

# MECHAN CONTROLS



## Installation Guide : F-SERIES Safety system

### Keep this guide for future reference

This information is designed to help suitably qualified personnel install and operate Mechan 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 it's amendments, Provision and Use of Work Equipment Regulations. Further information can be obtained from Mechan Controls Tel +44 (0)1695 722264

### Description

The F-Series safety system is a complete electronic safety switch and emergency stop button monitoring system for machine guarding applications.

The control unit can monitor up to 30 inputs (F-Series safety switches and emergency stop buttons), maintaining CAT 4 SIL 3 and PL e.

**FM1 Safety Control Module** contains the power supply regulation, dual safety contact outputs, external reset/monitoring circuit, system & gate indication, and the input for one safety switch sensor and it's volt free indicator output. The FM1 and a safety switch sensor are all that is required for a system that is monitoring one guard.

**FX1/FX2 Safety Extender Modules** connect to the FM1 to build systems monitoring more than 1 guard. By simply connecting the required number of FX1's (one guard switch input) or FX2's (two guard switch inputs) to the FM1 systems can be built to monitor up to 30 guards. The extender modules provide connections for the safety switches along with LED and volt free indicator outputs for each safety switch input.

**ESM Emergency Stop Monitor** allows the connection of dual channel Emergency stop buttons or other dual channel safety devices with volt free contact outputs. Giving indication for each input channel and overall output indication.

**F-Series Safety Switches** are solid state electronic devices with no contacts or moving parts. This provides a tamper proof safety system that can only be activated by the Mechan actuator. When energized the safety switches are continuously monitored whether the guard is opened or not.

The Safety switches are resin encapsulated into an ABS case, to provide a fully sealed, IP67, sensor which can withstand the most arduous of conditions. Water, dust, oil, machine vibration and even steam cleaning have little or no effect on their performance, and with a 7-10 mm switching distance they are easy to install and provide a long and reliable working life span.

### Applications

Interlocked guards where additional security required. Door locking is not required. Harsh environments where vibration, water or dust are problems.

Food and Beverage packing/filling systems Dairy Pharmaceutical Paper Industry, Can Forming and Filling, (Aluminium, Steel, Plastic) Semi conductor Manufacture/Assembly.



CAT 4  
SIL 3 PL e

### APPROVALS

|     |                                                                 |
|-----|-----------------------------------------------------------------|
| CE  | Complies with all relevant sections of the CE marking directive |
| TUV | CAT 4 SIL 3 PL e                                                |

### EUROPEAN DIRECTIVES

|                                                     |
|-----------------------------------------------------|
| Machinery Directive 2006/42/EC                      |
| Low Voltage Directive 2006/95/EC                    |
| Electromagnetic Compatibility Directive 2004/108/EC |

### EUROPEAN STANDARDS

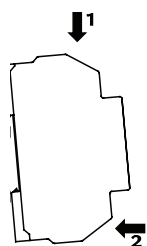
|                |                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------|
| EN ISO 13849-1 | Safety of Machinery<br>Safety related parts of control systems                                                                     |
| EN ISO 62061   | Safety of Machinery - Functional safety<br>of safety related electrical, electronic and<br>programmable electronic control systems |
| EN 60204       | Safety of Machinery<br>Electrical equipment for machines                                                                           |
| EN 60947-5-1   | Low voltage switch gear and control gear                                                                                           |
| EN 1088        | Interlocking devices associated with<br>guards                                                                                     |
| EN 60947-5-3   | Safety of Machinery<br>Specification for low voltage switch gear<br>and control gear                                               |

### Declaration of Conformity

See back page for declaration of conformity.

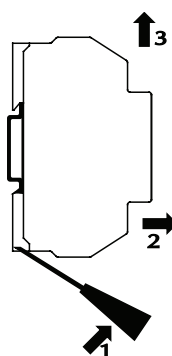
## SAFETY CONTROL UNIT

### Mounting on 35mm DIN Rail



The control modules are designed to be mounted in an IP55 (minimum) control cabinet. The modules clip on to standard 35 mm symmetric (top hat) DIN-Rail

### Removal from 35mm DIN Rail



To remove the modules, gently lever out the DIN clip with a small screw-driver as shown (1).

Tilt the unit in the direction (2) and slip the unit off the DIN Rail (3)

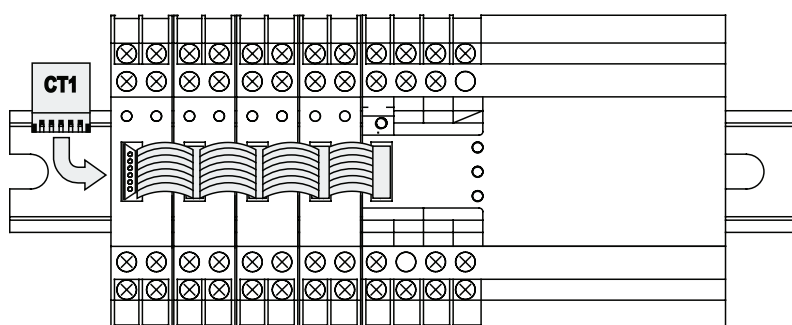
## System Assembly

Assemble the required number of modules on the DIN-Rail, starting with the FM1 and clipping the FX1, FX2 and, if required, ESM modules, to the left of the FM1.

The FM1 and FX1 monitor one safety switch each, whilst the FX2 must have 2 safety switches connected to it.

The ESM requires 2 x N/O inputs from an Emergency stop button, or other mechanical safety rated switch.

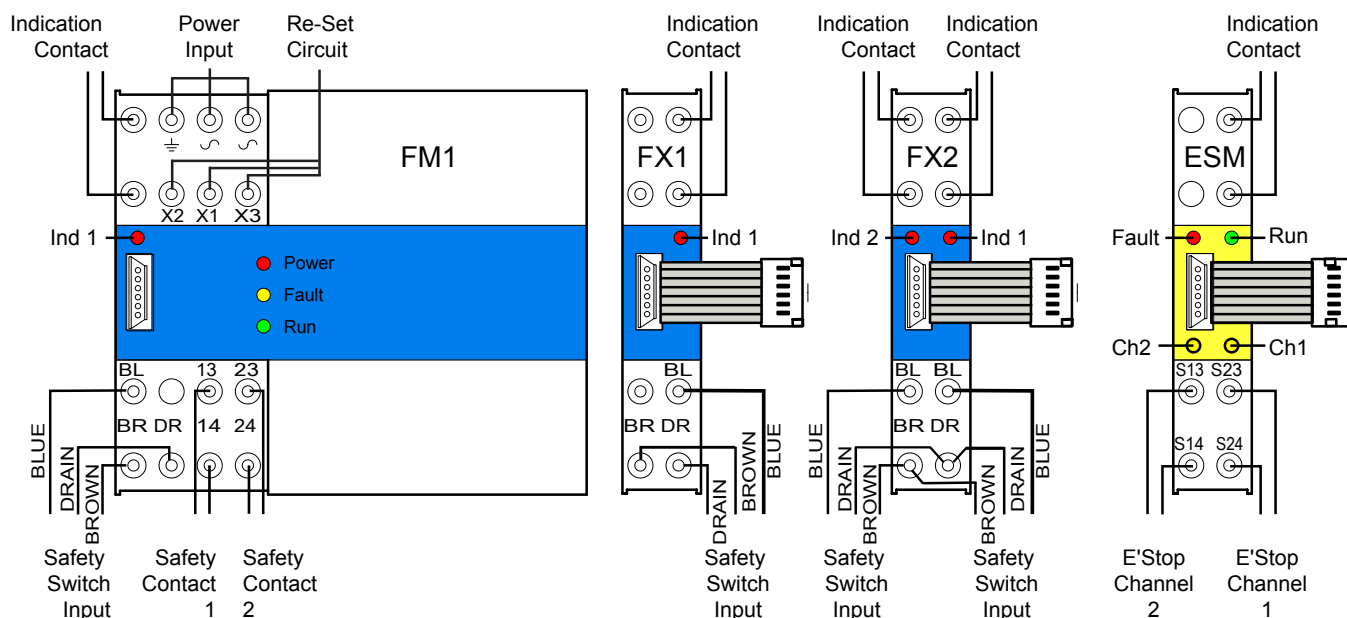
The maximum number of inputs that can be monitored by a DC supplied F-SERIES safety system is 30. The maximum number inputs that can be monitored by an AC supplied F-SERIES safety system is 10.



The 'Control Bus' straps on each extender unit connect to the adjacent (right hand side) module as shown.

The 'Control Bus' terminator, CT1 (supplied with the FM1), must be plugged into the last extender module in the system.

## Control Modules Connections & Indication

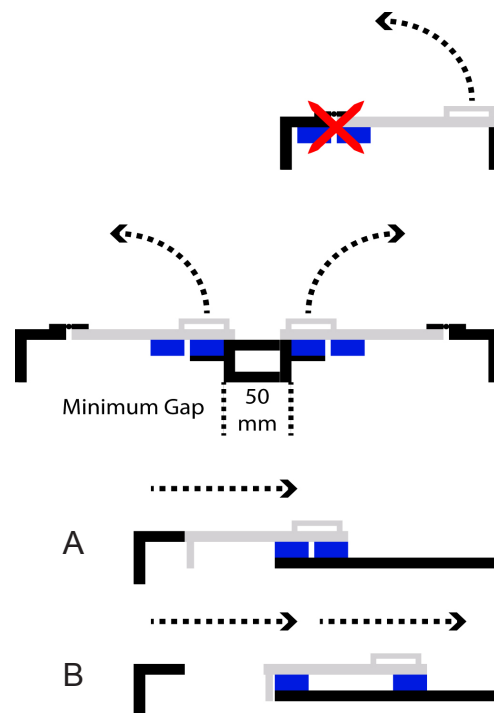


## SAFETY SWITCHES

### Mounting

Mount the switch on to the machine frame and the Actuator on to the opening edge of the door. Always try to mount the switch on non-ferrous material. (Ferrous materials may reduce the switching distance.) Use tamper proof screws to ensure additional security

Leave a minimum of 50 mm between any adjacent switches.  
Do not use the safety switch as a door stop.



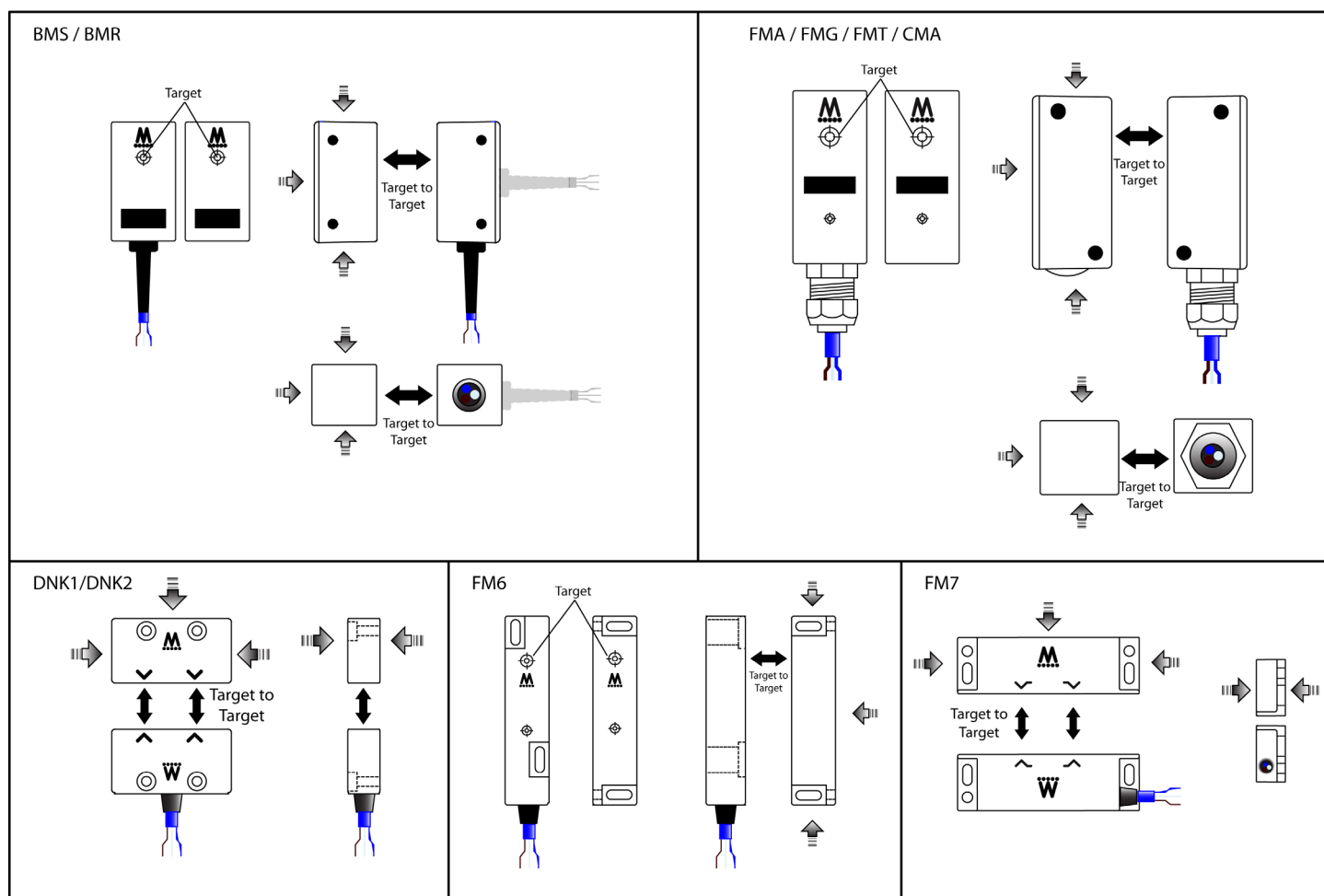
EN 1088 Provides some mounting suggestions, see example opposite.

When fixing the safety switch to a sliding door (A), ensure that when the door is opened (B) it is not easily accessible, helping prevent the system being overridden

### Operation

All Mechan electronic safety switches can only be operated by the mechan actuator. They can approach each other from most angles, but when in place the targets shown in the diagrams below must be aligned and facing each other.

The CMA safety switch & actuator are UNIQUELY CODED ( up to 500,000 codes) The CMA Safety switch and actuator are supplied as a pair and the switch will only operate with the correct actuator. Both switch and actuator are marked with a unique code.



## CONNECTIONS

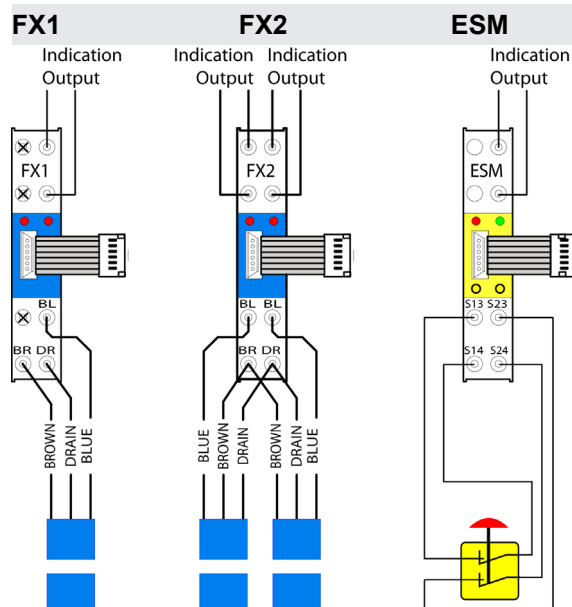
The Mechan fixed safety switch is supplied pre-wired with 5, 10 or 15 metres of cable encapsulated into it when manufactured. This ensures a completely water-tight seal to the electronics within the switch. Longer cables can be supplied up to maximum of 100 metres and this will not significantly affect performance.

Run the cable back to the control unit through cable protection (if required) and terminate into the appropriate input channel, following the colour coding of the wires to the label on the input terminals.

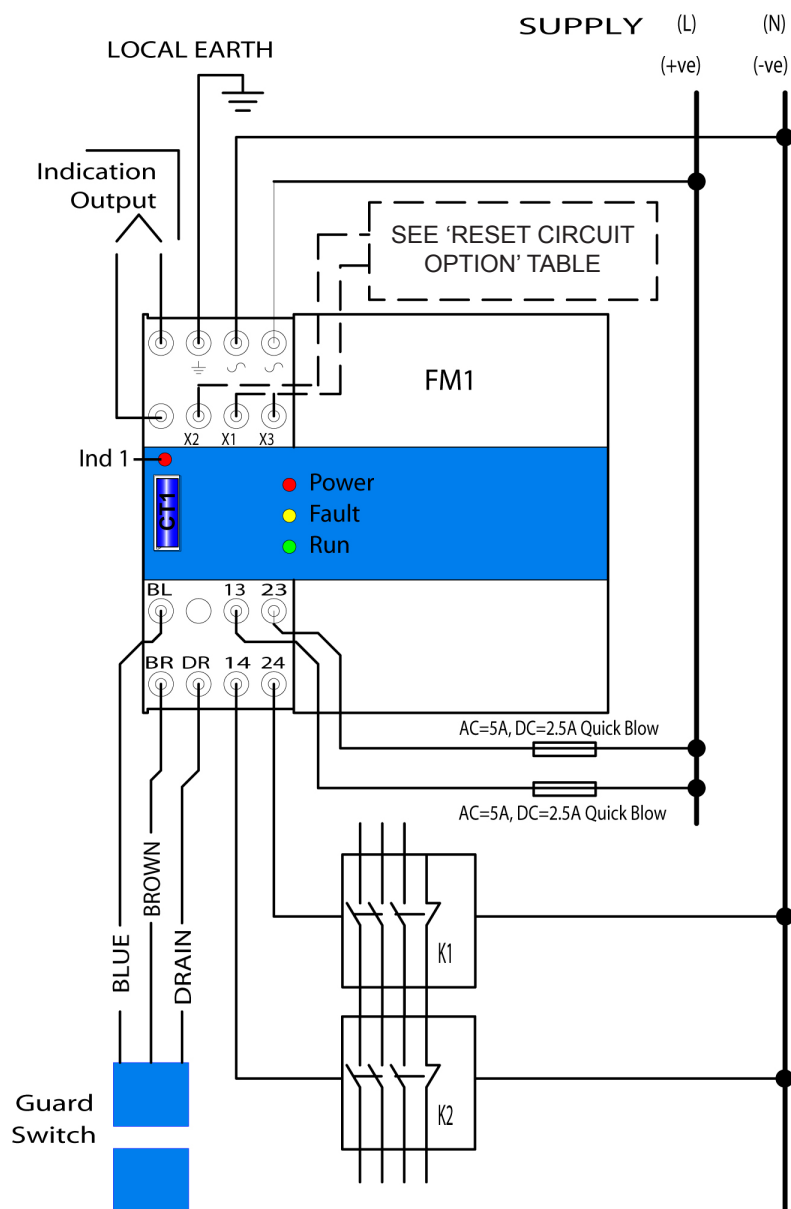
TREAT AS INSTRUMENT CABLES AND KEEP SEPARATE FROM POWER CABLES (150 mm separation is normally adequate)

If extending Mechan safety switch cables it is important to use the same type of cable, twisted pair with drain and screen. Multi-way versions of individually screened, twisted pair and drain cable may be used to run a number of sensors back to the control unit. Cable joints should be moisture proof and NOT EARTHED. The only earth connection must be via the drain terminal.

NOTE: The FX2 requires the commoning of the supply and drain wires (BROWN / DRAIN) from the two switches at the extender module as shown above.

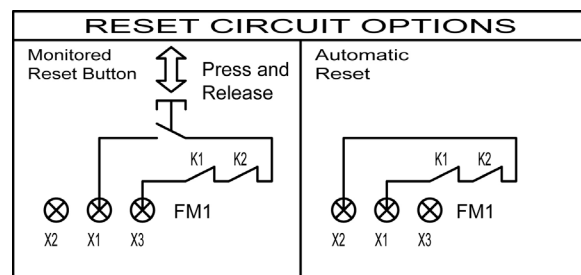


## CONNECTION FOR A SINGLE SWITCH

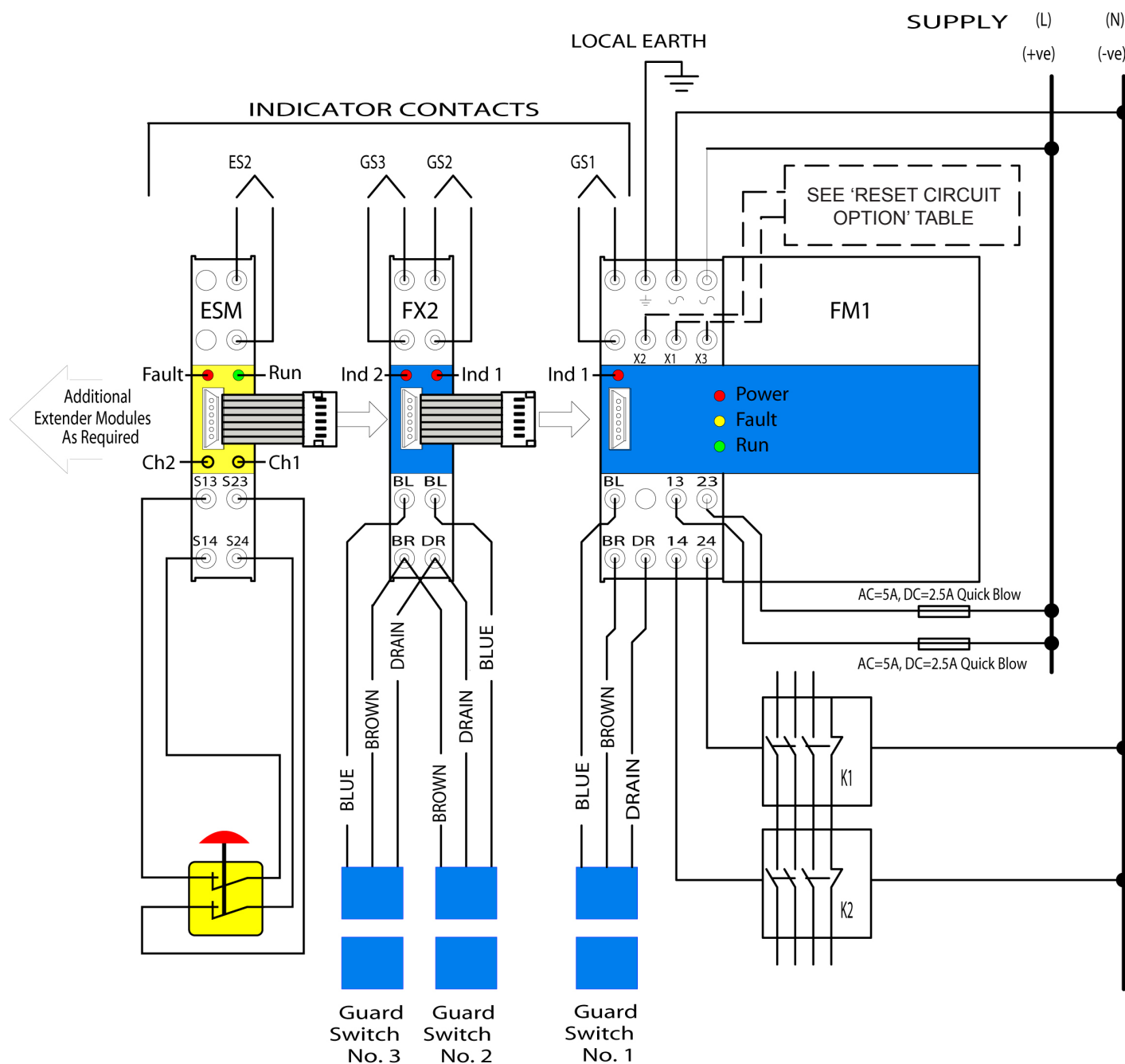


### Note :

- 1) When the unit is powered, the safety switch is closed and the re-set circuit is made the N/O safety outputs will close and the N/C indicator output will be open.
- 2) When the safety switch is opened, ( the actuator moved away from the switch) the N/O safety outputs will open and the N/C indicator output will close.



## CONNECTION FOR MULTI-GATE SYSTEM AND E'STOP

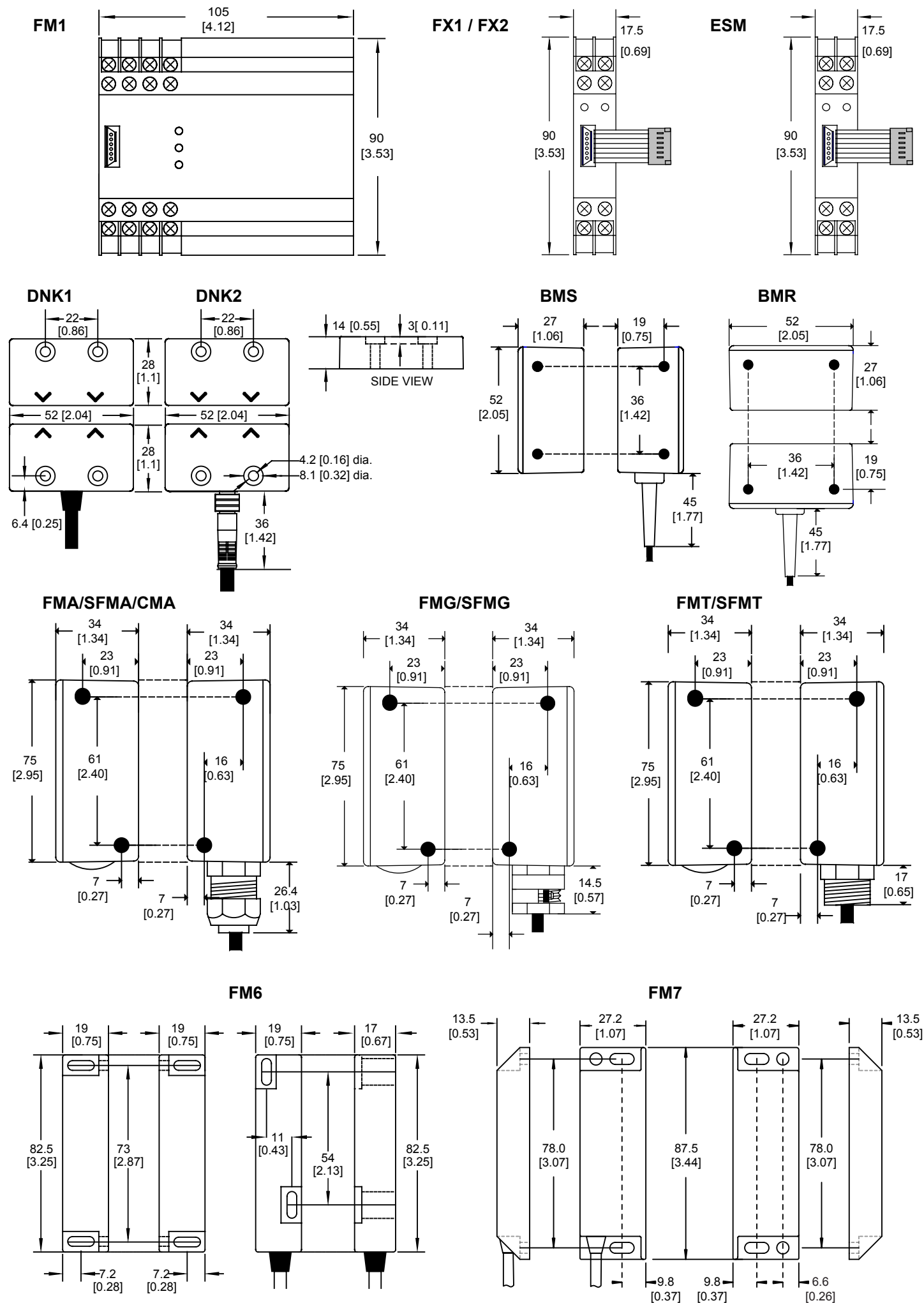


### Note :

1) When the unit is powered, safety switches closed, e'stop's released and the re-set circuit is made the N/O safety outputs will close and the N/C indicator output will be open.

2) When a safety switch is opened, ( the actuator moved away from the switch) or one of the e'stops actuated, the N/O safety outputs will open and the N/C indicator output will close. LED's on the input module will indicate which safety switch / e'stop is operated.

# **DIMENSIONS**



**TECHNICAL SPECIFICATIONS**

| SAFETY CONTROL UNIT                                         | FM1                                                                                       | FX1/FX2                                             | ESM                                                 |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| Supply nominal voltage                                      | 24Vdc 24Vac 110Vac 230Vac                                                                 |                                                     |                                                     |
| Nominal power consumption                                   | 6VA                                                                                       | 3VA                                                 | 3VA                                                 |
| Safety contacts                                             | 2 x N/O                                                                                   |                                                     |                                                     |
| 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                                                              |                                                     |                                                     |
| Internal fuse                                               | 500mA Resetable                                                                           |                                                     |                                                     |
| Internal fuse recovery time                                 | >2 Seconds                                                                                |                                                     |                                                     |
| Indication                                                  | LED's - Power, Fault, and Run<br>LED & Volt Free Contact for Safety Switch                | LED & Volt Free Contact For each input              | LED for each Channel & Volt Free Contact            |
| Indication Contact rating                                   | 500mA/30VDC                                                                               | 500mA/30VDC                                         | 500mA/30VDC                                         |
| Max conductor size                                          | 2 x 1.5mm stranded with sleeves,<br>2 x 2.5mm solid                                       | 2 x 1.5mm stranded with sleeves,<br>2 x 2.5mm solid | 2 x 1.5mm stranded with sleeves,<br>2 x 2.5mm solid |
| Installation group (Control unit)                           | C in accordance with VDE0110                                                              |                                                     |                                                     |
| Enclosure protection                                        | Housing IP30, Terminals IP20                                                              |                                                     |                                                     |
| Operating temperature                                       | 0C to +45C (85% Humidity max)                                                             | 0C to +45C (85% Humidity max)                       | 0C to +45C (85% Humidity max)                       |
| Storage temperature                                         | -20C to +60C                                                                              | -20C to +60C                                        | -20C to +60C                                        |
| Housing material                                            | PC-GF, Light Grey (RAL 7035)                                                              | PC-GF, Light Grey (RAL 7035)                        | PC-GF, Light Grey (RAL 7035)                        |
| Mounting / Fixing                                           | 35mm Symmetric DIN Rail                                                                   | 35mm Symmetric DIN Rail                             | 35mm Symmetric DIN Rail                             |
| <b>Utilisation category in accordance with EN 60947-4-1</b> |                                                                                           |                                                     |                                                     |
| Safety contacts : AC1 at 230 V                              |                                                                                           | Imin:10mA.Imax:4A                                   |                                                     |
| Safety contacts : DC1 at 24 V                               |                                                                                           | Imin:10mA.Imax:2A                                   |                                                     |
| <b>Air gap creepage in accordance with EN 60947-1</b>       |                                                                                           |                                                     |                                                     |
| Pollution Degree                                            | 2                                                                                         |                                                     |                                                     |
| Overvoltage Category                                        | III                                                                                       |                                                     |                                                     |
| Rated Insulation Voltage                                    | 250V                                                                                      |                                                     |                                                     |
| Rated Impulse Withstand Voltage                             | 4.0KV                                                                                     |                                                     |                                                     |
| <b>Vibration In Accordance With EN 60068-2-6</b>            |                                                                                           |                                                     |                                                     |
| Weight (AC/DC)                                              | 420g/290g                                                                                 | FX1 65g / FX2 75g                                   |                                                     |
| Frequency                                                   | 10-55Hz                                                                                   |                                                     |                                                     |
| Amplitude                                                   | 0.35mm                                                                                    |                                                     |                                                     |
| <b>Safety Related Data</b>                                  |                                                                                           |                                                     |                                                     |
| PL In accordance with EN ISO 13849-1                        | PL-e, CAT 4                                                                               |                                                     |                                                     |
| SIL CL in accordance with EN IEC 62061                      | SIL 3                                                                                     |                                                     |                                                     |
| PFHd in accordance with EN IEC 62061                        | $6.0 \times 10^{-9}$                                                                      |                                                     |                                                     |
| PFH                                                         | $6.52 \times 10^{-9}$                                                                     |                                                     |                                                     |
| B10d                                                        | 2000000                                                                                   |                                                     |                                                     |
| 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                                                         | 99.5%                                                                                     |                                                     |                                                     |

| SAFETY SWITCHES                   |           | F-Type                                                 | B-Type                             | C-Type                             | Dinky                                   | F6                                 | F7                                 |
|-----------------------------------|-----------|--------------------------------------------------------|------------------------------------|------------------------------------|-----------------------------------------|------------------------------------|------------------------------------|
| Pre-wired cables                  |           | Pre-wired 3 / 5 or 10 Metre Cables                     | Pre-wired 3 / 5 or 10 Metre Cables | Pre-wired 3 / 5 or 10 Metre Cables | Pre-wired 3 / 5 or 10 Metre Cables      | Pre-wired 3 / 5 or 10 Metre Cables | Pre-wired 3 / 5 or 10 Metre Cables |
| Quick Disconnect                  |           |                                                        |                                    |                                    | M8 Quick Disconnect 5 or 15 Metre Cable |                                    |                                    |
| Cable Gland                       |           | FMA Anaconda<br>FMG Cord Grip<br>FMT Brass 20mm Thread | BMS Side Exit<br>BMR Rear Exit     | CMA Anaconda                       |                                         |                                    |                                    |
| Unique Coding                     |           |                                                        |                                    | CMA - 500,000 Unique codes         |                                         |                                    |                                    |
| Operation                         |           | Electronic                                             |                                    |                                    |                                         |                                    |                                    |
| Safety Contact Operating Distance |           | 7mm ON / 10mm OFF                                      |                                    |                                    |                                         |                                    |                                    |
| Optimum Gap                       |           | 1mm                                                    |                                    |                                    |                                         |                                    |                                    |
| Dimensions                        |           | See page 6                                             |                                    |                                    |                                         |                                    |                                    |
| IP Rating                         |           | IP67                                                   |                                    |                                    |                                         |                                    |                                    |
| Cable Length                      |           | 100 Metres max                                         |                                    |                                    |                                         |                                    |                                    |
| Temperature                       | Operating | -25°C to +55°C                                         |                                    | -20°C to +50°C                     | -25°C to +55°C                          | -20 ° C to +50°C                   |                                    |
|                                   | Storage   | -25°C to +55°C                                         |                                    | -20°C to +50°C                     | -25°C to +55°C                          | -20 ° C to +50°C                   |                                    |
| Mounting                          |           | Target to target                                       |                                    |                                    |                                         |                                    |                                    |
| Construction                      |           | Blue ABS Resin Filled                                  |                                    | Orange ABS Resin Filled            | Blue ABS Resin Filled                   |                                    |                                    |

## Declaration of Conformity

We hereby declare that the products identified below conform to the relevant Essential Health & Safety Requirements of the European Machinery Directive (2006/42/EC), EMC Directive (2004/108/EC) and other relevant EC Directives as listed below.

| Mechan Product                     | Standards                                                                                                                                                                                                                    |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>F- Series</b>                   | BS EN60204-1:2006 – Safety of Machinery, Electrical equipment of machines. General requirements.                                                                                                                             |
| <b>FM1</b> Safety Control Unit     | BS EN60947-5-3:1999 + AMD 1 04.2005 – Low voltage switchgear and control gear – Part 5-3: Control circuit devices and switching elements – Requirements for proximity devices with defined behaviour under fault conditions. |
| <b>FX1</b> Safety Extender Module  |                                                                                                                                                                                                                              |
| <b>FX2</b> Safety Extender Module  | BS EN60947-5-1:2004 – Low voltage switchgear and control gear – Part 5-1: Control circuit devices and switching elements – electro- mechanical control circuits.                                                             |
| <b>ESM</b> Safety emergency Module |                                                                                                                                                                                                                              |
| <b>SAFETY SWITCHES</b>             | EN ISO 13849-1 : 2008 Safety of Machinery, Safety –related Parts of Control Systems                                                                                                                                          |
|                                    | EN 62061 : 2005 Safety of Machinery,-- Functional Safety of Safety elated electrical ,electronic and programmable electronic Control Systems                                                                                 |
|                                    | BS EN61000-6-4:2007 – EMC Generic emission standard. Industrial.                                                                                                                                                             |
|                                    | BS EN61000-6-2:2005 – EMC Generic immunity standard. Industrial.                                                                                                                                                             |

EC-type examination No. 44 205 371556 Notified body 0044, TÜV NORD CERT GmbH, Langemarckstr. 20, 45141 Essen, Germany.

[ 2002/95/EC Restriction of the use of certain Hazardous substances (RoHs) ]  
The overall machine must comply with the machinery directive. For further information please contact Mechan Controls Plc.

Authorized Signature



W. Boardman

WA Boardman, Managing Director – August 2011

**Mechan Controls Plc**

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### Maintenance

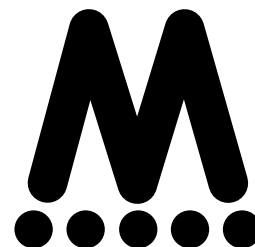
It is recommended to check the safe operation of the of the switches and look for signs of damage or excessive wear on a weekly basis. Damaged units should be replaced or returned to the manufacturer for repair where practical.

### NOTES

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. All information regarding Mechan equipment is believed to be accurate at the time of printing. Responsibility cannot be accepted for errors or omissions.



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Document Number : 327-400-IDv1-1



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ELECTRICAL ENGINEERING & FLUID CONTROL DISTRIBUTORS

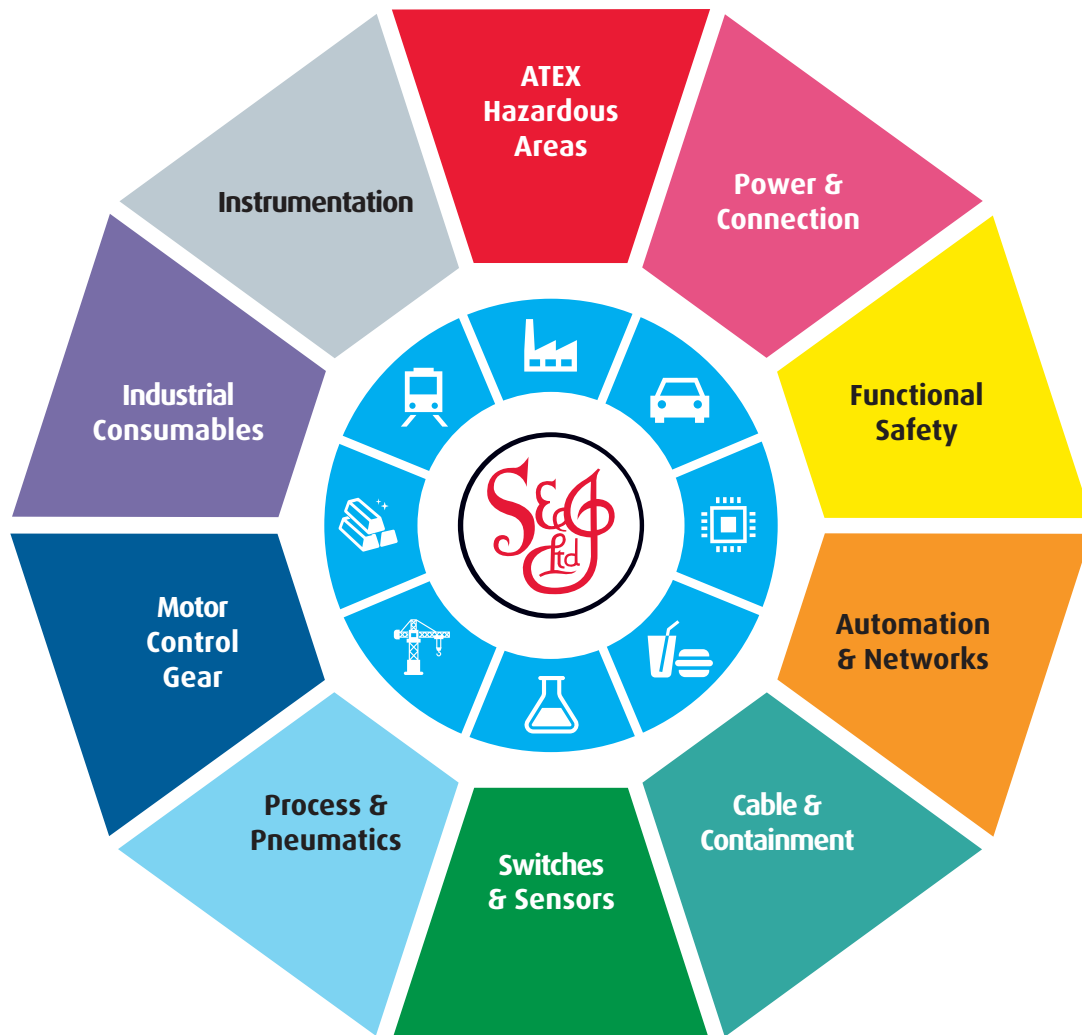
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