SERIES CSS 180

Pulse-Echo Based Non-Contact Safety Sensor

Features & Benefits

- **Non-contact sensing …** for long term reliability.
- **Sealed for moisture protection …** ideal for most hostile environments.
- **Tamper-resistant …** frequency-matched sensor and actuator required for operation.
- **Integral LED diagnostic indicators …** facilitate easy installation and troubleshooting.
- **Integral self-monitoring …** satisfy requirements of Safety Control Category 4. *See note below.
- **Designed for "daisy chaining" …** up to 200m.
- **Dual PNP 500mA safety outputs …** for application versatility.

Description

The CSS 180 non-contact, electronic safety sensor is designed for application in safety circuits and is used for monitoring the position of movable safety guards. In this application the safety sensor monitors the closed position of hinged, sliding or removable guards with the aid of a coded actuator.

The CSS 180 Safety Sensor fulfills the requirements for proximity devices with defined behavior under fault conditions according to EN 60947-5-3 with the classification PDF-M (self-monitoring).

Operation

The CSS 180 Safety Sensor and CST 180 actuator are a matched pair. As the actuator approaches the sensor, the sensor excites the actuator at a predetermined resonant frequency and the reads back the actuator oscillation. The sensor evaluates the actuator frequency and its distance to the actuator.

Identification of the actuator is interpreted as a closed guard by the safety sensor, and the safety outputs are enabled.

The safety sensor is a dual channel design with two short-circuit proof, safe PNP outputs, each of which can switch up to 500 mA. Due to continuous internal function tests and the monitoring of the safety outputs, a number of CSS 180 Safety Sensors can be wired in series without detriment to the control category. Series wired safety sensors continue to fulfill the requirements of Control Category 4 according to EN 954-1.

Typical Applications

The sealed, compact units are ideal for use on movable machine guards where multiple guard monitoring on a machine is required, and/or where hostile environments exist. Typical applications include printing machinery, textile machinery, paper converting equipment, material handling systems, packaging machinery, chemical processing equipment, and woodworking machinery.

AVAILABLE MODELS AND ACCESSORIES (Accessories Ordered Separately)

Model Number	Description
CSS-8-180-2P-E-L	End or single device with pre-wired cable
CSS-8-180-2P+D-E-L	End or single device with diagnostic output, pre-wired cable
CSS-8-180-2P-Y-L	Series device with double pre-wired cable
CSS-8-180-2P+D-M-L	Series device with diagnostic output, pre-wired cable
CST-180-1	Actuator
CSA-M-1	Magnetic latch
H-18	Mounting clamp

Sensors available with M12 cable connector – Add **ST** after L in catalog number

Safety Control Module Requirements

Dual-channel safety inputs, suitable for PNP semiconductor outputs. The internal function tests of the sensor cause the outputs to periodically switch off for a millisecond. This must be tolerated by the control module. The following SCHMERSAL safety control modules are recommended for this application: SRB 301 LCB and SRB 324ST

*Note: A safety control module may be required for reset function and/or feedback monitoring functions, as well as increased output current requirements.

SERIES CSS 180 TECHNICAL DATA

MECHANICAL SPECIFICATIONS

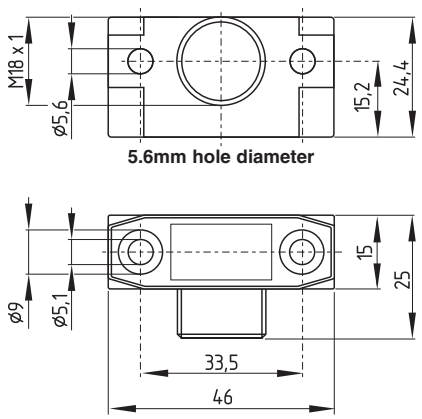
Housing	Glass fiber reinforced thermoplastic
Degree of Protection	IP67
Switching Distance	8mm (Nominal) 7.0mm to 9.5mm (Maximum)
Operating Temperature	–25°C to +55°C
Storage Temperature	–25°C to +85°C
Hysteresis	≤ 0.5mm
Repeatability	≤ 0.2mm
Response Time	≤ 30ms
Vibration Resistance	10-55Hz, amplitude 1mm
Shock Resistance	30g/11ms
Conformity to Standards	CE BG EN 60947-5-3 UL EN 954-1 IEC 61508

ELECTRICAL SPECIFICATIONS

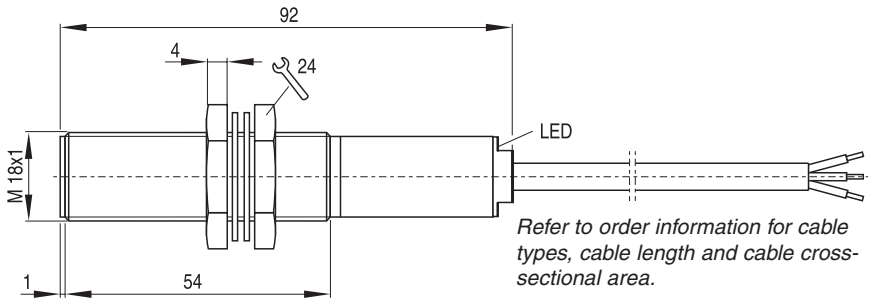
Mode of Operation	Inductive
Rated Operating Voltage	24 VDC -15%/+10%
Rated Operating Current	1.0A
No Load Current	0.05A
Residual Current	≤ 0.5mA
Rated Impulse Withstand Voltage	0.8kV
Rated Insulation Voltage	32 VAC/VDC
Safety Outputs	(2) PNP, short-circuit proof
Safety Output Current	0.5A per output
Safety Output Voltage Drop	Max. 0.5V
Signaling Output	PNP, short-circuit proof
Signaling Output Operating Voltage	Max. 4V below rated operating voltage
Signaling Output Operating Current	Max. 0.05A
Type Interconnection Cable	4x0.5mm², 5x0.34mm², or 7x0.25mm²

DIMENSIONS

CST Actuator

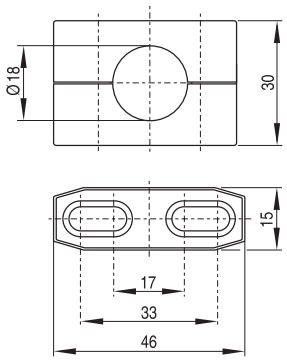


CSS 180 Safety Sensor

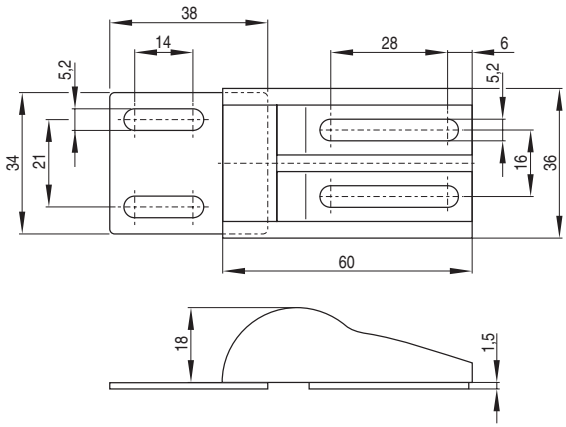


Refer to order information for cable types, cable length and cable cross-sectional area.

Mounting Clamp



Magnetic Latch



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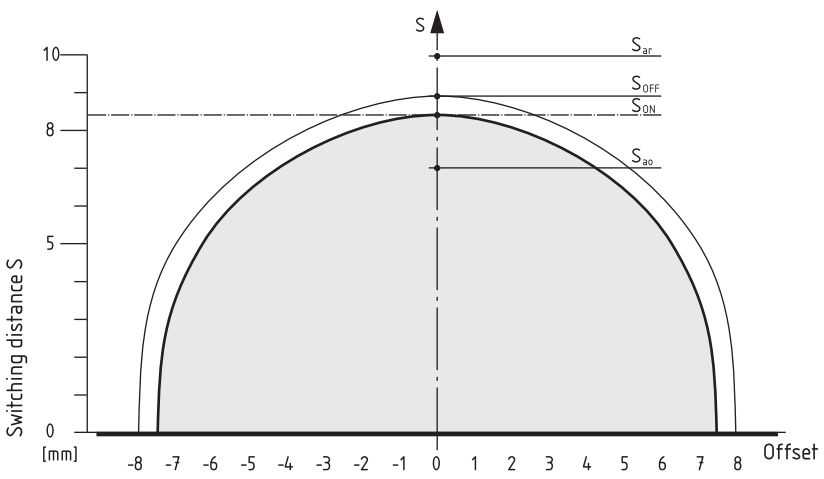
SERIES CSS 180 TECHNICAL DATA

SWITCHING DISTANCES, FLUSH MOUNTING



Minimum distance between two sensor sets: approximately 100mm

Typical Response Range of the Sensor CSS 180

S_{ON} Switch-on point $S_{ON} < S_H < S_{OFF}$

S_{OFF} Switch-off point S_H = Hysteresis area

S_{ao} Assured operation point

S_{ar} Assured release point according to EN 60947-5-3

The envelope curves indicate the switch-on and switch-off points of the CSS 180 sensor relative to the target. The maximum offset of the target from sensor axis is approx. 7mm. Flush-mounting of the sensor or actuator reduces the switching distance. (When the sensor and actuator protrude 2mm out of their mountings the switching distance is not reduced.) Changes in temperature have only a slight effect on the switching points.

NOTE ON SERIES CONNECTIONS

- Series-wiring of sensors: A chain of self-monitored CSS 180 safety sensors can be wired in series without loss of control category 4 to EN 954-1. In this configuration, the redundant output of the first sensor is wired into the input of the next sensor.
- The voltage drop over a long sensor chain should be taken into account when planning cable routing. It depends on several factors, which are operating voltage, cable length and section, ambient temperature, number of series-wired sensors and the input load of the safety controller, up to a maximum of 200m.

Function table of visual diagnostic LED, electronic diagnostic output and safety outputs

Visual diagnostic (red)	Cause of fault
1 pulse	Fault on Output Y1
2 pulses	Fault on Output Y2
3 pulses	Cross-wire short Y1/Y2
4 pulses	Ambient temperature too high
5 pulses	Incorrect or defective actuator
Contin-uous	Internal fault

Sensor condition	Diagnostic LED color in sensor end cap	Electronic diagnostic output 24 VDC, 50 mA	Safety outputs
No target/Power on	Green	0 V	0 V
Actuated	Yellow	24 V	24 V
Actuated in limit area	Flashes yellow	2 Hz cycle	24 V
Fault	Flashes red	10 s delay 24 V -> 0 V	1 min delay 24 V -> 0 V

Six different fault conditions are signalled by the diagnostic LED flashing with predefined pulse sequence or with continuous red light.

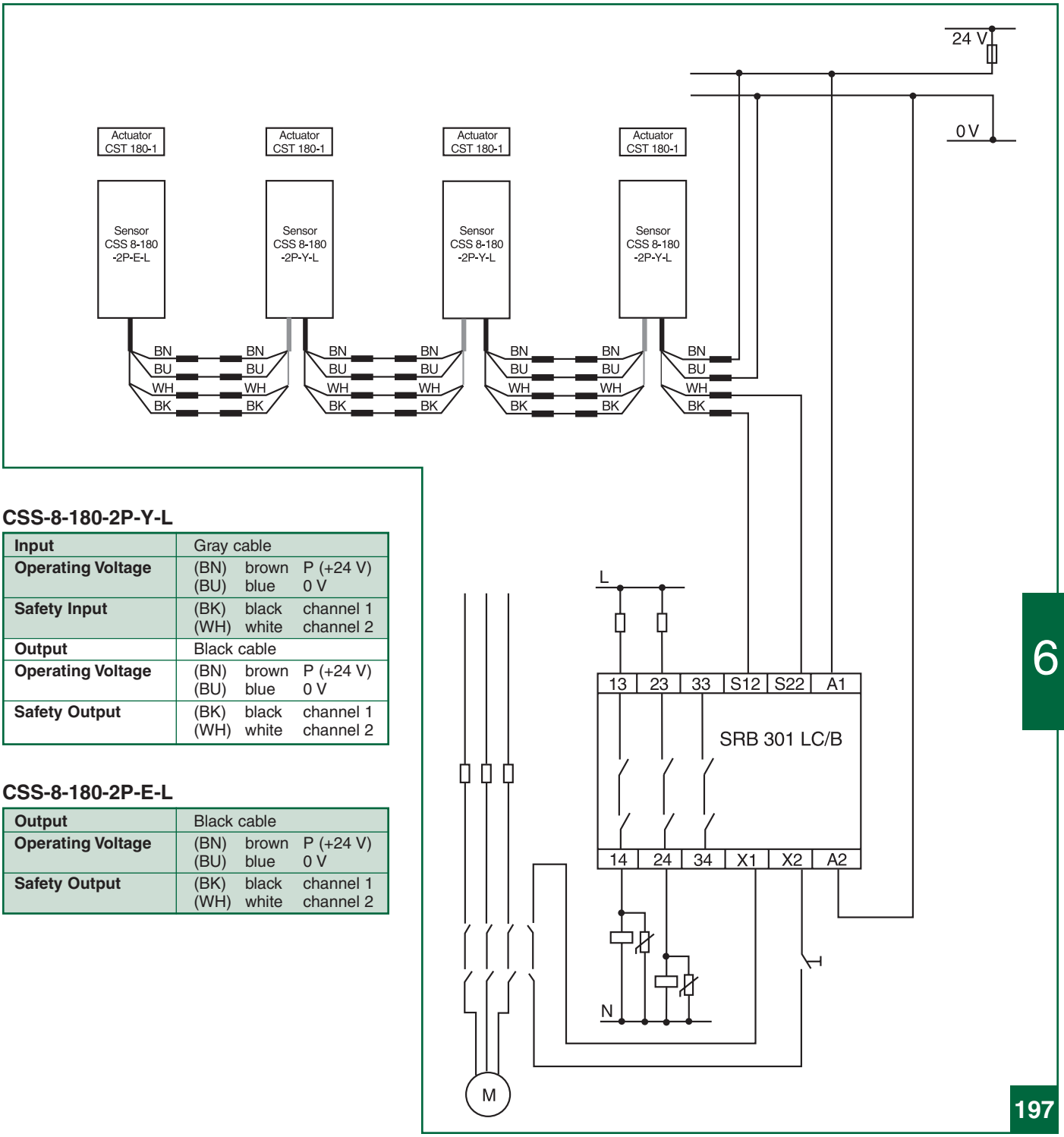
SERIES CSS 180 WIRING EXAMPLE 1

Safety Sensors in large systems
The sensors have separate input and output cables. The output of one sensor can be directly wired into the input of the next sensor. The sensor chain can be built up over a length of two hundred meters.

Sensors used:
1 Safety Sensor CSS-8-180-2P-E-L: This sensor has one output cable. It is designed for the beginning of a chain or for use as a single device.

3 Safety Sensors CSS-8-180-2P-Y-L: These sensors have separate input and output cables. The output of the first sensor is wired into the input of the next sensor and so on. This type of sensor can also be used as the first sensor in a chain, if the supply voltage is bridged to the safety inputs.

SERIES CONNECTION OF CSS-8-180



CSS-8-180-2P-Y-L

Input	Gray cable		
Operating Voltage	(BN) (BU)	brown blue	P (+24 V) 0 V
Safety Input	(BK) (WH)	black white	channel 1 channel 2
Output	Black cable		
Operating Voltage	(BN) (BU)	brown blue	P (+24 V) 0 V
Safety Output	(BK) (WH)	black white	channel 1 channel 2

CSS-8-180-2P-E-L

Output	Black cable		
Operating Voltage	(BN) (BU)	brown blue	P (+24 V) 0 V
Safety Output	(BK) (WH)	black white	channel 1 channel 2

SERIES CSS 180 WIRING EXAMPLE 2

Series connection of Safety Sensors CSS 180 in small systems with a centralized control cabinet or wiring via junction boxes.

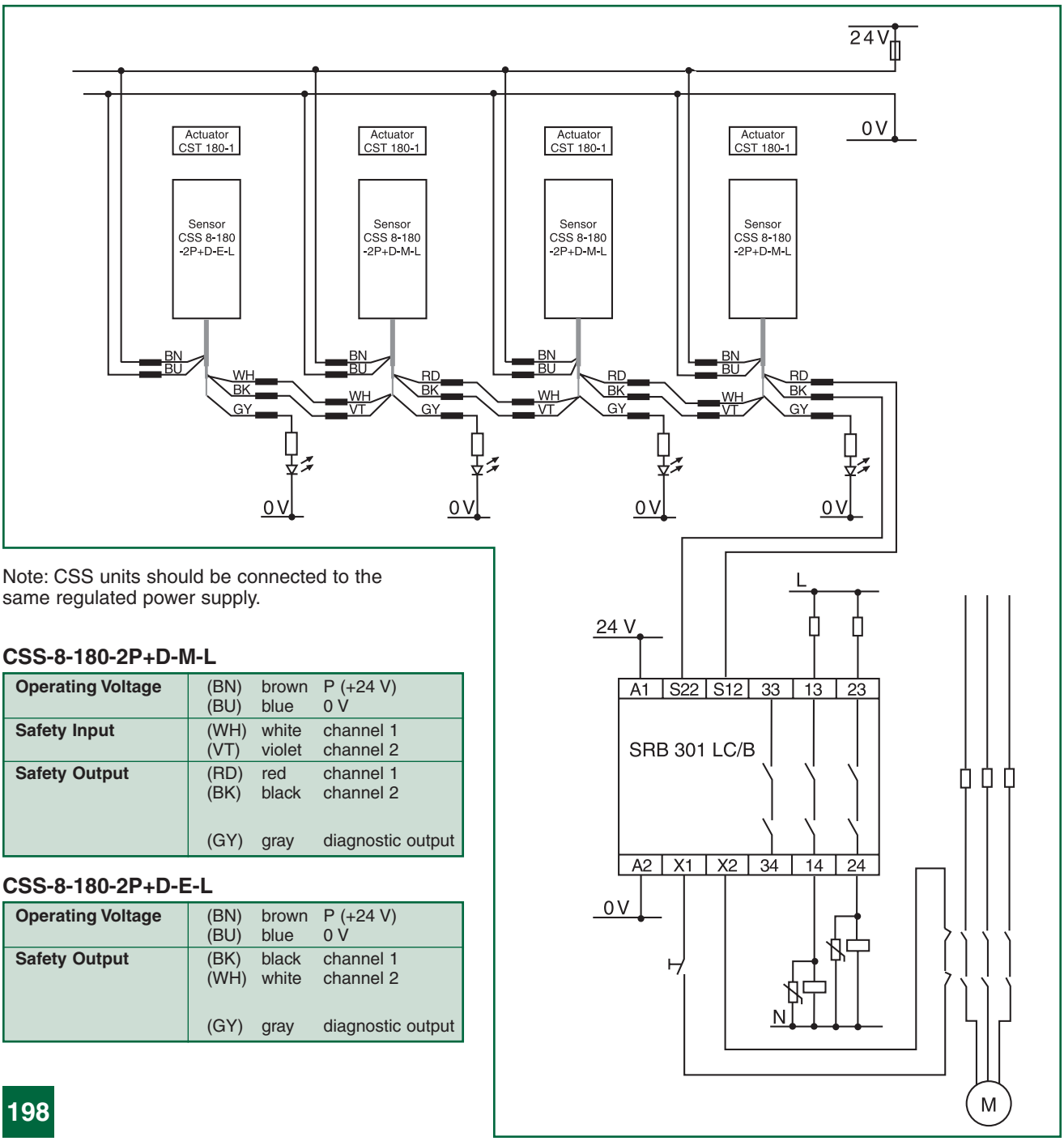
Sensors used:
1 Safety Sensor CSS-8-180-2P+D-E-L:
This sensor has one output cable. It is designed for the beginning of a chain or for use as a single device.

3 Safety Sensors CSS-8-180-2P+D-M-L:
The inputs and outputs of the sensors are brought out in one cable. The sensors are wired together in series in the control cabinet or in junction boxes.

This type of sensor can also be used as the first sensor in a chain, if the supply voltage is bridged to the safety inputs. For very long sensors chains it is recommended to feed the power supply directly to the first sensor in the chain to avoid excessive voltage drop. The safe outputs of the last sensor in the chain are connected to the safety control module.

If junction boxes are used, standard installation cable can be used for the wiring between junctions. When laid together with control cables in a separated cable channel, shielding is not necessary.

SERIES CONNECTION OF CSS-8-180



Note: CSS units should be connected to the same regulated power supply.

CSS-8-180-2P+D-M-L

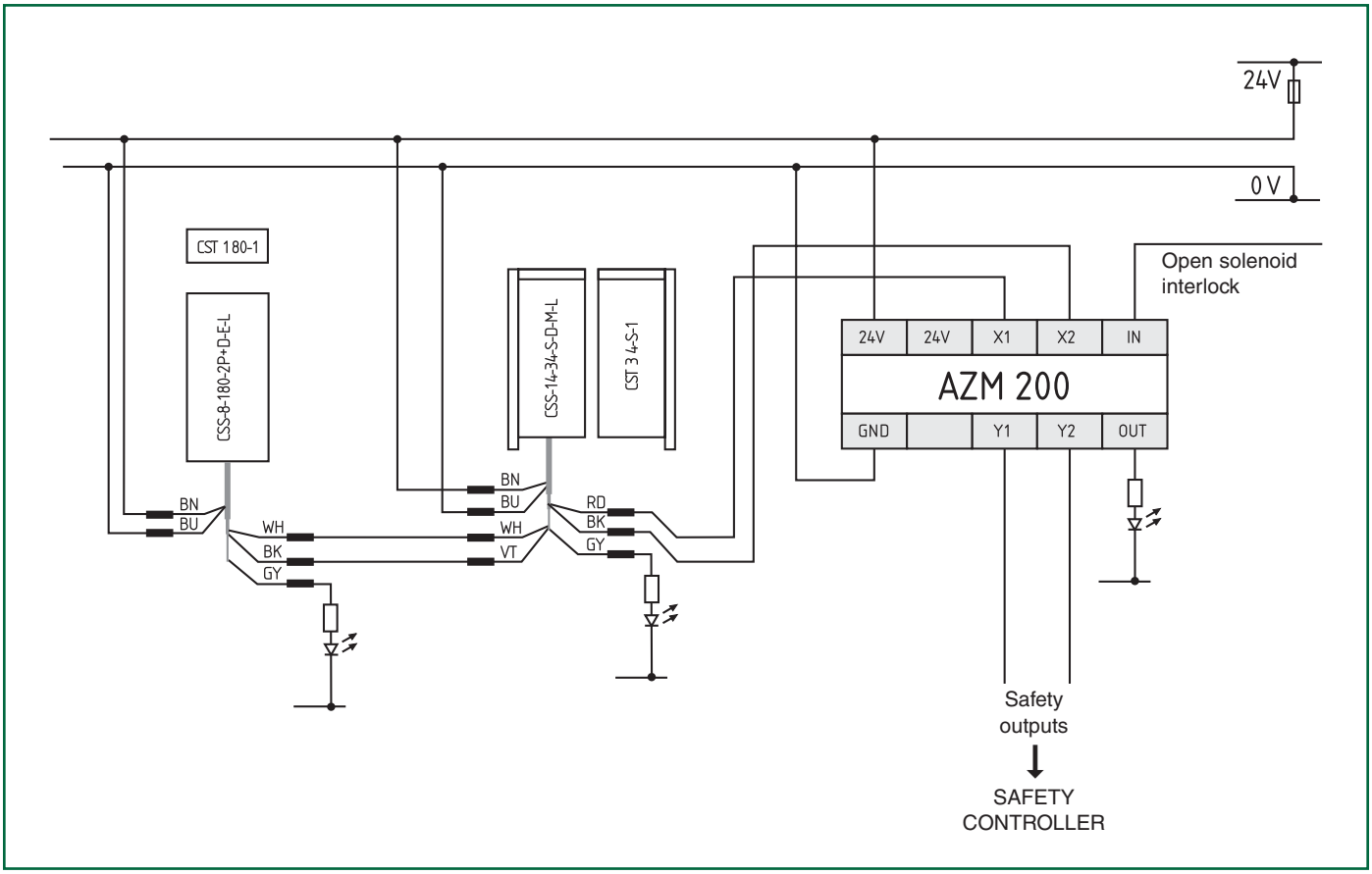
Operating Voltage	(BN)	brown	P (+24 V)
	(BU)	blue	0 V
Safety Input	(WH)	white	channel 1
	(VT)	violet	channel 2
Safety Output	(RD)	red	channel 1
	(BK)	black	channel 2
	(GY)	gray	diagnostic output

CSS-8-180-2P+D-E-L

Operating Voltage	(BN)	brown	P (+24 V)
	(BU)	blue	0 V
Safety Output	(BK)	black	channel 1
	(WH)	white	channel 2
	(GY)	gray	diagnostic output

WIRING EXAMPLES FOR PULSE-ECHO BASED SENSORS

SERIES-WIRING OF VARIOUS SENSORS AND SOLENOID INTERLOCKS WITH DIAGNOSTIC OUTPUT



The CSS 180, CSS 34, MZM 100, AZ 200 and AZM 200 can be wired in series in any desired combination. For the CSS 180, 16 devices maximum can be wired in series; for the CSS 34 and AZM 200, maximum 31 devices. If the CSS 180 is used in a “mixed” series-wiring, the maximum number of series-wired devices is limited to 16. The maximum number of devices depends upon a maximum cable length of 200m.

PRODUCT SELECTION

This example applies to the following series-wired devices.

Device	Description
CSS-8-180-2P+E-L with CST-180-1	With diagnostic output, connecting cable 5-wire Actuator
CSS-14-34-S-D-M-L with CST-34-S-1	Position of the active face, on the side, connecting cable, 7-wire Actuator, on the side
AZM 200..-T-1P2P,a	1 diagnostic output with power-to-lock principle and door detection sensor