SECTION G — PHYSICS

G05 CONTROLLING; REGULATING

Note(s)

1. This class covers methods, systems, and apparatus for controlling, in general.
2. Attention is drawn to the Notes following the title of section G, especially as regards the definition of the term "variable".

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 subclasses, e.g. G12B, subclasses of G01, H01; correcting units, see the appropriate subclasses, e.g. H02K)

Note(s) [7]

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 :
   a. systems for controlling or regulating non-electric variables in general, which are covered by subclass G05D;
   b. systems for regulating electric or magnetic variables in general, which are covered by subclass G05F;
   c. systems specially adapted for the control of particular machines or apparatus provided for in a single other subclass, which are classified in the relevant subclass for such machines or apparatus, provided that there is specific provision for control or regulation relevant to the special adaptation. Otherwise, classification is made in the most appropriate place in this subclass.
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 of specific control systems are classified in the group relevant to the system, if not otherwise provided for.

Subclass index

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) **[1, 2006.01]**

1/01 • electric **[1, 2, 2006.01]**

1/02 • • for comparing analogue signals **[2, 2006.01]**

1/03 • • for comparing digital signals **[2, 2006.01]**

1/04 • • with sensing of the position of the pointer of a measuring instrument **[1, 2006.01]**

1/06 • • • continuous sensing **[1, 2006.01]**

1/08 • • • stepwise sensing **[1, 2006.01]**

1/11 • fluidic **[2, 2006.01]**

5/00 Anti-hunting arrangements [1, 2006.01]

5/01 • electric **[1, 2006.01]**

5/04 • fluidic **[2, 2006.01]**

6/00 Internal feedback arrangements for obtaining particular characteristics, e.g. proportional, integral, differential (in automatic controllers G05B 11/00) **[1, 2006.01]**

6/02 • electric **[1, 2006.01]**

6/05 • fluidic **[2, 2006.01]**

7/00 Arrangements for obtaining smooth engagement or disengagement of automatic control [1, 2006.01]

7/02 • electric **[2, 2006.01]**

7/04 • fluidic **[2, 2006.01]**

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) **[1, 2006.01]**

9/02 • electric **[1, 2006.01]**

9/03 • • with multiple-channel loop, i.e. redundant control systems **[2, 2006.01]**

9/05 • fluidic **[2, 2006.01]**

11/00 Automatic controllers (G05B 13/00 takes precedence) **[1, 2006.01]**

11/01 • electric **[1, 2006.01]**

11/06 • • in which the output signal represents a continuous function of the deviation from the desired value, i.e. continuous controllers (G05B 11/26 takes precedence) **[1, 2006.01]**

11/10 • • • the signal transmitted being dc **[1, 2006.01]**

11/12 • • • the signal transmitted being modulated on an ac carrier **[1, 2006.01]**

11/14 • • in which the output signal represents a discontinuous function of the deviation from the desired value, i.e. discontinuous controllers (G05B 11/26 takes precedence) **[1, 2006.01]**

11/16 • • • Two-step controllers, e.g. with on/off action **[1, 2006.01]**

11/18 • • • Multi-step controllers **[1, 2006.01]**

11/26 • • in which the output signal is a pulse-train **[1, 2006.01]**

11/28 • • • using pulse-height modulation; using pulse-width modulation **[1, 2006.01]**

11/30 • • • using pulse-frequency modulation **[1, 2006.01]**

11/32 • • with inputs from more than one sensing element; with outputs to more than one correcting element **[1, 2006.01]**

11/36 • • with provision for obtaining particular characteristics, e.g. proportional, integral, differential **[1, 2006.01]**

11/38 • • • for obtaining a proportional characteristic **[1, 2006.01]**

11/40 • • • for obtaining an integral characteristic **[1, 2006.01]**

11/42 • • • for obtaining a characteristic which is both proportional and time-dependent, e.g. P. I., P. I. D. **[1, 2006.01]**

11/44 • pneumatic only **[1, 2006.01]**

11/46 • • without auxiliary power **[1, 2006.01]**

11/48 • • with auxiliary power **[1, 2006.01]**

11/50 • • • in which the output signal represents a continuous function of the deviation from the desired value, i.e. continuous controllers **[1, 2006.01]**

11/52 • • • in which the output signal represents a discontinuous function of the deviation from the desired value, i.e. discontinuous controllers **[1, 2006.01]**

11/54 • • • • Two-step controllers, e.g. with on/off action **[1, 2006.01]**

11/56 • • • • Multi-step controllers **[1, 2006.01]**

11/58 • • with inputs from more than one sensing element; with outputs to more than one correcting element **[1, 2006.01]**

11/60 • hydraulic only **[1, 2006.01]**

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; machine learning G06N 20/00) **[1, 3, 2006.01]**

13/02 • electric **[1, 2006.01]**

13/04 • • involving the use of models or simulators **[3, 2006.01]**

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) **[1, 3, 2006.01]**

15/02 • electric **[1, 2006.01]**

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) **[1, 3, 2006.01]**

17/02 • electric **[1, 2006.01]**

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) **[1, 2006.01]**

19/02 • electric **[1, 2006.01]**

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) **[1, 2006.01]**

19/042 • • • using digital processors (G05B 19/05 takes precedence) **[6, 2006.01]**

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 **[6, 2006.01]**

19/048 • • • Monitoring; Safety **[6, 2006.01]**

19/05 • • • Programmable logic controllers, e.g. simulating logic interconnections of signals according to ladder diagrams or function charts **[5, 2006.01]**

19/06 • • • using cams, discs, rods, drums, or the like (mechanical programme-control apparatus G05G 21/00) **[1, 2006.01]**

19/07 • • • where the programme is defined in the fixed connection of electrical elements, e.g. potentiometers, counters, transistors **[6, 2006.01]**

19/08 • • • using plugboards, cross-bar distributors, matrix switches, or the like **[1, 2006.01]**

19/10 • • • using selector switches **[1, 2006.01]**

19/12 • • • using record carriers **[1, 2006.01]**

19/14 • • • • using punched cards or tapes **[1, 2006.01]**

19/16 • • • • using magnetic record carriers **[1, 2006.01]**

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) **[1, 6, 2006.01]**

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 **[3, 6, 2006.01]**

Note(s) [6]

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.

19/21 • • • • using an incremental digital measuring device **[3, 2006.01]**

19/23 • • • • • for point-to-point control **[3, 2006.01]**

19/25 • • • • • for continuous-path control **[3, 2006.01]**

19/27 • • • • using an absolute digital measuring device **[3, 2006.01]**

19/29 • • • • • for point-to-point control **[3, 2006.01]**

19/31 • • • • • for continuous-path control **[3, 2006.01]**

19/33 • • • • using an analogue measuring device **[3, 2006.01]**

19/35 • • • • • for point-to-point control **[3, 2006.01]**

19/37 • • • • • for continuous-path control **[3, 2006.01]**

19/39 • • • • using a combination of the means covered by at least two of the preceding groups G05B 19/21, G05B 19/27 and G05B 19/33 **[3, 2006.01]**

19/40 • • • • Open loop systems, e.g. using stepping motor **[1, 3, 2006.01]**

19/401 • • • characterised by control arrangements for measuring, e.g. calibration and initialisation, measuring workpiece for machining purposes (G05B 19/19 takes precedence) **[6, 2006.01]**

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 (G05B 19/19 takes precedence) **[6, 2006.01]**

19/404 • • • characterised by control arrangements for compensation, e.g. for backlash, overshoot, tool offset, tool wear, temperature, machine construction errors, load, inertia (G05B 19/19, G05B 19/41 take precedence) **[6, 2006.01]**

19/406 • • • characterised by monitoring or safety (G05B 19/19 takes precedence) **[6, 2006.01]**

19/4061 • • • • Avoiding collision or forbidden zones **[6, 2006.01]**

19/4062 • • • • Monitoring servoloop, e.g. overload of servomotor, loss of feedback or reference **[6, 2006.01]**

19/4063 • • • • Monitoring general control system (G05B 19/4062 takes precedence) **[6, 2006.01]**

19/4065 • • • • Monitoring tool breakage, life or condition **[6, 2006.01]**

19/4067 • • • • Restoring data or position after power failure or other interruption **[6, 2006.01]**

19/4068 • • • • Verifying part programme on screen, by drawing or other means **[6, 2006.01]**

19/4069 • • • • Simulating machining process on screen (G05B 19/4068 takes precedence) **[6, 2006.01]**

19/408 • • • characterised by data handling or data format, e.g. reading, buffering or conversion of data **[6, 2006.01]**

19/409 • • • characterised by using manual data 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) **[6, 2006.01]**

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 **[6, 2006.01]**

19/4097 • • • characterised by using design data to control NC machines, e.g. CAD/CAM (G05B 19/4093 takes precedence; CAD in general G06F 30/00) **[6, 2006.01]**

19/4099 • • • • Surface or curve machining, making 3D objects, e.g. desktop manufacturing **[6, 2006.01]**

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) **[3, 6, 2006.01]**

19/4103 • • • • Digital interpolation **[6, 2006.01]**

19/4105 • • • • Analog interpolation **[6, 2006.01]**

19/414 • • • Structure of the control system, e.g. common controller or multiprocessor systems, interface to servo, programmable interface controller **[6, 2006.01]**

19/4155 • • • characterised by programme execution, i.e. part programme or machine function execution, e.g. selection of a programme **[6, 2006.01]**

19/416 • • • characterised by control of velocity, acceleration or deceleration (G05B 19/19 takes precedence) **[6, 2006.01]**

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) **[6, 2006.01]**

19/42 • • 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 **[1, 2006.01]**

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) **[6, 2006.01]**

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 **[6, 2006.01]**

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 **[6, 2006.01]**

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) **[6, 2006.01]**

19/43 • fluidic **[3, 2006.01]**

19/44 • • pneumatic **[1, 3, 2006.01]**

19/46 • • hydraulic **[3, 2006.01]**

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) **[1, 2006.01]**

21/02 • electric **[1, 2006.01]**

23/00 Testing or monitoring of control systems or parts thereof (monitoring of programme-control systems G05B 19/048, G05B 19/406) **[1, 2006.01]**

23/02 • Electric testing or monitoring **[1, 2006.01]**

24/00 Open-loop automatic control systems not otherwise provided for [2, 2006.01]

24/02 • electric **[2, 2006.01]**

24/04 • fluidic **[2, 2006.01]**

99/00 Subject matter not provided for in other groups of this subclass [2006.01]

G05D SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES (for continuous casting of metals B22D 11/16; valves per se F16K; sensing non-electric variables, see the relevant subclasses of G01; for regulating electric or magnetic variables G05F)

Note(s) [7, 2006.01]

1. This subclass does not cover features of general applicability to regulating systems, e.g. anti-hunting arrangements, which are covered by subclass G05B.
2. In this subclass, the following term is used with the meaning indicated:
   - "systems" includes self-contained devices such as speed governors, pressure regulators.
3. Control systems specially adapted for particular apparatus, machines or processes are classified in the subclasses for the apparatus, machines or processes, provided that there is specific provision for control or regulation relevant to the special adaptation, either at a detailed level, e.g. A21B 1/40: "for regulating temperature in bakers' ovens", or at a general level, e.g. B23K 9/095: "for automatic control of welding parameters in arc welding". Otherwise, classification is made in the most appropriate place in this subclass.

Subclass index

1/00 Control of position, course, altitude, or attitude of land, water, air, or space vehicles, e.g. automatic pilot (radio navigation systems or analogous systems using other waves G01S) **[1, 2006.01]**

1/02 • Control of position or course in two dimensions **[1, 2, 2006.01, 2020.01]**

1/03 • • using near-field transmission systems, e.g. inductive-loop type **[1, 2006.01]**

1/04 • Control of altitude or depth **[1, 2006.01]**

1/06 • • Rate of change of altitude or depth **[1, 2006.01]**

1/08 • Control of attitude, i.e. control of roll, pitch, or yaw **[1, 2006.01]**

1/10 • Simultaneous control of position or course in three dimensions (G05D 1/12 takes precedence) **[1, 2006.01]**

1/12 • Target-seeking control **[1, 2006.01]**

3/00 Control of position or direction (G05D 1/00 takes precedence; for numerical control G05B 19/18) **[1, 2006.01]**

3/10 • without using feedback **[3, 2006.01]**

3/12 • using feedback **[3, 2006.01]**

3/14 • • using an analogue comparing device **[3, 2006.01]**

3/16 • • • whose output amplitude can only take a number of discrete values (G05D 3/18 takes precedence) **[3, 2006.01]**

3/18 • • • delivering a series of pulses **[3, 2006.01]**

3/20 • • using a digital comparing device **[3, 2006.01]**

5/00 Control of dimensions of material [1, 2006.01]

5/02 • of thickness, e.g. of rolled material **[1, 2006.01]**

5/03 • • characterised by the use of electric means **[1, 2006.01]**

5/04 • of the size of items, e.g. of particles **[1, 2006.01]**

5/06 • • characterised by the use of electric means **[1, 2006.01]**

7/00 Control of flow (level control G05D 9/00; ratio control G05D 11/00; weighing apparatus G01G) **[1, 2006.01]**

7/01 • without auxiliary power **[1, 2006.01]**

7/03 • with auxiliary non-electric power **[1, 2, 2006.01]**

7/06 • characterised by the use of electric means **[1, 2006.01]**

9/00 Level control, e.g. controlling quantity of material stored in vessel [1, 2006.01]

9/02 • without auxiliary power **[1, 2006.01]**

9/04 • with auxiliary non-electric power **[1, 2, 2006.01]**

9/12 • characterised by the use of electric means **[1, 2006.01]**

11/00 Control of flow ratio (control of chemical or physico-chemical variables, e.g. pH-value, G05D 21/00; humidity control G05D 22/00; control of viscosity G05D 24/00) **[1, 3, 2006.01]**

11/02 • Controlling ratio of two or more flows of fluid or fluent material **[1, 2006.01]**

11/03 • • without auxiliary power **[1, 2006.01]**

11/035 • • with auxiliary non-electric power **[1, 2, 2006.01]**

11/04 • • • by sensing weight of individual components, e.g. gravimetric procedure **[1, 2006.01]**

11/06 • • • by sensing density of mixture, e.g. using aerometer **[1, 2006.01]**

11/08 • • • by sensing concentration of mixture, e.g. by measuring pH-value **[1, 3, 2006.01]**

11/10 • • • • by sensing moisture of non-aqueous liquids **[1, 2006.01]**

11/12 • • • by sensing viscosity of mixture **[1, 2006.01]**

11/13 • • characterised by the use of electric means **[1, 2006.01]**

11/16 • Controlling mixing ratio of fluids having different temperatures, e.g. by sensing the temperature of a mixture of fluids having different viscosities **[1, 2006.01]**

13/00 Control of linear speed; Control of angular speed; Control of acceleration or deceleration, e.g. of a prime mover (synchronising telegraph receiver and transmitter H04L 7/00) **[1, 2006.01]**

13/02 • Details **[1, 2006.01]**

13/04 • • providing for emergency tripping of an engine in case of exceeding maximum speed **[1, 2006.01]**

13/06 • • providing for damping of erratic vibrations in governors **[1, 2006.01]**

13/08 • without auxiliary power **[1, 2006.01]**

13/10 • • Centrifugal governors with fly-weights **[1, 2006.01]**

13/12 • • • Details **[1, 2006.01]**

13/14 • • • • Fly-weights; Mountings thereof; Adjusting equipment for limits, e.g. temporarily **[1, 2006.01]**

13/16 • • • • Risers; Transmission gear therefor; Restoring mechanisms therefor **[1, 2006.01]**

13/18 • • • counterbalanced by spider springs acting immediately upon the fly-weights **[1, 2006.01]**

13/20 • • • counterbalanced by spider springs acting upon the articulated riser **[1, 2006.01]**

13/22 • • • counterbalanced by fluid pressure acting upon the articulated riser **[1, 2006.01]**

13/24 • • • counterbalanced by two or more different appliances acting simultaneously upon the riser, e.g. with both spring force and fluid pressure, with both spring force and electromagnetic force **[1, 2006.01]**

13/26 • • • with provision for modulating the degree of non-uniformity of speed **[1, 2006.01]**

13/28 • • • with provision for performing braking effects in case of increased speed **[1, 2006.01]**

13/30 • • Governors characterised by fluid features in which the speed of a shaft is converted into fluid pressure (transducers converting variations of physical quantities into fluid-pressure variations F15B 5/00) **[1, 2006.01]**

13/32 • • • using a pump **[1, 2006.01]**

13/34 • with auxiliary non-electric power (fluid-pressure converters F15B 3/00) **[1, 2, 2006.01]**

13/36 • • using regulating devices with proportional band, i.e. P. regulating devices **[1, 2006.01]**

13/38 • • • involving centrifugal governors of fly-weight type **[1, 2006.01]**

13/40 • • • involving centrifugal governors of pump type **[1, 2006.01]**

13/42 • • • involving fluid governors of flow-controller type, i.e. the width of liquid flow being controlled by fly-weights **[1, 2006.01]**

13/44 • • • involving fluid governors of jet type **[1, 2006.01]**

13/46 • • using regulating devices with proportional band and integral action, i.e. P.I. regulating devices **[1, 2006.01]**

13/48 • • • involving resilient restoring mechanisms **[1, 2006.01]**

13/50 • • • involving connecting means for superimposing a proportional regulating device and an integral regulating device **[1, 2006.01]**

13/52 • • using regulating devices with proportional band and derivative action, i.e. P.D. regulating devices **[1, 2006.01]**

13/54 • • • involving centrifugal governors of fly-weight type exerting an acceleratory effect **[1, 2006.01]**

13/56 • • • involving restoring mechanisms exerting a delay effect **[1, 2006.01]**

13/58 • • • involving means for connecting a speed-regulating device and an acceleration-regulating device **[1, 2006.01]**

13/60 • • using regulating devices with proportional band, derivative, and integral action, i.e. P.I.D. regulating devices **[1, 2006.01]**

13/62 • characterised by the use of electric means, e.g. use of a tachometric dynamo, use of a transducer converting an electric value into a displacement **[1, 2006.01]**

13/64 • Compensating the speed difference between engines meshing by a differential gearing or the speed difference between a controlling shaft and a controlled shaft **[1, 2006.01]**

13/66 • Governor units providing for co-operation with control dependent upon a variable other than speed **[1, 2006.01]**

15/00 Control of mechanical force or stress; Control of mechanical pressure [1, 2006.01]

15/01 • characterised by the use of electric means **[1, 2006.01]**

16/00 Control of fluid pressure [1, 2006.01]

16/02 • Modifications to reduce the effects of instability, e.g. due to vibrations, friction, abnormal temperature, overloading, unbalance (vibration-dampers F16F 7/00) **[1, 2006.01]**

16/04 • without auxiliary power **[1, 2006.01]**

16/06 • • the sensing element being a flexible member yielding to pressure, e.g. diaphragm, bellows, capsule **[1, 2006.01]**

16/08 • • • Control of liquid pressure **[1, 2006.01]**

16/10 • • the sensing element being a piston or plunger **[1, 2006.01]**

16/12 • • the sensing element being a float **[1, 2006.01]**
16/14 • with auxiliary non-electric power **[1, 2, 2006.01]**
16/16 • • derived from the controlled fluid **[1, 2006.01]**
16/18 • • derived from an external source **[1, 2006.01]**
16/20 • characterised by the use of electric means **[1, 2006.01]**

17/00 Control of torque; Control of mechanical power [1, 2006.01]
17/02 • characterised by the use of electric means **[1, 2006.01]**

19/00 Control of mechanical oscillations, e.g. of amplitude, of frequency, of phase [1, 2006.01]
19/02 • characterised by the use of electric means **[1, 2006.01]**

21/00 Control of chemical or physico-chemical variables, e.g. pH-value [1, 3, 2006.01]
21/02 • characterised by the use of electric means **[1, 2006.01]**

22/00 Control of humidity [1, 2, 2006.01]
22/02 • characterised by the use of electric means **[1, 2006.01]**

23/00 Control of temperature (automatic switching arrangements for electric heating apparatus H05B 1/02) **[1, 2006.01]**
23/01 • without auxiliary power **[1, 2006.01]**
23/02 • • with sensing element expanding and contracting in response to changes of temperature (G05D 23/13 takes precedence) **[1, 2006.01]**
23/08 • • • with bimetallic element (arrangement of valves and flow lines specially adapted for mixing fluid F16K 11/00) **[1, 2006.01]**
23/10 • • • • with snap-action elements (for valves F16K 31/56) **[1, 2006.01]**
23/12 • • with sensing element responsive to pressure or volume changes in a confined fluid **[1, 2006.01]**
23/13 • • by varying the mixing ratio of two fluids having different temperatures **[1, 2006.01]**
23/185 • with auxiliary non-electric power **[1, 2, 2006.01]**
23/19 • characterised by the use of electric means **[1, 2006.01]**
23/20 • • with sensing elements having variation of electric or magnetic properties with change of temperature (G05D 23/13 takes precedence) **[1, 2006.01]**
23/22 • • • the sensing element being a thermocouple **[1, 2006.01]**
23/24 • • • the sensing element having a resistance varying with temperature, e.g. thermistor **[1, 2006.01]**
23/26 • • • the sensing element having a permeability varying with temperature **[1, 2006.01]**
23/27 • • with sensing element responsive to radiation **[1, 2006.01]**
23/275 • • with sensing element expanding, contracting, or fusing in response to changes of temperature **[1, 2006.01]**
23/30 • • Automatic controllers with an auxiliary heating device affecting the sensing element, e.g. for anticipating change of temperature (automatic controllers in general and not restricted to control of temperature G05B) **[1, 2006.01]**
23/32 • • • with provision for adjustment of the effect of the auxiliary heating device, e.g. as a function of time **[1, 2006.01]**

24/00 Control of viscosity [1, 2006.01]
24/02 • characterised by the use of electric means **[1, 2006.01]**

25/00 Control of light, e.g. intensity, colour, phase (mechanically operable parts of lighting devices for the control of light F21V; optical devices or arrangements using movable or deformable elements for controlling light independent of the light source G02B 26/00; devices or arrangements, the optical operation of which is modified by changing the optical properties of the medium of the devices or arrangements for the control of light, circuit arrangements specially adapted therefor, control of light by electro-magnetic waves, electrons or other elementary particles G02F 1/00) **[1, 4, 2006.01]**
25/02 • characterised by the use of electric means **[1, 2006.01]**

27/00 Simultaneous control of variables covered by two or more of main groups G05D 1/00-G05D 25/00 [1, 2006.01]
27/02 • characterised by the use of electric means **[1, 2006.01]**

29/00 Simultaneous control of electric and non-electric variables [1, 2006.01]

99/00 Subject matter not provided for in other groups of this subclass [2006.01]

G05F SYSTEMS FOR REGULATING ELECTRIC OR MAGNETIC VARIABLES (regulating the timing or recurrence frequency of pulses in radar or radio navigation systems G01S; regulation of current or voltage, specially adapted for use in electronic time-pieces G04G 19/02; closed-loop systems for regulating non-electric variables by electric means G05D; regulating power supply of digital computers G06F 1/26; for obtaining desired operating characteristics of electromagnets with armatures H01F 7/18; regulating electric power distribution networks H02J; regulating the charging of batteries H02J 7/00; regulating of the output of static converters, e.g. switching regulators, H02M; regulation of the output of electric generators H02N, H02P 9/00; controlling transformers, reactors or choke coils H02P 13/00; regulating frequency response, gain, maximum output, amplitude or bandwidth of amplifiers H03G; regulating tuning of resonant circuits H03J; controlling generators of electronic oscillations or pulses H03L; regulating characteristics of transmission lines H04B; controlling electric light sources H05B 39/04, H05B 41/36, H05B 45/10, H05B 45/20, H05B 47/10; electric control of X-ray apparatus H05G 1/30) **[4, 5]**

Note(s) [4]

1. This subclass covers:
   - systems only;
   - use of hydraulic, pneumatic, mechanical, and electrical motors for varying electric characteristics of devices which restore the quantity regulated;
   - the combination of static converters and current or voltage regulators, if the essential characteristic resides in the combination.

2. This subclass does not cover elements per se, which are covered by the relevant subclasses.

1/00 Automatic systems in which deviations of an electric quantity from one or more predetermined values are detected at the output of the system and fed back to a device within the system to restore the detected quantity to its predetermined value or values, i.e. retroactive systems [1, 2006.01]

1/02 • Regulating electric characteristics of arcs (arrangements for feeding or moving of electrodes for spot or seam welding or cutting B23K 9/12; arrangements for feeding electrodes for electric heating or electric lighting H05B 7/109, H05B 31/18; automatic control of power for heating by discharge H05B 7/148) **[1, 2, 2006.01]**

1/04 • • by means of saturable magnetic devices **[1, 2006.01]**

1/06 • • by means of discharge tubes **[1, 2006.01]**

1/08 • • by means of semiconductor devices **[1, 2006.01]**

1/10 • Regulating voltage or current (G05F 1/02 takes precedence; for electric railways B60M 3/02) **[1, 2006.01]**

1/12 • • wherein the variable is actually regulated by the final control device is ac (G05F 1/625 takes precedence) **[1, 4, 2006.01]**

1/13 • • • using ferroresonant transformers as final control devices **[4, 2006.01]**

1/14 • • • using tap transformers or tap changing inductors as final control devices **[1, 4, 2006.01]**

1/147 • • • • with motor driven tap switch **[4, 2006.01]**

1/153 • • • • • controlled by discharge tubes or semiconductor devices **[4, 2006.01]**

1/16 • • • • combined with discharge tubes or semiconductor devices **[1, 2006.01]**

1/20 • • • • • semiconductor devices only **[1, 2006.01]**

1/22 • • • • combined with separate magnetic control devices having a controllable degree of saturation **[1, 2006.01]**

1/24 • • • using bucking or boosting transformers as final control devices **[1, 2006.01]**

1/247 • • • • with motor in control circuit **[4, 2006.01]**

1/253 • • • • the transformers including plural windings in series between source and load (G05F 1/247 takes precedence) **[4, 2006.01]**

1/26 • • • • combined with discharge tubes or semiconductor devices **[1, 2006.01]**

1/30 • • • • • semiconductor devices only **[1, 2006.01]**

1/32 • • • using magnetic devices having a controllable degree of saturation as final control devices **[1, 2006.01]**

1/325 • • • • with specific core structure, e.g. gap, aperture, slot, permanent magnet **[4, 2006.01]**

1/33 • • • • with plural windings through which current to be controlled is conducted **[4, 2006.01]**

1/335 • • • • • on different cores **[4, 2006.01]**

1/34 • • • • combined with discharge tubes or semiconductor devices **[1, 2006.01]**

1/38 • • • • • semiconductor devices only **[1, 2006.01]**

1/40 • • • using discharge tubes or semiconductor devices as final control devices **[1, 2006.01]**

1/42 • • • • discharge tubes only **[1, 2006.01]**

1/44 • • • • semiconductor devices only **[1, 2006.01]**

1/445 • • • • • being transistors in series with the load **[3, 2006.01]**

1/45 • • • • • being controlled rectifiers in series with the load **[3, 2006.01]**

1/455 • • • • • • with phase control **[3, 2006.01]**

1/46 • • wherein the variable actually regulated by the final control device is dc (G05F 1/625 takes precedence) **[1, 4, 2006.01]**

1/52 • • • using discharge tubes in series with the load as final control devices **[1, 2006.01]**

1/54 • • • • additionally controlled by the unregulated supply **[1, 2006.01]**

1/56 • • • using semiconductor devices in series with the load as final control devices **[1, 2006.01]**

1/563 • • • • including two stages of regulation, at least one of which is output level responsive, e.g. coarse and fine regulation **[4, 2006.01]**

1/565 • • • • sensing a condition of the system or its load in addition to means responsive to deviations in the output of the system, e.g. current, voltage, power factor (G05F 1/563 takes precedence) **[4, 2006.01]**

1/567 • • • • • for temperature compensation **[4, 2006.01]**

1/569 • • • • • for protection **[4, 2006.01]**

1/571 • • • • • • with overvoltage detector **[4, 2006.01]**

1/573 • • • • • • with overcurrent detector **[4, 2006.01]**

1/575 • • • • characterised by the feedback circuit **[4, 2006.01]**

1/577 • • • • for plural loads **[4, 2006.01]**

1/585 • • • • • providing voltages of opposite polarities **[4, 2006.01]**

1/59 • • • • including plural semiconductor devices as final control devices for a single load **[4, 2006.01]**

1/595 • • • • • semiconductor devices connected in series **[4, 2006.01]**

1/607 • • • using discharge tubes in parallel with the load as final control devices **[3, 2006.01]**

1/61 • • • • including two stages of regulation, at least one of which is output level responsive **[4, 2006.01]**

1/613 • • • using semiconductor devices in parallel with the load as final control devices **[3, 2006.01]**

1/614 • • • • including two stages of regulation, at least one of which is output level responsive **[4, 2006.01]**

1/618 • • • using semiconductor devices in series and in parallel with the load as final control devices **[4, 2006.01]**

1/62 • • • using bucking or boosting dc sources **[1, 2006.01]**

1/625 • • wherein it is irrelevant whether the variable actually regulated is ac or dc **[4, 2006.01]**

1/63 • • • using variable impedances in series with the load as final control devices **[4, 2006.01]**

1/635 • • • • being Hall effect devices, magnetoresistors or thermistors **[4, 2006.01]**

1/644 • • • • being pressure-sensitive resistors **[4, 2006.01]**

1/648 • • • • being plural resistors among which a selection is made **[4, 2006.01]**

1/652 • • • using variable impedances in parallel with the load as final control devices **[4, 2006.01]**

1/656 • • • using variable impedances in series and in parallel with the load as final control devices **[4, 2006.01]**
1/66 • Regulating electric power **[1, 2006.01]**
1/67 • • to the maximum power available from a generator, e.g. from solar cell **[4, 2006.01]**
1/70 • Regulating power factor; Regulating reactive current or power **[3, 2006.01]**

3/00 Non-retroactive systems for regulating electric variables by using an uncontrolled element, or an uncontrolled combination of elements, such element or such combination having self-regulating properties [1, 2006.01]
3/02 • Regulating voltage or current **[1, 2006.01]**
3/04 • • wherein the variable is ac **[1, 2006.01]**
3/06 • • • using combinations of saturated and unsaturated inductive devices, e g. combined with resonant circuit **[1, 2006.01]**
3/08 • • wherein the variable is dc **[1, 2006.01]**
3/10 • • • using uncontrolled devices with non-linear characteristics **[1, 4, 2006.01]**
3/12 • • • • being glow discharge tubes **[1, 2006.01]**
3/16 • • • • being semiconductor devices **[3, 2006.01]**
3/18 • • • • • using Zener diodes **[3, 2006.01]**
3/20 • • • • • using diode-transistor combinations (G05F 3/18 takes precedence) **[3, 2006.01]**
3/22 • • • • • • wherein the transistors are of the bipolar type only (G05F 3/26, G05F 3/30 take precedence) **[4, 2006.01]**
3/24 • • • • • • wherein the transistors are of the field-effect type only (G05F 3/26, G05F 3/30 take precedence) **[4, 2006.01]**
3/26 • • • • • • Current mirrors **[4, 2006.01]**
3/28 • • • • • • • combined with a non-linear current amplifier **[4, 2006.01]**
3/30 • • • • • • Regulators using the difference between the base-emitter voltages of two bipolar transistors operating at different current densities (G05F 3/26 takes precedence) **[4, 2006.01]**

5/00 Systems for regulating electric variables by detecting deviations in the electric input to the system and thereby controlling a device within the system to obtain a regulated output [1, 2006.01]
5/02 • Phase controlled switching using electronic tubes or three or more terminal semiconductive devices **[4, 2006.01]**
5/04 • using a transformer or inductor as the final control device **[4, 2006.01]**
5/06 • • saturable **[4, 2006.01]**
5/08 • using a linearly acting final control device **[4, 2006.01]**

7/00 Regulating magnetic variables (details of apparatus for measuring magnetic variables involving magnetic resonance G01R 33/28) **[1, 5, 2006.01]**

G05G CONTROL DEVICES OR SYSTEMS INSOFAR AS CHARACTERISED BY MECHANICAL FEATURES ONLY ("Bowden" or like mechanisms F16C 1/10; gearings or mechanisms not peculiar to this purpose F16H; speed changing or reversing mechanisms for gearings conveying rotary motion F16H 59/00-F16H 63/00)

Note(s) [6, 7]

1. This subclass covers :
   - members of general applicability for mechanical control;
   - mechanical systems for moving members to one or more definite settings.
2. Systems peculiar to the control of particular machines or apparatus provided for in a single other class are classified in the relevant class for such machines or apparatus.

Subclass index

1/00 Controlling members, e.g. knobs or handles; Assemblies or arrangements thereof; Indicating position of controlling members (joysticks G05G 9/04; steering wheels for motor vehicles B62D) **[1, 2006.01, 2008.04]**

Note(s) [2008.04]

In this group, the first place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the first appropriate place.

1/01 • Arrangements of two or more controlling members with respect to one another (double foot control, e.g. for instruction vehicles G05G 1/34; mounting units comprising an assembly with two or more pedals G05G 1/36) **[2008.04]**

1/015 • Arrangements for indicating the position of a controlling member (means for continuously detecting pedal position G05G 1/38; means for detecting position through tactile feedback G05G 5/03) **[2008.04]**

1/02 • Controlling members for hand-actuation by linear movement, e.g. push buttons **[1, 7, 2006.01]**

1/04 • Controlling members for hand-actuation by pivoting movement, e.g. levers **[1, 7, 2006.01]**

1/06 • • Details of their grip parts **[1, 7, 2006.01]**

1/08 • Controlling members for hand-actuation by rotary movement, e.g. hand wheels **[1, 7, 2006.01]**

1/10 • • Details, e.g. of discs, knobs, wheels or handles **[1, 2006.01]**

1/12 • • • Means for securing the members on rotatable spindles or the like **[1, 2006.01]**

1/30 • Controlling members actuated by foot **[2008.04]**

1/32 • • with means to prevent injury **[2008.04]**

1/323 • • • means disconnecting the connection between pedal and controlled member, e.g. by breaking or bending the connecting rod **[2008.04]**

1/327 • • • means disconnecting the pedal from its hinge or support, e.g. by breaking or bending the support **[2008.04]**

1/34 • • Double foot controls, e.g. for instruction vehicles **[2008.04]**

1/36 • • Mounting units comprising an assembly of two or more pedals, e.g. for facilitating mounting **[2008.04]**

1/38 • • comprising means to continuously detect pedal position **[2008.04]**

1/40 • • adjustable **[2008.04]**

1/405 • • • infinitely adjustable **[2008.04]**

1/42 • • non-pivoting, e.g. sliding **[2008.04]**

1/44 • • pivoting **[2008.04]**

1/445 • • • about a central fulcrum **[2008.04]**

1/46 • • Means, e.g. links, for connecting the pedal to the controlled unit **[2008.04]**

1/48 • • Non-slip pedal treads; Pedal extensions or attachments characterised by mechanical features only **[2008.04]**

1/483 • • • Non-slip treads **[2008.04]**

1/487 • • • Pedal extensions **[2008.04]**

1/50 • • Manufacturing of pedals; Pedals characterised by the material used **[2008.04]**

1/52 • Controlling members specially adapted for actuation by other parts of the human body than hand or foot **[2008.04]**

1/54 • Controlling members specially adapted for actuation by auxiliary operating members or extensions; Operating members or extensions therefor (pedal extensions G05G 1/487) **[2008.04]**

1/56 • • Controlling members specially adapted for actuation by keys, screwdrivers or like tools **[2008.04]**

1/58 • Rests or guides for relevant parts of the operator's body **[2008.04]**

1/60 • • Foot rests or foot guides **[2008.04]**

1/62 • • Arm rests **[2008.04]**

3/00 Controlled members (gear shifter yokes F16H 63/32)**; Assemblies or arrangements thereof** (interlocking of controlled members G05G 5/08) **[1, 7, 2006.01]**

5/00 Means for preventing, limiting or returning the movements of parts of a control mechanism, e.g. locking controlling member (G05G 17/00 takes precedence) **[1, 5, 2006.01]**

5/02 • Means preventing undesired movements of a controlling member which can be moved in two or more separate steps or ways, e.g. restricting to a stepwise movement or to a particular sequence of movements (G05G 5/28 takes precedence) **[1, 2006.01]**

5/03 • Means for enhancing the operator's awareness of the arrival of the controlling member at a command or datum position; Providing feel, e.g. means for creating a counterforce (arrangements for indicating the position of the controlling member G05G 1/015) **[5, 2006.01, 2008.04]**

5/04 • Stops for limiting movement of members, e.g. adjustable stop (G05G 5/03, G05G 5/05, G05G 5/28 take precedence) **[1, 5, 2006.01]**

5/05 • Means for returning or tending to return controlling members to an inoperative or neutral position, e.g. by providing return springs or resilient end-stops (G05G 5/28 takes precedence) **[5, 2006.01]**

5/06 • for holding members in one or a limited number of definite positions only (G05G 5/03, G05G 5/05, G05G 5/28 take precedence) **[1, 5, 2006.01]**

5/08 • • Interlocking of members, e.g. locking a member in a particular position before or during the movement of another member **[1, 2006.01]**

5/12 • for holding members in an indefinite number of positions, e.g. by a toothed quadrant (G05G 5/28 takes precedence) **[1, 5, 2006.01]**

5/14 • • by locking a member with respect to a fixed quadrant, rod, or the like **[1, 2006.01]**

5/16 • • • by friction **[1, 2006.01]**

5/18 • • • by positive interengagement, e.g. by a pawl **[1, 2006.01]**

5/20 • • by locking a quadrant, rod, or the like carried by the member **[1, 2006.01]**

5/22 • • • by friction **[1, 2006.01]**

5/24 • • • by positive interengagement, e.g. by a pawl **[1, 2006.01]**

5/26 • • by other means than a quadrant, rod, or the like **[1, 2006.01]**

5/28 • for preventing unauthorised access to the controlling member or its movement to a command position **[5, 2006.01]**

7/00 Manually-actuated control mechanisms provided with one single controlling member co-operating with one single controlled member; Details thereof (controlling members G05G 1/00) **[1, 2006.01]**

7/02 • characterised by special provisions for conveying or converting motion, or for acting at a distance **[1, 2006.01]**

7/04 • • altering the ratio of motion or force between controlling member and controlled member as a function of the position of the controlling member **[1, 2006.01]**

7/06 • • in which repeated movement of the controlling member produces increments of movement of the controlled member (G05G 7/08 takes precedence) **[1, 2006.01]**

7/08 • • in which repeated movement of the controlling member moves the controlled member through a cycle of distinct positions **[1, 2006.01]**

7/10 • • specially adapted for remote control (G05G 7/04-G05G 7/08 take precedence) **[1, 2006.01]**

7/12 • specially adapted for actuating a member on a system in motion with respect to the controlling member, e.g. on a rotating shaft **[1, 2006.01]**

7/14 • characterised by means for delaying initiation of, or making more gradual throughout, the movement of the controlled member in response to a given input from the controlling member, e.g. by providing lost motion in the command train **[1, 2006.01]**

7/16 • Special provisions for reducing the effect of slight relative movement between supports of the mechanism, e.g. resulting from resilient mounting of a controlled mechanism **[1, 2006.01]**

9/00 Manually-actuated control mechanisms provided with one single controlling member co-operating with two or more controlled members, e.g. selectively, simultaneously [1, 2006.01]

9/02 • the controlling member being movable in different independent ways, movement in each individual way actuating one controlled member only **[1, 2006.01]**

9/04 • • in which movement in two or more ways can occur simultaneously **[1, 2006.01]**

9/047 • • • the controlling member being movable by hand about orthogonal axes, e.g. joysticks **[5, 2006.01]**

9/053 • • • • the controlling member comprising a ball **[5, 2006.01]**

9/06 • the controlled members being actuated successively by repeated movement of the controlling member **[1, 2006.01]**

9/08 • the controlled members being actuated successively by progressive movement of the controlling member **[1, 2006.01]**

9/10 • with preselection and subsequent movement of each controlled member by movement of the controlling member in two different ways, e.g. guided by a shift gate **[1, 2006.01]**

11/00 Manually-actuated control mechanisms provided with two or more controlling members co-operating with one single controlled member [1, 2006.01]

13/00 Manually-actuated control mechanisms provided with two or more controlling members and also two or more controlled members (interlocking G05G 5/08) **[1, 2006.01]**

13/02 • with separate controlling members for preselection and shifting of controlled members **[1, 2006.01]**

15/00 Mechanical devices for initiating a movement automatically due to a specific cause [1, 2006.01]

15/02 • due to alteration of the sense of movement of a member **[1, 2006.01]**

15/04 • due to distance or angle travelled by a member **[1, 2006.01]**

15/06 • due to the speed of rotation or of bodily movement of a member, e.g. passing an upper or lower limit thereof (speedometers G01P) **[1, 2006.01]**

15/08 • due to the load or torque on a member, e.g. if exceeding a predetermined value thereof **[1, 2006.01]**

17/00 Mechanical devices for moving a member after being released; Trip or release mechanisms characterised thereby [1, 2006.01]

19/00 Servo-mechanisms with follow-up action, e.g. occurring in steps [1, 2006.01]

21/00 Mechanical apparatus for control of a series of operations, i.e. programme control, e.g. involving a set of cams (G05G 5/02 takes precedence) **[1, 2006.01]**

23/00 Means for ensuring the correct positioning of parts of control mechanisms, e.g. for taking-up play [1, 2006.01]

23/02 • self-adjusting **[1, 2006.01]**

25/00 Other details, features or accessories of control mechanisms, e.g. supporting intermediate members elastically [1, 2006.01]

25/02 • Inhibiting the generation or transmission of noise **[5, 2006.01]**

25/04 • Sealing against entry of dust, weather or the like **[5, 2006.01]**