SECTION G — PHYSICS

G05 CONTROLLING; REGULATING

G05D SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

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. using automatic pilots (drive control systems specially adapted for autonomous road vehicles B60W 60/00) **[1, 2006.01, 2024.01]**

Note(s) [2024.01]

In this main group, it is desirable to add the indexing codes of groups G05D 101/00-G05D 111/00.

1/20 • Control system inputs **[2024.01]**
1/22 • • Command input arrangements **[2024.01]**
1/221 • • • Remote-control arrangements **[2024.01]**
1/222 • • • • operated by humans **[2024.01]**
1/223 • • • • • Command input arrangements on the remote controller, e.g. joysticks or touch screens **[2024.01]**
1/224 • • • • • Output arrangements on the remote controller, e.g. displays, haptics or speakers **[2024.01]**
1/225 • • • • operated by off-board computers **[2024.01]**
1/226 • • • • Communication links with the remote-control arrangements **[2024.01]**
1/227 • • • • Handing over between remote control and on-board control; Handing over between remote control arrangements **[2024.01]**
1/228 • • • Command input arrangements located on-board unmanned vehicles **[2024.01]**
1/2285 • • • • using voice or gesture commands **[2024.01]**
1/229 • • • Command input data, e.g. waypoints **[2024.01]**
1/24 • • Arrangements for determining position or orientation **[2024.01]**
1/241 • • • Means for detecting physical contact, e.g. touch sensors or bump sensors **[2024.01]**
1/242 • • • Means based on the reflection of waves generated by the vehicle (using passive navigation aids external to the vehicle G05D 1/244; using signals provided by artificial sources external to the vehicle G05D 1/247) **[2024.01]**
1/243 • • • Means capturing signals occurring naturally from the environment, e.g. ambient optical, acoustic, gravitational or magnetic signals (using passive navigation aids external to the vehicle G05D 1/244; using signals from positioning sensors located off-board the vehicle G05D 1/249) **[2024.01]**
1/244 • • • using passive navigation aids external to the vehicle, e.g. markers, reflectors or magnetic means **[2024.01]**
1/245 • • • using dead reckoning **[2024.01]**
1/246 • • • using environment maps, e.g. simultaneous localisation and mapping [SLAM] **[2024.01]**
1/247 • • • using signals provided by artificial sources external to the vehicle, e.g. navigation beacons **[2024.01]**
1/248 • • • • generated by satellites, e.g. GPS **[2024.01]**
1/249 • • • • from positioning sensors located off-board the vehicle, e.g. from cameras **[2024.01]**
1/40 • Control within particular dimensions **[2024.01]**

1/43 • • Control of position or course in two dimensions **[2024.01]**
1/435 • • • resulting in a change of level, e.g. negotiating lifts or stairs **[2024.01]**
1/437 • • • for aircraft during their ground movement **[2024.01]**
1/46 • • Control of position or course in three dimensions **[2024.01]**
1/461 • • • for unpowered vehicles, e.g. gliders or parachutes **[2024.01]**
1/467 • • • for movement inside a confined volume, e.g. indoor flying **[2024.01]**
1/48 • • Control of altitude or depth **[2024.01]**
1/485 • • • Control of rate of change of altitude or depth **[2024.01]**
1/49 • • Control of attitude, i.e. control of roll, pitch or yaw **[2024.01]**
1/495 • • • to ensure stability **[2024.01]**
1/60 • Intended control result **[2024.01]**
1/606 • • Compensating for or utilising external environmental conditions, e.g. wind or water currents (station keeping G05D 1/611) **[2024.01]**
1/611 • • Station keeping, e.g. for hovering or dynamic anchoring **[2024.01]**
1/617 • • Safety or protection, e.g. defining protection zones around obstacles or avoiding hazards (arrangements for controlling the position or course of two or more vehicles for avoiding collisions therebetween G05D 1/693; arrangements for reacting to or preventing system or operator failure G05D 1/80) **[2024.01]**
1/622 • • • Obstacle avoidance (predicting or avoiding probable or impending collision of road vehicles B60W 30/08) **[2024.01]**
1/628 • • • • following the obstacle profile, e.g. a wall or undulated terrain **[2024.01]**
1/633 • • • • Dynamic obstacles **[2024.01]**
1/639 • • • Resolving or avoiding being stuck or obstructed **[2024.01]**
1/644 • • Optimisation of travel parameters, e.g. of energy consumption, journey time or distance **[2024.01]**
1/646 • • Following a predefined trajectory, e.g. a line marked on the floor or a flight path **[2024.01]**
1/648 • • Performing a task within a working area or space, e.g. cleaning **[2024.01]**
1/65 • • Following a desired speed profile **[2024.01]**
1/652 • • Take-off (delivering or retrieving payloads G05D 1/667) **[2024.01]**
1/654 • • Landing (docking at a base station G05D 1/661) **[2024.01]**
1/656 • • Interaction with payloads or external entities **[2024.01]**
1/661 • • • Docking at a base station (delivering or retrieving payloads G05D 1/667) **[2024.01]**
1/667 • • • Delivering or retrieving payloads **[2024.01]**
1/672 • • • Positioning of towed, pushed or suspended implements, e.g. ploughs **[2024.01]**
1/678 • • • for tethered vehicles (positioning towed, pushed or suspended implements G05D 1/672) **[2024.01]**
1/683 • • • Intercepting moving targets (docking at a base station G05D 1/661) **[2024.01]**
1/686 • • • Maintaining a relative position with respect to moving targets, e.g. following animals or humans (for pointing payloads towards targets G05D 1/689; involving controlling the position or course of two or more vehicles G05D 1/69) **[2024.01]**
1/689 • • • Pointing payloads towards fixed or moving targets (positioning towed, pushed or suspended implements G05D 1/672) **[2024.01]**
1/69 • • Coordinated control of the position or course of two or more vehicles **[2024.01]**
1/692 • • • involving a plurality of disparate vehicles **[2024.01]**
1/693 • • • for avoiding collisions between vehicles **[2024.01]**
1/695 • • • for maintaining a fixed relative position of the vehicles, e.g. for convoy travelling or formation flight **[2024.01]**
1/697 • • • for rendezvous of two or more vehicles, e.g. for in-flight refuelling (docking at a base station G05D 1/661) **[2024.01]**
1/698 • • • Control allocation **[2024.01]**
1/80 • Arrangements for reacting to or preventing system or operator failure (handing over between remote control and on-board control, or handing over between remote control arrangements G05D 1/227) **[2024.01]**
1/81 • • Handing over between on-board automatic and on-board manual control **[2024.01]**
1/82 • • Limited authority control, e.g. enforcing a flight envelope (limitation of acceleration or structural stress G05D 1/83) **[2024.01]**
1/83 • • Limitation of acceleration or structural stress **[2024.01]**
1/85 • • Fail-safe operations, e.g. limp home mode **[2024.01]**
1/86 • • Monitoring the performance of the system, e.g. alarm or diagnosis modules **[2024.01]**
1/87 • • using redundant control arrangements **[2024.01]**

3/00 **Control of position or direction** (G05D 1/00 takes precedence; numerical control to execute positioning 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; control of flow ratio G05D 11/00) **[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; control of humidity G05D 22/00; control of temperature by varying the mixing ratio of two fluids having different temperatures G05D 23/13; 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 [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 or 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 **[1, 2006.01]**
13/32 • • • using a pump **[1, 2006.01]**
13/34 • with auxiliary non-electric power **[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 or imbalance **[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 [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 **[1, 2006.01]**
23/10 • • • • with snap-action elements **[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 **[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 or phase (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]

Indexing scheme associated with group G05D 1/00 [2024.01]

101/00 Details of software or hardware architectures used for the control of position [2024.01]
101/10 • using artificial intelligence [AI] techniques **[2024.01]**
101/15 • • using machine learning, e.g. neural networks **[2024.01]**
101/20 • using external object recognition **[2024.01]**

103/00 Adaptations for complying with regulatory restraints on the operations of the controlled vehicles, e.g. compliance with airspace or traffic regulations [2024.01]

105/00 Specific applications of the controlled vehicles [2024.01]
105/05 • for soil shifting, building, civil engineering or mining, e.g. excavators **[2024.01]**
105/10 • for cleaning, vacuuming or polishing **[2024.01]**
105/15 • for harvesting, sowing or mowing in agriculture or forestry **[2024.01]**
105/20 • for transportation **[2024.01]**
105/22 • • of humans **[2024.01]**
105/28 • • of freight **[2024.01]**
105/30 • for social or care-giving applications **[2024.01]**
105/35 • for combat **[2024.01]**
105/40 • for communications, e.g. wireless network relays **[2024.01]**
105/45 • for manufacturing, maintenance or repairing **[2024.01]**
105/50 • for animal husbandry or control, e.g. catching, trapping or scaring of animals **[2024.01]**
105/55 • for emergency activities, e.g. search and rescue, traffic accidents or fire fighting **[2024.01]**
105/60 • for sport or gaming activities **[2024.01]**
105/65 • for shows or performances **[2024.01]**
105/70 • for displaying or announcing information **[2024.01]**
105/80 • for information gathering, e.g. for academic research **[2024.01]**
105/85 • • for patrolling or reconnaissance for police, security or military applications **[2024.01]**

107/00 Specific environments of the controlled vehicles [2024.01]

107/10 • Outdoor regulated spaces **[2024.01]**
107/13 • • Spaces reserved for vehicle traffic, e.g. roads, regulated airspace or regulated waters **[2024.01]**
107/17 • • Spaces with priority for humans, e.g. populated areas, pedestrian ways, parks or beaches **[2024.01]**
107/20 • Land use **[2024.01]**
107/30 • Off-road **[2024.01]**
107/40 • Indoor domestic environment **[2024.01]**
107/50 • Confined spaces, e.g. tanks, pipelines, tunnels or containers **[2024.01]**
107/60 • Open buildings, e.g. offices, hospitals, shopping areas or universities **[2024.01]**
107/70 • Industrial sites, e.g. warehouses or factories **[2024.01]**
107/80 • Transportation hubs **[2024.01]**
107/90 • Building sites; Civil engineering **[2024.01]**

109/00 Types of controlled vehicles [2024.01]

109/10 • Land vehicles **[2024.01]**
109/12 • • with legs **[2024.01]**
109/15 • • Climbing vehicles **[2024.01]**
109/18 • • Holonomic vehicles, e.g. with omni wheels **[2024.01]**
109/20 • Aircraft, e.g. drones **[2024.01]**
109/22 • • with fixed wings **[2024.01]**
109/25 • • Rotorcrafts **[2024.01]**
109/28 • • Missiles **[2024.01]**
109/30 • Water vehicles **[2024.01]**
109/40 • Space vehicles **[2024.01]**
109/50 • Vehicles specially adapted for two or more of space, air, land or water environments, e.g. amphibious vehicles **[2024.01]**

111/00 Details of signals used for control of position, course, altitude or attitude of land, water, air or space vehicles [2024.01]

111/10 • Optical signals **[2024.01]**
111/20 • Acoustic signals, e.g. ultrasonic signals **[2024.01]**
111/30 • Radio signals **[2024.01]**
111/40 • Inductive-loop type signals **[2024.01]**
111/50 • Internal signals, i.e. from sensors located in the vehicle, e.g. from compasses or angular sensors **[2024.01]**
111/60 • Combination of two or more signals **[2024.01]**
111/63 • • of the same type, e.g. stereovision or optical flow **[2024.01]**
111/67 • • Sensor fusion **[2024.01]**