05B 2219/50305 | . . . | For every diameter a tape  |
| G05B 2219/50306 | . . . | Tool height, axial displacement from center of circular workpiece, surface   |
| G05B 2219/50307 | . . . | Correction by probing dimension of machined workpiece                        |
| G05B 2219/50308 | . . . | Estimate wear from machining data and conditions                             |
| G05B 2219/50309 | . . . | Correction of wear as function of dressing                                   |
| G05B 2219/50311 | . . . | Compensate tool wear by grinding tool to a known position                    |
| G05B 2219/50312 | . . . | Compensation of tool wear by adapting program to profile of tool             |
| G05B 2219/50313 | . . . | Tool offset, tool wear   |
| G05B 2219/50314 | . . . | Search for reference, go to reference  |
| G05B 2219/50315 | . . . | Selfcorrecting by measurement during machining                               |
| G05B 2219/50316 | . . . | Calculate as function of empirical calculated values from used tools         |
| G05B 2219/50317 | . . . | As function of number of workpieces  |
| G05B 2219/50318 | . . . | As function of number of cutting edges of saw, mill                          |
| G05B 2219/50319 | . . . | As function of tool geometry and machining data                              |
| G05B 2219/50321 | . . . | As function of machined volume per time unit                                 |
| G05B 2219/50322 | . . . | As function of effective machining time                                      |
| G05B 2219/50323 | . . . | As function of tool type   |
| G05B 2219/50324 | . . . | As function of coolant   |
| G05B 2219/50325 | . . . | As function of measured vibrations   |
| G05B 2219/50326 | . . . | As function of feed forces   |
| G05B 2219/50327 | . . . | As function of cutting forces  |
| G05B 2219/50328 | . . . | As function of motor spindle load, current                                   |
| G05B 2219/50329 | . . . | Tool offset for pockets, area machining avoiding interference with wall      |
| G05B 2219/50331 | . . . | Electrode, wire gap compensation in edm, wire cutting                        |
| G05B 2219/50332 | . . . | Tool offset for 3-D surfaces normal to surface                               |
| G05B 2219/50333 | . . . | Temperature  |
| G05B 2219/50334 | . . . | Tool offset, diameter correction   |
| G05B 2219/50335 | . . . | Tool offset for straight lines   |
| G05B 2219/50336 | . . . | Tool, probe offset for curves, surfaces, contouring                          |
| G05B 2219/50337 | . . . | Tool offset for point  |
| G05B 2219/50338 | . . . | Tool with rom chip   |
| G05B 2219/50339 | . . . | Select machining portion of tool according to surface of work                |
| G05B 2219/50341 | . . . | Tool with right and left nose value, different radius                        |

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| G05B 2219/50342 | . . . | Use two tools with different diameter   |
| G05B 2219/50343 | . . . | Ball end tool, end is spherical   |
| G05B 2219/50344 | . . . | Flat end tool, end is flat  |
| G05B 2219/50345 | . . . | Bull nose tool, end is practical flat with rounded corners                        |
| G05B 2219/50346 | . . . | Ion ray   |
| G05B 2219/50347 | . . . | Tool sends via electromagnetic waves actual working condition                     |
| G05B 2219/50348 | . . . | Deform tool to adapt to workpiece, bow tool with pressure                         |
| G05B 2219/50349 | . . . | Obtain normal vector of two points on surface, interpolate in between             |
| G05B 2219/50351 | . . . | Rotate cutting tool to vary cutting tool geometry                                 |
| G05B 2219/50352 | . . . | Inclination of tool as function of diameter of workpiece                          |
| G05B 2219/50353 | . . . | Tool, probe inclination, orientation to surface, posture, attitude                |
| G05B 2219/50354 | . . . | If tool loses contact, change angle of tool with 90-degrees                       |
| G05B 2219/50355 | . . . | Tool perpendicular to a 2-D curve   |
| G05B 2219/50356 | . . . | Tool perpendicular, normal to 3-D surface   |
| G05B 2219/50357 | . . . | Tool tangential to path or surface  |
| G05B 2219/50358 | . . . | Work handling, automatic load unload workpiece                                    |
| G05B 2219/50359 | . . . | Rotate workpiece pallet, workpieces on it, machine and load simultaneous          |
| G05B 2219/50361 | . . . | Translatory workpiece pallet, translate between two stations                      |
| G05B 2219/50362 | . . . | Load unload with robot  |
| G05B 2219/50363 | . . . | Load unload with two robots, one to load, other to unload                         |
| G05B 2219/50364 | . . . | Buffer for workpieces, pallets, trays with articles                               |
| G05B 2219/50365 | . . . | Convey workpiece downwards on pallet, to machine rotate upwards                   |
| G05B 2219/50366 | . . . | Work handling with changeable hands   |
| G05B 2219/50367 | . . . | Several workpiece holders in a single cell  |
| G05B 2219/50368 | . . . | Pallet with autonomous control unit   |
| G05B 2219/50369 | . . . | Display empty supply or discharge pallet  |
| G05B 2219/50371 | . . . | Index table holds same number of load and unload cups, alternative                |
| G05B 2219/50372 | . . . | Load pallets manually, with visual instruction assistance                         |
| G05B 2219/50373 | . . . | If pallet is not loaded conforming to instruction, warning                        |
| G05B 2219/50374 | . . . | Cylindrical workpiece holder, for each workpiece a separate tool slide            |
| G05B 2219/50375 | . . . | Reject or reload workpiece if misaligned, excessive error in location             |
| G05B 2219/50376 | . . . | Workholder receives also parts to be assembled with work                          |
| G05B 2219/50377 | . . . | Two robots with common workbase slides in unison along pallets                    |
| G05B 2219/50378 | . . . | Control height gripper as function of thickness of workpiece and height of pallet |
| G05B 2219/50379 | . . . | Workpiece detector, sensor  |
| G05B 2219/50381 | . . . | Load, unload workpiece while machining other one, dual table machine              |
| G05B 2219/50382 | . . . | Position claws of first chuck relative to second chuck, to grip small workpiece   |

|                                 |   |   |   |   |
|---------------------------------|---|---|---|---|
| <a href="#">G05B 2219/50383</a> | . | . | . | Bar feeder applies torque to compensate bending of workpiece during machining |
| <a href="#">G05B 2219/50384</a> | . | . | . | Modular, exchangeable parts feeder  |
| <a href="#">G05B 2219/50385</a> | . | . | . | Fast forward in idle time   |
| <a href="#">G05B 2219/50386</a> | . | . | . | Feeder, feeding of workpiece, bar   |
| <a href="#">G05B 2219/50387</a> | . | . | . | Two chucks, grippers, feeder bar, transfer workpiece from one to other        |
| <a href="#">G05B 2219/50388</a> | . | . | . | Integrated loader, shuttle transfer   |
| <a href="#">G05B 2219/50389</a> | . | . | . | Gantry loader   |
| <a href="#">G05B 2219/50391</a> | . | . | . | Robot   |
| <a href="#">G05B 2219/50392</a> | . | . | . | Overhead conveyor   |
| <a href="#">G05B 2219/50393</a> | . | . | . | Floor conveyor, AGV automatic guided vehicle                                  |
| <a href="#">G05B 2219/50394</a> | . | . | . | Bulk hopper   |
| <a href="#">G05B 2219/50395</a> | . | . | . | Pallet magazines, transport dollies   |
| <a href="#">G05B 2219/50396</a> | . | . | . | Gantry loader with two grippers, one always empty                             |
| <a href="#">G05B 2219/50397</a> | . | . | . | Two conveyors transporting together a workpiece to station                    |
| <a href="#">G05B 2219/50398</a> | . | . | . | For a single machine  |
| <a href="#">G05B 2219/50399</a> | . | . | . | Between machines  |
| <a href="#">G05B 2219/50401</a> | . | . | . | In line work storage system   |