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**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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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard 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*.

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 document. 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 International Standard, 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) and 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 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 Figure 2 and 3.3.5 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 for achieving 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 for information only in this International Standard.

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 with 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 the left-side window or windows, the left-side crank should be anticlockwise. To lower the right-side window or windows, the right-side crank should be rotated counter clockwise.

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

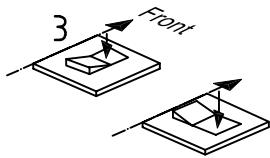
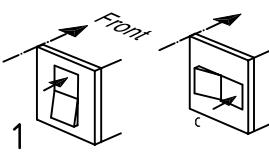
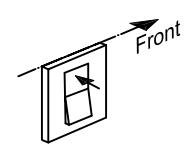
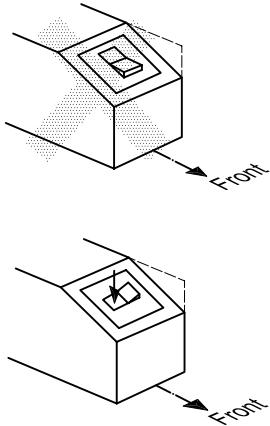
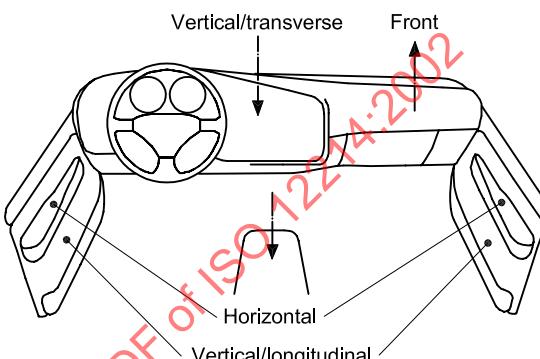
Rotating the left stalk over the top should be the direction for turning on headlamps. Pulling the left stalk should be the motion for turning on the headlamp high beam.

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

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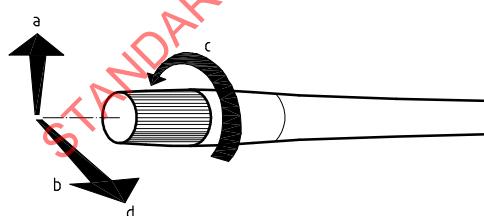
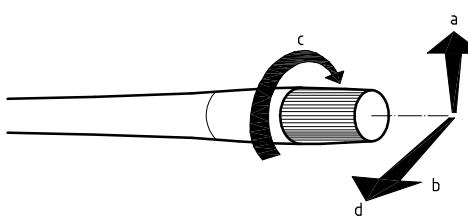
Control type	Mounting plane		
	Horizontal (X-Y)	Vertical/transverse (Y-Z)	Vertical/longitudinal (X-Z)
Rocker switches			
Inclined downwards			

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

NOTE Unbroken arrows indicate the direction-of-motion for on/increase control, the dotted reference line is parallel to the x-axis (front-rear) of the vehicle 5 and crossed-out configurations are not recommended.

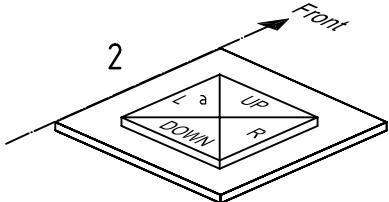
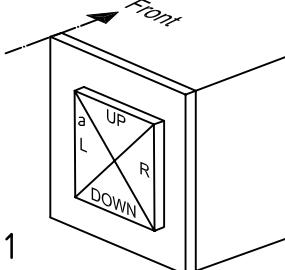
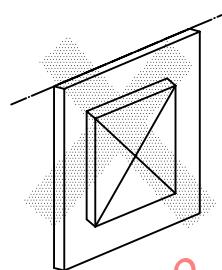
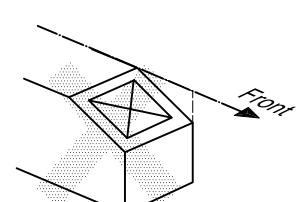
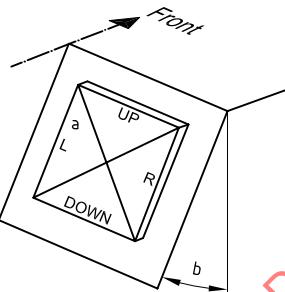
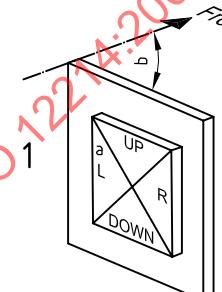
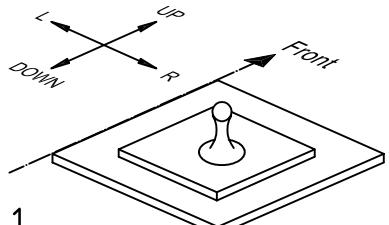
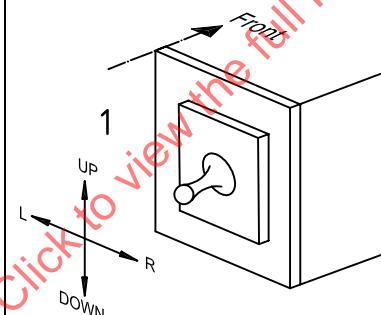
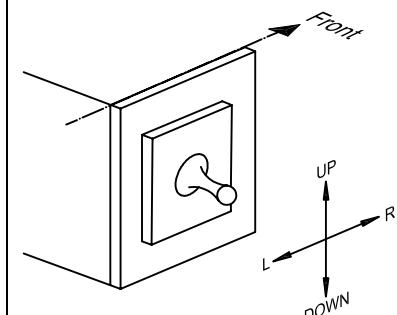
- a Not on left in Japan.
- b Strong on right in Japan.
- c Not on right in Japan.

Figure 1 — On/increase controls**a) Left****b) Right**

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

- 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

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

Key

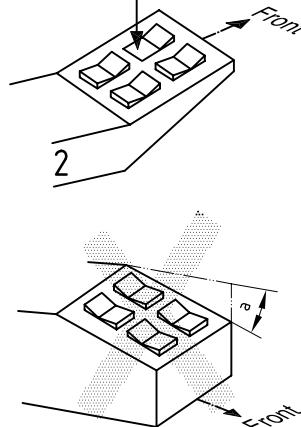
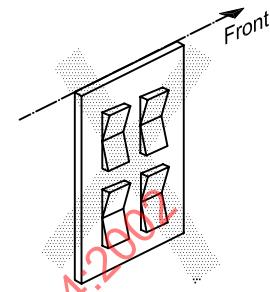
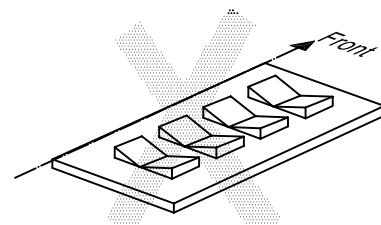
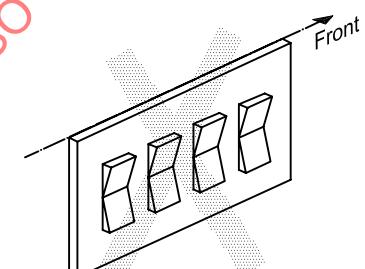
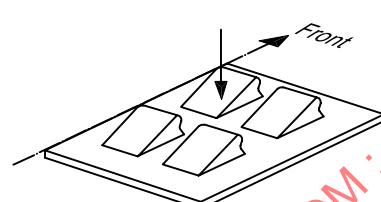
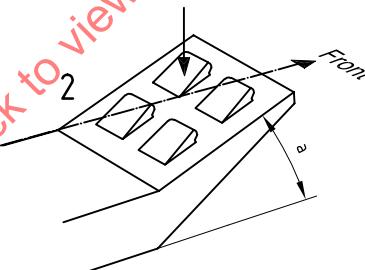
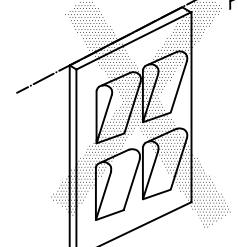
- 1 Very strong stereotype
- 2 Very strong stereotype if to right of driver

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), and crossed-out configurations are not recommended.

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°.

Figure 3 — Power mirror controls

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

Key

1 Very strong stereotype in US, moderate in Japan
 2 Very strong stereotype when angled by 60° max.

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

a Can be any angle between 0° and 60°.

Figure 4 — Power window controls