
**Road vehicles — Direction-of-motion
stereotypes for automotive hand controls**

*Véhicules routiers — Stéréotypes de sens d'action sur les commandes
manuelles dans l'automobile*



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Foreword

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12214 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 13, *Ergonomics applicable to road vehicles*.

This second edition cancels and replaces the first edition (ISO 12214:2002), of which it constitutes a minor revision.

The following significant changes have been made to the first edition:

- incorporation of recommendations for right stalk controls in 3.3.5.3;
- addition of a second note to Figure 1;
- revision of angle callout for vertical/longitudinal inclined surface power mirror control in Figure 3 to between 0° and 30°;
- deletion of angle callout for angled up/down from horizontal 2 × 2 toggle or rocker power window control in Figure 4;
- new drawing for angled up/down from horizontal push/pull power window control in Figure 4 and revision of angle callout to between 0° and 45°.

Introduction

Drivers develop expectations regarding the operating motions of various types of controls as a result of their accumulated experience with vehicle controls. To simplify the operation of controls for drivers, the direction-of-motion to operate these controls needs to conform to these expectations, or stereotypes.

The strength of a stereotype varies with the control configuration (control type, location, orientation and mounting plane). Studies have demonstrated that stereotype strength is not related to driver age, gender, or left- or right-handedness. Failure to conform to direction-of-motion stereotypes can lead to actuation errors, longer operating times and an increase in driver workload.

This International Standard is based on past research and general human factor principles. Control labelling and tactile or shape coding are not addressed in this International Standard. However, appropriate labelling and coding can improve the accuracy of control use.

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Road vehicles — Direction-of-motion stereotypes for automotive hand controls

1 Scope

This International Standard gives design recommendations and requirements for the direction-of-motion of hand controls found in passenger, multipurpose and commercial vehicles, and buses.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

control configuration

particular combination of control type, location, orientation and mounting plane

2.2

direction-of-motion stereotype

direction of control motion expected by a majority of people to achieve a given effect for a specified control configuration

2.3

stereotype strength

percentage of people who activate the control in a particular direction

2.4

on/increase control

control whose function is to turn something on/off or to increase/decrease some unspecified effect

2.5

specific function control

control used to activate some specific function or achieve a specific effect

EXAMPLE Control to lock or unlock doors, raise or lower windows, or turn on headlamps, headlamp high beam or windshield wipers.

3 Design

3.1 General

This International Standard gives the recommended direction-of-motion and control orientation for controls mounted on each of three orthogonal planes:

- horizontal (X-Y) plane;
- vertical-transverse (Y-Z) plane;
- vertical-longitudinal (X-Z) plane.

Some of the figures in this International Standard also include inclined mounting planes. The direction-of-motion stereotypes are indicated by the unbroken arrows on each control configuration. Those control configurations exhibiting an exceptionally strong stereotype are identified. Control configurations found to have weak stereotypes are shown crossed out, in order to indicate that they are not recommended.

3.2 On/increase controls

3.2.1 General

Normally, for the control configurations shown, the on/increase control directions should be

- up,
- forward,
- right,
- pull towards (push/pull knob or stalk), and
- rotate over top.

For commercial trucks, a downward direction for the “on” control may be used.

Rocker controls mounted in a fore-aft orientation on a surface sloping down and away from drivers, and toggle controls mounted in a fore-aft orientation on a vertical-longitudinal (X-Z) plane, shall not be used.

See Figure 1 for thumb wheel, toggle, lever and linear-slide controls, rotary and push/pull knobs, and rocker switches.

See 3.3.5 and Figure 2 for stalk-mounted controls.

3.3 Specific function controls

3.3.1 General

A variety of controls are used for controlling specific functions in motor vehicles. Some of those in common use are covered in this International Standard. Other controls may also be appropriate for these functions. It is not the intent of this International Standard to restrict the type of control that may be used for a specific function.

As a general rule, in order to create the strongest stereotypes, the orientation and motion of the control should correspond to the orientation and motion of the controlled element.

The mounting of power mirrors or power windows, and fore-aft orientations of switches, on surfaces that slope down and away from drivers shall not be permitted.

3.3.2 Power mirror controls

Direction labels shown on the four-way pad control and arrows on the joystick control in Figure 3 indicate stereotypes for moving the mirror field of view up, down, left or right. However, these labels are given in this International Standard for information only.

Stereotypes are very strong for mounting planes angled 30° or more out from the door plane so that the switch faces the driver. Mirror switches mounted in a vertical-transverse plane also have very strong stereotypes. It is likely that mounting planes inclined as much as 45° to 60° from vertical-transverse toward horizontal would also produce very strong stereotypes. These configurations are therefore recommended. The four-way pad switch should not be mounted in the door plane (vertical-longitudinal).

3.3.3 Power window controls

Toggle or rocker controls mounted on surfaces that are horizontal or angled up from horizontal (0° to 60°) and with a 2×2 fore-aft switch configuration have a very strong stereotype for both window selection (left, right, front, rear) and direction of operation. The push/pull control with the same configuration also has a very strong stereotype. These control configurations are therefore recommended.

A 2×2 switch configuration mounted on a vertical plane parallel to the door panel shall not be used, and 1×4 switch configurations shall not be used at all because the switch layout does not correspond to the window layout (in plan view in Figure 4).

3.3.4 Window regulators (cranks)

Window cranks on both the left and right sides should be oriented so that the handles point forward and are about 45° above horizontal when the windows are fully raised, although angles from 15° to 75° above horizontal may also be used. It is recommended that the handle point forward when the window is fully lowered. However, other concerns such as rotational effort and travel shall be considered.

To lower a left-side window, the crank on the left-side door should be rotated clockwise. To lower a right-side window, the crank on the right-side door should be rotated anticlockwise.

See Figure 5.

3.3.5 Stalk-mounted controls

3.3.5.1 Turn signal

Raising or lowering the left stalk on left-hand drive vehicles should be the motion for, respectively, signalling a right or left turn.

3.3.5.2 Wipers

Rotating the left stalk over the top should be the direction for turning on windshield wipers. If mounted on a right stalk, the wipers may be turned on by rotating over the top or by either raising or lowering the stalk.

3.3.5.3 Headlamps

Rotating the left or right stalk over the top should be the direction for turning on headlamps. Pulling the left or right stalk should be the motion for turning on the headlamp high beam.

3.3.6 Power door locks

No stereotype was found for any configurations of rocker switches. Labels or tactile coding or both should be used for the lock and/or unlock settings of rocker switches that control power door locks.

Control type	Mounting plane		
	Horizontal (X-Y)	Vertical/transverse (Y-Z)	Vertical/longitudinal (X-Z)
Thumb wheel			
Toggles and levers			
Linear slide			
Rotary knob			
Push/pull			

Figure 1 (continued)

Control type	Mounting plane		
	Horizontal (X-Y)	Vertical/transverse (Y-Z)	Vertical/longitudinal (X-Z)
Rocker switches			
Inclined downwards			

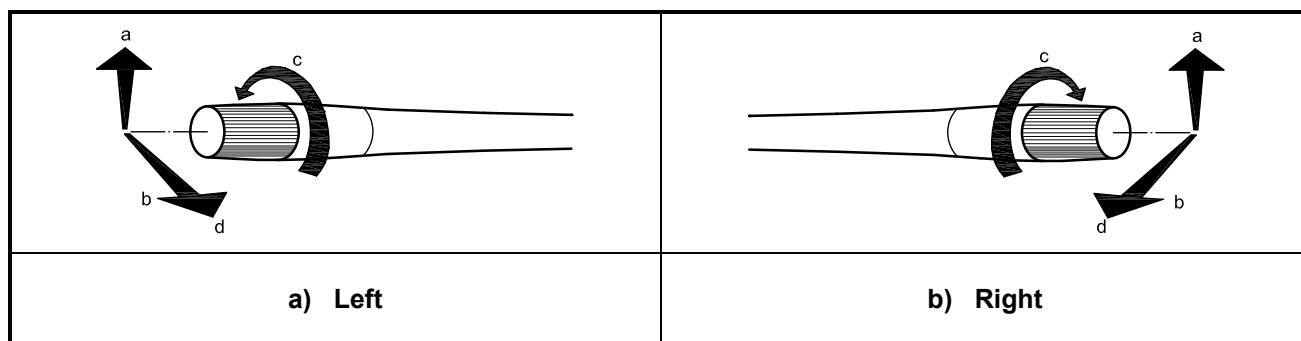
NOTE 1 Unbroken arrows indicate the direction-of-motion for on/increase control; the dotted reference line is parallel to the x-axis (front-rear); crossed-out configurations are not recommended.

NOTE 2 Toggle controls mounted in the X-Z plane can be used for controlling the fore/aft (X) or up/down (Z) motion of a seat. See 3.3.1.

Key

- 1 very strong stereotype
- 2 very strong when mounted to the right of steering wheel in left-hand drive vehicle
- 3 not recommended in Japan
- 4 moderately strong stereotype on right side in Japan
- a Not on left in Japan.
- b Strong on right in Japan.
- c Not on right in Japan.

Figure 1 — On/increase controls



NOTE Unbroken arrows indicate the direction-of-motion for on/increase (turn signal not included).

Key

- a Raise. In Japan, there is a very weak stereotype in favour of lowering, not raising.
- b The Japanese stereotype is very weak.
- c Over the top.
- d Pull.

Figure 2 — Stalk-mounted controls

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Control type	Mounting plane		
	Horizontal (X-Y)	Vertical/transverse (Y-Z)	Vertical/longitudinal (X-Z)
Four-way pad			
Inclined surface			
Joystick			

NOTE Unbroken arrows indicate the direction-of-motion for the corresponding field of view motion; the dotted reference line is parallel to the x-axis (front-rear); crossed-out configurations are not recommended.

Key

- 1 very strong stereotype
- 2 very strong stereotype if to right of driver
- a Area of control to be activated to move field of view right, left, up or down.
- b Can be any angle between 0° and 90°.
- c Can be any angle between 30° and 90°.

Figure 3 — Power mirror controls

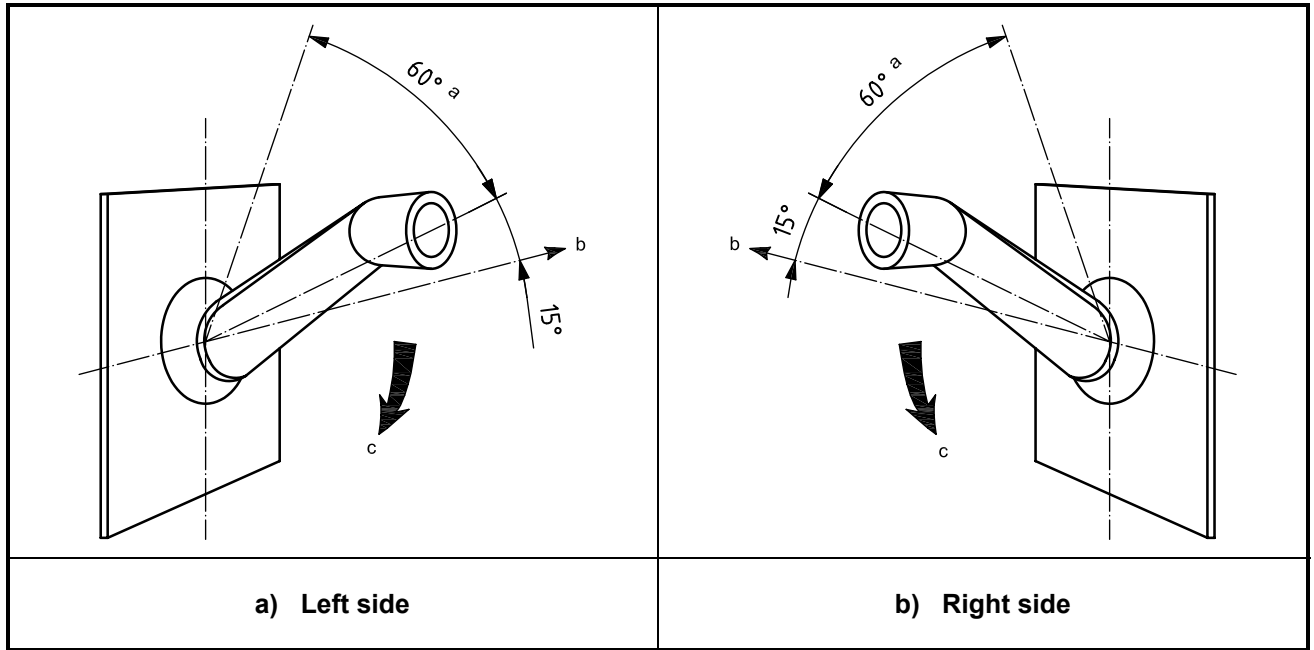
Control type	Mounting plane		
	Horizontal (X-Y)	Angled up/down from horizontal	Vertical/longitudinal (X-Z)
Toggle or rocker 2 × 2			
1 × 4			
Push/pull			

NOTE Unbroken arrows indicate the direction-of-motion to lower the left front window; the dotted reference line pointing to the front is parallel to the x-axis (front-rear) of the vehicle; crossed-out configurations are not recommended.

Key

- 1 very strong stereotype in US; moderate in Japan
- 2 very strong stereotype when angled up by a maximum of 60°
- ^a Can be any angle between 0° and 45°.

Figure 4 — Power window controls



Key

- a Handle should rest in this range when window is fully raised (it is desirable that it be in this range when fully lowered, too).
- b Front.
- c Lower.

Figure 5 — Window regulators (crank)

Bibliography

- [1] MCGRATH, J.J. *SAE study of vehicle controls location*, Report No. 182-11, Anacapa Sciences, Inc., USA, 1974
- [2] MCGRATH, J.J. *Driver expectancy and performance in locating automotive controls*, SAE SP-407, Society of Automotive Engineers, USA, 1976
- [3] BLACK, T.L., WOODSON, W.E. and SELBY P.H. *Development of recommendations to improve controls operability*, Report DOT-HS-6-01445, US Department of Transportation, 1977
- [4] GREEN, P., KERST, J., OTTENS, D., GOLDSTEIN, S. and ADAMS, S. *Driver preferences for secondary controls*, Tech. Report UMTRI-87-47 (NTIS No. PB 90 150541/AS), University of Michigan Transportation Research Institute, 1987
- [5] JACK, D.D. *Rocker switch tactile coding and direction-of-motion stereotypes*, Proceedings of 29th Annual Meeting, Human Factors Society, 1985
- [6] MCFARLANE, J. and WIERWILLE, W.W. *Overview of a study on direction-of-motion stereotype strengths for automobile controls*, SAE Paper 910115, Society of Automotive Engineers, USA, 1991
- [7] MCFARLANE, J. and WIERWILLE, W.W. *Study of direction-of-motion stereotypes for automobile controls*, ISE Report 90-02, Virginia Polytechnic Institute and State University, USA, 1990
- [8] MCGRATH, J.J. *Analysis of the expectancies of European drivers and the commonality of automotive control locations in European cars*, Report TM 247-1, Anacapa Sciences, Inc., USA, 1974
- [9] SAE J1139:1977, *Supplemental Information — Driver Hand Controls Location for Passenger Cars, Multi-Purpose Passenger Vehicles, and Trucks (10,000 GVW and Under)*, 4, SAE Handbook, Society of Automotive Engineers, USA
- [10] JSAE:1995, *Overview of a study on direction-of-motion stereotype strengths for automobile controls*, ISO/TC22/SC13/WG3 N167

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