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)

Definition statement

This place covers:

Features of control systems or elements for regulating specific variables, which are clearly more generally applicable to any system.

Relationships with other classification places

In this subclass, details or specific control systems are classified in the group relevant to that system, if not otherwise provided for.

References

Limiting references

This place does not cover:

Systems for controlling or regulating non-electric variables	G05D
Systems for regulating electric or magnetic variables	G05F
Control systems characterised by mechanical features only	G05G

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

adjustable operating tables, operating chairs or dental chairs	A61G 15/02
positioning tool carriers for forging, pressing or hammering	B21K 31/00
pressure or injection die casting of metals	B22D 17/32
tool or work positioning for boring or drilling	B23B 39/26
machines for shearing or similar cutting stock travelling otherwise than in the direction of the cut	B23D 36/00
driving or feeding mechanisms of machine tools	B23Q 5/00
feed movement, cutting velocity or position of machine tools	B23Q 15/00
position of grinding tool or work	B24B 47/22
manipulators	B25J 13/00
copying from a pattern or master model for machine tools	**B25Q35/00**
position of cutters in cutting machines	B26D 5/02
shaping techniques for plastic substances	B29C 51/00
presses	B30B 15/16
composing machines	B41B 27/00

printing machines or presses	B41F 33/00
feeding sheets or webs in typewriters	B41J 11/42
apparatus or devices for manifolding, duplicating or printing for commercial purposes	B41L 39/00
addressing machines	B41L 47/56
vehicle suspension	B60G 21/00
vehicle brakes	B60T 15/00
conjoint control of vehicle sub-units	B60W
machines for packaging	B65B 57/00
conveyors	B65G 43/00
sequence of drive operations for dredging or soil-shifting	E02F 3/43
earth drilling operations	E21B 44/00
steam accumulators	F01K 1/16
steam engine plants	F01K 13/02
air intakes for gas-turbine or jet-propulsion plants	F02C 7/05
gas-turbine plants; fuel supply in air-breathing jet-propulsion plants	F02C 9/00
combustion engines	F02D
jet pipes or nozzles in jet-propulsion plants	F02K 1/76
jet-propulsion plants	F02K 9/00
positive-displacement machines	F04B 49/00
non-positive displacement pumps, pumping installations or systems	F04D 27/00
external control of clutches	F16D 48/00
suppression of vibrations using fluid means	F16F 15/02
control of gearings	F16H 61/00
steam boilers	F22B 35/00
incineration of waste	F23G 5/50
combustion in combustion apparatus	F23N
combustion in open fires using solid fuel	F24B 1/18
solar heating	F24J 2/40
drying processes of solid materials or objects	F26B 25/22
steam or vapour condensers	F28B 11/00
heat-exchange apparatus with intermediate heat-transfer medium in closed tubes passing into or through conduit walls, in which the medium condenses and evaporates	F28D 15/06
heat-exchanges or heat-transfer apparatus in general	F28F 27/00
measurement in general	G01
computers	G06F 11/00
traffic	G08G
indicating devices using static means to present variable information	G09G
driving, starting or stopping of record carriers	G11B 19/00

nuclear reaction	G21C 7/00
nuclear-power plant	G21D 3/00
electron-beam or ion-beam tubes used for localised treatment of objects	H01J 37/30
Processes or apparatus adapted for the manufacture or treatment of semiconductor or solid state devices	H01L 21/00
Circuit arrangements for ac mains or ac distribution networks	H02J 3/00
electric motors, generators, or dynamo-electric converters	H02P

Informative references

Attention is drawn to the following places, which may be of interest for search:

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,
Correcting units, see the appropriate subclass, e.g.	H02K

Glossary of terms

In this place, the following terms or expressions are used with the meaning 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"

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

NC	Numerical Controller
PLC	Programmable Logic Controller

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)

Definition statement

This place covers:

Structural elements used to compare the actual with the desired value of a variable that needs to be controlled in a control or regulation system.

Relationships with other classification places

The actual measurement of a signal should be classified in the appropriate class of G01.

References

Limiting references

This place does not cover:

comparing phase or frequency of two electric signals	H03D 13/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

actual value	the measured or estimated value of the variable to be controlled
reference	the desired value of the variable being controlled
error	the difference between the actual value of a variable and the reference

G05B 5/00

Anti-hunting arrangements

Definition statement

This place covers:

Arrangements in a control or regulation system to avoid a "hunting" effect.

The "hunting" effect appears when a lag between the actual value and the reference of a variable to be controlled leads to overcompensation of the error and/or unstable behaviour of the system being controlled.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

overswing, overshoot	situation in which the error between the actual and desired values of a variable is overcompensated
damping	technique used to reduce or eliminate the overcompensation of an error

G05B 6/00

Internal feed-back arrangements for obtaining particular characteristics, e.g. proportional, integral, differential (in automatic controllers G05B 11/00)

Definition statement

This place covers:

Internal feed-back arrangements for obtaining particular characteristics, e.g. proportional, integral, differential

References

Limiting references

This place does not cover:

P, PI and PID responses in automatic controllers	G05B 11/00

G05B 7/00

Arrangements for obtaining smooth engagement or disengagement of automatic control

Definition statement

This place covers:

Systems with several controller modes or phases, in which the problem is related to switching between controller modes without provoking unnecessary oscillations or instability in the response of the system.

One of these modes or phases could be the absence of control, and then the problem would be related to obtaining a smooth response of the system during a starting transition.

References

Limiting references

This place does not cover:

smooth engagement of gears in automatic transmission systems	F16H 61/04

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

switchover	change from a first control mode to a second control mode

G05B 9/00

Safety arrangements (G05B 7/00 takes precedence; safety arrangements in programme-control systems G05B 19/048, G05B 19/406; safety valves F16K 17/00; emergency protective circuit arrangements in general H02H)

Definition statement

This place covers:

Arrangements to assure the correct working of a control system in case of failure, for example, redundant control systems.

Arrangements to prevent damage to personnel or to equipment as a result of the control action.

Relationships with other classification places

Group G05B 9/00 covers the safety aspects of the control of a system, not of the system as such. This means that aspects related to the safe use of a product or device should be classified in the corresponding application places, unless it involves decisions related to the control of the process, product or device, in which case this group would be the appropriate one.

References

Limiting references

This place does not cover:

anti-hunting arrangements	G05B 5/00
arrangements for obtaining smooth engagement or disengagement of automatic control	G05B 7/00
safety arrangements in programme-control systems other than numerical control	G05B 19/0428
safety arrangements in programme-control systems	G05B 19/048
safety arrangements in programme-control systems using programmable logic controllers (PLC)	G05B 19/058
safety arrangements in numerical control systems (NC)	G05B 19/406
monitoring of control system, i.e. detection of failures in the control action and response to those failures	G05B 23/00
emergency protective circuit arrangements in general	H02H

Informative references

Attention is drawn to the following places, which may be of interest for search:

safety for robotic manipulators	B25J 9/1674
safety valves	F16K 17/00
safety devices acting in conjunction with the control or operation of a machine	F16P 3/00
light barriers for detection of intrusion of a machine in a safety zone	G01V 8/10

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

intrinsic safety	safe operation of control in explosive or hazardous environments

G05B 11/00

Automatic controllers (G05B 13/00 takes precedence)

Definition statement

This place covers:

Non-adaptive automatic controllers, i.e., the controller does not adjust itself as a result of the system response to its control action.

References

Limiting references

This place does not cover:

adaptive control systems	G05B 13/00
programme-control systems	G05B 19/00

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)

Definition statement

This place covers:

Adaptive automatic controllers, i.e., the controller adjusts itself as a result of the system response to its control action, in order to obtain an optimum performance according to some criterion.

References

Limiting references

This place does not cover:

programme-control systems	G05B 19/00
learning machines in digital computing systems when not applied to control	G06F 15/18

Informative references

Attention is drawn to the following places, which may be of interest for search:

creation of a mathematical model of the system to be controlled	G05B 17/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

knowledge base	a set of representations of facts about the system to be controlled and its environment
knowledge-based agent	a software module that uses a knowledge base to implement control decisions
expert system	a type of intelligent control system which can emulate the reasoning procedures of a human expert in order to generate the necessary control action
learning sytem	an automatic control in which the nature of control parameters and algorithms is modified by the actual experience of the system

G05B 13/04

involving the use of models or simulators

Special rules of classification

This subgroup should be used when the key concept stresses or deals with the adaptive part of the control, whereas G05B 17/00 should be used when the emphasis is on the control model.

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)

Definition statement

This place covers:

Systems controlled by a computer not provided by other classes.

Control of whole Building Automation Systems as e.g. domotics.

References

Limiting references

This place does not cover:

If the control relates to a specific application, then it should be classified in the proper application or control classes

automatic controllers	G05B 11/00
adaptive control systems	G05B 13/00
programme-control systems	G05B 19/00
computers per se	G06

Informative references

Attention is drawn to the following places, which may be of interest for search:

control of air-conditioning and HVACs	F24F 11/00
home automation networks	H04L 12/2803
control of lighting	H05B 37/02

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)

Definition statement

This place covers:

Use of a model or simulator to control a system.

Use of detailed representations of real systems to facilitate control of a system.

Creation and adaptation of the mathematical model used to control a system.

References

Limiting references

This place does not cover:

analogue computers for specific processes, systems, or devices, e.g. simulators	G06G 7/48

Informative references

Attention is drawn to the following places, which may be of interest for search:

adaptive control systems	G05B 13/00
systems controlled by a computer	G05B 15/00
programme-control systems	G05B 19/00

Special rules of classification

Documents to be classified in G05B 17/00 should be those in which the model of the controlled system is the key concept. For example, creating or adapting the model, and not the control of a system to be controlled, Hardware/Software-in-Loop systems, e.g. connection of a controller to a computer that simulates a machine such as a car, manufacturing machine. G05B 13/04 should be used when the key concept stresses or deals with the adaptive part of the control.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

first-principles knowledge	a fundamental understanding of the process or system to be controlled, expressed in the form of a mathematical model

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)

Definition statement

This place covers:

Programme control in sequence or logic controllers, e.g. simulating logic interconnections of signals according to ladder diagrams or function charts.

Programme control in controllers using digital processors, or using logic state machines, or using cams, discs, rods, drums, or where the programme is defined in the fixed connection of electrical elements, e.g. potentiometers, counters, transistors, or using plugboards, cross-bar distributors, matrix switches, or using selector switches or using record carriers.

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

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)

Recording and playback 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

References

Limiting references

This place does not cover:

Programme-control of manipulators	B25J 9/16
CAD system	G06F 17/50
Control of speed of electric motors	H02P

Informative references

Attention is drawn to the following places, which may be of interest for search:

domestic washing or cleaning	A47L 15/00
programmed medicine dispensers	A61J 7/04
disinfection or sterilising	A61L 2/24
heart pace-makers	A61N 1/36
centrifuges	B04B 13/00
thickness of work produced by metal-rolling mills	B21B 37/24
bending metal rods, profiles, or tubes	B21D 7/12
boring or drilling machines	B23B 39/08, B23B 39/24
electrical discharge or electromechanical machining	B23H 7/20
assembling of parts to compose units	B23P 21/00
series of individual steps in grinding a workpiece	B24B 51/00
manipulators	B25J 9/00
presses	B30B 15/26
sequence of operations in printing machines or presses	B41F 33/16
feeding sheets or webs in typewriters	B41J 11/44
sequence of operations in apparatus or devices for manifolding, duplicating or printing for commercial purposes	B41L 39/16
selecting text or image to be printed in addressing machines	B41L 47/64
traction motor speed of electrically-propelled vehicles	B60L 15/20
piling articles	B65H 31/24
crane drives	B66C 13/48, B66C 23/58
dispensing, delivering or transferring liquids	B67D 7/14
sewing machines	D05B 19/00, D05B 21/00
embroidering machines	D05C 5/04
operations in washing machines	D06F 33/00

combustion engines	F02D 27/02, F02D 28/00
supply of combustible mixture or its constituents to combustion engines	F02D 41/26
fluid-pressure actuator systems	F15B 21/02
combustion in combustion apparatus	F23N 5/20, F23N 5/22
weighing apparatus	G01G 19/38
electromechanical clocks or watches	G04C 23/08, G04C 23/34
mechanically operating digital computers	G06C 21/00
control units for electric digital data processing	G06F 9/00
peripheral devices for electric digital data processing	G06F 13/10
electrically operating digital computers	G06F 15/00
electrically or magnetically operating analogue computers	G06G 7/06
Marking or sensing record carriers with digital information	G06K
electrically-operated teaching apparatus or devices	G09B 7/04, G09B 7/08, G09B 7/12
Information storage	G11
Clocks with attached or built-in means operating any device at a preselected time interval	H01H 43/00
electron-beam or ion-beam tubes used for localised treatment of objects	H01J 37/30
electronic switching or gating	H03K 17/296
selecting arrangements in electric communication technique	H04Q 3/54

Special rules of classification

The classification must be done using also the associated Indexing Code scheme.

Indexing Code orthogonal classification:

In addition to one or more symbols relating to the invention information, where appropriate, one or more Indexing Code symbols relating to orthogonal classification, i.e. covering aspects which are spanning over one or more groups, should be allocated. Classification in these indexing groups is optional but advisable.

G05B 2219/00 Program-control systems

relates to problems specific to groups from G05B 19/04 till G05B 19/42

G05B 2219/10 . Plc systems

relates to problems specific to programmable logic controllers only (G05B 19/05)

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

G05B 2219/12 . . Plc mp multi processor system

G05B 2219/13 . . Plc programming

G05B 2219/14 . . Plc safety

G05B 2219/15 . . Plc structure of the system

G05B 2219/16 . . Plc to applications

G05B 2219/20 . Pc systems

relates to problems specific to microprocessor-based controllers (except PLC), i.e. specific to groups from G05B 19/04 till G05B 19/16 (except G05B 19/05)

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

G05B 2219/12 . . Pc mp multi processor system

G05B 2219/13 . . Pc programming

G05B 2219/14 . . Pc safety

G05B 2219/15 . . Pc structure of the system

G05B 2219/16 . . Pc to applications

G05B 2219/30 . Nc systems

relates to problems specific to Numerical Control of machines (G05B 19/18 till G05B 19/42)

G05B 2219/31 . . Computer integrated manufacturing (G05B 19/418)

G05B 2219/33 . . NC Controller

G05B 2219/35 . . Input / Output

G05B 2219/37 . . Measuring problems

G05B 2219/39 . . Numerical Control of manipulators

G05B 2219/41 . . Servo-Controller

G05B 2219/43 . . Control of Speed in NC systems

G05B 2219/45 . . Special applications

G05B 21/00

Systems involving sampling of the variable controlled (G05B 13/00 - G05B 19/00 take precedence; transmission systems for measured values G08C; electronic switching or gating H03K 17/00)

Definition statement

This place covers:

Decision on the rate of sampling of the variable to be controlled.

Accurate sampling of the variable to be controlled by, for example, adding a timestamp to the signal.

References

Limiting references

This place does not cover:

electronic switching or gating	H03K 17/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

adaptive control systems	G05B 13/00
systems controlled by a computer	G05B 15/00
programme-control systems	G05B 19/00
transmission systems of control signals	G08C

G05B 23/00

Testing or monitoring of control systems or parts thereof (monitoring of programme-control systems G05B 19/048, G05B 19/406)

Definition statement

This place covers:

Detection of faults in the control of a process or device. A fault is a departure from an acceptable range of an observed variable or a calculated parameter associated with a process. Process fault detection comprises three main steps:

A. Configuration of a monitoring or supervisory system, when this system is used to monitor or test the control of a system.

B. Detection of an existing (usually called "diagnostics") or incipient (usually called "prognostics") fault in the control of a system.

C. Reaction to the detection of an existing or incipient fault in the control of a system.

Relationships with other classification places

Group G05B 23/00 covers the monitoring (or testing) of the control of a system, not of the system as such. This means that testing the quality of a process, product or device should be classified in the corresponding application classes, unless it involves decisions related to the control or monitoring of the process, product or device, in which case this group would be the appropriate one.

References

Limiting references

This place does not cover:

Monitoring of programme-control systems	G05B 19/048, G05B 19/406
monitoring tool breakage, life or condition, including wear of a machine tool	G05B 19/4065
data acquisition during manufacturing	G05B 19/4183
control of the quality of the end product in a manufacturing process	G05B 19/41875
process diagnostics in road vehicle drive control systems	B60W 50/00
safety or indicating devices for abnormal conditions	F02D 41/22
testing vehicle engines	G01M 15/00
testing of electronic circuits	G01R 31/28
testing dynamo-electric machines	G01R 31/34

generation of clock signal, power supply for computers (including related diagnostics and monitoring aspects)	G06F 1/00
detecting defective computer hardware, usually applied to computers used in an office, non-industrial environment	G06F 11/267
error detection concerning software (i.e. debugging) usually applied to computers used in an office, non-industrial environment	G06F 11/36
image analysis for industrial inspection or for determining position or orientation of objects	G06T 7/0002, G06T 7/004
error checking in memories	G11C 29/00
fault management of packet-switched data network or network elements	H04L 12/2419
monitoring/testing of packet-switched data network or network elements	H04L 12/2602, H04L 12/2697

Informative references

Attention is drawn to the following places, which may be of interest for search:

adaptation of model in model-based fault detection systems	G05B 17/02
Systems involving sampling of the variable controlled	G05B 21/02
registering or indicating the condition of working machines or other apparatus, i.e. testing whether the machine is in good condition	G07C 3/00
communication of monitoring information, if the problem is related only to the communication of that information	H04L 29/00

Special rules of classification

When classifying a document in group G05B 23/00, one should, as a general rule, avoid giving more than one classification in each subgroup; i.e. a maximum of one classification under G05B 23/0208, one classification under G05B 23/0218, and one classification under G05B 23/0259 should be assigned. Attention should be paid to which of the above-mentioned steps A-C is given detail and appropriate classification should be assigned for that step.

Only if the document deals with several aspects of a sub-group, then more than one class could be assigned, although in that case the classifier should consider whether assigning a more general class (even the sub-group) would better describe the document being classified.

Groups G05B 23/02 and G05B 23/0202 should no longer be used (these groups stopped being used on June 1st, 2011).

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

based on process history	in this methods, only the availability of large amount of historical process data is assumed, i.e. no fundamental understanding of the process is assumed.
diagnostics	this term can be ambiguous, as sometimes it will mean detection of a failure, and sometimes it will mean detection of cause or root of failure
fault detection	detection of both existing and incipient failures
fault isolation	estimation of cause or root of failure

model-based	a fundamental understanding of the process using first-principles knowledge, that is, an explicit or implicit relationship between the observations (symptoms) of a process and the faults.
prognostics	detection of an incipient failure
qualitative	rule based decisions; if-then relations between variables
quantitative	only mathematical relationships between the variables used in the fault detection and isolation

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

PCA	Principal Component Analysis
PLS	Partial Least Square
abnormal, failure, malfunction	fault

G05B 23/0208

{characterized by the configuration of the monitoring system}

Definition statement

This place covers:

Problems that deal with the configuration of a fault detection system previous to its application for detecting faults.

References

Limiting references

This place does not cover:

An important exception in this sub-group is the generation of a model of a system. As such a model is important for both control and monitoring, this kind of documents should be classified in G05B 17/02 (for general controls) or in G05B 13/04 (in case of adaptive controls).

G05B 23/0218

{characterised by the fault detection method dealing with either existing or incipient faults}

Definition statement

This place covers:

Preprocessing and preparation of observation values so that they may be used in the fault detection process.

Model based fault detection.

Process history based fault detection.

Injection of test monitoring signals and analysis of the control response.

Special rules of classification

This is the main problem dealt with in group G05B 23/00.

In case of doubt, i.e. a document so general that it does not give much detail about any problem, and if we are confident that the document belongs to G05B 23/00, then at least one class of this subgroup should be assigned to the document, preferably G05B 23/0224 or G05B 23/0243, as deciding whether the document deals with fault detection using a model of the system being monitored or process history of that system should be obvious.

G05B 23/0259

{characterized by the response to fault detection}

Definition statement

This place covers:

Confirmation of fault detection

Control of logging system used to store observation and/or fault values.

Communication of fault detection results to operators.

Fault Isolation and Identification.

Predictive Maintenance. This means monitoring the control of a system and, based on the results of this monitoring, adapting the maintenance schedule of the monitored process or device.

Modifications of the monitored process or device to prevent an incipient fault or to reduce the severity of an occurring fault.

Modifications of the monitoring system as a result of the fault detection.

References

Limiting references

This place does not cover:

repair maintenance, i.e. repairing a broken or failed process or system	appropriate application groups, such as:A47L 15/00, B23B 39/08, B23B 39/24, B25J 9/16, B60W 50/00, F02D 27/02, F02D 41/22, G01M 15/00, G01R 31/00, G05B 19/406, G06F 11/00
preventive maintenance, i.e. planning maintenance according to the available resources without monitoring the system	G06Q 10/06

G05B 24/00

Open-loop automatic control systems not otherwise provided for

References

Limiting references

This place does not cover:

open loop control of positioning, e.g. using step motors	G05B 19/40

G05B 99/00

Subject matter not provided for in other groups of this subclass

Definition statement

This place covers:

Subject matter not provided for in other groups of this subclass.