SECTION G — PHYSICS

G05 CONTROLLING; REGULATING

G05B CONTROL OR REGULATING SYSTEMS IN GENERAL; FUNCTIONAL ELEMENTS OF SUCH SYSTEMS; MONITORING OR TESTING ARRANGEMENTS FOR SUCH SYSTEMS OR ELEMENTS (systems for controlling or regulating non-electric variables G05D; systems for regulating electric or magnetic variables G05F; control devices or systems insofar as characterised by mechanical features only G05G)

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

CONTROL SYSTEMS
- Adaptive....13/00
- Controlled by computer....15/00
- Involving the use of models or simulators....17/00
- Controlled by programme....19/00
- Involving sampling....21/00
- Open-loop automatic control systems not otherwise provided for....24/00

SYSTEM DETAILS
- Comparing elements....1/00
- Anti-hunting arrangements....5/00
- Internal feedback arrangements....6/00
- Obtaining smooth engagement or disengagement of automatic control....7/00
- Safety arrangements....9/00
- Automatic controllers....11/00

TESTING, MONITORING....23/00
SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS....99/00

1/00 Comparing elements, i.e. elements for effecting comparison directly or indirectly between a desired value and existing or anticipated values [1, 2006.01]

1/01 • electric **[1, 2, 2006.01]**

1/02 • • for comparing analogue signals (circuits for comparing the phase or frequency of two mutually-independent oscillations H03D 13/00) **[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 or differential [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) **[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) **[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) **[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) **[1, 3, 2006.01]**

17/02 • electric **[1, 2006.01]**

19/00 **Programme-control systems [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) **[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 **[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 or 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) **[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] or 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, leader-follower 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) **[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]