

CM Series

Operating Instructions for CM-S41, CM-S21, CM-SE, CM-S11, CMS31 CM Series Safety System

CAUTION

This information is designed to help suitably qualified personnel install and operate STI Safety Switch equipment. Before using this product, read this guide thoroughly along with any relevant European and/or National standards e.g. Machinery Directive 89/392/EEC and its amendments, Provision and Use of Work Equipment Regulations.

Further information can be obtained from STI

***** KEEP THIS GUIDE FOR FUTURE REFERENCE *****

DESCRIPTION

The CM Series safety system is a tamper resistant non-contact safety switch system, suitable for use in most types of machine guarding applications where guard locking is not required. The system comprises of a control unit and 1 or more safety switches and actuators. The CM Series non-contact safety switches are easy to install, tolerant to misalignment and suitable for use in harsh or wet environments.

CM-S41 Control Unit

The CM-S41 is a combined Safety Switch and E-Stop control unit. Along with the ability to monitor up to four CM Series safety switches it can also monitor the normally closed contacts of emergency stop buttons or mechanical safety switches in dual channel control circuits.

The CM-S41 has 2 normally open safety contact outputs and 1 normally closed auxiliary output, an external re-set/proving circuit and LED indication for 'Power', 'Run' and the status of each activated gate switch.

CM-S21 Control Unit

The CM-S21 control unit is a 24V ac/dc system that can monitor up to 2 CM Series safety switches.

The CM-S21 has 2 normally open safety contact outputs and 1 normally closed auxiliary output, an external re-set/proving circuit and LED indication for 'Power', 'Run' and the status of each activated gate switch.

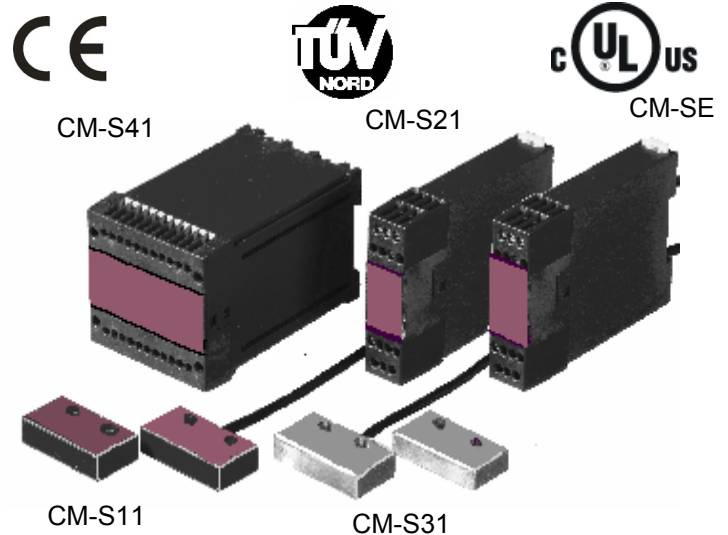
CM-SE Extender Module

The CM-SE Extender module is a 24V ac/dc unit that can be added to either the CM-S41 or CM-S21 to monitor an additional 5 CM Series safety switches. Connection to the main control unit is by a simple 2-wire bus connection. The status of each guard switch is shown by the YELLOW LED's. Additional CMS-E extender modules can be added to monitor larger systems.

Safety Switches

The CM Series safety switches are non-contact, tamper resistant safety switches. Resin encapsulated into an ABS or Stainless Steel case providing environmental protection to IP67, the switches can withstand most conditions including: water, dust and high pressure hose cleaning.

The 2-wire connection to each safety switch is monitored by the control unit, detecting both open and short circuit faults immediately and returning the control unit to the off state even if the gate is not operated.



APPLICATIONS

Interlocked guards where door locking is not required.
 Food and Beverage packing/filling systems;
 Dairy, Pharmaceutical, Paper Industry
 Can Forming and Filling, (Aluminum, Steel, Plastic)
 Semiconductor Manufacture/Assembly
 Concrete Block Manufacture.

APPROVALS

CE	Complies with the relevant sections of the CE marking directive.
UL	UL 508 Industrial Control Equipment
TUV	Tested to EN954-1

EUROPEAN DIRECTIVES

Machinery Directive 98/37/EC
Low Voltage Directive 73/23/EC
Electromagnetic Compatibility Directive 89/336/EC

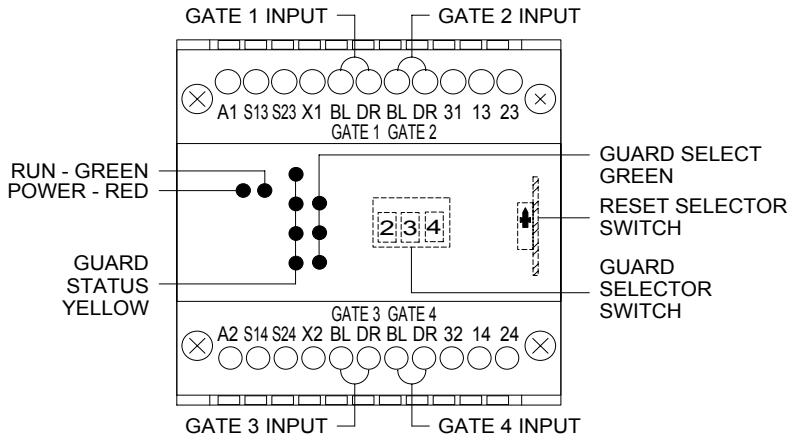
EUROPEAN STANDARDS

EN292	Safety of Machinery Basic concepts, general principles for design.
EN 60204	Safety of Machinery Electrical equipment of machines.
EN 954-1	Safety of Machinery Safety related parts of controls systems
EN 1088	Interlocking devices associated with guards.
EN 60947-5-3	Safety of Machinery Specification for low voltage switchgear and control gear.

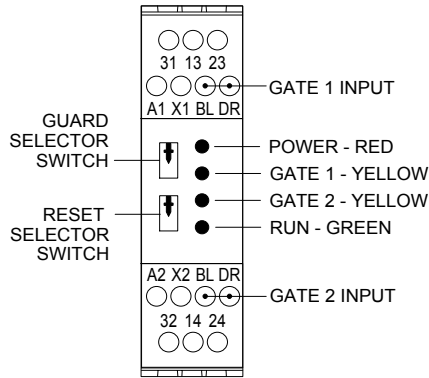
CERTIFICATE OF CONFORMITY

A certificate of conformity can be obtained from the OMRON STI Web Site: WWW.STI.COM

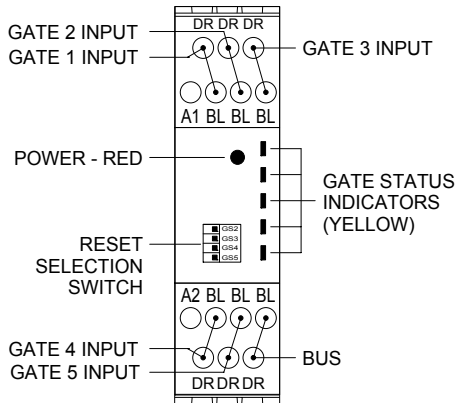
PRODUCT IDENTIFICATION AND TERMINAL LAYOUT



CM-S41 TERMINAL INFORMATION	
TERMINAL NUMBER	DESCRIPTION
A1 ; A2	Power Supply
S13 ; S14	E-Stop / Mechanical Safety Input—Channel 1
S23 ; S24	E-Stop / Mechanical Safety Input—Channel 2
X1 ; X2	External Proving / Reset
BL ; DR - Gate inputs 1 to 4	Guard Switch Inputs
13 ; 14	N/O Safety Contact 1
23 ; 24	N/O Safety Contact 2
31 ; 32	N/C Auxiliary Contact



CM-S21 TERMINAL INFORMATION	
TERMINAL NUMBER	DESCRIPTION
A1 ; A2	Power Supply
X1 ; X2	External Proving / Reset
BL ; DR - Gate inputs 1 & 2	Guard Switch Inputs
13 ; 14	N/O Safety Contact 1
23 ; 24	N/O Safety Contact 2
31 ; 32	N/C Auxiliary Contact



CM-SE TERMINAL INFORMATION	
TERMINAL NUMBER	DESCRIPTION
A1 ; A2	Power Supply
BL ; DR - Gate inputs 1 to 5	Guard Switch Inputs
BL ; DR - BUS	Bus connection to main control unit

SYSTEM INSTALLATION

This installation guide is to help trained personnel to install the CM-Series non-contact safety switch system.

The CM-Series system is suitable for most types of machine guarding applications where guard locking is not required. The safety switches can be fitted to sliding, hinged or removable machine guards.

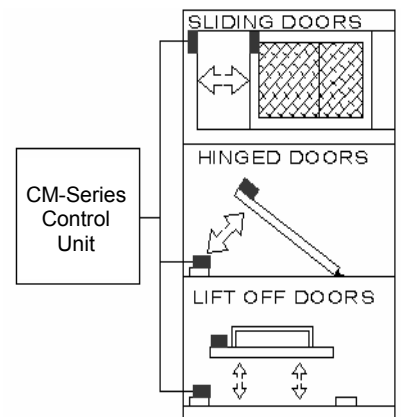
Comprising of a Safety Control Unit CM-S41/S21/SE and one or more Safety Switch and Actuators, systems can easily be assembled to monitor 30+ machine guards while retaining the high control category performance required in many applications. (CAT 3 according to EN954-1)

To assemble the system, mount the control unit in a suitably IP rated control panel (Min IP54) and fix the safety switches to the gates as shown. Connect the safety switches to the control unit. Using the appropriate selection table set the required active gate inputs and reset options.

IMPORTANT :

Always check the correct operation of all the safety functions after installation and periodically through the life of the system.

It is the responsibility of the user to ensure safe and proper use of any safety

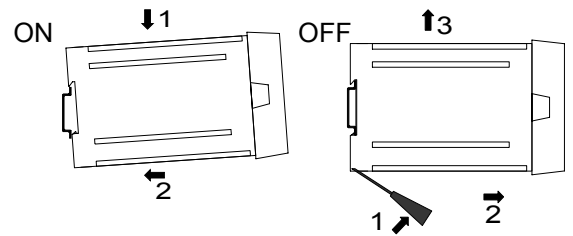


INSTALLING THE CONTROL UNIT

The CM-Series control units are designed to fit standard 35mm symmetric DIN rail.

TO FIT : Hook the unit onto the DIN rail (1) and gently push into place (2). The catch should hold the unit securely in place.

TO REMOVE: Place the tip of a small screwdriver into the white catch at the bottom of the box (1) and gently lever out. This releases the retaining clip and allows the unit to be tilted (2) and removed (3).

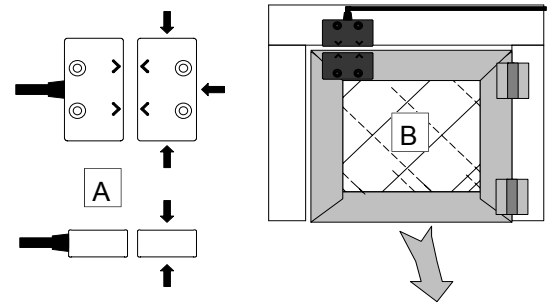


INSTALLING THE SAFETY SWITCHES

The CM-Series safety switch sensors have 2 pre-drilled mounting holes and are supplied with M4 x 20mm TORX Tamper Proof screws. (see page 7 for dimension details)

The gate switches can approach each other from any angle (A), but must end up with the arrows on the printed face pointing towards each other. Mount the fixed part of the safety switch to the machine frame and the actuator on to the opening edge of the door (B).

For the best results, mount the sensors with a gap of approximately 1mm. when the guard is closed. This gives a high level of lateral tolerance to allow for 'gate sag' and freedom from nuisance tripping due to machine / guard vibration.



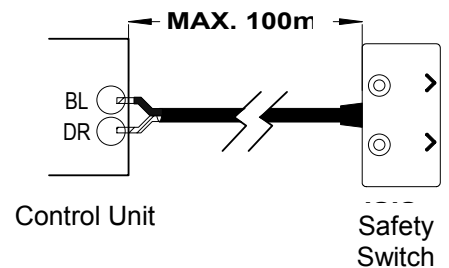
CONNECTING SWITCHES TO THE CONTROL UNIT

The CM-Series safety switches are supplied with 3 or 5 metres of cable encapsulated into the switch. This ensures a completely water-tight connection at the switch.

Cables can be extended using the same type of screened cable.

Run the cable back to the control unit through cable protection (if required) and terminate into the appropriate control unit input channel.

Follow the color coding of the wires to the labels on the control unit input terminals. i.e. BLUE wire to BL and DRAIN wire to DR.

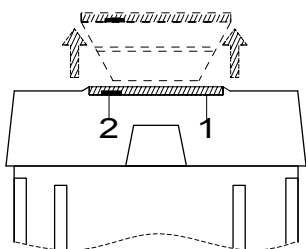


IMPORTANT: Use the GATE inputs in sequence. Examples:

One Guard System—Use input 1 on the CM-S21 (Or input 1 on the CM-S41 if E-Stop function required);

Three Guard System—Use inputs 1, 2 & 3 on the CM-S41;

Seven Guard System—Use inputs 1,2 & 3 for Guard Switches on the CM-S41 and Input 4 to connect to the CM-SE Extender module Bus connection. Then use inputs 1,2,3 & 4 on the CM-SE.



GUARD SELECTOR & RESET SWITCHES

The central part of the CM-Series control unit lid (1) is removable. Using a small screwdriver in the recess (2) gently pry the lid upwards. This allows access to the Automatic/Manual monitored Reset switch and the Guard Selector Switch.

Using the table next to the relevant control unit overleaf, set the CM-Series control unit to the required number of guard switch inputs and type of reset required.

IMPORTANT:

The number of inputs (safety switches) must match the gate selector setting. Any incorrect setting will stop the system from operating correctly.

MOUNTING THE SWITCHES

1) Always try to mount the safety switch on non-ferrous material. Ferrous materials will reduce the switching distance.

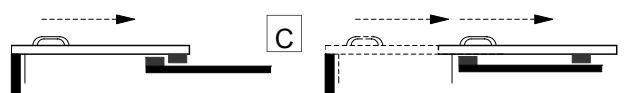
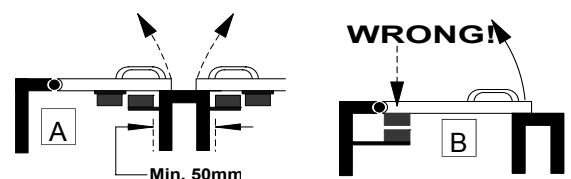
2) Leave a minimum 50mm gap between actuators. (A)

3) Avoid mounting the safety switch on the hinged side of the door, as this may allow the door to be opened too far before the switch de-activates. (B)

EN 1088

provides some mounting suggestions, see example (C).

When fixing the switches to a sliding door, ensure that when the door is opened the switch is not easily accessible.



CM-S41 CONNECTIONS

POWER SUPPLY:

24Vac/dc ; 110Vac or 230Vac

POWER SUPPLY FUSING:

Internal resettable fuse with 2 second delay after fault removal.

INDICATION:

RED - Power On, GREEN - Run, YELLOW - Guard Status, GREEN - Guard Selected status.

GUARD SELECTION:

See CM-S41 switch table.

RE-SET & MONITORING:

The X1, X2 circuit is for reset buttons and/or monitoring external contactors.

Manual Reset: (see table) A normally open momentary push button should be placed across X1 & X2. The push button must be pressed and released as it is monitored for short circuit faults.

Automatic Reset: Link X1, X2 and the system will reset when all active guards are closed.

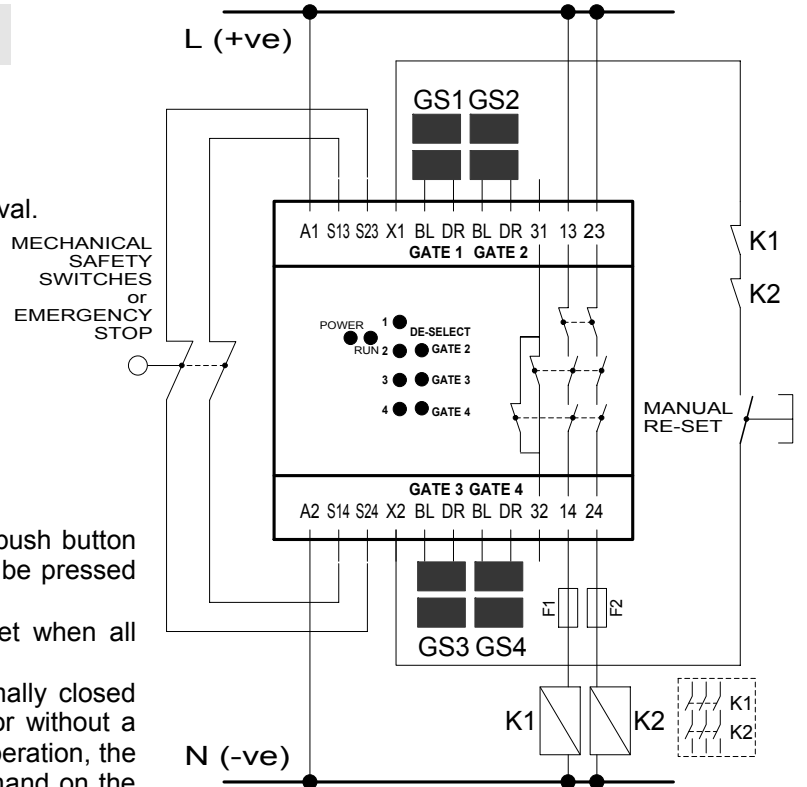
Monitor External Contactors: (K1 & K2) Place a normally closed contact off each contactor in series with X1 & X2 (with or without a reset button as required) If either K1 or K2 welds during operation, the other contactor will operate correctly and on the next demand on the safety system the X1 X2 circuit will prevent a restart. Use PGC relays for K1 & K2 if monitoring required.

CONTROL CONTACTS: Two sets of positively guided N/O safety contacts on terminals, 13,14; and 23,24 (rating 4 Amps). One auxiliary N/C contact, (31-32). External fusing is recommended.

EMERGENCY STOP MONITORING: Dual channel emergency stop buttons and/or mechanical safety switches can be monitored using the S13/S14 & S23/S24 circuits. **If this feature is not used link terminals S13 to S14 and S23 to S24.**

OPERATION: When power is applied to the control module, the RED 'Power Led' will illuminate. The GREEN 'De-select' indicators will show how many guard switch inputs are activated. NOTE: The number of inputs selected must match the number of guard switches, more or less and the control unit will not operate. The YELLOW 'Guard status' indicators will be illuminated if the guard is closed or be permanently on if the guard is de-selected.

If all the monitored machine guards are closed, the EMERGENCY STOP buttons (when used) are re-set and the RE-SET button is pressed and released (Manual Re-set Option), the control relays will energize closing the normally open safety contacts on terminals 13,14 / 23,24 and the normally closed auxiliary contact 31 & 32 will open. The GREEN Run LED will illuminate. If set to automatic re-set (i.e. link in X1 & X2) the control relays will energize when all active guards are closed and the emergency stop button(s) are re-set. Faults on the safety switch cables, either open or short circuit will be detected immediately causing the control relays to de-energize.



CM-S41 GUARD SELECTION SWITCH & INDICATION			
Guard Indication (Yellow)	De-select Indicator (Green)	Channel Selector Switch	Operation
1 2 3 4	○ ○ ○ ○		1 Gate Operation—Yellow LED No. 1 will illuminate when gate switch 1 is closed. All other Yellow gate indicators will remain illuminated. No green LED's illuminated.
1 2 3 4	● ○ ○ ○		2 Gate Operation—Yellow LED's 1 & 2 will illuminate when corresponding gate switch is closed. All other Yellow gate indicators will remain illuminated. Top green LED illuminated.
1 2 3 4	● ● ○ ○		3 Gate Operation—Yellow LED's 1,2 &3 will illuminate when corresponding gate switch is closed. All other Yellow gate indicators will remain illuminated. Top two green LED's illuminated
1 2 3 4	● ● ● ○		4 Gate Operation—Yellow LED's 1,2,3 & 4 will illuminate when corresponding gate switch is closed. All three Green LED's illuminated
○= LED off ●= GREEN LED on = LED on when activated by guard closing ○= YELLOW LED on			

CM-S41 RESET AND MONITORING SWITCH	
Reset Switch Position	Operation
	Automatic Reset Link required between terminal X1 & X2. ISIS-4 will reset when all active guards are closed.
	Manual / Monitored Reset Requires a reset button in the X1—X2 connection. The system will reset when all guards are closed and the re-set button is pressed and released. The reset button is monitored for faults.

CM-S21 CONNECTIONS

POWER SUPPLY:

24Vac/dc

POWER SUPPLY FUSING:

Internal resettable fuse with 2 second delay after fault removal.

INDICATION:

RED - Power On, GREEN - Run, YELLOW - Guard Status.

GUARD SELECTION:

See CM-S21 Guard selection chart.

RE-SET & MONITORING:

The X1, X2 circuit is for reset buttons and/or monitoring external contactors.

Manual Reset: (see table) A normally open momentary push button should be placed across X1 & X2. The push button must be pressed and released as it is monitored for short circuit faults.

Automatic Reset: Link X1, X2 and the system will reset when all active guards are closed.

Monitor External Contactors: (K1 & K2) Place a normally closed contact off each contactor in series with X1 & X2 (with or without a reset button as required) If either K1 or K2 welds during operation, the other contactor will operate correctly and on the next demand on the safety system the X1 X2 circuit will prevent a restart. Use PGC relays for K1 & K2 if monitoring required.

CONTROL CONTACTS:

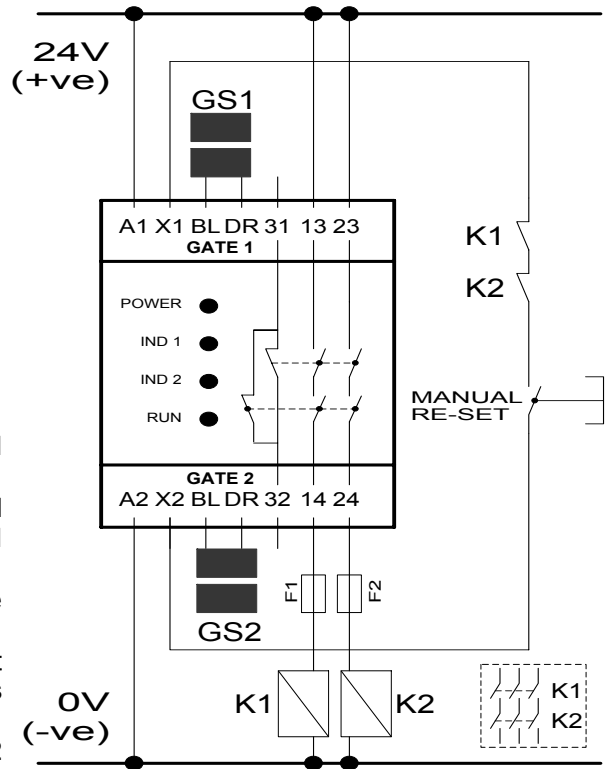
Two sets of positively guided N/O safety contacts on terminals, 13,14; and 23,24 (rating 4 Amps). One auxiliary N/C contact, (31-32). External fusing is recommended.

OPERATION:

When power is applied to the control module, the RED 'Power Led' will illuminate. The number of inputs selected must match the number of guard switches, more or less and the control unit will not operate. The YELLOW 'Guard status' indicators will be illuminated if the guard is closed or be permanently on if the guard is de-selected.

If all the monitored machine guards are closed and the RE-SET button is pressed and released (Manual Re-set Option), the control relays will energize closing the normally open safety contacts on terminals 13,14 / 23,24 and the normally closed auxiliary contact 31 & 32 will open. The GREEN Run LED will illuminate.

If set to automatic re-set (i.e. link in X1 & X2) the control relays will energize when all active guards are closed and the emergency stop button(s) are re-set. Faults on the safety switch cables, either open or short circuit will be detected immediately causing the control relays to de-energize.



IMPORTANT

On all CM-S safety control units use the guard inputs in sequence.

Always set the control unit guard selector switch to match the number of safety switches used.

Any other setting may cause improper operation.

CM-S21 GUARD SELECTOR SWITCH & INDICATION		
Gate Indication	Gate Selector Switch	Operation
Yellow		
1 2		1 Gate Operation—Yellow LED No. 1 will illuminate when gate switch 1 is closed. Yellow LED No. 2 will remain illuminated.
1 2		2 Gate Operation—Yellow LED's 1 & 2 will illuminate when corresponding gate switch is closed.
= LED on = LED on when activated by guard closing.		

CM-S21 RESET AND MONITORING SWITCH	
Reset Switch Position	Operation
	Automatic Reset Link required between terminal X1 & X2. ISIS-2 will reset when all active guards are closed.
	Manual / Monitored Reset Requires a reset button in the X1—X2 connection. The system will reset when all guards are closed and the re-set button is pressed and released. The reset button is monitored for faults.

CM-SE CONNECTIONS

POWER SUPPLY :

24Vac/dc

POWER SUPPLY FUSING :

Internal resettable fuse with 2 second delay after fault removal.

INDICATION :

RED - Power On.

YELLOW - guard status indicators.

GUARD SELECTION :

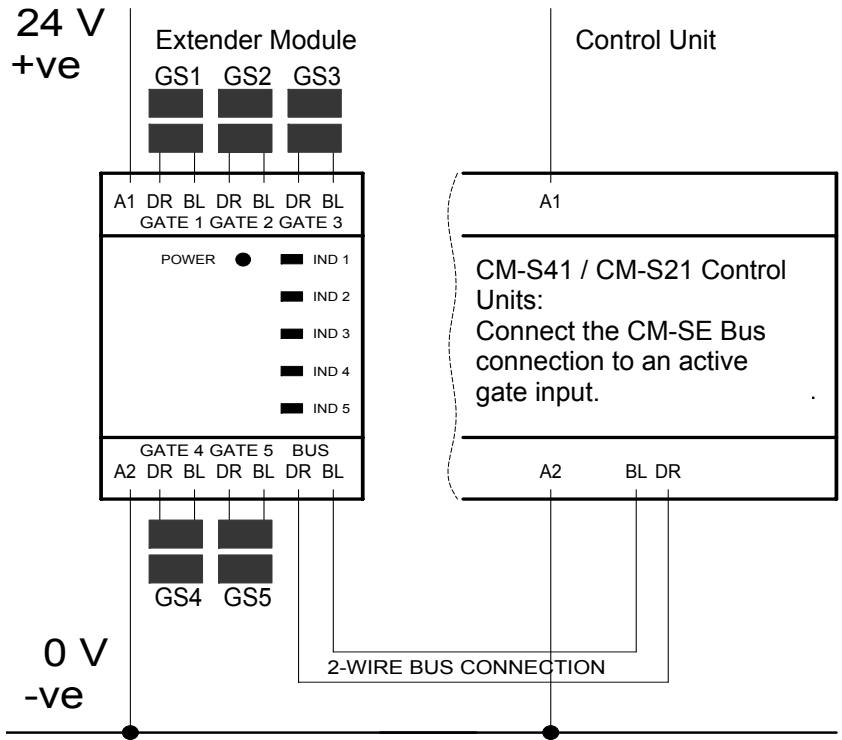
See CM-SE Guard selection chart.

CONNECTION TO MAIN CONTROL UNIT:

The CM-SE can be connected to any active guard switch input on an CM-S21 or CM-S41.

Connect the 2-wire BUS (BL DR) terminals on the CM-SE module to any activated guard input on the main control module. (Max distance 100 metres)

For larger systems further CM-SE extender modules can be connected to active guard switch inputs on an CM-SE extender module.

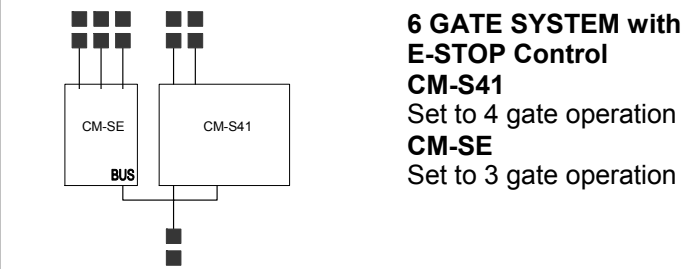


OPERATION :

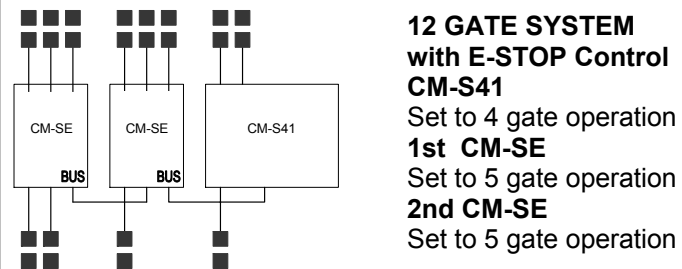
When power is applied to the control module, the RED 'Power Led' will illuminate. The number of inputs selected must match the number of guard switches, more or less and the control unit will not operate. The YELLOW 'Guard status' indicators will be illuminated if the guard is closed or be permanently on if the guard is de-selected.

If all the monitored machine guards are closed and the RE-SET button is pressed and released on the main control unit, the control relays will energize and the normally open safety contacts on terminals 13,14 / 23,24 (main control unit) will close. The normally closed auxiliary contact 31 & 32 (main control unit) will open. If set to automatic re-set (i.e. link in X1 & X2) the control relays will energize when all active guards are closed and the emergency stop button(s) (if connected) are re-set. Faults on the safety switch cables, either open or short circuit will be detected immediately causing the control relays to de-energize.

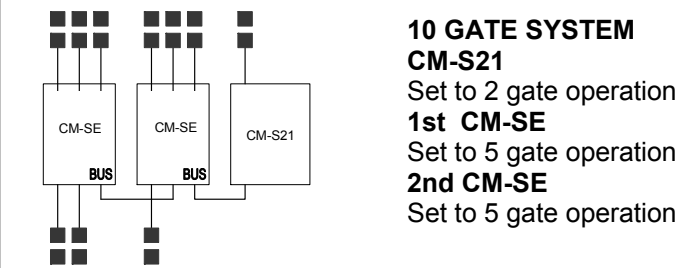
SYSTEM EXAMPLES WITH EXTENDER MODULES



6 GATE SYSTEM with E-STOP Control
CM-S41
 Set to 4 gate operation
CM-SE
 Set to 3 gate operation



12 GATE SYSTEM with E-STOP Control
CM-S41
 Set to 4 gate operation
1st CM-SE
 Set to 5 gate operation
2nd CM-SE
 Set to 5 gate operation



10 GATE SYSTEM
CM-S21
 Set to 2 gate operation
1st CM-SE
 Set to 5 gate operation
2nd CM-SE
 Set to 5 gate operation

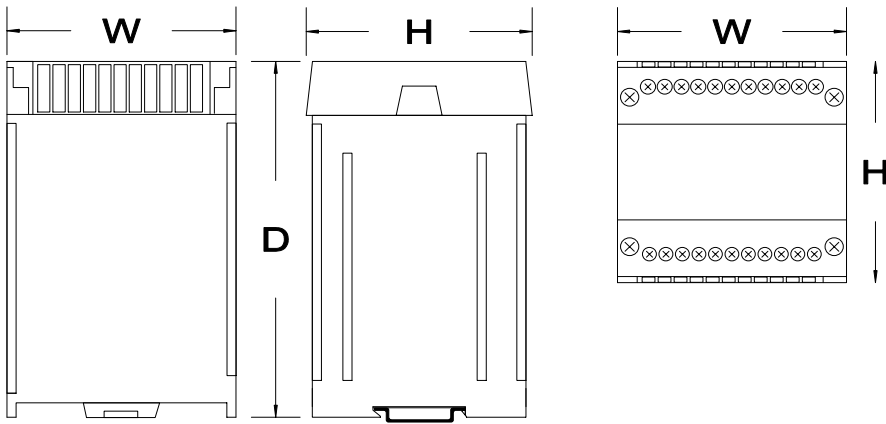
CM-SE GUARD SELECTOR SWITCH & INDICATION

Guard Indication (Yellow)	Channel Selector Switch	Operation
IND 1 IND 2 IND 3 IND 4 IND 5	GS2 GS3 GS4 GS5	1 Gate Operation—Yellow LED No. 1 will illuminate when gate switch 1 is closed. All others gate indicators remain illuminated.
IND 1 IND 2 IND 3 IND 4 IND 5	GS2 GS3 GS4 GS5	2 Gate Operation—Yellow LED's 1&2 will illuminate when corresponding gate switch is closed. IND 3, 4 & 5 remain illuminated.
IND 1 IND 2 IND 3 IND 4 IND 5	GS2 GS3 GS4 GS5	3 Gate Operation—Yellow LED's 1,2 & 3 will illuminate corresponding gate switch is closed. IND 4 & 5 remain illuminated.
IND 1 IND 2 IND 3 IND 4 IND 5	GS2 GS3 GS4 GS5	4 Gate Operation—Yellow LED's 1,2,3 & 4 will illuminate when corresponding gate switch is closed. IND 5 remains illuminated.
IND 1 IND 2 IND 3 IND 4 IND 5	GS2 GS3 GS4 GS5	5 Gate Operation—Yellow LED's 1,2,3,4 & 5 will illuminate when corresponding gate switch is closed.

=LED On
 =LED activated by guard closing

DIMENSIONS

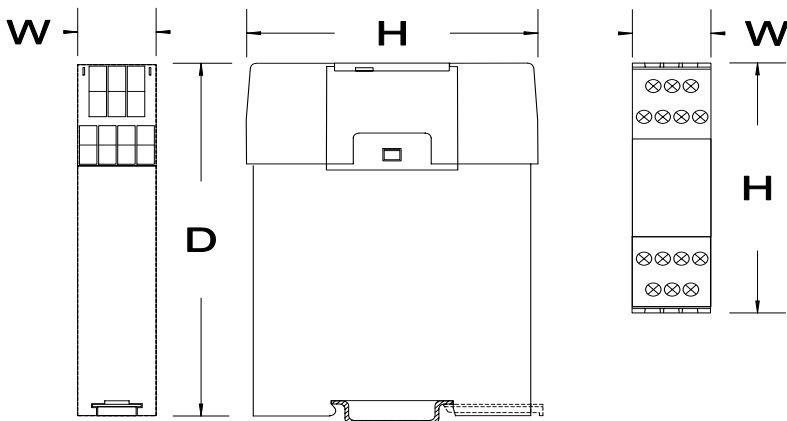
CM-S41 (all voltages)



Dimensions

	CM-S41 (mm / inches)
W	75 / 2.95
H	74 / 2.91
D	119 / 4.68
Information only	

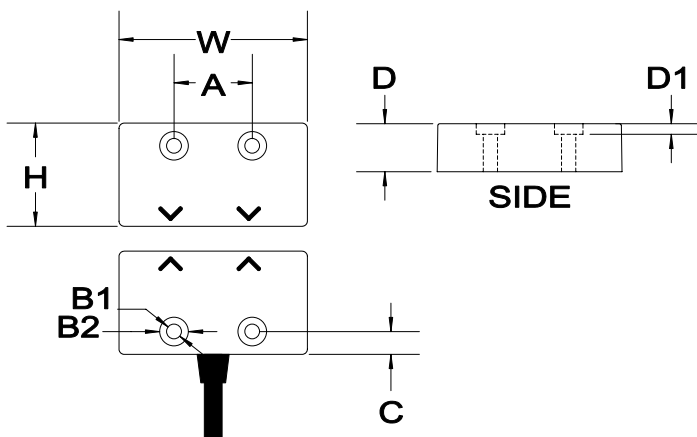
CM-S21 / CM-SE



Dimensions

	CM-S21 & CM-SE (mm / inches)
W	22.5 / 0.88
H	84 / 3.3
D	119 / 4.68
Information only	

CM-SERIES SAFETY SWITCHES



Dimensions

	CM-S11 (mm / inches)	CM-S31 (mm / inches)
H	28 / 1.1	29 / 1.14
W	52 / 2.04	53 / 2.08
D	14 / 0.55	13.5 / 0.53
D1	3 / 0.11	3 / 0.11
A	22 / 0.86	22 / 0.86
B1	4.2 / 0.16 dia.	4.2 / 0.16 dia.
B2	8.1 / 0.32 dia.	8.1 / 0.32 dia.
C	6.4 / 0.25	6.4 / 0.25
Information only		

TECHNICAL INFORMATION

SPECIFICATIONS	CONTROL UNITS			SAFETY SWITCHES	
	CM-S41	CM-S21	CM-SE	CM-S11	CM-S31
Supply nominal voltage	24Vac/dc 110 or 230Vac	24Vac/dc	24Vac/dc	-	-
Nominal power consumption	6VA	3VA	3VA	-	-
Safety contacts	2 x N/O		-	-	-
Auxiliary contact	1 x N/C		-	-	-
Output contact rating (max)	4A/230Vac; 2A/24Vdc(Res.)@Cos=1		-	-	-
Output contact rating (min)	10V/10mA		-	-	-
Output contact fuse rating	AC=5A; DC=2.5A; Quick blow		-	-	-
Drop out time	Deactivation by sensor 13ms		-	-	-
Nominal voltage across BL/DR sensor	ON: 4V; OFF 0 to 10Vdc		-	-	-
Internal fuse	500mA Resettable		-	-	-
Internal fuse recovery time	>2 Seconds		-	-	-
Internal switches	Active gate selector; Manual or Monitored reset selection		Active gate selector	-	-
Max conductor size	1 x 2.5mm stranded with sleeves, 1 x 4mm solid		-	-	-
Installation group (Control unit)	C in accordance with VDE0110		-	-	-
Contamination level	III		-	-	-
Vibration resistance	Amplitude 2mm, frequency 10 to 55 Hz		-	-	-
Enclosure protection	Housing IP40, Terminals IP20		-	-	IP67
Switching distance	-	-	-	5-7mm ON; 8-12mm OFF	
Minimum gap	-	-	-	1mm	
Cable length	-	-	-	3 or 5 metres (Max 100 metres)	
Operating temperature	-10C to +55C (85% Humidity max)		-	-10C to +55C	
Storage temperature	-20C to +60C		-	-20C to +60C	
Housing material	Polycarbonate Red		-	ABS Red	316 Stainless Steel
Mounting / Fixing	35mm Symmetric DIN Rail		-	22mm Centres; M4 security screws supplied	
Weight (AC/DC) (3m/5m)	575g max.	183g	135g	207g max	265g
Dimensions	See page 7				

OMRON

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