OMRON

SAFETY, TECHNOLOGY & INNOVATION

Model D41D

High-Coded Safety Door Switch

EN Instruction Manual

Thank you for purchasing Omron products. This product is a high-coded safety door switch. Please read and understand this document before using the products. Keep this document ready to use whenever needed. Only qualified person trained in professional electrical technique should handle the product. Please consult your Omron representative if you have any questions or comments. Make sure that information written in this document are delivered to the final user of the product.

OMRON Corporation

Original Instructions 5673883-0C

The D41D High-Coded Safety Door Switch is designed for safety circuits and is used to monitor the position of movable guards. Instructions in the EU languages and a signed EU Declaration of Conformity are available on our website at www.industrial.omron.eu/safety.

Declaration of Conformity

OMRON declares that the D41D is in conformity with the requirements of the following EU Directives and UK Legislation:
EU: Machinery Directive 2006/42/EC, RE Directive 2014/53/EU
RoHS Directive 2011/65/EU
UK: 2008 No. 1597 Machinery (Safety), 2017 No. 1206 RE
2012 No. 3032 RoHS

Safety Standards

D41D is designed and manufactured in accordance with the following standards:
- EN ISO 13849-1: PL e Category 4
- EN 60947-5-3
- EN 300 330
- EN ISO 14119
- IEC 61508

Dispose in accordance with applicable regulations.

Safety Precautions

⚠ WARNING — **Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.**

Alert Statements

⚠ WARNING

Use only appropriate components or devices complying with relevant safety standards corresponding to the required performance level and safety category. Failure to do so may result in serious injury or death. Conformity to requirements of the performance level and safety category must be determined as an entire system. It is recommended to consult a certification body regarding assessment of conformity to the required safety level.

Do not apply DC voltages exceeding the rated voltages, nor any AC voltages to the product. Failure to do so may result in serious injury or death.

Install the switch and actuator in a position where the opening of the guard door can be detected within a safe distance. Failure to do so may result in serious injury or death.

When complying with safety standards, install the product in an appropriate manner in accordance with ISO 14119, with due consideration of the risk of defeat by the operator. Failure to do so may result in serious injury or death.

Make sure that the DC power supply meets the following items. Failure to do so may result in serious injury or death.
- Satisfies the requirements of PELV power supply defined in IEC 60204-1.
- Satisfies the requirements of class 2 circuits defined in UL508.

Precautions for Safe Use

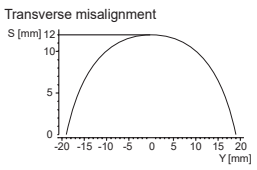
(1) Disconnect the product from power supply when wiring the product. Failure to do so may cause unexpected operation of devices connected to the product.
(2) Wire the input and output terminals correctly and verify the correct operation of the product before using the system in which the product is incorporated. Incorrect wiring may lead to loss of the safety function.
(3) Do not use the product in any direction other than the specified mounting orientations of the main body and actuator.
(4) Dispose of the product in accordance with the laws set by each country.

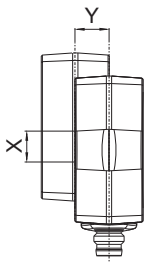
Precautions for Correct Use

(1) Do not drop the product to the ground or expose to excessive vibration or mechanical shocks. Doing so may damage the product and cause failure.
(2) Do not store or use the product under the following conditions. Doing so may damage the product and cause failure.
1) At ambient operating temperatures out of the range of -25 to 65°C
2) At ambient storage temperatures out of the range of -25 to 85°C
3) At relative humidity of 93% or more
4) In direct sunlight
5) Under drastic temperature changes
6) In high humidity that causes condensation
(3) Keep the product away from oil or solvent. Oil or solvent make the marking on the product illegible and cause deterioration of some parts.
(4) Do not use in an environment with corrosive gas.
(5) The product may not operate normally in the vicinity of devices that generate strong radio waves or magnetic fields, such as RFID systems, proximity sensors, motors, inverters, and switch-mode power supplies. If the device is used in the vicinity of such devices, check the effect before use.
(6) Installing the switch and the actuator on a metallic material may affect the operating distance. If installation on a metallic material is necessary, be sure to check the effect on the operating distance before use.
(7) Tighten the screws with a specified torque.
(8) Use the wires specified by OMRON to wire the product. (Refer to Connection.)
(9) Do not extend the cables in excess of the specification of this product. Carry out electrical connection according to the wiring examples shown in this document and verify the correct operation of the product.
(10) During installation, make sure that the safety door switch does not come in contact with the actuator due to rattling of the guard door. (The performance of the product may be degraded by a collision caused by opening or closing the guard door.)
(11) Do not pull or bend the cable excessively. A disconnection may cause a malfunction.
(12) Risk time remains unchanged by series connection. However, carry out electrical connection according to the wiring examples shown in this document.
(13) Be sure to inspect the product daily and every 6 months. Failure to do so may cause a system failure and serious injury.
(14) When determining the safety distance, take into account the delay of the output of the product caused by the response time. Failure to do so may cause the operator to reach the hazardous source before the machine is stopped, resulting in serious injury.
(15) Install the product so that the LED indicators of the safety door switch are as visible as possible. Misinterpreting the status of the safety door switch may result in danger.
(16) Do not use the product at an altitude of 2,000 m or higher.
(17) Do not connect a product different from this product in series with this product. Doing so may disturb waveforms of the input and output signals, leading to loss of the safety function.
(18) Do not use the product in the water or continuous water exposure environment. Doing so may cause water to leak into the product. (The degree of protection does not guarantee the protection under continuous water exposure environment.)
(19) Do not tamper the product with a replacement actuator. Store replacement actuators in a safe place where they cannot be easily reached.
(20) Build a safety system using the outputs of both Safety Outputs 1 and 2. Wiring with only one safety output may lead to loss of the safety function due to a single failure.
(21) Wiring should meet the requirements specified in Section 9.4.3 of IEC 60204-1 to prevent malfunction due to ground faults in the safety output lines.
(22) Do not wire the product to an input of a safety controller in parallel.
(23) Do not try to disassemble, repair, or modify the product. Doing so may cause loss of the safety function.
(24) Do not operate the product in an environment with flammable or explosive gas.
(25) After installation of the product, qualified personnel should verify to see that the installation, inspection, and maintenance are properly performed. The qualified personnel should be qualified and authorized to secure the safety on each phase of design, installation, running, maintenance and disposal of system.
(26) Auxiliary output is NOT a safety output. Do not use the Auxiliary output individually for any safety function. Such incorrect use causes loss of the safety function of the product and its relevant systems.
(27) Disconnect the product and the controller connected to the product from power supply when replacing the product. Failure to do so may cause unexpected operation of devices connected to the product.
(28) The safety function may not operate normally due to a malfunction of the wiring, setting, or switch, and the machine may continue to operate, which may result in personal injury. Make sure that the safety function works before starting operation.
(29) Do not use the product as a door stopper. (The performance of the product may be degraded due to a collision caused by opening and closing the guard door.)

Detection Range (Typical Data)

Operating distance
The side allows for a maximum height misalignment (X) of safety door switch and actuator of ±8 mm (e.g. mounting tolerance or due to guard door sagging). The axial misalignment (Y) is max. ±18 mm.
Actuating curves
The actuating curves represent the typical operating distance of the safety door switch during the approach of the actuator subject to the actuating direction.





The continuous signal of the yellow LED signals the actuator detection; the flashing of the yellow LED signals that the safety door switch is actuated in the different travel area.

Preferred actuation directions: from front or from side
In case of a lateral actuation, the operating distances are reduced by approx. 3 mm.

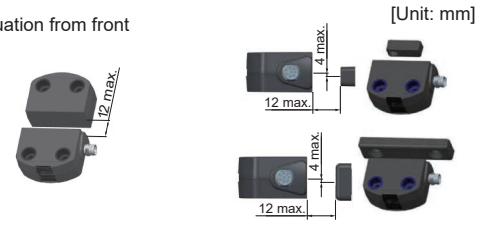
Recommended Adjustment
Align the safety door switch and actuator at a distance of 0.5 x assured operating distance (Sao).

The correct functionality of both safety channels must be checked by means of the connected safety controller.

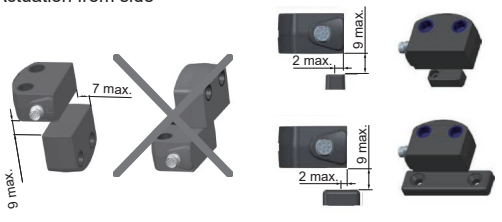
Actuator Mounting Direction

[Unit: mm]

Actuation from front



Actuation from side



Note: 1. Lateral actuation only from the shown side of the safety door switch.

Ratings and Specifications

Model		D41D
Technical		
Detection method		RFID
Frequency band		125 kHz
Transmitter outputs		-6 dBm max.
Interlock type (ISO 14119)		Type 4
Coded level (ISO 14119)		D41D-1: High (individual coding) D41D-2: High (individual coding re-teaching enabled)
Actuator		D41D-A1, D41D-A2, D41D-A3
Response time (ON to OFF)		100 ms max.
Risk time		200 ms max.
Startup time		2 s max.
Typical operating distance (Sn)(IEC 60947-5-3)		12 mm (lateral actuation: 9mm)
Assured operating distance (Sao) (IEC 60947-5-3)		10 mm (-10 to 60°C) 6 mm (-10 to 60°C, lateral) 8 mm (-25 to 65°C) 4 mm (-25 to 65°C, lateral)
Assured switch-off distance (Sar)		18 mm (lateral actuation: 15 mm)
Differential travel		<2.0 mm
Repeat accuracy (R)		<0.5 mm
Electrical		
Supply voltage (Ue)		24 VDC (-15%/+10%) (stabilized PELV-power supply)
Current consumption (Io)		35 mA
Overvoltage category		III
Pollution degree		3 (UL certification is 2)
Conditional short-circuit current		100 A
External device fuse rating		2 A max.
Safety input	Accepted test pulse duration on input signal	1.0 ms max.
	Test pulse interval	100 ms min.
	Current consumption per input	5 mA
Safety output (OSSD)	Switching element	PNP type, short-circuit proof
	Utilization category	DC-12: 24 VDC (Ue)/0.25 A (Ie) DC-13: 24 VDC (Ue)/0.25 A (Ie)
	Operating current (Ie1)	0.25 A max.
	Voltage drop (Ud)	<1 V
	Test pulse duration	1.0 ms max.
	Test pulse interval	1,000 ms
Auxiliary output	Switching element	PNP type, short-circuit proof
	Utilization category	DC-12:24 VDC (Ue)/0.05 A (Ie) DC-13:24 VDC (Ue)/0.05 A (Ie)
	Operating current (Ie2)	0.05 A max.
	Voltage drop (Ud)	<2 V
Switching frequency (f)		1 Hz
Rated insulation voltage (Ui)		32 VDC
Rated impulse withstand voltage (Uimp)		0.8 kV
Minimum operating current (Im)		0.5 mA
OFF-state leakage current (Ir)		<0.5 mA
Mechanical		
Fixing screws		2×M4 (Refer to the outline drawing for the actuator)
Tightening torque of fixing screws		0.8 N•m (Refer to the outline drawing for the actuator)
Material		Thermoplastic PBT (enclosure)
Weight		Unit: <50 g, Packaged: <110 g
Environmental		
Ambient operating temperature		-25 to 65°C
Ambient storage temperature (including during transportation)		-25 to 85°C
Ambient operating humidity		93% max. (non-condensing, non-icing)
Degree of protection (IEC 60529)		IP65 and IP67
Vibration resistance		10 to 55 Hz, amplitude 1.0 mm
Shock resistance		30 g/11 ms
Connection		
Series connection		31 max. (*1)
Cable lengths		100m max. (between switch and power supply)
Connection		D41D-1CD-N1: Connector plug M8, 8-pole, A-coded D41D-2CD-025-N2: Connecting cable 0.25-m long with connector M12

*1. Refer to the product catalog for connection specifications with the controller.

Safety classification information

Standard	ISO 13849-1, IEC 61508
PL	e
DC	99 %
Safety category	4
PFH (number)	6.8 x10^{-10}/h
PFD	1.2 x 10^{-4}
SIL	Suitable for SIL3 applications
Mission time	20 years

Note:1. If multiple safety door switches are involved in the same safety function, the PFH values of the individual components must be added.

c UL us

For use in NFPA 79 Applications.
Adapters providing field wiring means are available from the manufacturer. Refer to manufacturer's information.
For use in Pollution Degree 2 Environment.

FC

This device complies with part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s).
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

This device complies with the Nerve Stimulation Exposure Limits (ISED RSS-102) for direct touch operations. Changes or modifications not expressly approved by OMRON Corporation could void the user's authority to operate the equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.
L'exploitation est autorisée aux deux conditions suivantes:
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

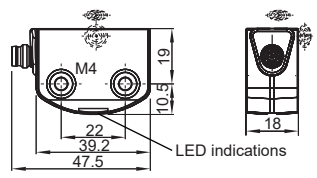
Cet appareil est conforme aux limites d'exposition relatives à la stimulation des nerfs (ISED CNR-102) pour les operations tactiles directes. Changements ou modifications non expressément approuvés par OMRON corporation pourrait annuler le droit de l'utilisateur à utiliser l'équipement.

Dimensions

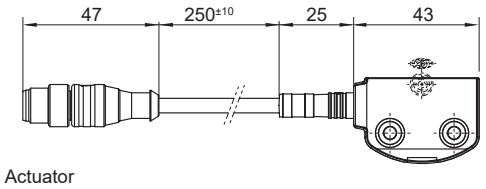
[Unit: mm]

active area

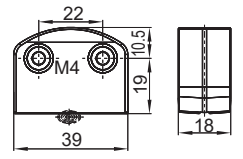
Safety door switch
D41D-*CD-N1



D41D-*CD-025N2

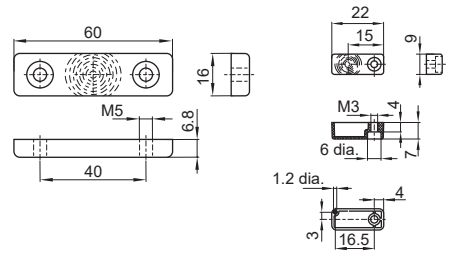


Actuator
D41D-A1: M4 screw
(Tightening torque: 0.8 N•m)



D41D-A2 : M5 screw
(Tightening torque: 2 N•m)

D41D-A3 : M3 screw
(Tightening torque: 0.6 N•m)



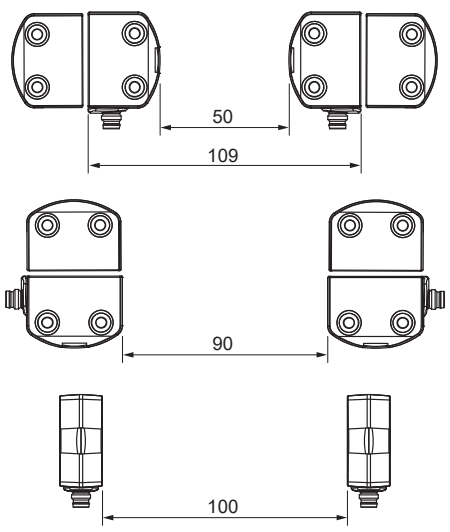
Mounting

The mounting holes provide for a mounting by means of M4 screws (max. tightening torque 0.8 N•m). The product can be mounted in any position. The minimum bend radius of the -025-type cable is 25 mm. The active areas of the safety door switch and the actuator have to face each other. The safety door switch must only be used within the assured operating distances ≤ Sao and ≥ Sar.

To avoid any interference inherent to this kind of system and any reduction of the operating distances, please observe the following guidelines:

- See the figures below for the minimum distances between two safety door switches and other systems of the same frequency (125 kHz).

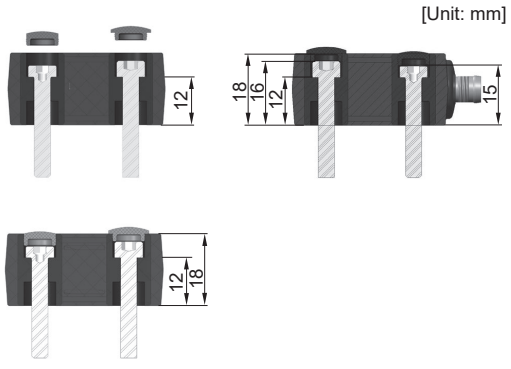
[Unit: mm]



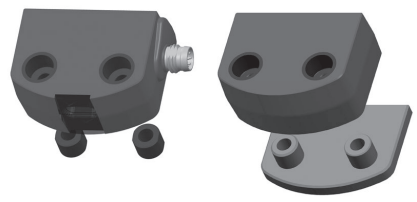
Accessory

Sealing Kit (D41D-SK)
Contents: 4 flat plugs and 4 plugs with rim for high screw head
Purpose: Used to seal the mounting holes

[Unit: mm]



Mounting Kit (D41D-MS)
Contents: 2 mounting plates and 4 ferrule plugs
Purpose (Mounting plate): Used to fix to a non-flat surface such as a profile.
Purpose (Ferrule plug): Used for applications with considerable changes in ambient temperature.



Connection

Function		Pin assignment of connector plug M8/M12, 8-pole, A-coded	Color code of the OMRON's connector (M8/M12 connector cable) M8: D41D-8P5-CFM8-7**M M12: D41L-8P5-CFM12-9**M
A1	U_e	1	WHITE
X1	Safety input 1	2	BROWN
A2	GND	3	GREEN
Y1	Safety output 1	4	YELLOW
OUT	Auxiliary output	5	GRAY
X2	Safety input 2	6	PINK
Y2	Safety output 2	7	BLUE
IN	without function	8	RED

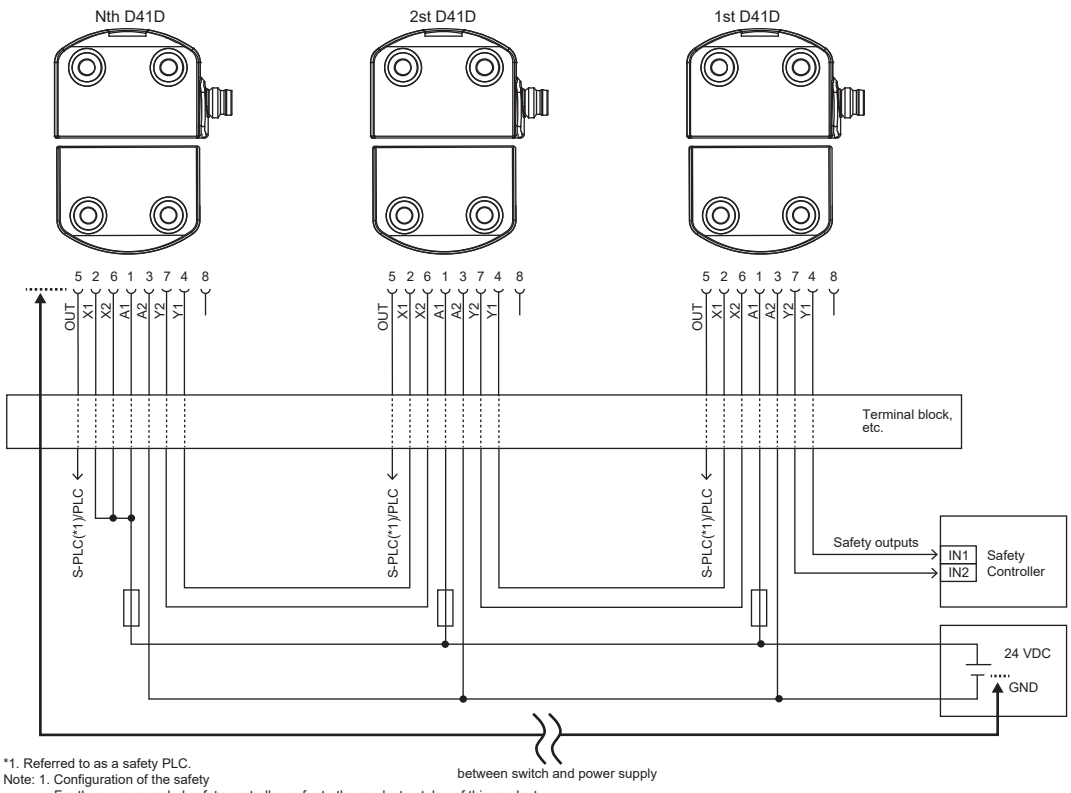
Note: 1. When using an OMRON cable, the tightening torque of the connector is 1 N•m

Wiring Examples

The application examples shown are suggestions. They however do not release the user from carefully checking whether the Safety door switch and its set-up are suitable for the individual application.
The power supply for the safety door switch must provide protection against permanent overvoltage. To that effect, stabilized PELV supply units must be used. The safety outputs can be directly integrated in the safety circuit of the control system. For applications of PL e / safety category 4 in accordance with ISO 13849-1, the safety outputs of the safety door switch or safety door switch of the chain must be connected to a safety controller or safety relay unit of the same Safety Category. Protection is not required when pilot wires are laid. The cables however must be separated from the supply and energy cables. If the safety door switch is wired to relays or to non-safety relevant control components, a new risk analysis must be carried out.
If the safety door switch is connected to the safety input of a safety controller or safety relay unit, the controller must have a dual-channel monitoring time of at least 100 ms and the accepted test pulse duration of at least 1 ms. Also, the cross-wire-short monitoring function must be disabled. Typically, a switch-off time of 250 µs is reached with a 30-m connecting cable. The switch-off time of the safety door switch is additionally extended depending on the cable length and the capacity of the cable used.

Note: Configuration of the safety controller
For the recommended safety controller, refer to the catalog of this product.

D41D series connection example



*1. Referred to as a safety PLC.
Note: 1. Configuration of the safety
For the recommended safety controller, refer to the product catalog of this product.

Teaching

Individually coded safety door switches and actuators will require the following teach-in procedure:

1. Keep the actuator away from the detection range and switch the safety door switch's voltage supply off and back on.
2. Introduce the actuator in the detection range. The teach-in procedure is signalled at the safety door switch, red LED on, yellow LED flashes (1 Hz).
3. After 10 seconds, the yellow LED gives brief cyclic flashes (3 Hz). Switch off the supply voltage of the safety door switch. (If the voltage is not switched off within 5 minutes, the safety door switch cancels the teach-in procedure and signals a false actuator by 5 red flashes).
4. Switch the supply voltage back on. The actuator must be detected once more in order to activate the taught actuator code. In this way, the activated code is definitively saved.

For ordering suffix D41D-1, the executed allocation of safety door switch and actuator is irreversible.

For ordering suffix D41D-2, the teach-in procedure for a new actuator can be repeated an unlimited number of times. When a new actuator is taught, the code, which was applicable until that moment, becomes invalid. Subsequent to that, the safety outputs will be disabled for ten minutes, thus providing for an increased protection against intentional tampering.
The green LED will flash until the expiration of the time (10 minutes) of the enabling inhibit and the detection of the new actuator.
In case of power failure during the lapse of time, the 10-minutes tampering protection time will restart.

Operating Principle

The safety outputs can be connected to the safety circuit of the control system. The opening of a guard door, i.e. the actuator is removed out of the active zone of the safety door switch, will immediately disable the safety outputs of the safety door switch. (For operating distances, refer to Ratings and Specifications.)

Any error that does not immediately affect the functionality of the safety door switch (e.g. too high ambient temperature, interference potential at the safety outputs, cross-wire short) will lead to a warning message, disabling of the auxiliary output and a delayed shutdown of the safety outputs. (Refer to Troubleshooting.)

The safety outputs are disabled if the error warning is active for 30 minutes. The signal combination, auxiliary output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

After fault rectification, the error message is reset by opening and reclosing the corresponding guard door. The safety outputs enable and allow a restart.

Diagnostic Functions

Operating principle of the diagnostic LEDs
The safety door switch indicates the operating condition and faults by means of three-color LEDs located in the lateral surfaces of the safety door switch.
The green LED indicates that the safety door switch is ready for operation. The supply voltage is on and all safety inputs are present. Flashing (1 Hz) of the green LED signals that a voltage is missing on one or both of the safety inputs (X1 and/or X2).
The yellow LED always signals the presence of an actuator within range. If the actuator is operating near the limit of the differential travel range of the safety door switch, the LED is flashing.
The flashing can be used to prematurely detect variations in the clearance between the safety door switch and the actuator (e.g. sagging of a guard door). The safety door switch must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

Operating principle of the auxiliary output
An auxiliary output additionally indicates the operating condition (refer to Table 1). The auxiliary output OUT can be used for central visualization or control functions, e.g. in a PLC. It indicates the switching condition as shown in Table 1.

Commission, Set-up and Maintenance

Functional testing
The safety function of the safety components must be tested. The following conditions must be previously checked and met:
1. Fitting of the safety door switch and the actuator.
2. Fitting and integrity of the power cable.
3. The system is free of dirt and soiling (in particular metal chips).

Maintenance
Maintenance frequency
SIL3 / PLe at least once a month
SIL2 / PLd at least once a year

(Daily inspection)
• For each guard door, check that the machine stops when the guard door opens.

(Inspection every 6 months)
1. Check the fitting and integrity of the safety door switch, the actuator and the cable.
2. Remove possible metal chips.
3. Check that the cable is connected correctly and there is no problem.

Disassembly and Disposal

Disassembly
The product must be disassembled in a de-energized condition only.

Disposal
The product must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.

Troubleshooting

Error
Errors, which no longer guarantee the function of the safety door switch (internal errors) cause the safety outputs to be disabled within the risk time.
After the rectification of the error, the error message is reset by opening the corresponding guard door.
Error warning
The auxiliary output can also be used to detect clearance variations between the safety door switch and the actuator in the same way as the yellow LED. An active fault is visualized by the red LED and causes the auxiliary output to be disabled. The safety outputs are disabled after a maximum of 30 minutes if the fault is not rectified. This signal combination, auxiliary output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

LED indication (red)		Error cause
1 flash pulse		Error output Y1
2 flash pulses		Error output Y2
3 flash pulses		Cross-wire short between Y1 and Y2
4 flash pulses		Ambient temperature too high
5 flash pulses		Incorrect or defective actuator
Continuous red		Internal fault, with yellow flashing teaching procedure

Table 1: Diagnostic information for safety door switch with auxiliary output

Switch function	LEDs			Auxiliary output	Safety outputs	Note
	Green	Red	Yellow		Y1, Y2	
Supply voltage	On	Off	Off	0 V	0 V	Voltage on, no evaluation of the voltage quality
Actuated	On	Off	On	24 V	24 V	The yellow LED always signals the presence of an actuator within range.
Actuated in limit area	On	Off	Flashes (1Hz)	24 V pulsed	24 V	The safety door switch must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine.
Error warning, switch actuated	Off	Flashes	On	0 V	24 V	The safety outputs are disabled after 30 minutes if the error is not rectified.
Error	Off	Flashes	On	0 V	0 V	Refer to table with flash codes
Teach actuator	Off	On	Flashes	0 V	0 V	Safety door switch in teaching mode
Tampering protection time (*1)	Flashes	Off	Off	0 V	0 V	10 minutes pause after re-teaching
Error in input circuit X1 and/or X2	Flashes (1Hz)	Off	Off	0 V	0 V	Example: door open; a door in the safety circuit upstream is also open.
Error in input circuit X1 and/or X2	Flashes (1Hz)	Off	On	24 V	0 V	Example: door closed, a door in the safety circuit upstream is open.

*1. Refer to Teaching.

Declaration of Conformity

No.EUSC0005B

Original

OMRON

EU DECLARATION OF CONFORMITY

1. **Product Models/Products:**
D41D series

2. **Name and address of the manufacturer:**
OMRON Corporation
Shiokoji Horikawa Shimogyo-Ku, Kyoto, 600-8530 Japan

3. **This declaration of conformity is issued under the sole responsibility of the manufacturer.**

4. **Objects of the declaration:**
D41D Series, Safety Door Switch

5. **The objects of the declaration described above are in conformity with the relevant Union harmonisation legislation:**
2014/53/EU RE Directive
2011/65/EU RoHS Directive
2006/42/EC Machinery Directive

6. **References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:**
RE Directive: EN 300 330 V2.1.1:2017, EN 60947-5-3:2013
Machinery Directive: EN 60947-5-3:2013, EN ISO 14119:2013, EN ISO 13849-1:2023
EN 61508 part1-7:2010
RoHS Directive: EN IEC 63000:2018

7. **Name, address, and identification number of Notified Body, Number of EC Type Examination**
Machinery Directive:
Notified body: TÜV Rheinland Industrie Service GmbH
Address: Am Grauen Stein, 51105 Köln, Germany
Notified Body identification No.: 0035
Certificate for EU Type Examination: 01/205/5826.01/25

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No.EUSC0005B

Signed and on behalf of: OMRON Corporation
Place and date of issue: Kyoto, Japan

Signature:
Name: Kenta Yamakawa
Function: Industrial Automation Company, Safety Division, General Manager

Name and address of contact in EU
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Quality & Environment Department
Attn: J.J.P.W. Vogelaar, European Quality & Environment Manager
Zilverenberg 2, 5234 GM, 's-Hertogenbosch, The Netherlands

Additional information
Type: D41D Series

D41D-	( )	CD	-	( )	N	( )
	I			II		III

I : 1, 2
II : Blank, 025
III : 1, 2

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