MECHAN CONTROLS
machine guard safety solutions

Operating Instructions for ISIS-Series Safety System

Description:

The ISIS 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 ISIS non-contact safety switches are easy to install, tolerant to misalignment and suitable for use in harsh or wet environments.

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.

ISIS 4 Control Unit

The ISIS-4 is a combined Safety Switch and E-Stop control unit. Along with the ability to monitor up to four ISIS safety switches it can also monitor the normally closed contacts of emergency stop buttons or mechanical safety switches in dual channel control circuits. The ISIS-4 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.

ISIS-2 Control Unit

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

ISIS-E Extender Module

The ISIS-E Extender module is a 24V ac/dc unit that can be added to either the ISIS-4 or ISIS-2 to monitor an additional 5 ISIS 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 LEDs. Additional ISIS-E extender modules can be added to monitor larger systems.

Safety Switches

The ISIS 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.

KEEP THIS GUIDE FOR FUTURE REFERENCE

The information is designed to help suitably qualified personnel install and operate Mechan Controls safety equipment. Before using this product, read this guide thoroughly along with any relevant European and/or National Standards E.g. Machinery Directive 2006/42/EC and its Amendments, Provision and Use of Work Equipment Regulations. **Further information can be obtained from Mechan Controls Ltd.**

| APPROVALS	
CE / UKCA	Complies with the relevant sections of the CE marking directive.
UL	Tested by the Underwriters Laboratories, USA, to comply with the relevant USA and Canadian requirements. UL 508 Industrial Control
TUV	SIL 3 PLe
EUROPEAN DIRECTIVES	
Machinery Directive 2006/42/EC, Low Voltage Directive 2014/35/EU	
Electromagnetic Compatibility Directive 2014/30/EU	
RoHS Directive 2011/65/EC	
EUROPEAN STANDARDS	
EN ISO 13849-1	Safety of Machinery Safety related parts of controls systems.
EN ISO 62061	Safety of Machinery Functional safety of safety related electrical, electronic and programmable electronic controls systems.
EN 60204	Safety of Machinery Electrical equipment of machines
EN 14119	Interlocking devices associated with guards.
EN 60947-5-1	Low voltage switchgear and control gear.
EN 60947-5-3	Safety of Machinery Specification for low voltage switchgear and control gear.
CERTIFICATE OF CONFORMITY	
A certificate of conformity can be supplied covering Mechan non-contact safety switch equipment. Call our technical help-line on +44 (0) 1695 722 264	

PRODUCT IDENTIFICATION AND TERMINAL LAYOUT
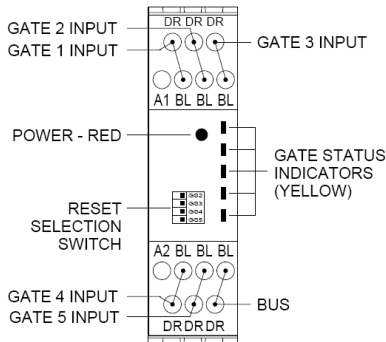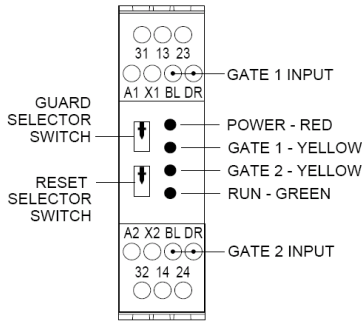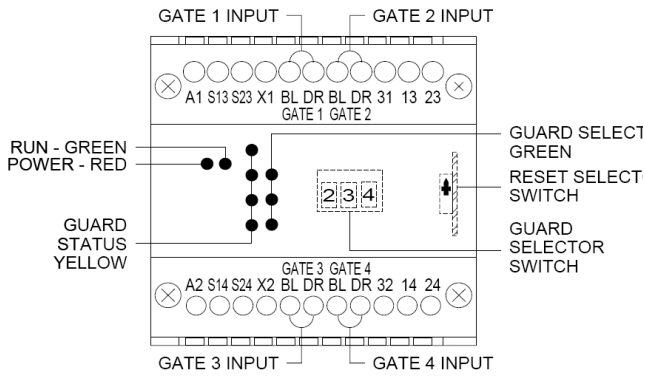
ISIS-4 TERMINAL INFORMATION

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

ISIS-2 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

ISIS-E 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 ISIS non-contact safety switch system. The ISIS safety 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 ISIS-4 / ISIS-2 / ISIS-E 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. (SIL3 PLe according to EN 62061 & EN 13849-1)

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
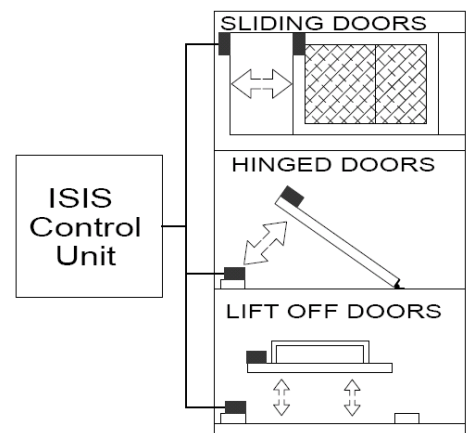
INSTALLING THE CONTROL UNIT

The ISIS 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).
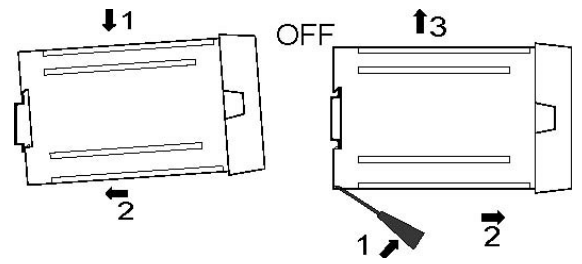
INSTALLING THE SAFETY SWITCHES

The ISIS 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.
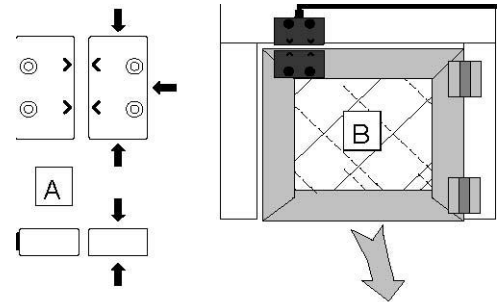
CONNECTING SWITCHES TO THE CONTROL UNIT

The ISIS 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 colour coding of the wires to the labels on the control unit input terminals. I.e. BLUE wire to BL and DRAIN wire to DR.
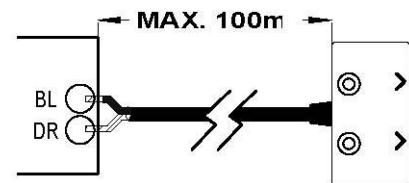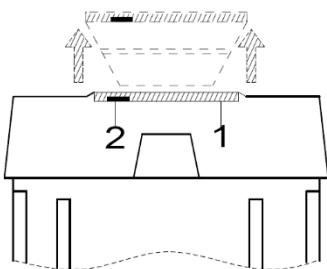
> **IMPORTANT: Use the GATE inputs in sequence. Examples:**
> **One Guard System**—Use input 1 on the ISIS-2 (Or input 1 on the ISIS-4 if E-Stop function required);
> **Three Guard System**—Use inputs 1, 2 & 3 on the ISIS-4;
> **Seven Guard System**—Use inputs 1, 2 & 3 for Guard Switches on the ISIS-4 and Input 4 to connect to the ISIS-E Extender module Bus connection. Then use inputs 1, 2, 3 & 4 on the ISIS-E.

GUARD SELECTOR & RESET SWITCHES

The central part of the ISIS 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 ISIS 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.

MOUNTING THE SWITCHES

1) Always try to mount the safety switch on non-ferrous material. **Ferrous materials will reduce the switching distance.**
2) 2) Leave a minimum 50mm gap between actuators. (A)
3) 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)
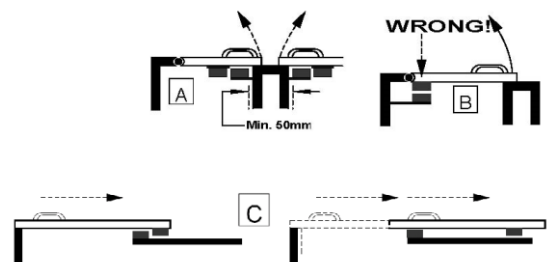
EN 14119 provides some mounting suggestions, see example (C). When fixing the switches to a sliding door, ensure that when the door is opened the switch is not easily accessible.

ISIS-4 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.

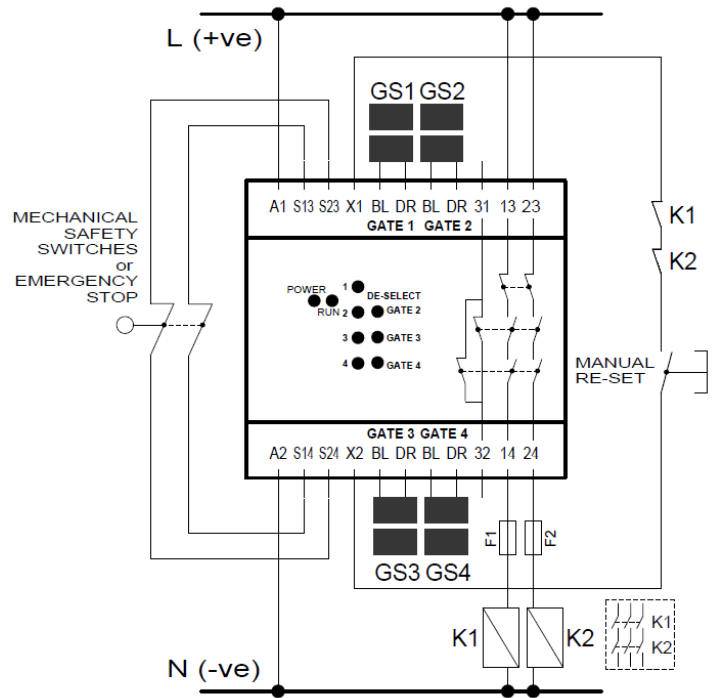**GUARD SELECTION:**
See ISIS-4 switch table.

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.

ISIS-4 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			

ISIS-4 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.

ISIS-2 CONNECTIONS

POWER SUPPLY:
24V ac/dc

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:
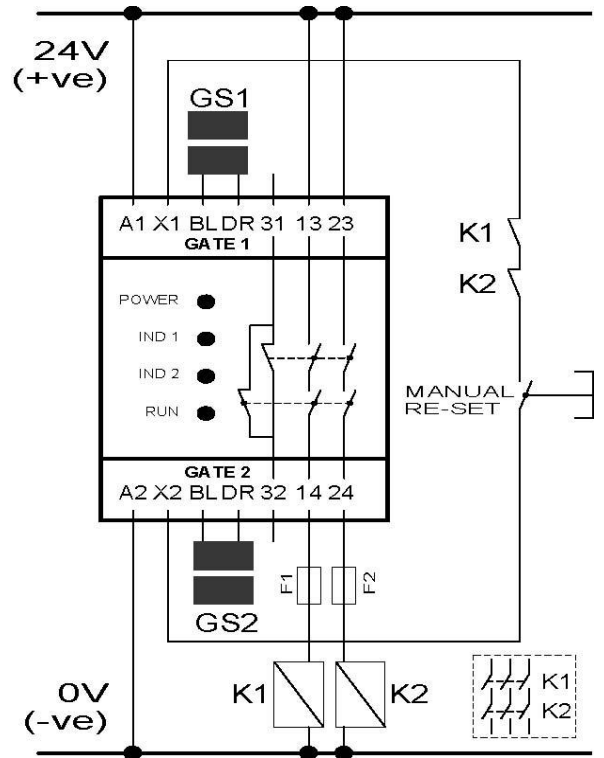See ISIS-2 switch table.

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.

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 ISIS safety control units use the guard inputs in sequence. Always set the control unit guard selector switch to match the number of safety switches fitted. Any other setting may cause improper operation.		

ISIS-2 GUARD SELECTOR SWITCH & INDICATION		
Gate Indication Yellow	Gate Selector Switch	Operation
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.		

| ISIS-2 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.

ISIS-E CONNECTIONS

POWER SUPPLY:
24Vac/dc

POWER SUPPLY FUSING:
Internal resettable fuse with 2 second delay after fault removal.

INDICATION:
RED - Power On.
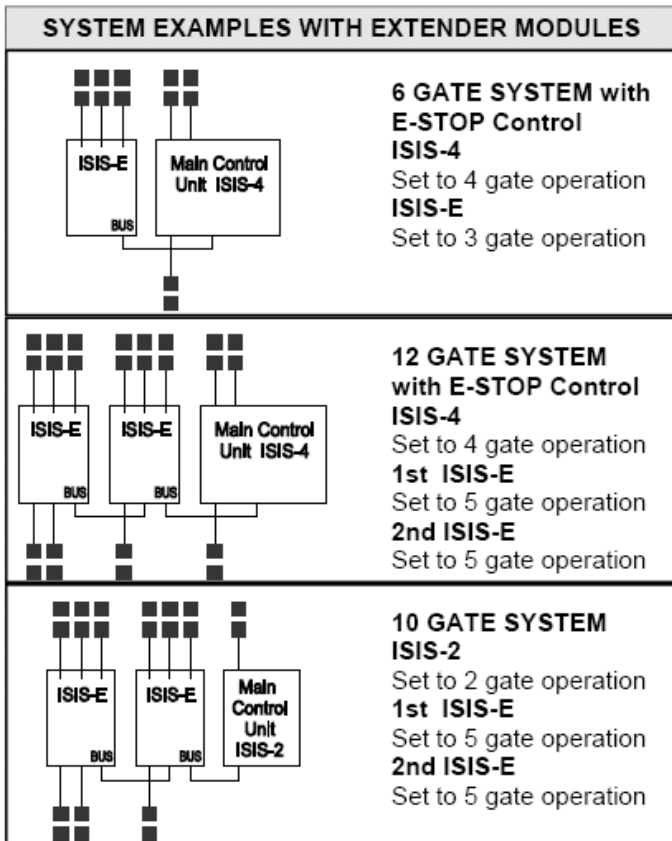YELLOW - guard status indicators.

GUARD SELECTION:
See ISIS-E Guard selection chart.

CONNECTION TO MAIN CONTROL UNIT:
The ISIS-E can be connected to any active guard switch input on an ISIS-2 or ISIS-4.
Connect the 2-wire BUS (BL DR) terminals on the ISIS-E module to any activated guard input on the main control module. (Max distance 100 metres) For larger systems further ISIS-E extender modules can be connected to active guard switch inputs on an ISIS-E extender module.
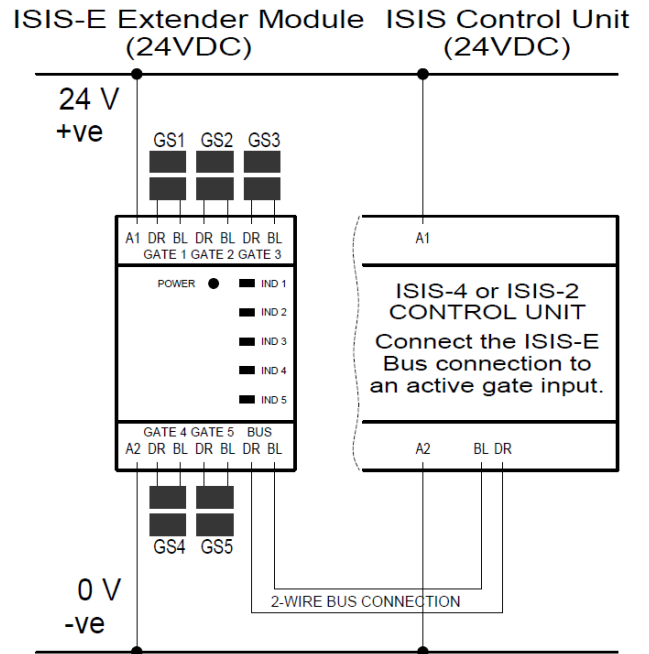
ISIS-E Extender Module (24VDC)   ISIS Control Unit (24VDC)

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
ISIS-4
Set to 4 gate operation
ISIS-E
Set to 3 gate operation

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

10 GATE SYSTEM
ISIS-2
Set to 2 gate operation
1st ISIS-E
Set to 5 gate operation
2nd ISIS-E
Set to 5 gate operation

ISIS-E GUARD SELECTOR SWITCH & INDICATION

Guard Indication (Yellow)	Channel Selector Switch	Operation
IND1, IND2, IND3, IND4, IND5	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.
IND1, IND2, IND3, IND4, IND5	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.
IND1, IND2, IND3, IND4, IND5	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.
IND1, IND2, IND3, IND4, IND5	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.
IND1, IND2, IND3, IND4, IND5	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

ISIS-4 (ALL VOLTAGES)
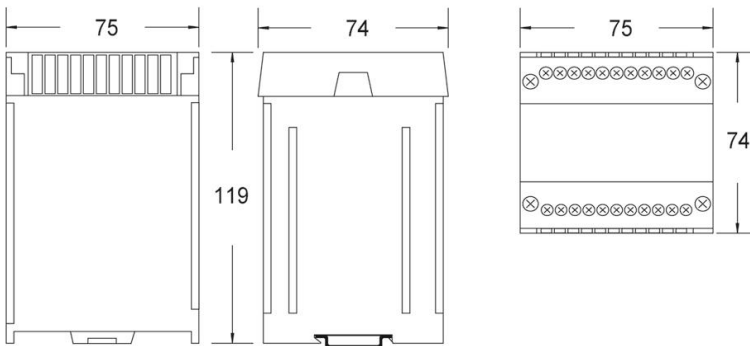
Dimensions	
	ISIS-4 (mm/inches)
W	75 / 2.95
H	74 / 2.91
D	119 / 4.68

ISIS-2 / ISIS-E
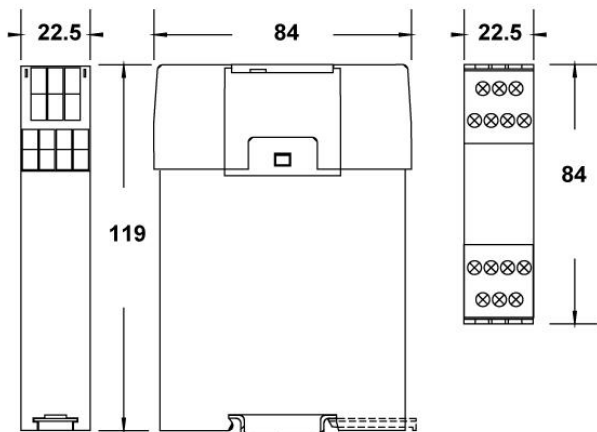
Dimensions	
	ISIS-2 & ISIS-E (mm/inches)
W	22.5 / 0.88
H	84 / 3.3
D	119 / 4.68

ISIS SAFETY SWITCHES

ISIS SAFETY SWITCHES ABS / STAINLESS STEEL
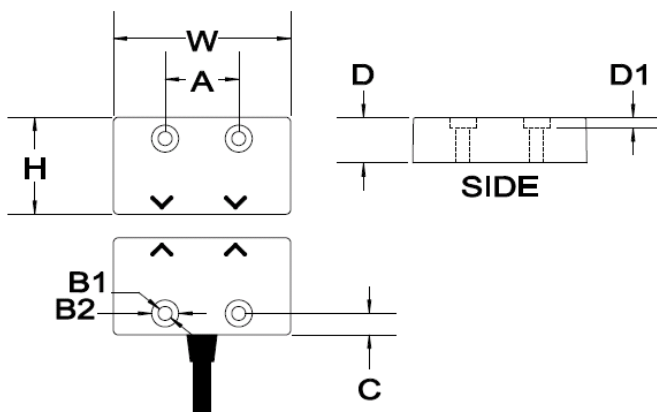
Dimensions		
	ISIS-03M (mm / inches)	ISIS-SS-03M (mm / inches)
H	28 / 1.1	29 / 1.14
W	52 / 2.04	53 / 2.08
D	14 / 0.55	13.5 / 0.53
D1	3 / 0.11	3 / 0.11
A	22 / 0.86	22 / 0.86
B1	4.2 / 0.16 dia.	4.2 / 0.16 dia.
B2	8.1 / 0.32 dia.	8.1 / 0.32 dia
C	6.4 / 0.25	6.4 / 0.25
Information only		

Technical Specification

Technical Specifications	CONTROL UNITS			SAFETY SWITCHES	
	ISIS-4	ISIS-2	ISIS-E	ISIS-03M / 05M	ISIS-SS-03M
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	-	-	-	Minimum gap 1mm	
Operating temperature	-10°C to +55°C (85% Humidity max)			-10°C to +55°C	
Housing material	Polycarbonate Red			ABS Red	316 Stainless Steel
Mounting / Fixing	35mm Symmetric DIN Rail			22mm Centres; M4 security screws supplied	

Safety Related Data	
PL in accordance with EN ISO 13949-1	PLe
SIL in accordance with EN ISO 62061	SIL 3
PFHd in accordance with EN ISO 62061	3.37×10^{-8}
PFH	5.63×10^{-8}
B10d	2,000,000
MTTFd	High > 100 Years (Based on usage rate of 360 Days/Year, 24 Hours/Day, 10 Operations/Hour)
TM (Mission Time)	20 Years
DC	99%
SFF	99.40%

Declaration of Conformity

Mechan Controls declares that the products shown conform to the Essential Health and Safety Requirements of the European Machinery Directive. The above products have been third party tested to conform to the requirements of EN-13849-1 and EN 62061. Full declaration of conformity can be downloaded from the Mechan Controls web site www.mechancontrols.com or by contacting Mechan directly Tel: + 44 1695 722264

In the interest of product development specifications are subject to change without notice. It is the responsibility of the user to ensure compliance with any acts or by-laws in place. All information regarding Mechan equipment is believed to be accurate at the time of printing. Responsibility cannot be accepted for errors or omissions.

Document Number: 370-400-Iss16