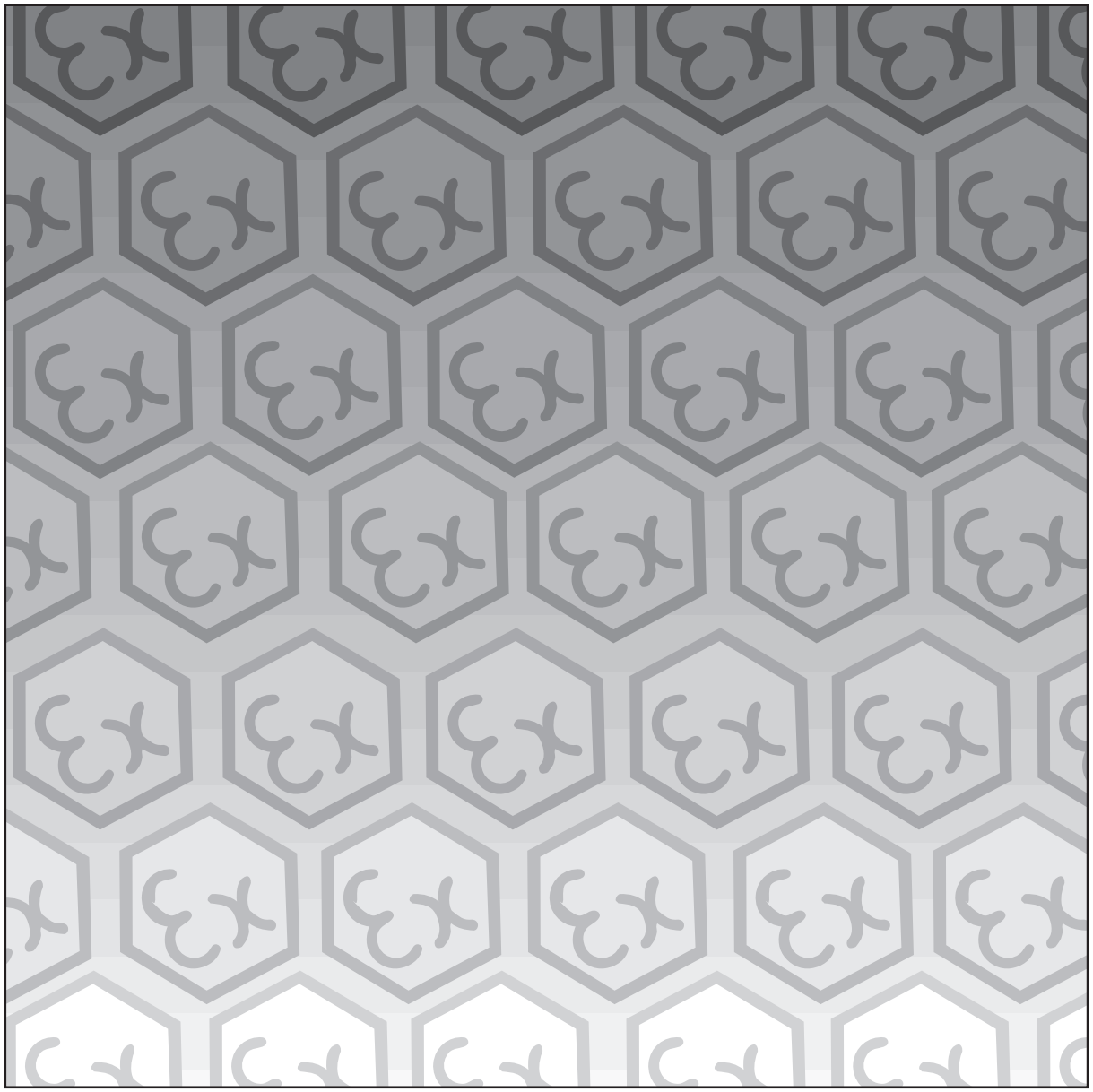
MTL4000 Series
Isolating IS interface units



Instruction Manual

INM4000

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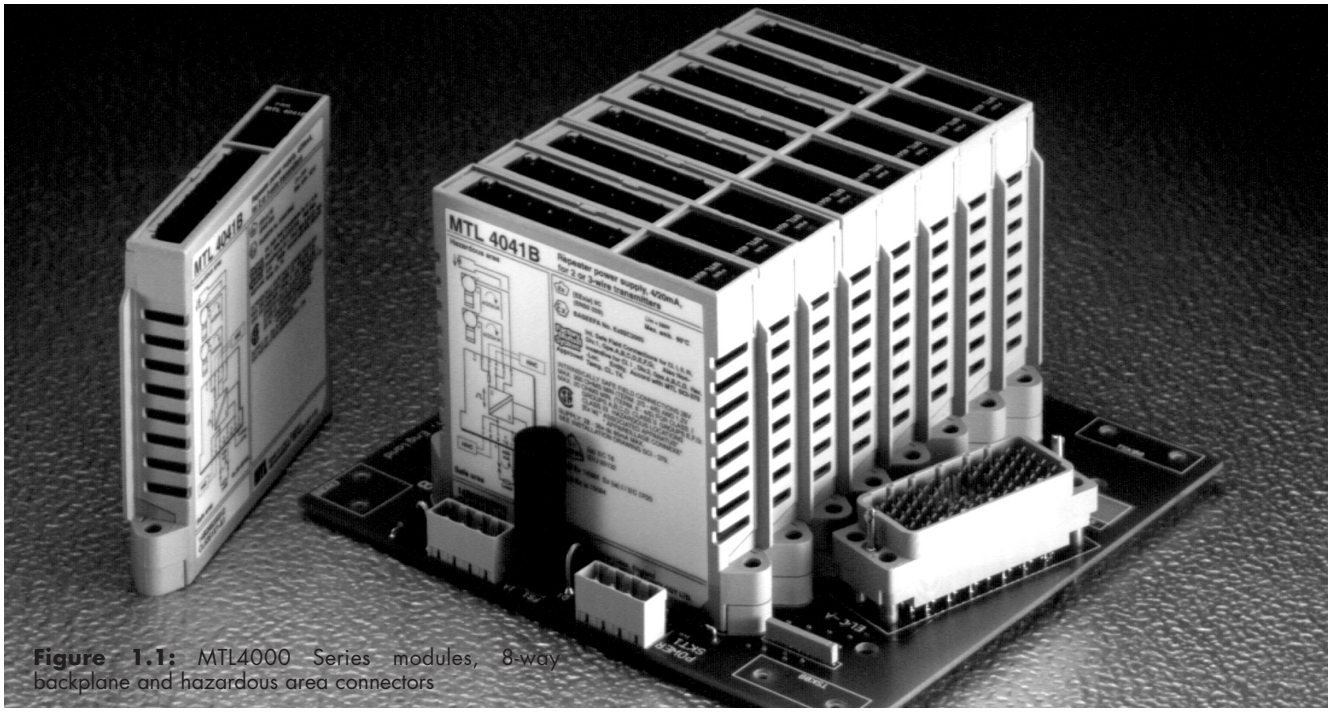


Figure 1.1: MTL4000 Series modules, 8-way backplane and hazardous area connectors

1 INTRODUCTION

1.1 General

This instruction manual describes the procedures for installing, connecting, checking and maintaining MTL4000 Series isolating interfaces and accessories. Section 2 describes the series and accessories, section 3 the precautions that should be taken prior to and during installation, section 4 the installation procedure for backplanes and enclosures, section 5 the installation procedure for modules. Section 6 includes relevant technical data, section 7 fault-finding and maintenance and section 8 test procedures for all modules.

1.2 The MTL4000 concept

The MTL4000 Series of modules and accessories is designed for use with process connected systems. It consists of compact isolating interface modules mounted on backplanes carrying safe-area signals and power supplies. Hazardous-area circuits are connected to the tops of the modules. Backplanes can be integrated into the process system architecture or mounted in separate enclosures.

2 DESCRIPTION

2.1 MTL4000 Series isolating interface modules

Individual modules are provided with multiway connectors in the base which plug into matching connectors on the backplanes. This connection carries all appropriate safe-area circuits and power supplies. A separate connector, which plugs into the top of the module, carries hazardous-area circuits. Hazardous-area connectors are available with either screw-clamp terminals or crimp terminals. All connectors are keyed so connections cannot be made the 'wrong way round'. Status LEDs, configuration switches and configuration ports (where appropriate) are located on the tops of the modules for easy access.

The range of modules includes a number of 'key' types to handle the majority of applications covering on/off or analogue signals between hazardous-area equipment and safe-area systems. All modules, except the non-IS MTL4099, MTL4401, MTL4421RS and MTL4403 trip amplifier, incorporate proven intrinsically safe isolation techniques internationally certified for equipment and wiring in all zones and explosive atmospheres. Full dc isolation is provided between the input and output so that the modules are intrinsically safe without needing an earth.

2.2 MTL4000 Series standard backplanes

MTL standard backplanes accommodate 8, 16 or 24 modules with either screw-clamp or multiway connectors for safe-area signals, and 24V dc dual redundant power supplies with three-point status monitoring. In applications where a number of 8- and 16-way backplanes are installed, the power supply can be interconnected. Optional earth-rail kits are available for 8- and 16-way backplanes and tagging-strip kits for all backplanes.

2.3 MTL4000 Series customised backplanes

Since the backplanes do not carry any hazardous-area circuits (these being plugged directly into the tops of the modules), they do not need certification. Thus, customised backplanes can be produced easily, either by MTL or by the user. These give opportunities for closer integration into given system architectures by being designed to match exactly the size, shape, method of mounting, type of connector, pin assignments, etc, of the particular process system.

2.4 MTL4000 Series enclosures

Weatherproof enclosures, made from impact-resistant polycarbonate and protected to IP65, are available for applications where separate safe-area enclosures for the backplanes are needed. Supplied in three sizes to accommodate one 8-way, one 16-way and two 16-way backplanes respectively, they are provided with mounting clips and with trunking to marshal connecting cables. The tops of modules and the tell-tale LEDs are clearly visible through transparent lids.

Note:16 & 32 way discontinued 2002

2.5 MTL4000 Series accessories

Accessories for mounting standard MTL backplanes include surface-mounting kits, T-section and G-section DIN-rail mounting kits and end stops and a horizontal plate for mounting 24-way backplanes in 19-inch racks.

3 INSTALLATION – PRECAUTIONS

3.1 General

Please read this section before beginning to install backplanes, enclosures, modules etc.

3.2 Precautions

a) Make sure that all installation work is carried out in accordance with all relevant local standards, codes of practice and site regulations.

b) Check that the hazardous-area equipment complies with the descriptive system document.

c) If in doubt, refer to the certificate/catalogue for clarification of any aspects of intrinsic safety, or contact MTL or your local MTL representative for assistance.

d) Note that the units MUST NOT be installed in a hazardous area unless protected by a locally acceptable explosion-proof technique.

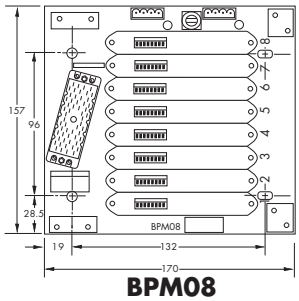
e) Check that the interface unit(s) function(s) are correct for the application(s).

f) When plugging modules into backplanes and hazardous-area connectors into modules, check the identification labels to make sure the items are mated correctly.

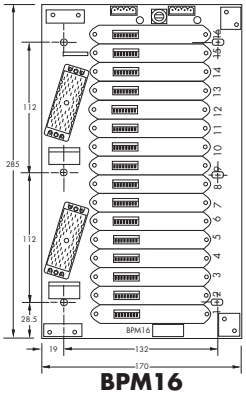
4 INSTALLATION – BACKPLANES and ENCLOSURES

4.1 Backplanes – mounting

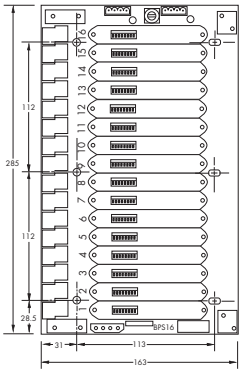
See table 4.1 for listings of the mounting methods and kits and accessories applicable to MTL standard backplanes and Figure 4.1 for dimensions and mounting centres.



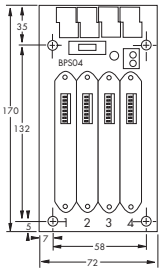
BPM08



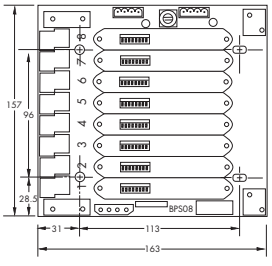
BPM16



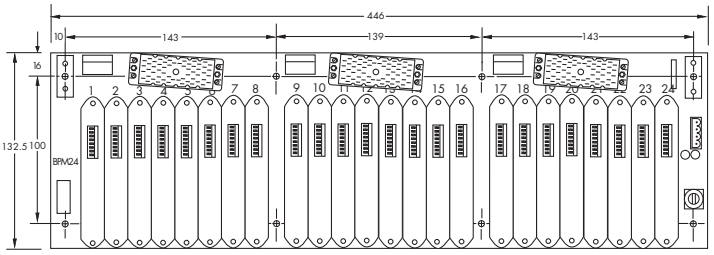
BPS16



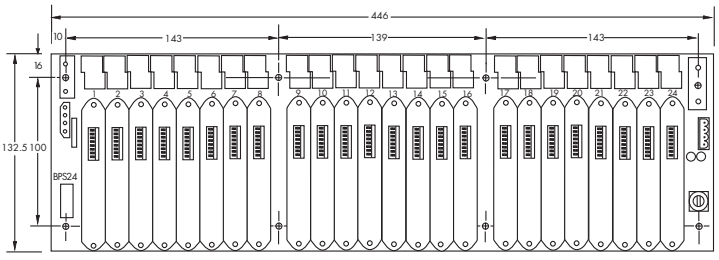
BPS04



BPS08



BPM24



BPS24

A = Backplane mounting centres

B = Tagging-strip mounting centres

C = Earth-rail mounting centres

All dimensions in mm

Figure 4.1: Dimensional diagrams - standard backplanes

Table 4.1: Backplanes, mounting kits and accessories

Backplane model no.	Number of modules	Safe-area connections	MOUNTING KITS			ACCESSORIES		
			Surface	DIN-rail (T or G)	19-inch rack	Earth-rail kit	Tagging strip kit	Spare fuse pack
BPS04	4	Screw-clamp	SMS01	DMK01	–	–		FUS0
BPM08	8	Multiway	SMS01	DMK01	–	ERK08	TSK08	FUS08
BPS08	8	Screw-clamp	SMS01	DMK01	–	ERK08	TSK08	FUS08
BPM16	16	Multiway	SMS01	DMK01	–	ERK16	TSK16	FUS16
BPS16	16	Screw-clamp	SMS01	DMK01	–	ERK16	TSK16	FUS16
BPM24	24	Multiway	SMS01	DMK01	HMP24	–	TSK24	FUS24
BPS24	24	Screw-clamp	SMS01	DMK01	HMP24	–	TSK24	FUS24

***Note**:see also section 4.6 which describes the use of MTL enclosuresfor housing backplanes.*

4.1.1 Surface mounting – with kit SMS01

See Figures 4.1 and 4.2.

a) Select the appropriate number of M4 x 20mm screws for the size of backplane (4 for a 4-way and 8-way, 6 for a 16-way and 8 for a 24-way backplane).

b) Prepare holes in the surface at centres **A**, tapping these if retaining nuts are not required (Figure 4.1).

c) Place a locking washer (2) and a plain washer (3) over each M4 x 20mm screw (1) (Figure 4.2).

d) Insert the screws through the backplane at each mounting centre **A** (Figures 4.1 and 4.2).

e) Fit M4 x 10mm spacers (5), retaining them with retaining washers (6) (Figure 4.2).

f) Attach the assemblies into the pre-drilled surface holes at centres **A**, retaining the screws with a suitable nut if the holes are not tapped.

4.1.2 T- or G-section DIN-rail mounting (ex BPM/S/24) –with kit DMK01

See Figures 4.1, 4.3, 4.4 and 4.5.

a) Select two pieces of T- or G-section DIN-rail of the appropriate lengths for the number of 4-, 8-, 16- and/or 24-way backplanes due for mounting end to end.

b) Mount the two lengths of DIN-rail side-by-side at centres **A**, 113mm (BPS backplanes) or 131mm (BPM backplanes) apart (Figures 4.1 and 4.3).

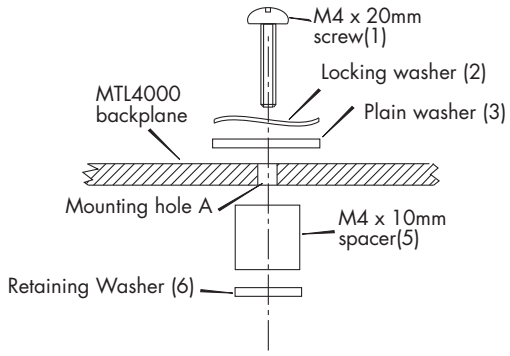


Figure 4.2: Surface mounting procedure

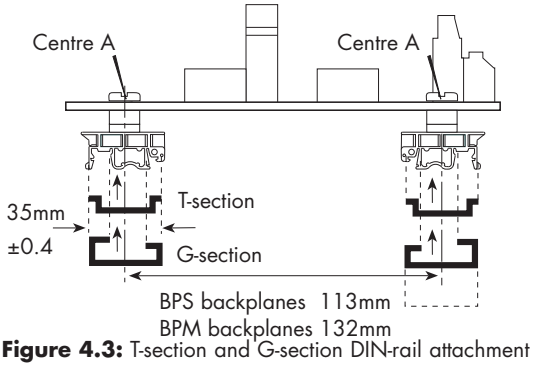


Figure 4.3: T-section and G-section DIN-rail attachment

c) Clip the appropriate number of mounting feet (7) to the DIN rail (8) at centres **A** (4 for each 4/8-way, 6 for each 16-way and 8 for each 24-way backplane) (Figure 4.4).

d) Select the appropriate number of No. 6 x 1/2-inch screws.

e) Place a locking washer (2) and a plain washer (3) onto each No. 6 x 1/2-inch screw (1) (Figure 4.4).

f) Insert the assemblies through the mounting holes **A** on the backplane (Figures 4.1 and 4.4).

g) Fit spacers (5), retaining them with the washers (6) (Figure 4.4).

h) Locate the assemblies over the mounting feet and attach the screws (1) to the feet (Figure 4.4).

i) For vertically orientated backplanes attach one end stop (11) to the lower end of each DIN-rail supporting a column of backplanes by clipping the stops into place and tightening the appropriate screw [(12) for T-section and (13) for G-section DIN-rails] (Figure 4.5).

j) Additional end stops should be attached between backplanes to increase the stability of tall columns of backplanes.

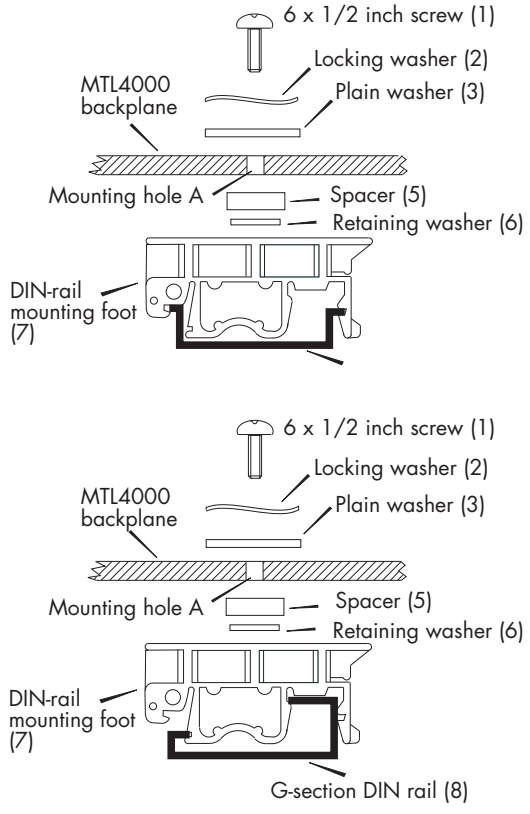


Figure 4.4: Mounting a backplane onto DIN-rail

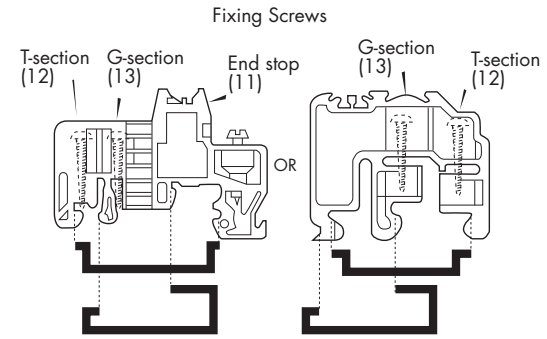


Figure 4.5: Mounting end stops onto DIN-rail

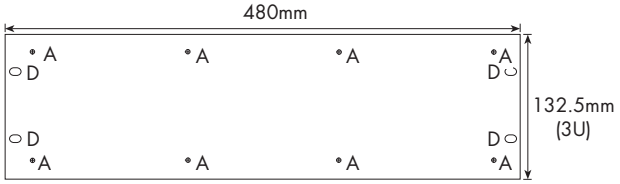


Figure 4.6: HMP24 Horizontal mounting plate

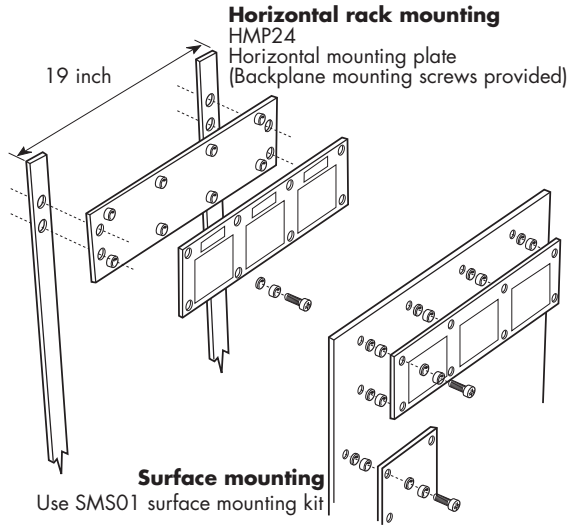


Figure 4.7: 19-inch rack fixing centres

4.1.3 19-inch rack mounting (BPM/BPS/24 backplanes only) – HMP24 mounting plate

See Figures 4.6 and 4.7.

a) Place an unloaded backplane onto the HMP24 mounting plate (Figure 4.6).

b) Attach the backplane to the mounting plate at centres **A** with the eight M4 x 12mm screws provided (Figure 4.6).

c) Attach the assembly to the 19-inch rack centres at **D** (Figure 4.7).

4.2 Backplanes – identification and tagging

Backplane labelling facilities include marked areas for identifying backplanes, specific module locations and system connections (multiway backplanes only). Mounting holes for earth-rail and tagging-strip attachments are similarly marked

Table 4.2: MTL4000 Series top label colour coding

Colour	Module no. (MTL)	Function
Black	4013	Two-channel switch/proximity detector interface, solid-state output
White	4014	Switch/proximity detector interface, with line fault detection
White	4015	Switch/proximity detector interface, with line fault detection
White	4016	Two-channel switch/proximity detector interface, dual relay output
White	4017	Two-channel switch/proximity detector interface, with line fault detection
Red	4021	Solenoid/alarm driver
Red	4021S	Solenoid/alarm driver, with fail-safe override facility
Red	4023	Solenoid/alarm driver, with line fault detection
Red	4024	Solenoid/alarm driver for 24V systems, loop powered
Red	4025	Solenoid/alarm driver, low current output
Blue	4031	Vibration transducer interface
Pink	4032	Pulse isolator
Blue	4041A	Current repeater, 4/20mA passive input for smart transmitters
Blue	4041B	Repeater power supply, 4/20mA, for 2- or 3-wire transmitters
Blue	4041P	High-power repeater power supply, 4/20mA, for 2- or 3-wire transmitters
Blue	4042	Repeater power supply IIB, 4/20mA, for 2-wire transmitters
Blue	4043	Repeater power supply
Blue	4044	Two channel repeater power supply
Green	4045B/C	Isolating driver, 4/20mA, with line fault detection
Green	4046	Isolating driver, for HART valve positioners with LFD
Green	4046C	Isolating driver, for HART valve positioners with open-circuit detection
Green	4046P	High-power isolating driver, for HART valve positioners
Blue	4047	Repeater power supply, 4/20mA, for Bailey 'smart' transmitters
Blue	4048	Repeater power supply, 4/20mA, for Foxboro 'smart' transmitters
Blue	4061	Two-channel fire and smoke detector interface
Orange	4073	Temperature converter
Orange	4075	Temperature converter, with trip alarm
Orange	4081	Millivolt isolator, for low-level signals
Orange	4083	Voltage isolator
Grey	4099	Dummy isolator
Yellow	4113P	Switch/proximity detector interface, fail-safe, with LFD
Yellow	4114P	Switch/proximity detector interface, fail-safe
Red	4215	IS-output switch-operated relay
Red	4216	Two-channel IS-output switch-operated relay
Brown	4220	Earth leakage detector
Maroon	4401	Honeywell DE trip amplifier, non IS
White	4403	High-level trip amplifier, non IS
White	4421RS	General purpose switch operated relay

4.21 Backplane identification labels

See Figure 4.8.

a) Attach a suitably marked label to the area BACKPLANE IDENT. to identify an individual backplane (Figure 4.8).

b) Attach suitably marked MPL01 module position labels to the areas MODULE IDENT (Figure 4.8).

4.2.2 Tagging strip mounting kit (TSK08, TSK16, TSK24)

See Figures 4.1, 4.9, 4.10 and 4.11.

a) Locate the tagging strip mounting posts (1) at backplane centres **B** (Figure 4.1).
b) Attach each mounting post (1) to the backplane with two M3 x 12mm mounting screws (2) and washers (3) (Figure 4.9).
c) Attach colour coding labels (4) to the tag label (5) (Figure 4.10). See table 2 for suggested colour codes for individual modules.
d) Mark the tag label (5) with the tag reference (Figure 4.10).
e) Slide the tag label (5) into the plastic holder (6) and retain with a plastic rivet (9) (Figure 4.10).
f) Attach the plastic retaining tie (7) with two plastic rivets (8) (Figure 4.11).
g) Clip the tag strip holder (6) onto the mounting posts (1) by pushing it downwards (Figure 4.11).
h) If required, swivel the tagging strip vertically (Figure 4.11)

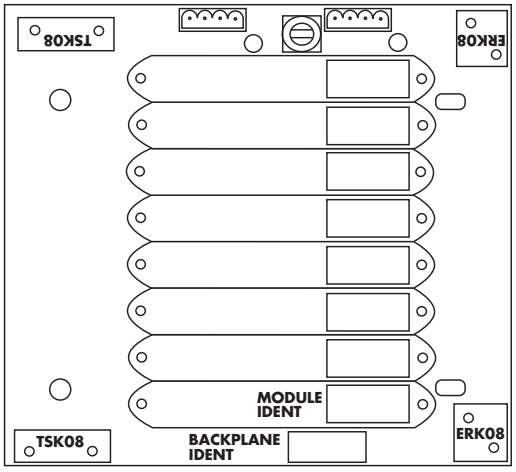


Figure 4.8: Backplane layout showing locations for labels and attachment of accessories

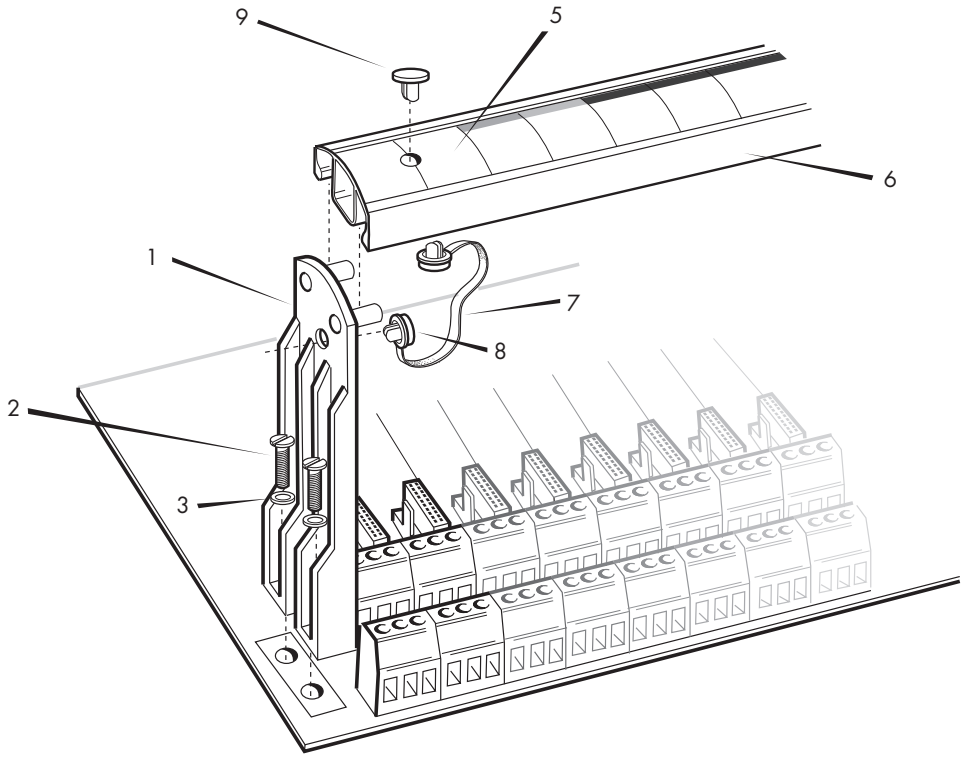


Figure 4.9: Mounting a tagging-strip post

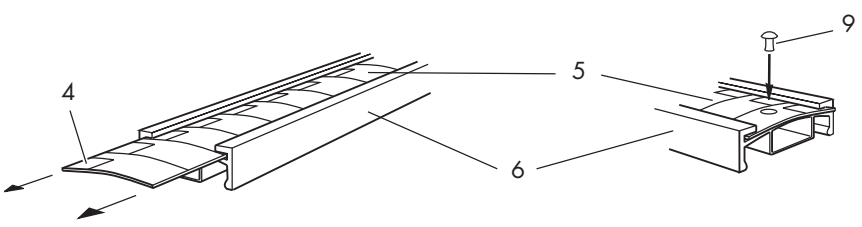


Figure 4.10: Attaching colour-coding labels to tagging -strips

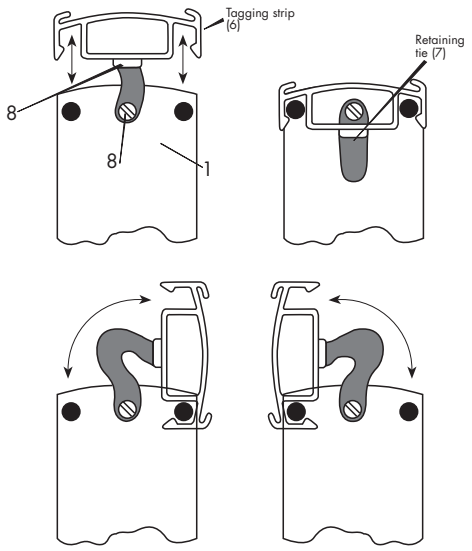


Figure 4.11: Attaching and swivelling a tagging strip

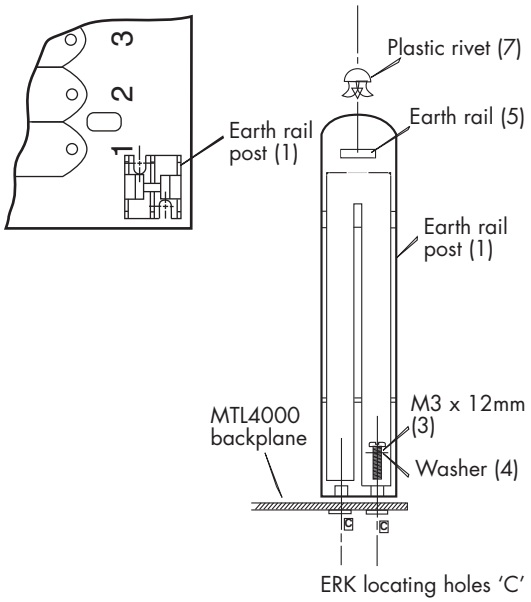


Figure 4.12: Attaching an earth-rail mounting post to a backplane

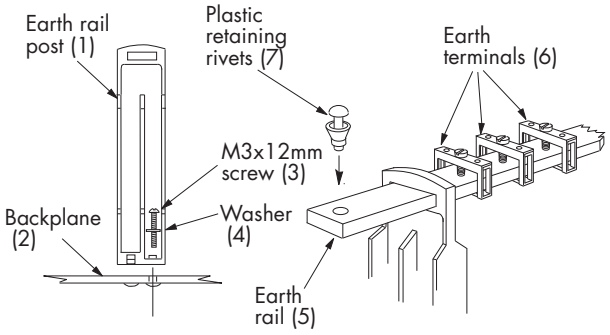


Figure 4.13: Assembly the earth rail and attaching earth terminals and rivets

4.3 Backplanes - earth rails

Optional earth rails are available for 8- and 16-way backplanes (kits ERK08 and ERK16 respectively). Cable screens from hazardous-area circuits or spare pairs from a multicore cable are connected to the terminals on the earth rails, which are mounted on the backplane at the same height as the tops of the modules, close to the hazardous-area connectors. Earth rails are attached using the following procedure:–

4.3.1 Earth rail kit (ERK08 and ERK16)

See Figures 4.1, 4.12 and 4.13 (page 6).

a) Locate the earth rail mounting posts (1) at backplane centres C (Figures 4.1 and 4.12).

b) Attach the mounting posts (1) with M3 x 12 screws (3) and washers (4) (Figure 4.12).

c) Slide the earth rail (5) through the slots in the tops of the mounting posts (1) (Figure 4.13).

d) Fit the earth terminal(s) (6) on the rail (5) (Figure 4.13).

e) Attach plastic retaining rivets (7) to each end of the earth rail (5) (Figure 4.13).

4.4 Backplanes – connections

Connections for safe-area circuits are made to the backplane in one of two ways – either by multiway connectors (BPM08/BPM16/BPM24) or by screw-clamp terminals (BPS08/BPS16/BPS24). See section 4.4.1 for multiway connectors and section 4.4.2 for screw-clamp connectors.

Power supply connections are also made to the backplanes. See section 4.4.3 for details, section 4.4.4 for a procedure used to interconnect power supplies on multiple 8- and 16-way backplanes and section 4.4.5 for details of connecting power supplies on 24-way backplanes. See also section 4.4.6 for power status sensing and monitoring details.

4.4.1 Safe-area circuits – multiway connector (BPM) versions

Each multiway backplane is provided with one 56-way Elco connector for each group of eight modules. These are male connectors. The mating version is supplied as an accessory – MTL part number ELC56 (Elco part number 00 8016 056 000 910), each of which uses 56 solder-tag contacts (Elco part number 60 8017 0363 00 339) which are included as part of kit ELC56. The connection procedure is:–

a) For each module position, check the base pin assignments for the module type by referring to the appropriate circuit diagrams reproduced in Figures 6.1 to 6.35 in Section 6.

b) Note that each backplane multiway connector relates to the eight positions closest to it (Figure 4.14).

c) Using the contacts provided, make the appropriate connections to the mating half of the multiway Elco connector according to the pin assignments detailed in Figure 4.15 and table 4.3 (page 8).

Note: *the connector headshell must be fitted with a cable exit towards the larger locating pin end of the connector*

d) Complete the connector tag label (2) and attach it to the backplane (Figure 4.14).

e) Plug the multiway connector onto the backplane in the correct position and secure it with the locking screw.

4.4.2 Safe-area circuits – screw-clamp terminal (BPS) versions

In the case of the screw-clamp terminal backplanes, each module position is provided with a 6-way split-level terminal block for safe-area signals. Make connections as follows:–

a) For each module position, check the base pin assignments for the module type by referring to the circuit diagrams reproduced in Figures 6.1 to 6.35 (Section 6).

b) Make the appropriate connections to the module position terminal block (1) in accordance with the same pin assignment numbers reproduced in Figure 4.16.

c) The maximum permissible wire gauge is 2.5mm^2 (14 AWG). Wire entry for each terminal is from the side of the block.

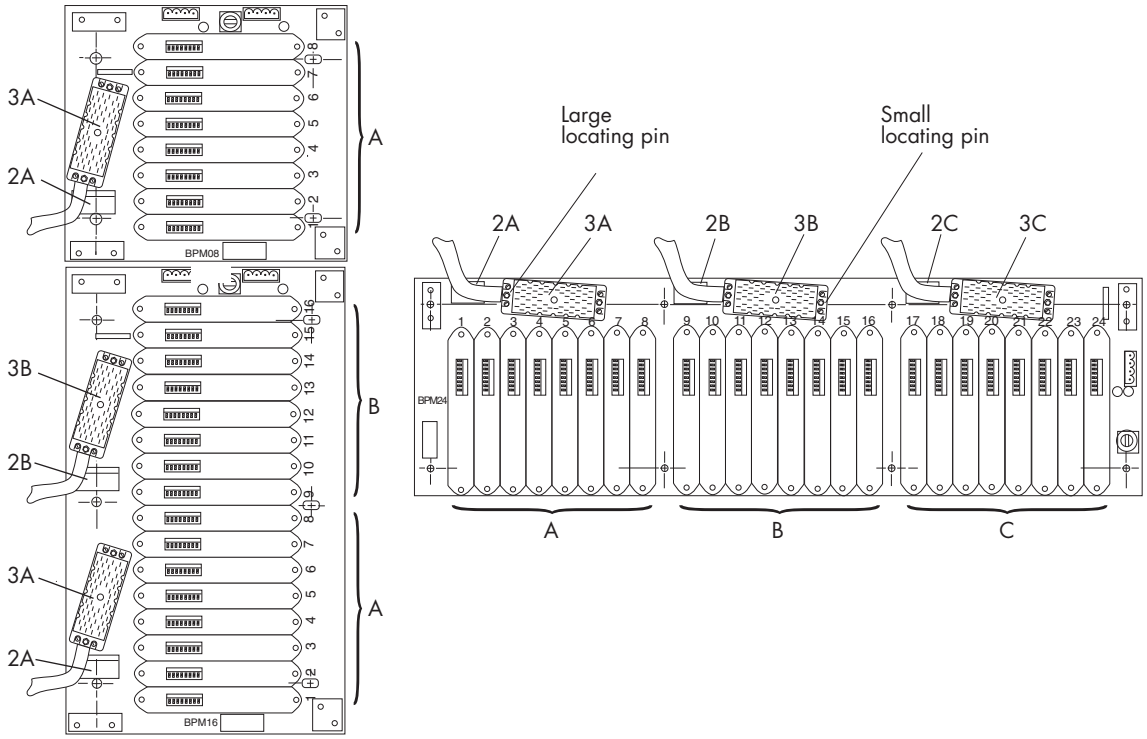


Figure 4.14: Backplane multiway connector positions

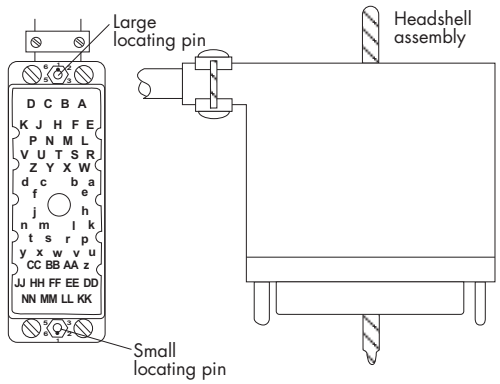


Figure 4.15: Multiway connectors - pin assignments and headshell assembly

4.4.3 Safe area – discrete power supply connections (8- and 16-way backplanes)

Dual 24V power supplies, to provide redundancy, are routed to individual backplanes by plug-in connectors and are then bussed by the backplanes to individual isolators. LEDs on the backplane indicate that the two supplies are operational. A diode circuit between the two ensures that the highest voltage supply is the one in use at any given moment, so providing automatic switchover of supplies if the primary source fails. The procedure for connecting power supplies is:–

a) Connect each of the two 21V to 35V dc power supply connectors to the independent supply sources according to the terminal assignments shown in Figure 4.17. The maximum permissible wire gauge is 2.5mm2 (14 AWG).

b) Plug the power supply connectors into the base connectors on the backplanes.

c) Ratings for the fuses located between the two supply connectors on the backplanes are:-

8-way: 1A (FUS08 fuse kit)

16-way: 2A (FUS16 fuse kit)

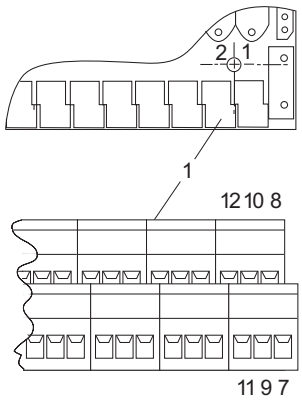


Figure 4.16: Screw-clamp terminal pin assignments - BPS backplanes

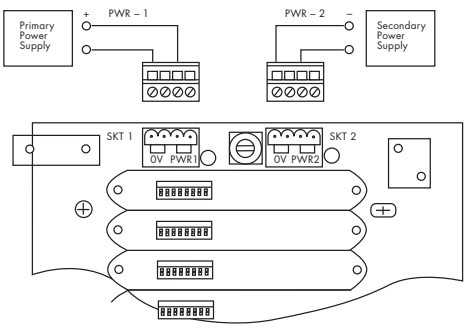


Figure 4.17: Power supply connections - 8- and 16-way backplanes

4.4.4 Interconnection of power supplies for multiple 8- and 16-way backplanes

Power supplies for 8- and 16-way backplanes can be interconnected, so reducing wiring while still permitting individual backplanes to be taken out of service without affecting supplies to other backplanes. More than one backplane can be removed, provided that they are neighbours and do not leave any other backplanes without an active supply.

a) Make the connections shown in Figure 4.18.

Note: *a mixture of 8- and 16-way backplanes can be interconnected, provided that the maximum circuit current does not exceed 12A. Wire sizes up to 2.5mm2 (14 AWG) can be used and should be chosen according to load and voltage drop.*

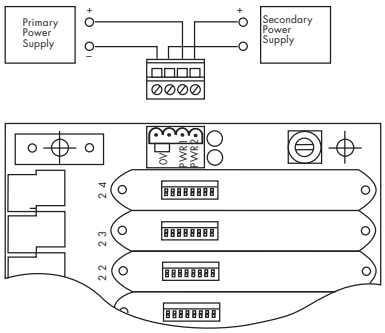


Figure 4.19: Power supply connections (24-way backplanes)

4.4.5 Safe area – discrete power supply connections (24-way backplanes)

Dual 24V power supplies, to provide redundancy, are routed to individual backplanes by plug-in connectors, and are then bussed by the backplanes to individual isolators. LEDs on the backplane indicate that the two supplies are operational. A diode circuit between the two ensures that the highest voltage supply is the one in use at any given moment, so providing automatic switchover of supplies if the primary source fails. The procedure for connecting power supplies is:–

a) Connect the power supply cables to the connector according to the pin assignments shown in Figure 4.19. The maximum permissible wire gauge is 2.5mm2 (14 AWG).

b) Plug the power supply connector into the base connector on the backplane.

c) The rating of the fuse is:–

24-way: 3.15A (FUS24 fuse kit)

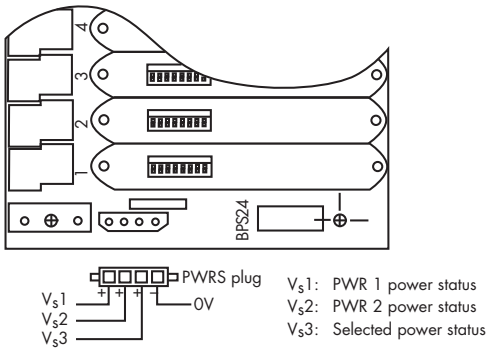


Figure 4.20: Location and wiring connections to the power status connector

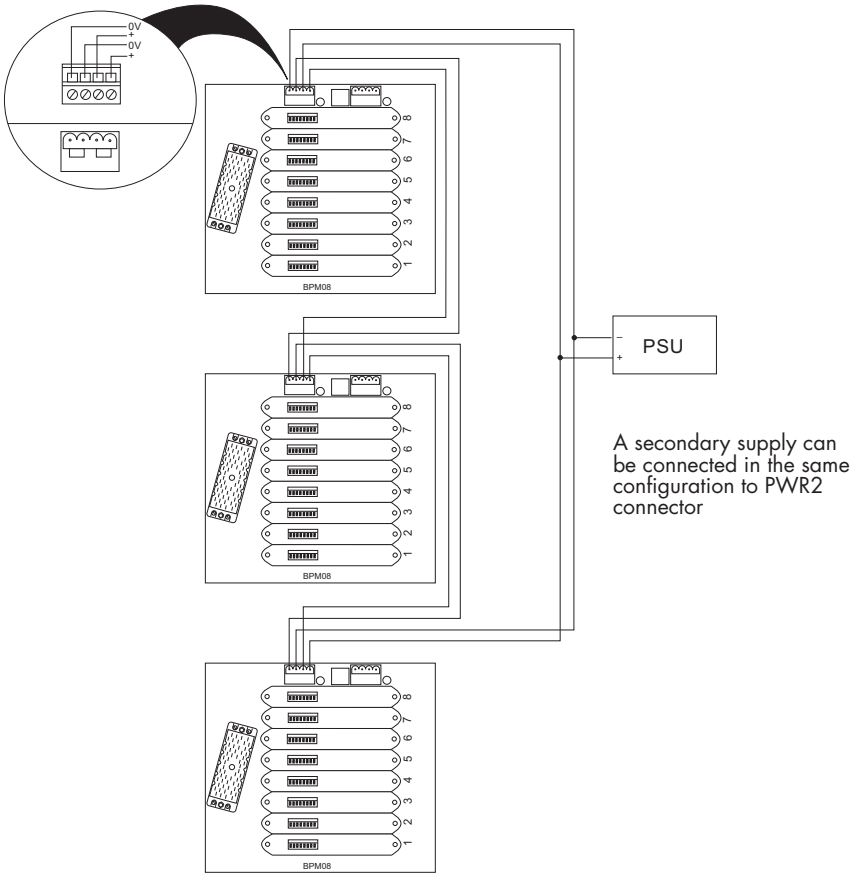


Figure 4.18: Power supply circuitry for interconnecting 8- and 16-way backplanes

4.4.6 Power supply status

Three sensing points, connected to safe-area circuit terminals, monitor the power supply voltages to provide the process system with status indication. Output voltages to the process system are current limited by 10kΩ resistors. On BPS backplanes, the monitoring connections to the system are made through a separate power status connector (Figure 4.20). This separate connector is not needed on BPM backplanes as the connection is made through pins EE to KK on the multiway connectors carrying safe-area signals.

4.5 Backplanes – non-standard

For information about installing customised backplanes (whether supplied by MTL or by a third party), see the separate instructions provided with the units.

4.6 Enclosures – use and installation

Three MTL4000 Series enclosures, rated IP65, are available. These accommodate one 8-way, one 16-way and two 16-way backplanes respectively. See Figures 4.21 to 4.23 for layout details, section 4.6.1 for the procedure for mounting backplanes inside enclosures and section 4.6.2 for enclosure installation.

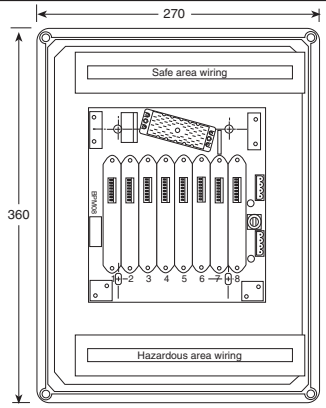


Figure 4.21: Layout of BX08 enclosures

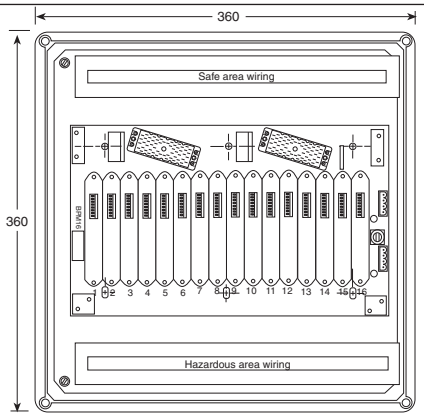


Figure 4.22: Layout of BX16 enclosures (terminated 2002)

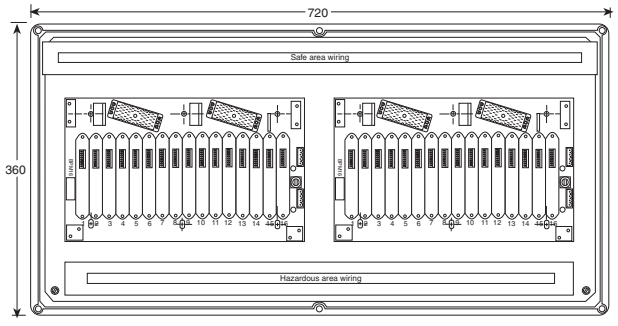


Figure 4.23: Layout of BX32 enclosures (terminated 2002)

Table 4.3: Multiway connectors - pin assignments

Elco connector pin identification	BPM08/16/24 module/pin configuration	BPM16/24 module/pin configuration	BPM24 module/pin configuration
	module 1	**module 9**	**module 17**
A	7	7	7
B	8	8	8
C	9	9	9
D	10	10	10
E	11	11	11
F	12	12	12
	module 2	**module 10**	**module 18**
H	7	7	7
J	8	8	8
K	9	9	9
L	10	10	10
M	11	11	11
N	12	12	12
	module 3	**module 11**	**module 19**
P	7	7	7
R	8	8	8
S	9	9	9
T	10	10	10
U	11	11	11
V	12	12	12
	module 4	**module 12**	**module 20**
W	7	7	7
X	8	8	8
Y	9	9	9
Z	10	10	10
a	11	11	11
b	12	12	12
	module 5	**module 13**	**module 21**
c	7	7	7
d	8	8	8
e	9	9	9
f	10	10	10
h	11	11	11
j	12	12	12
	module 6	**module 14**	**module 22**
k	7	7	7]
l	8	8	8
m	9	9	9
n	10	10	10
p	11	11	11
r	12	12	12
	module 7	**module 15**	**module 23**
s	7	7	7
t	8	8	8
u	9	9	9
v	10	10	10
w	11	11	11
x	12	12	12
	module 8	**module 16**	**module 24**
y	7	7	7
z	8	8	8
AA	9	9	9
BB	10	10	10
CC	11	11	11
DD	12	12	12
EE	pwr 1 power status	pwr 1 power status	pwr 1 power status
FF	0V	0V	0V
HH	prw 2 power status	pwr 2 power status	pwr 2 power status
JJ	0V	0V	0V
KK	Selected power status	Selected power status	Selected power status
LL	0V	0V	0V
MM	0V	0V	0V
NN	0V	0V	0V

4.6.1 Mounting backplanes within the enclosure

a) Using the surface mounting kit (SMS01), assemble the components as described in section 4.1.1.

b) Fix the assemblies onto the enclosure backing plate at centres **A** and **B** for backplanes with screw clamp connectors (BPS08 and BPS16 – Figure 4.24)

c) Fix the assemblies onto the enclosure backing plate at centres **A** and **C** for backplanes with multiway connectors (BPM08 and BPM16 – Figure 4.24)

4.6.2 Installation and mounting of enclosures

The preferred orientation is with the backplanes/cable trunking horizontally mounted (see section 4.6.3 for temperature considerations). See Figures 4.25 and 4.26.

a) Attach the wall mounting lugs (1) to the underside of the enclosure (2) (Figure 4.25).

b) Secure the lugs with the fixing screws (3) (Figure 4.25).

c) Mount the enclosure on the surface at centres D (Figure 4.26).

d) Remove the gland plate(s) and drill them to accept the fitting of glands.

Note: glands are not supplied with the enclosure

e) Replace the gland plate(s) complete with the glands.

f) Attach the 'Take Care' IS label to the inside of the lid top. Ensure that the text is clearly visible when the lid is fixed to the enclosure.

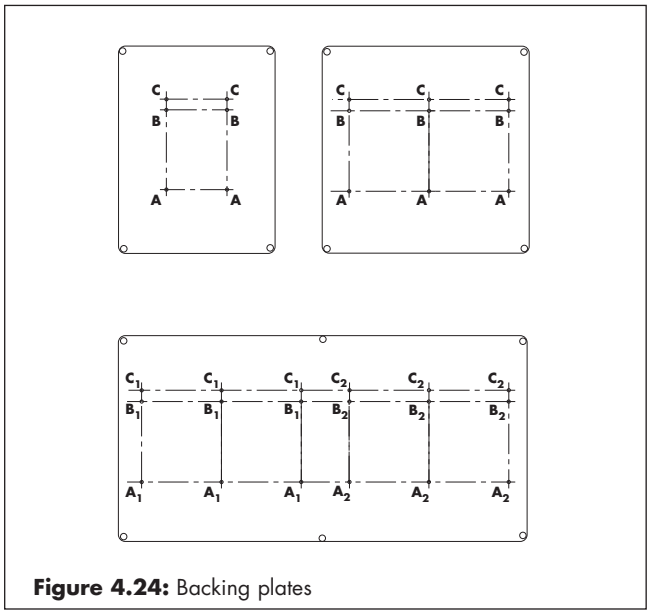


Figure 4.24: Backing plates

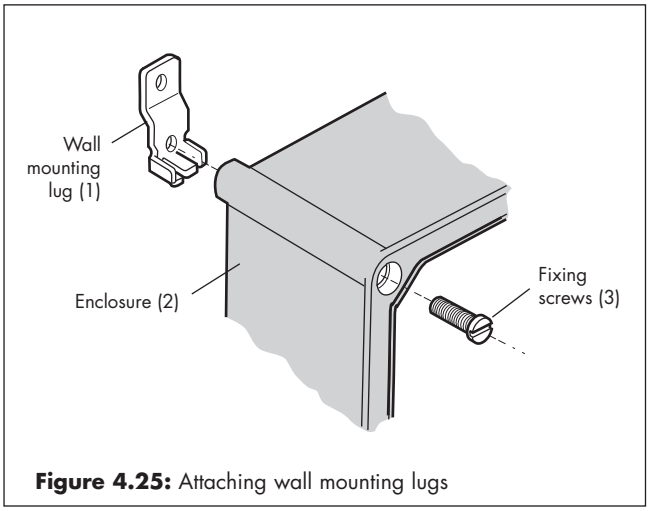


Figure 4.25: Attaching wall mounting lugs

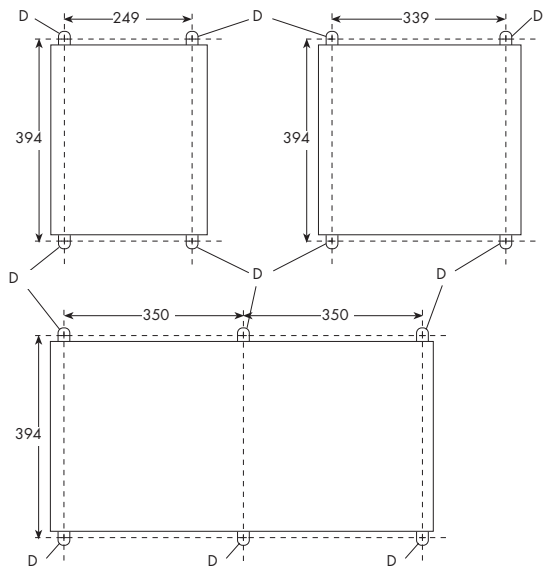


Figure 4.26: Drilling centres for enclosure mounting

4.6.3 Enclosure temperature considerations

The preferred orientation of an enclosure is with the backplanes and cable trunking mounted horizontally as in Figures 4.21 to 4.23. With enclosures mounted in this orientation the following temperature effects should be taken into account:–

a) When MTL4000 modules are installed in a BX enclosure, the power they dissipate will cause the temperature inside the enclosure to rise. See Figure 4.27. As an example, consider the installation of five MTL4041B units and three MTL4016 units, all operating at 24V, into a BX08 enclosure.

b) Each MTL4041B and MTL4016 dissipates 1.2W at 24V.

c) The total dissipation is therefore 9.6W. Referring to Figure 4.27, this would cause an internal temperature rise of 23°C in the BX08.

d) To keep within the MTL4000 Series maximum temperature of 60°C, the maximum ambient temperature in which the enclosure can be mounted is (60 – 23)°C, ie 37°C.

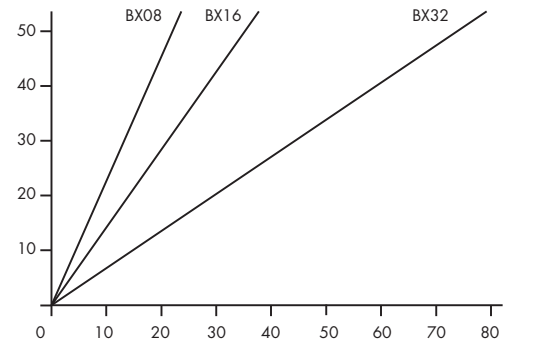


Figure 4.27: Power dissipated vs temperature rise within enclosure

5 INSTALLATION – MODULES

WARNING: When installing MTL4000 Series isolators it is essential to make sure that intrinsically- safe and non-intrinsically-safe wiring is segregated as required by a nationally accepted authority or as described in BS 5345, ISA RP 12.6 or DIN VDE-165.

WARNING: Make sure the correct hazardous-area connector (field-wiring plug) is plugged into the corresponding isolator. It is recommended that the connector is identified by the same tag number as the matching isolator.

5.1 Modules – hazardous-area connectors

The two alternative types of hazardous-area connectors and the methods of connecting hazardous-area circuits are shown in Figure 5.1. Note that the conductors should be between 1.6mm and 0.5mm in diameter (14 AWG and 24 AWG respectively). The MTL4220 earth leakage detector is a special case and is provided with three 3-way screw-clamp terminal connectors.

5.1.1 Screw-clamp connectors (SCC01, SCJ01 and MTL4220 terminals)

Note: *the SCJ01 connector incorporates integral CJC and is specifically designed for use with MTL4073 units used with inputs from THCs needing CJ compensation*

For wires without crimps:–

- **a)** Trim back the insulation of the conductors by 12mm.
- **b)** Check pin assignments – see the circuit diagrams in Section 6 for these.
- **c)** Insert conductors according to the pin assignments and tighten the screws.
- **d)** Attach a tag label (if required) to the side of the connector.

Note: *If the wires are fitted with crimp ferrules, the wire stripped length should be 14mm when used with the recommended crimp ferrule tube length of 12mm.*

CAUTION: Do not use SCC01/SCJ01 hazardous area screw-terminal connectors marked with a reversed 'S' with MTL4000 Series units manufactured after year 1997, week 33 (9733) on the date code label (older modules) or bar code label (newer modules) as there is a possibility of an unreliable connection.

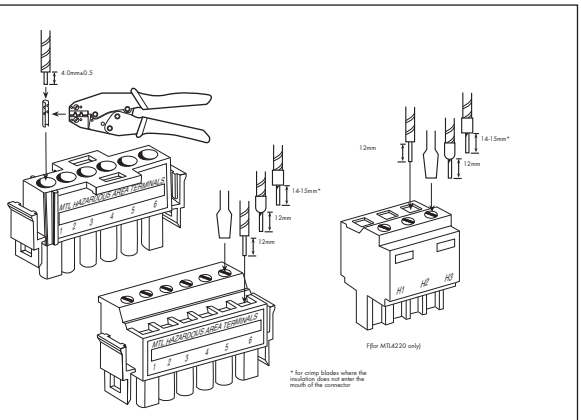


Figure 5.1: Hazardous-area connectors

5.1.2 Crimp connectors (CCH01)

- **a)** Check the gauge of the conductors and select the appropriate crimps:–
  - CRC01 1.6mm to 0.8mm dia (14 AWG to 20 AWG)
  - CRC02 1.0mm to 0.5mm dia (18 AWG to 24 AWG)
- **b)** Trim back the insulation of the conductors by 4mm.
- **c)** Apply crimps to the bared conductors with crimp tool CRT01for CRC01 crimps or CRT02 for CRC02 crimps.
- **d)** Check pin assignments — see the circuit diagrams in Section 6.
- **e)** Insert conductors according to the pin assignments.

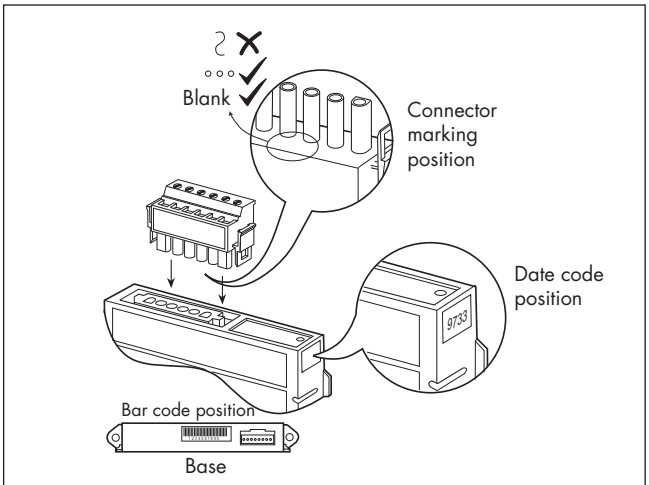


Figure 5.2: SCC01/SCJ01 Hazardous area connectors "CAUTION"

Note: To identify the connectors and when the unit was manufactured see Fig. 5.2.

- **f)** Attach a tag label (if required) to the side of the connector.
- **g)** If necessary, crimps can be removed using crimp removal tool CRR01.

5.1.3 Connections for MTL4220 earth leakage detectors

MTL4013/14/15/16/17/21/21S/23/24/25/61 modules can be used with an MTL4220 earth leakage detector so hazardous-area circuit faults can be identified and rectified without needing to shut down the loop ('no-fail' operation). The procedure for each module is:–

- **a)** Connect the module terminal 3 or 6 (as specified by the circuit diagram in Section 6) to any terminal between H1 and H8 on the MTL4220 unit.
- **b)** Connect terminal E on the MTL4220 unit to earth.

In operation, each channel connected to the MTL4220 is individually monitored. An earth fault is indicated by an LED on the MTL4220 and a relay alarm signal is also activated.

5.2 Modules – installation

Important

- **Work should be carried out in accordance with all relevant local standards, codes of practice and site regulations**
- **Check that the hazardous-area equipment complies with the descriptive system document**
- **Refer to the certificate/catalogue for clarification of any aspects of intrinsic safety or contact MTL or your local MTL representative for assistance**
- **The units must be installed in a non- hazardous area unless protected by a locally accepted explosion-proof technique**

Installation

- **a)** Check interface unit function is correct for application
- **b)** Trim insulation: crimp connector (Figure 5.1)
  or screw terminal connector

  Note: *MTL4073 - For thermocouple inputs requiring cold junction compensation an SCJ01 hazardous-area connector (with integrated CJC sensor) is necessary.*
- **c)** Fit tag label
- **d)** Terminate hazardous area circuits on blue connector

e) Segregate intrinsically safe and non-intrinsically safe cables as required by a nationally accepted authority or as described in PD60079.14:2000 (BS5345 is now obsolescent) - ISA RP 12.6 or DIN/VDE-0165.
Note: MTL4081 - When using with a thermocouple and compensating cables, take care to minimise the temperature difference between the hazardous- and safe-area terminals
Note: MTL4421RS General purpose switch operated relay must not be mounted adjacent to any MTL4000 IS module. The minimum distance between IS and Non-IS is 50mm
Note: MTL4220 - Make earth (E) connection to a reference earth point/plant OV point as directed.

f) Mount interface unit on an MTL or customised backplane (Figure 5.3)
- Fit position label (optional).
- Locate interface unit on backplane safe-area/power supply connector.
- Tighten mounting screws.
- Insert hazardous-area connectors into the top of the interface unit.

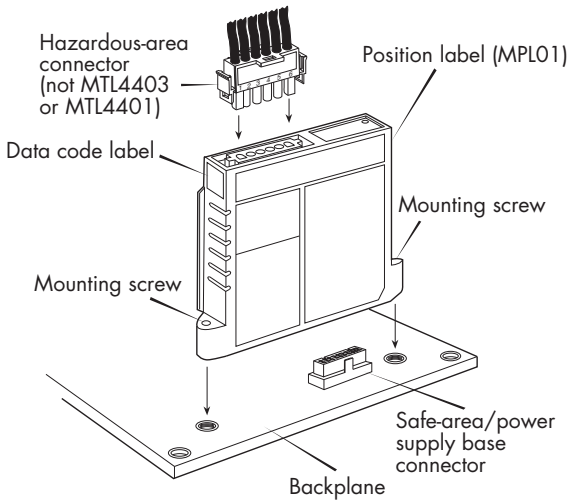


Figure 5.3: Mounting a module onto a backplane

Table 5.1: Indicators and controls by model number

Module number (MTL)	Power on LEDs	Safe-area output status LEDs	Additional facilities
4013	Yes	Yes – channels 1 and 2	
4014	Yes	Yes	Line fault detection (LFD) LED; see also table 5.1
4015	Yes	Yes	Phase reversal and LFD switches; see also table 5.2
4016	Yes	Yes – channels 1 and 2	Phase reversal and LFD switches (both channels); see also table 5.2
4017	Yes	Yes – channels 1 and 2	Line fault detection (LFD) LEDs (both channels); see also table 5.1
4021	Yes	Yes	
4021S	Yes	Yes	
4023/R	Yes	Yes	Line fault detection (LFD) LED
4024	Yes	No	
4025	Yes	Yes	
4031	Yes	No	
4032	Yes	Yes	
4041A	Yes	No	
4041B	Yes	No	
4041P	Yes	No	
4042	Yes	No	
4043	Yes	No	
4044	Yes	No	
4045B/C	Yes	No	
4046/C	Yes	No	
4046P	Yes	No	
4047	Yes	No	
4048	Yes	No	
4061	Yes	No	
4073/75	Yes	No	'Power on' LED provides power and status information (see table 5.6)
4081	Yes	No	
4083	Yes	No	
4113P	Yes	Yes	Fail-safe output and line fault detection (LFD) see also table 5.9
4114P	Yes	Yes	Fail-safe output
4215	Yes	No	Hazardous-area relay on LED
4216	Yes	No	Hazardous-area relay on LEDs (both channels)
4220	Yes	No	Earth fault status LED for each of 8 inputs
4403	Yes	No	High/low trip point switch: trip LEDs for channels A and B
4421RS	Yes	Yes	24V logic override facility
4099	No	No	

5.3 Modules - installation checks

Table 5.1 identifies the modules fitted with power ON LED's. The only check required is to establish that the LED is illuminated. The following paragraphs and tables detail the installation checks to be carried out on the modules with additional LED's.

PWR = Power
CH1 = Channel 1
CH2 = Channel 2

Figure 5.4: MTL4013 installation checks

Carry out the installation checks on the modules as follows:

5.3.1 MTL4013 (Figure 5.4)

a) Operate sensors and check that the status LEDs light up.

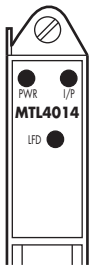
b) Hazardous-area contact closed; safe-area transistor on; status LED on

5.3.2 MTL4014/4017 (Figure 5.5)

a) For switch sensor inputs, make sure resistors (22kΩ and 620Ω) are fitted (section 6).

b) Operate sensor and check results with table 5.2

c) If interface unit is potentially faulty, exchange it working unit.



PWR = Power
I/P = Channel 1Status
LFD = Line Fault detection

PWR = Power
CH1 = Channel 1Status
CH2 = Channel 2 Status
LF1 = Line Fault detection channel 1
LF2 = Line Fault detection channel 2

Figure 5.5: MTL4014 & MTL4017 installation checks

Table 5.2: MTL4014/4017, table of test results

(Results expected when sensor operated as shown)

Operation	Input value	Channel LED	Channel relay	LFD LED	LFD relay
Normal	>2.1mA	On	Closed	Off	Closed
	<1.2mA	Off	Open	Off	Closed
Broken line	<50µA	Off	Open	On	Open
Shorted line	<100Ω	Off	Open	On	Open

Table 5.3: MTL4015/4016, table of test results

(Results expected when sensor operated as shown)

Operation	Input value	Phase (PH) Direct-acting	Phase (PH) Reverse-acting	LFD	LED	Relay output
Normal	<1.2mA	On	–	On	Off	Open
	>2.1mA	On	–	On	On	Closed
	<1.2mA	–	On	On	On	Closed
	>2.1mA	–	On	On	Off	Open
Broken line	<100µA	On	–	On	Off	Open
	<100µA	–	On	On	Off	Open
	<100µA	On	–	Off	Off	Open
	<100µA	–	On	Off	On	Closed
Shorted line	>6.5mA	On	–	On	Off	Open
	>6.5mA	–	On	On	Off	Open
	>6.5mA	On	–	Off	On	Closed
	>6.5mA	–	On	Off	Off	Open

Note: *if line fault detection is switched on for switch sensors, make sure that the resistors (22kΩ and 620Ω) are fitted as shown in fugure 6.3 and 6.4*

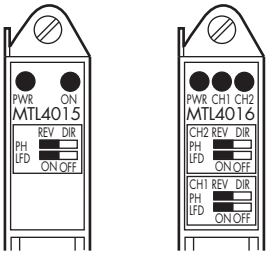
5.3.3 MTL4015/4016 (Figure 5.6)

a) Set phase switch(es) (PH) to the position required.

b) Set line fault detection (LFD) switch(es) as required.

c) If using LFD with switch sensors, make sure resistors (22kΩ and 620Ω) are fitted (section 6).

d) Operate sensors and check results with table 5.3



PWR = Power
ON = Channel 1 Status
LFD = Line Fault detection
PWR = Power
CH1 = Channel 1 Status
CH2 = Channel 2 Status
LFD = Line Fault detection
PH = Phase Reversal

Figure 5.6: MTL4015 & MTL4016 installation checks

5.3.4 MTL4021/4025 (figure 5.7)

a) Simulate control and overide inputs, monitor the output/status LED according to table 5.4.

Table 5.4: MTL4021/4025, table of test results

		Control input	
		On	**Off**
Overide input	On	Output Off	Output Off
	Off	Output On	Output On

Note: *Status LED is lit when load is energized (output on)*

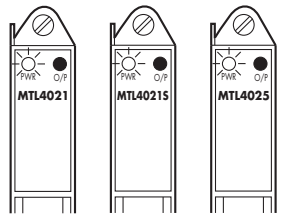


Figure 5.7: MTL4021/4025/4021S installation checks

5.3.5 MTL4021S (figure 5.7)

a) Simulate control and overide inputs, monitor the output/status LED according to table 5.5.

Control input

Suitable for switch contacts, an open collector transistor or logic drive applied across terminals 10 and 11

On = input switch closed, transistor on or <1.4V

Off = input switch open, transistor off or >4.5V

Override input

A 24V logic signal applied across terminals 8 and 9 allows the solenoid/alarm to be operated by the control input. If the logic signal is disconnected, the solenoid/alarm is off.

Table 5.5: MTL4021S, table of test results

Voltage across terminals 8 and 9	State of solenoid/alarm
<2.0V	OFF
>9.0V	controlled across terminals 10 and 11
>2.0V but <9.0V	undetermined

Note: *Status LED is lit when load is energized (output on)*

5.3.6 MTL 4023/4023R (figure 5.8)

a) Simulate control and overide inputs, monitor the output/status LED

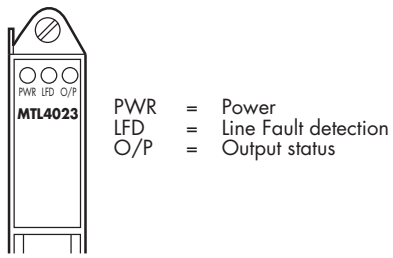


Figure 5.8: MTL4023 installation checks

Table 5.6: MTL4023/4023R, table of test results

Control	Yellow LED O/P)
Closed	On
Open	Off

Field Circuit	Red LED (LFD)
>50Ω& <7kΩ	Off
Open Circuit	On
Short Circuit	On

5.3.7. MTL4024 (figure 5.9)

a) Simulate control and overide inputs, monitor the output/status LED

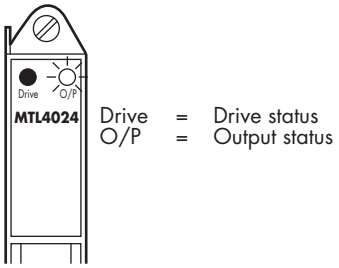


Figure 5.9: MTL4024 installation checks

5.3.8. MTL4032 (figure 5.10)

a) Voltage pulse input Vsp

Set threshold switches A & B as required according to table 5.7

Table 5.7: MTL4032

Overide input	A	B
3V	0	0
6V	0	1
12V	1	1

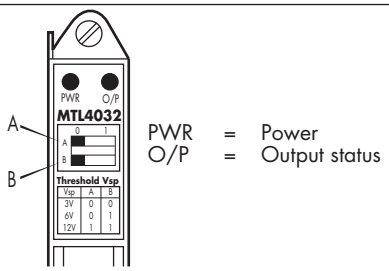


Figure 5.10: MTL4032 installation checks

5.3.9 MTL4073/4075 (figure 5.11)

a) Before operation, the interface unit must be configured for the particular application

Note: *Refer to section 5.4 for configuration instructions.*

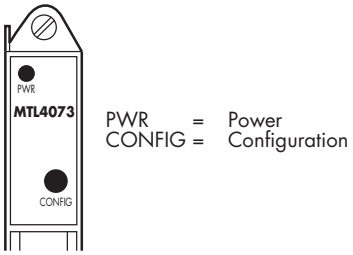


Figure 5.11: MTL4073/4075 installation checks

Table 5.8: MTL4073/4075, power and status information

LED	Status
Steady state ON	Unit working normally
Slow flash	Output at 1mA, module in low alarm or downscale drive
Fast flash	Output at 21mA, module in high alarm or upscale drive
Off	No power to module

Note: *Refer to section 5.4 for configuration data.*

5.3.10 MTL4081 (figure 5.12)

a) Set safety drive ON or OFF as required

b) If safety drive is ON, select upscale(+) or downscale (-) operation as required

PWR = Power

Figure 5.12: MTL4081 installation checks

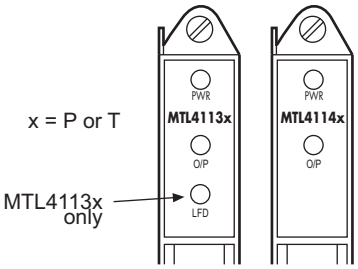
5.3.11 MTL4113P/4114P (figure 5.13)

a) For switch sensor inputs, make sure resistors (10kΩ and 1k4Ω) are fitted (section 6.27)

b) Operate sensors and check results with table 5.9

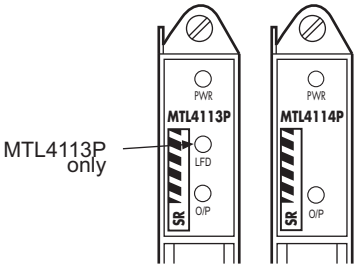
c) If interface units potentially faulty, exchange with working unit

Pre-2003 model labels



Note:
The following versions are now discontinued: **4113T, 4114T** and **4114P**

2003 & later model labels (see Note 1)



PWR = Power
O/P = Fail-safe output
LFD = Line fault detection

Note 1 Positions of LFD and O/P LEDs are reversed on 2003 models and later

Figure 5.13: MTL4113P/4114P installation checks

5.3.12 MTL4215 (figure 5.14)

a) Simulate safe-area input, monitor the output/status LED according to table 5.10.

PWR = Power
O/P = Fail-safe output

Figure 5.14: MTL4215 installation checks

Table 5.10: MTL4215, table of test results

Non-IS switch (10 & 11)	IS-relay A (1 & 3)	IS-relay A (2 & 3)	IS-relay B (4 & 5)	IS-relay B (4 & 6)	LED
Open	Open	Closed	Closed	Open	Off
Closed	Closed	Open	Open	Closed	On

5.3.13 MTL4216 (figure 5.15)

a) Simulate safe-area input, monitor the output/status LED according to table 5.11.

Table 5.11: MTL4216, table of test results

Non-IS switch (8 & 9)	Non-IS switch (10 & 11)	IS-relay A (1 & 3)	IS-relay A (2 & 3)	IS-relay B (4 & 5)	IS-relay B (4 & 6)	LED CH1	LED CH2
Open	Open	Closed	Closed	Open	Off	Off	–
Closed	Closed	Open	Open	Closed	On	On	–
–	Open	–	–	Closed	Open	–	Off
–	Closed	–	–	Open	Closed	–	On

PWR = Power
CH1 = Channel 1
CH2 = Channel 2

Figure 5.15: *MTL4216 installation checks*

5.3.14 MTL4220 (figure 5.16)

Following power-up, the unit tests itself and associated hazardous-area wiring.

a) Ignore LED and relay operations until 60s have elapsed after power-up

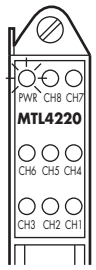
b) Confirm operation with table 5.12.

Table 5.12: MTL4220, table of test results

Operation	Power LED	Channel LED	Relay
Normal	On	Off	Energised
Earth fault	On	On	De-energised
Unit fault	On	Off	De-energised
Power fault	Off	Off	De-energised

Table 5.9: MTL4113P/4114P, table of test results

Operation	Input value	Channel LED	Channel Output	LFD LED	LFD relay
Normal (ON)	2.9mA<Is<3.9mA (MTL4113P/14P)	On	energised	Off	Closed
	<1.9mA & >6.1mA (MTL4113P/14P)	Off	de-energised	Off	Closed
Broken line	<50µA (MTL4113P)			On	Open
Shorted line	<100Ω(MTL4113P)			On	Open



PWR = Power
CH8 = Channel 8
CH7 = Channel 7
CH6 = Channel 6
CH5 = Channel 5
CH4 = Channel 4
CH3 = Channel 3
CH2 = Channel 2
CH1 = Channel 1

Figure 5.16: MTL4220 installation checks

5.3.15 MTL4401 (figure 5.17)

a) Set trip switches on top to required positions.

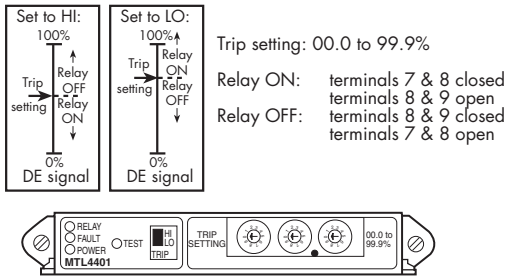


Figure 5.17: MTL4401

Table 5.13: MTL4401, LED and relay status

Trip	Operation	Power	Relay		Fault
HI	DE > Trip setting	On	Off	Off	Off
HI	DE < Trip setting	On	On	On	Off
HI	Test	On	Off	Off	Off
LO	DE > Trip setting	On	On	On	Off
LO	DE < Trip setting	On	Off	Off	Off
LO	Test	On	Off	Off	Off
–	Out-of-range	On	Off	Off	On
—	–	Off	Off	Off	Off

5.3.16 MTL4403 (figure 5.18)

For each of channels A and B:

a) Set trip switches to HIGH or LOW as required (see table 5.14 for relayeration).

b) For approximate setting and checking of trip level: TEST points provide 1-5V, equivalent to 4-20mA through 250Ω resistor. For accurate setting of trip level: use current meter to set input current.

c) Adjust SET until LED Trip A/Trip B is on: then slowly adjust SET until LED goes out.

d) Relays are energised in normal operation and de-energise outside trip point. Lit LED shows safe condition (not tripped).

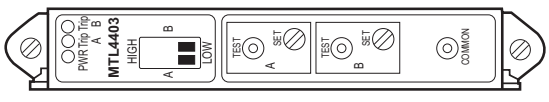


Figure 5.18: MTL4403

Table 5.14: MTL4403, LED and relay status

Trip switch A or B	Operation	Power	Trip A or B LED	Relay contacts
HIGH	Input>Trip setting	On	Off	Open
HIGH	Input<Trip setting	On	On	Closed
LOW	Input>Trip setting	On	On	Closed
LOW	Input<Trip setting	On	Off	Open
–	–	Off	Off	Open

5.3.17 MTL4421RS (figure 5.19)

a) Simulate control and override inputs, monitor the output/status LED according to table 5.15.

Control input

Suitable for switch contacts, an open collector transistor or logic drive applied across terminals 10 and 11

On = input switch closed, transistor on or <1.4V
Off = input switch open, transistor off or >4.5V

Override input

A 24V logic signal applied across terminals 8 and 9 allows the solenoid/alarm to be operated by the control input. If the logic signal is disconnected, the solenoid/alarm is off.

Overide input	Control input	Output state
0V	Closed	Off
0V	Open	On
24V	Closed	Off
24V	Open	Off

Table 5.15: MTL4421RS, table of test results

Figure 5.19: MTL4421RS installation checks

5.4 Modules – setting and configuration

All modules are provided with a green LED (PWR) on top of the unit to indicate 'power on'. Many units also include additional LEDs to indicate status, setting switches and configuration facilities. These are listed in table 5.14 and other additional tables in this section.

Before an MTL4073 module can be used it must be configured for the intended application.

Default configuration

Unless ordered differently, every MTL4073 module is supplied withthe following default configuration.

Input type	Type K thermocouple
Linerisation	enabled
Units	°C
CJ Compensation	enabled
Damping value	0 seconds
Smoothing value	0 seconds
Output zero	0°C
Output span	250°C
Tag and description fields	blank
Open circuit alarm	set high (upscale)
Transmitter failure alarm	set low (downscale)
CJ failure alarm	set low (downscale)
Line frequency	50Hz

Configuration (using CNF41-now discontinued)

Configuration is carried out with an MTL611 intrinsically safe hand-held terminal fitted with a CNF41 configurator interface unit operating version 3.1. software (or higher) and a CAB73 cable.
***Note**: to update earlier software, contact MTL or a local representative.*

a) Insert the 8-pin plug on cable CAB73 to socket 3 of the CNF41.

b) Insert the 3.5mm jack plug of cable CAB73 into the 'Config' socket on top of the module.

Initiating configuration

a) Switch on the MTL611 by pressing 'ON', the menu will display MTL4073, MTL414, MTL418: if not, press 'ON' again.

***Note:** during configuration, make selections by moving the cursor with the arrow keys and pressing 'EXE' or by pressing the initial letter of the selection (if two selections have the same initial, the cursor will cycle between them until stopped by pressing 'EXE').*

b) Press 'ON' to deselect the last selection.

Checking current configuration

a) Select the M4073 option.
b) Select Newtx to open communication with the module; Working is displayed followed by the module tag name and module hardware and software version numbers.
c) Select Upload to read the module configuration into the MTL611 terminal; display shows Loading.
d) Select Configure followed by List to read the current configuration; this is displayed as a list and can be paged through using the up/down arrows.
e) Exit by pressing 'ON'.

Configuring 'Online' or 'Offline'

Module configurations can be changed directly with the module **Online**.

Alternatively, when a number of modules must be configured with the same parameters, configuration can be carried out **Offline** within the **configurator** and **Download**(ed) later into individual modules.

By default, the configurator operates **Online**; to take it **Offline**, select **Configure**, **Mode** and **Offline**, followed by pressing 'EXE'.

Checking current configuration

a) Select the M4073 option.
b) Select **Newtx** to open communication with the module; **Working** is displayed followed by the module tag name and module hardware and software version numbers.
c) Select **Upload** to read the module configuration into the MTL611 terminal; display shows **Loading**.
d) Select **Configure** followed by **List** to read the current configuration; this is displayed as a list and can be paged through using the up/down arrows.
e) Exit by pressing 'ON'.

Configure menu

Parameters are changed through sub-menus selected from the **Configure** menu:–

Input: Facilities for changing sensor type, units, damping, etc

Output: Select to choose process variables equivalent to 4mA and 20mA.

Txopt:

o/c alarm –	polarity for an open-circuit sensor
Tx fail –	failure of self tests (upscale or downscale)
Calibrate –	recalibrate 4-20mA output
Line frequency –	select line frequency
cj fail –	for failed or absent cold junction sensor

***Note:** DO NOT use the Calibrate facility for ranging*

Comms: Facilities for changing the **Tag** name and **description**.

Monitor menu

Select sub-menus from the Monitor menu for:–

Current: display loop Current in mA

Process: display Process variable

Cj temp: display temperature of module terminals
Only operational in THC or mV modes when used with an SCJ01 hazardous-area connector with integral CJC sensor

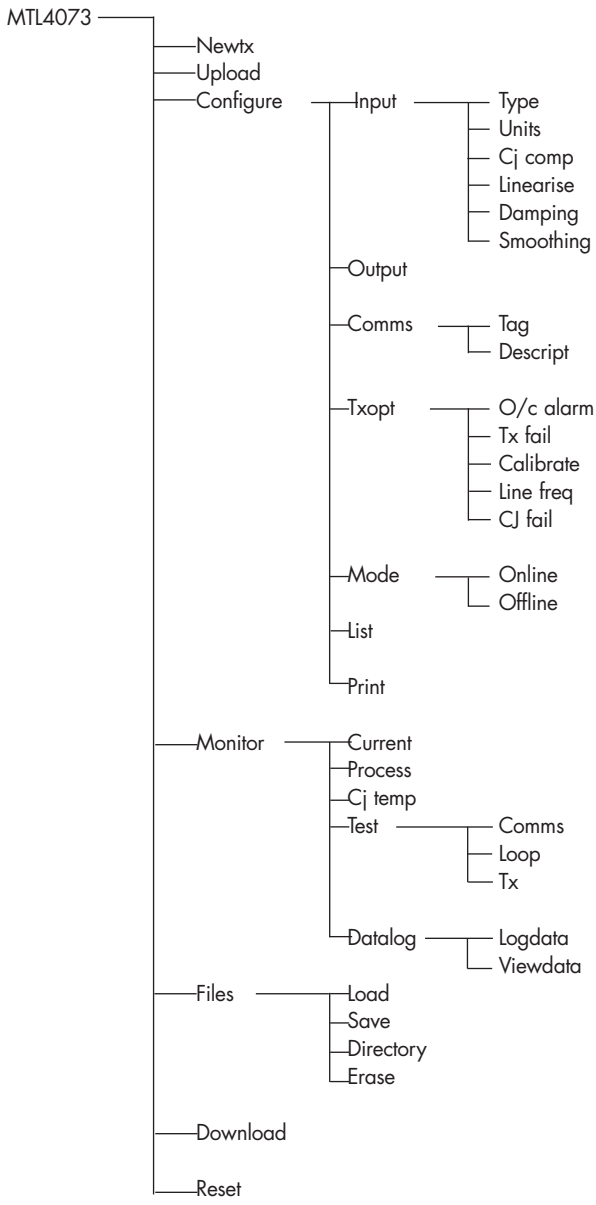


Figure 5.20: MTL4073 configuration

5.5 Configuration using PCS45/PCL45

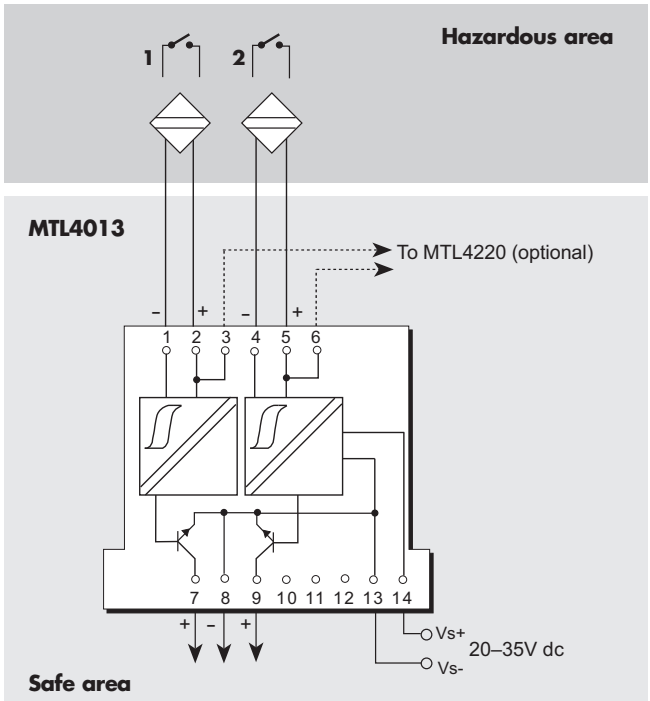
The PCS45 software, used in conjunction with PCL45 serial link, is the latest means by which to configure MTL4073/4075 modules. Instructions are contained within the softwre. Please refer to these via the computer.

6 TECHNICAL DATA

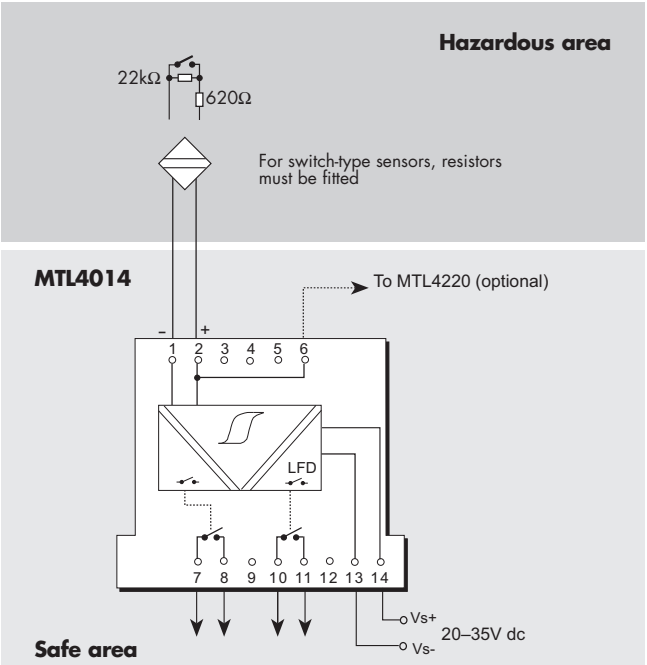
6.1 Module circuit diagrams and pin assignments

Figures 6.1 to 6.35 in this section depict the circuit diagrams and pin assignments for all MTL4000 Series isolators.

Figure 6.1: MTL4013 2-channel switch/proximity detector interface

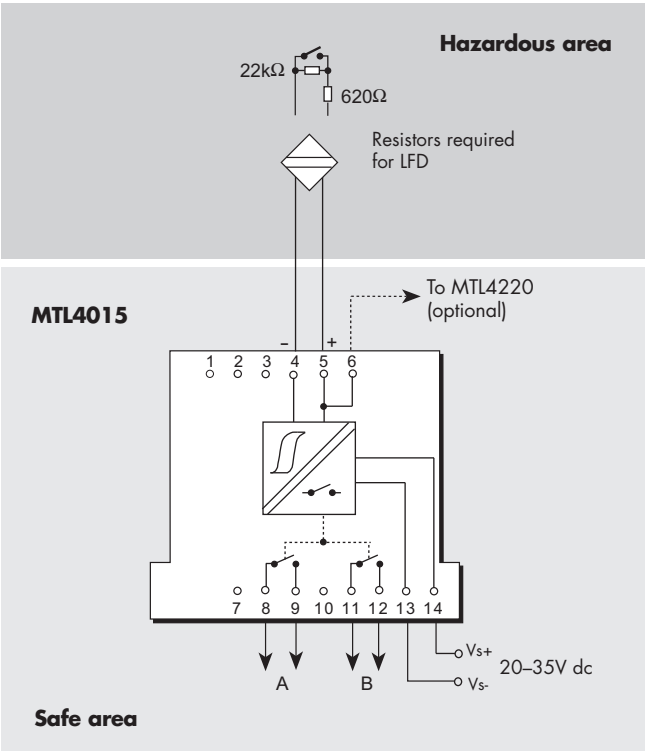


Terminal	Function
1	Input 1 –ve
2	Input 1 +ve
3	Optional link from input 1 to MTL4220
4	Input 2 –ve
5	Input 2 +ve
6	Optional link from input 2 to MTL4220
7	Output 1 +ve
8	Outputs 1/2 –ve
9	Output 2 +ve
13	Supply –ve
14	Supply +ve



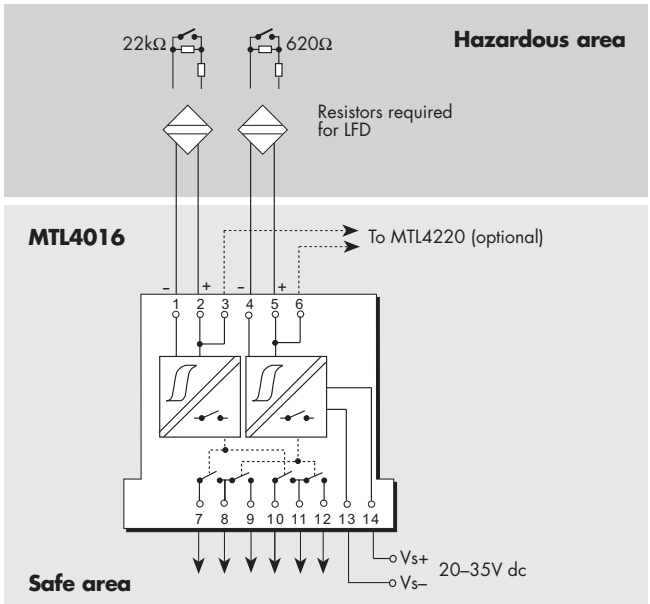
Terminal	Function
1	Input 1 –ve
2	Input 1 +ve
6	Optional link to MTL4220
7, 8	Output
10, 11	Line fault signal
13	Supply –ve
14	Supply +ve

Figure 6.2: MTL4014 switch/proximity detector interface



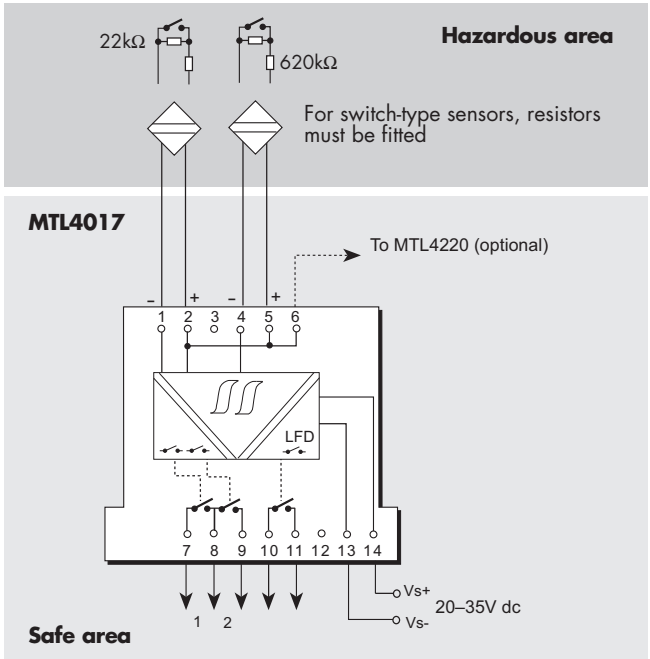
Terminal	Function
4	Input –ve
5	Input +ve
6	Optional link from input to MTL4220/MTL2220
8, 9	Output A
11, 12	Output B
13	Supply –ve
14	Supply +ve

Figure 6.3: MTL4015 switch/proximity detector interface



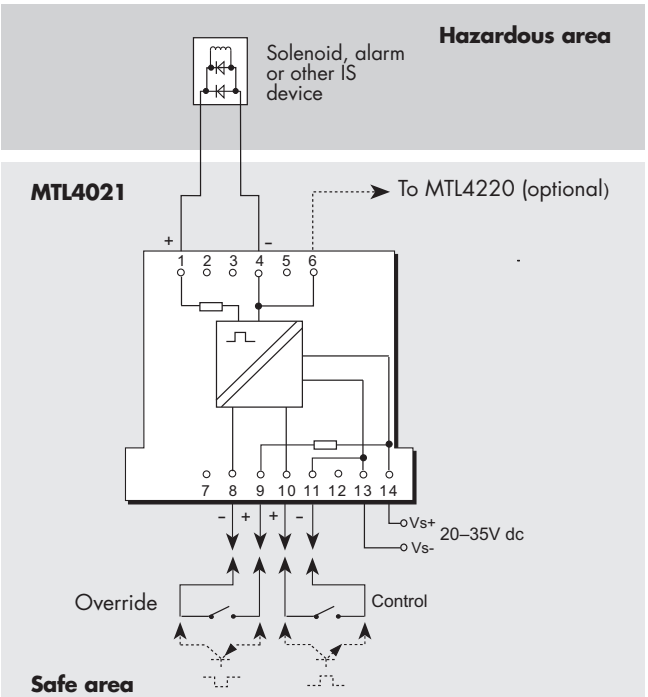
Terminal	Function
1	Input 1 –ve
2	Input 1 +ve
3	Optional link from input 1 to MTL4220
4	Input 2 –ve
5	Input 2 +ve
6	Optional link from input 2 to MTL4220
7, 8	Output 1A
8, 9	Output 2A
10, 11	Output 1B
11, 12	Output 2B
13	Supply –ve
14	Supply +ve

Figure 6.4: MTL4016 2-channel switch/proximity detector interface



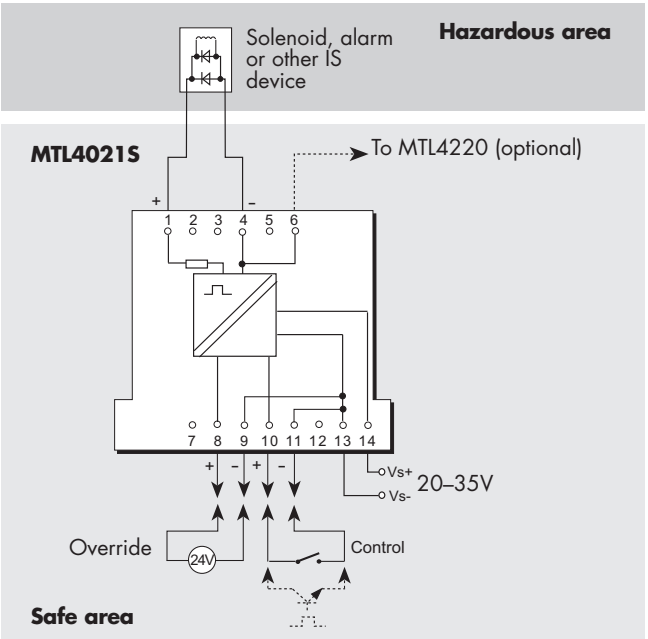
Terminal	Function
1	Input 1 –ve
2	Input 1 +ve
4	Input 2 –ve
5	Input 2 +ve
6	Optional link to MTL4220
7, 8	Output 1
8, 9	Output 2
10, 11	Line fault signal
13	Supply –ve
14	Supply +ve

Figure 6.5: MTL4017 2-channel switch/proximity detector interface



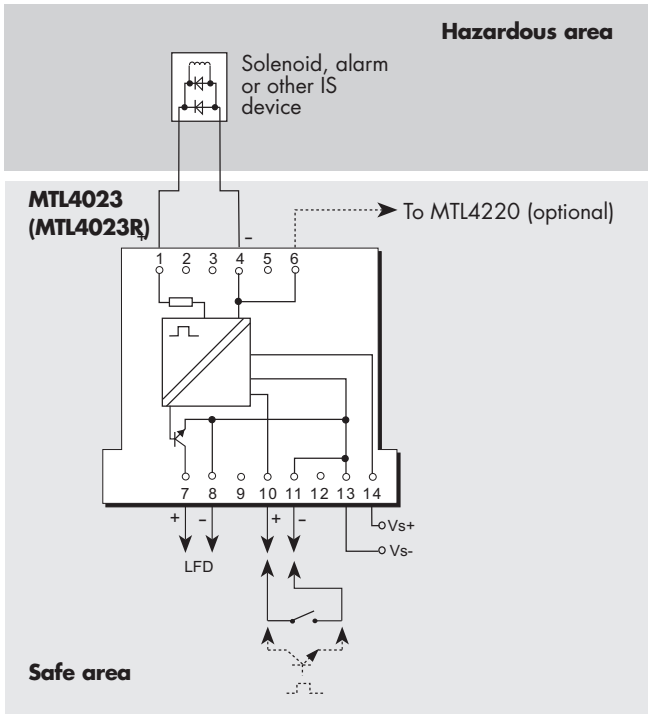
Terminal	Function
1	Output +ve
4	Output –ve
6	Optional link to MTL4220
8	Override –ve
9	Override +ve
10	Control +ve
11	Control –ve
13	Supply –ve
14	Supply +ve

Figure 6.6: MTL4021 solenoid/alarm driver



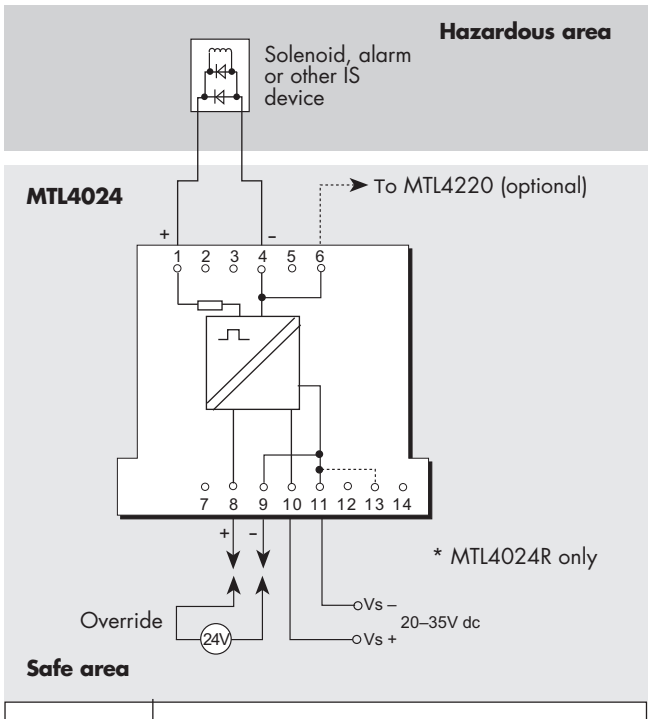
Terminal	Function
1	Output +ve
4	Output –ve
6	Optional link to MTL4220
8	Override +ve
9	Override –ve
10	Control +ve
11	Control –ve
13	Supply –ve
14	Supply +ve

Figure 6.7: MTL4021S solenoid/alarm driver



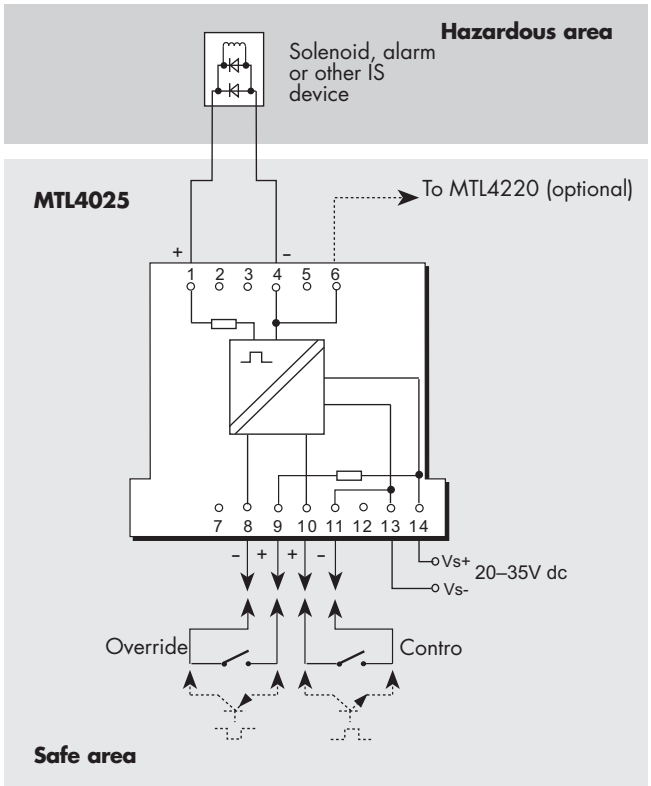
Terminal	Function
1	Output +ve
4	Output –ve
6	Optional link to MTL4220
7	Line fault signal +ve
8	Line fault signal –ve
10	Control +ve
11	Control –ve
13	Supply –ve
14	Supply +ve

Figure 6.8: MTL4023 solenoid/alarm driver



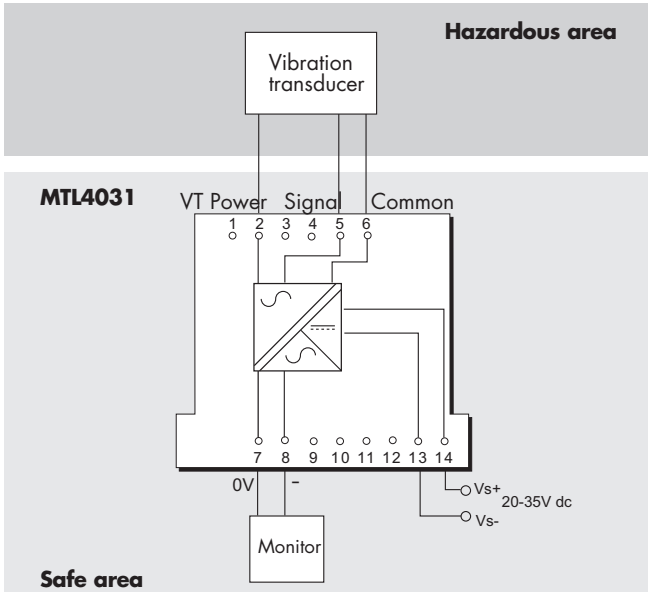
Terminal	Function
1	Output +ve
4	Output –ve
6	Optional link to MTL4220
8	Override +ve
9	Override –ve
10	Supply +ve
11	Supply –ve

Figure 6.9: MTL4024 solenoid/alarm driver, loop powered



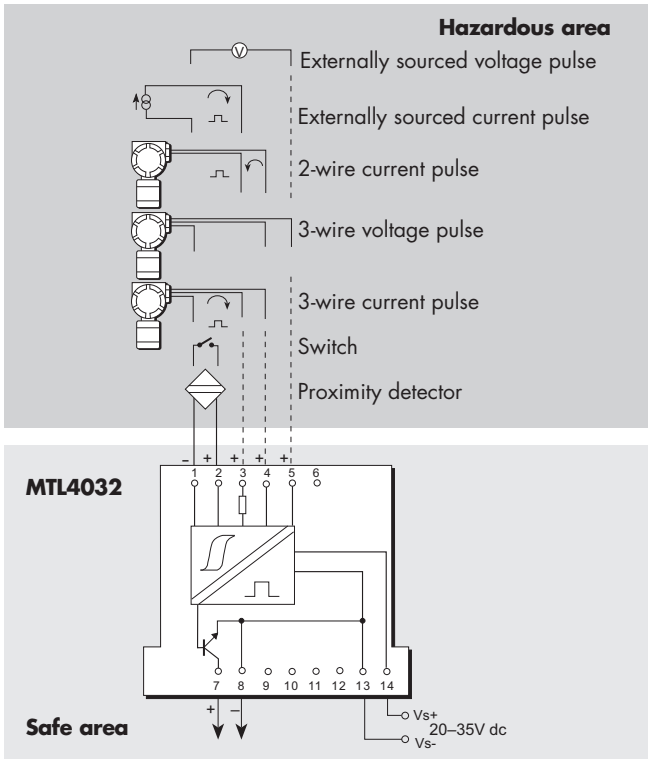
Terminal	Function
1	Output +ve
4	Output –ve
6	Optional link to MTL4220
8	Override –ve
9	Override +ve
10	Control +ve
11	Control –ve
13	Supply –ve
14	Supply +ve

Figure 6.10: MTL4025 solenoid/alarm driver



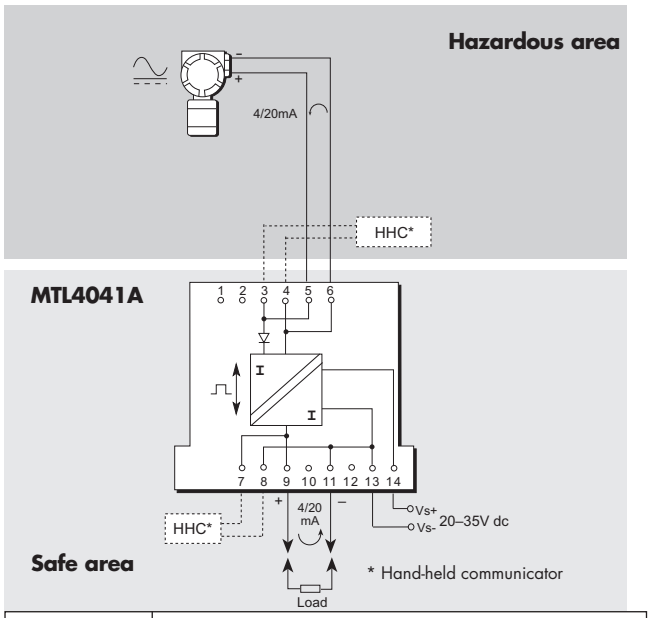
Terminal	Function
2	Supply to hazardous area
5	Signal input
6	Common (0V)
7	Signal (0V)
8	Signal output –ve
13	Supply –ve
14	Supply +ve

Figure 6.11: MTL4031 vibration transducer interface



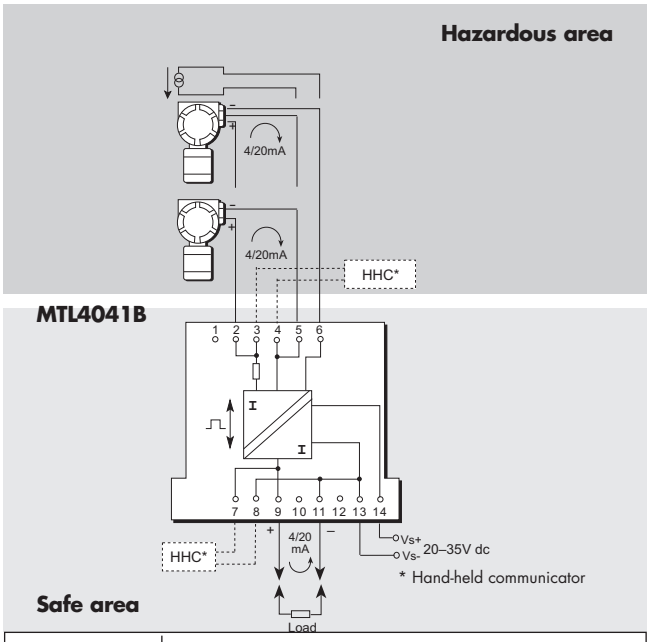
Terminal	Function
1	Common input –ve
2	Switch/proximity input +ve
3	Current pulse input +ve
4	Tx supply +ve
5	Voltage pulse input +ve
7	Pulse output +ve
8	Pulse output –ve
13	Supply –ve
14	Supply +ve

Figure 6.12: MTL4032 pulse isolator



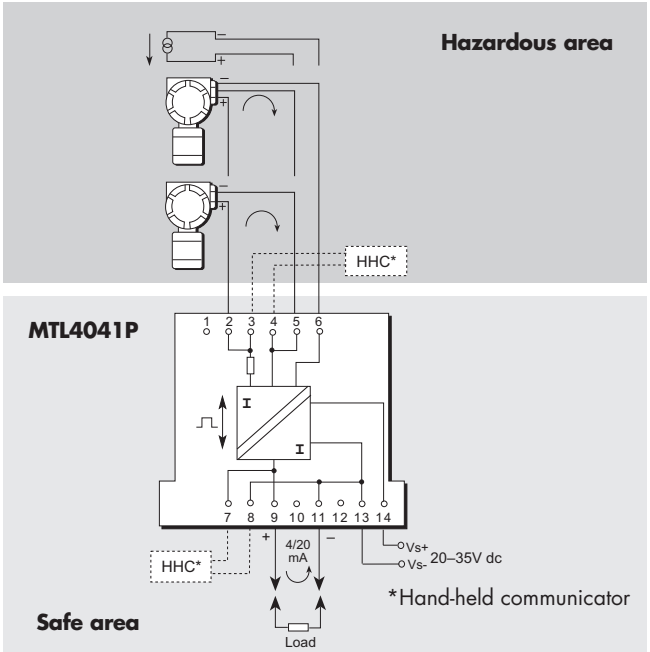
Terminal	Function
3	Optional HHC connection +ve
4	Optional HHC connection –ve
5	Tx signal +ve
6	Tx signal –ve
7	Optional HHC connection +ve
8	Optional HHC connection –ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.13: MTL4041A current repeater



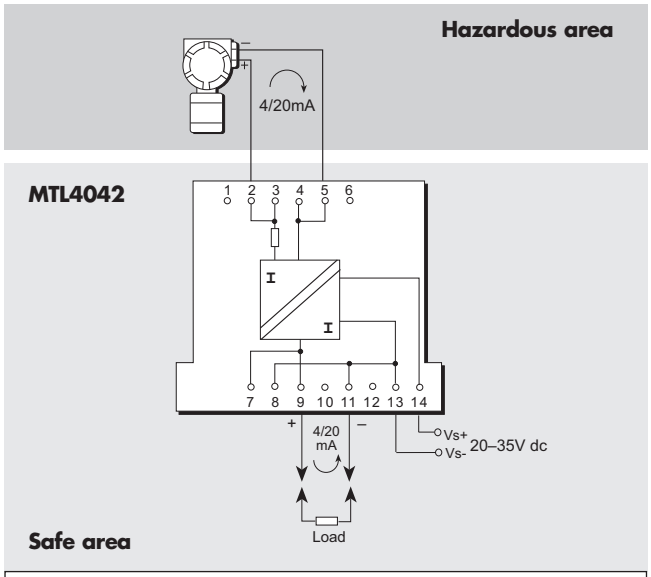
Terminal	Function
2	Tx supply +ve
3	Optional HHC connection +ve
4	Optional HHC connection –ve
5	Current input –ve
6	Common
7	Optional HHC connection +ve
8	Optional HHC connection –ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.14: MTL4041B repeater power supply



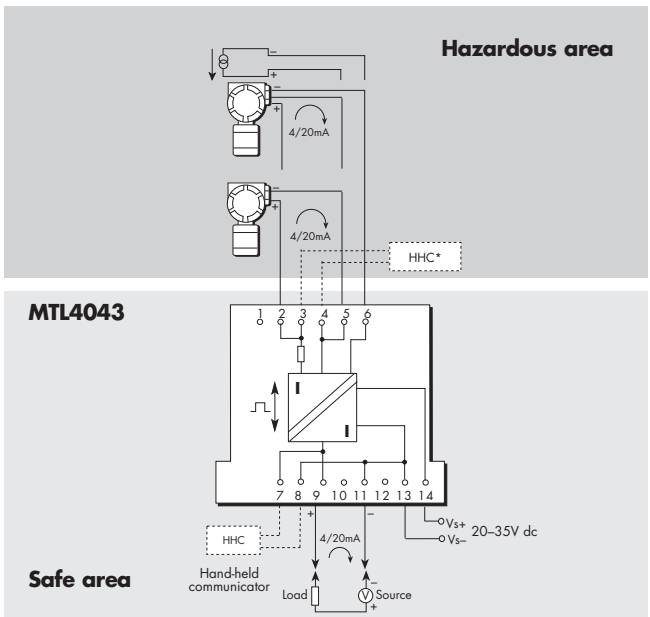
Terminal	Function
2	Tx supply +ve
3	Optional HHC connection +ve
4	Optional HHC connection –ve
5	Current input –ve
6	Common
7	Optional HHC connection +ve
8	Optional HHC connection –ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.15: MTL4041P repeater power supply



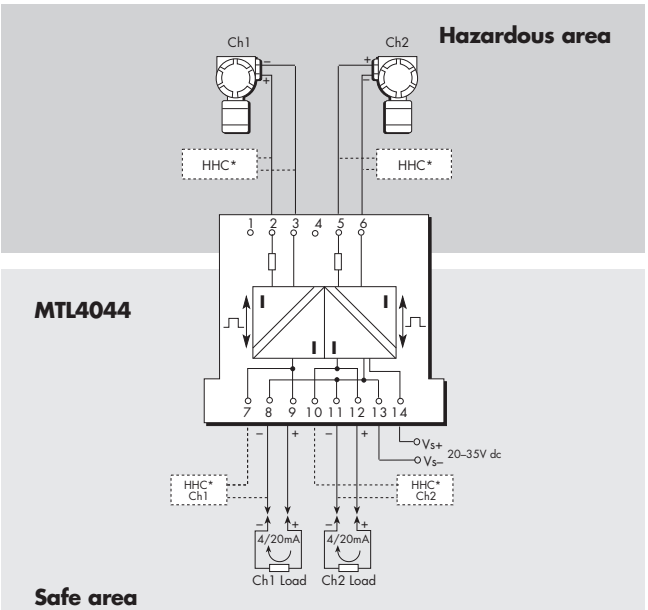
Terminal	Function
2	Tx supply +ve
3	Optional connection +ve
4	Optional connection –ve
5	Current input –ve
7	Optional connection +ve
8	Optional connection –ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.16: MTL4042 repeater power supply, IIB



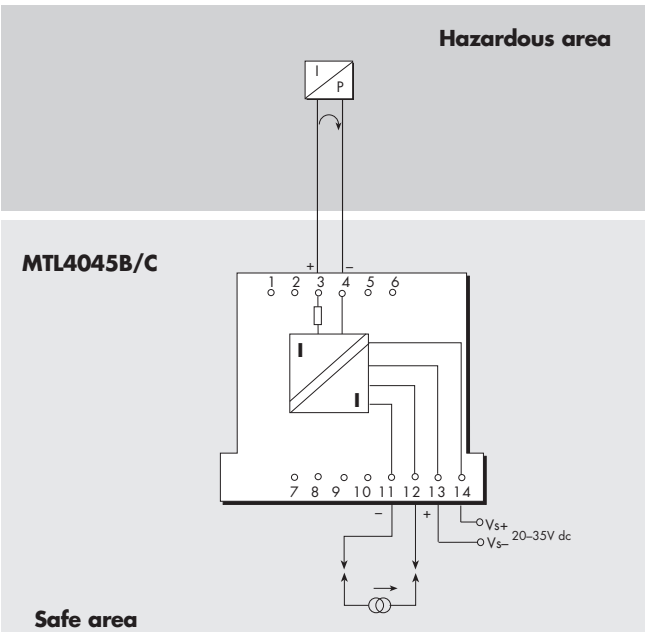
Terminal	Function
2	Tx supply +ve
3	Optional HHC connection + ve
4	Optional HHC connection - ve
5	Current input –ve
6	Common
7	Optional HHC connection +ve
8	Optional HHC connection -ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.17: MTL4043 repeater power supply



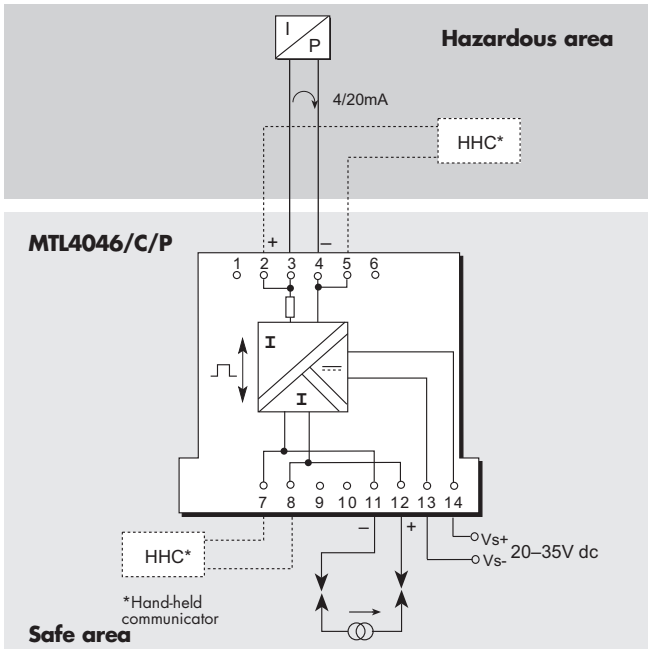
Terminal	Function
2	Ch1 tx supply +ve
3	Ch1 tx supply –ve
5	Ch2 tx supply +ve
6	Ch2 tx supply –ve
7	Ch1 optional HHC connection +ve
8	Ch1 output –ve/HHC –ve
9	Ch1 output +ve
10	Ch2 optional HHC connection +ve
11	Ch2 output –ve/HHC –ve
12	Ch2 output +ve
13	Supply –ve (internally connected to terminals 8 and 11)
14	Supply +ve

Figure 6.18: MTL4044 repeater power supply



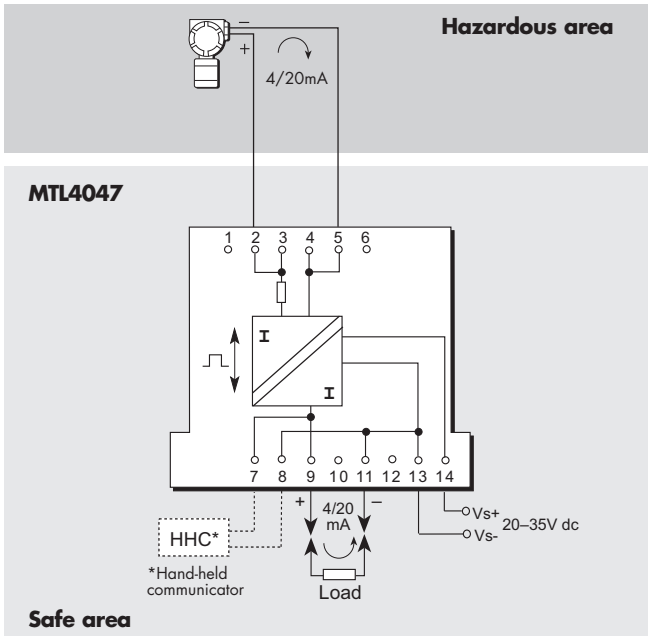
Terminal	Function
3	Output +ve
4	Output –ve
11	Input –ve
12	Input +ve
13	Supply –ve
14	Supply +ve

Figure 6.19: MTL4045B/C repeater power supply



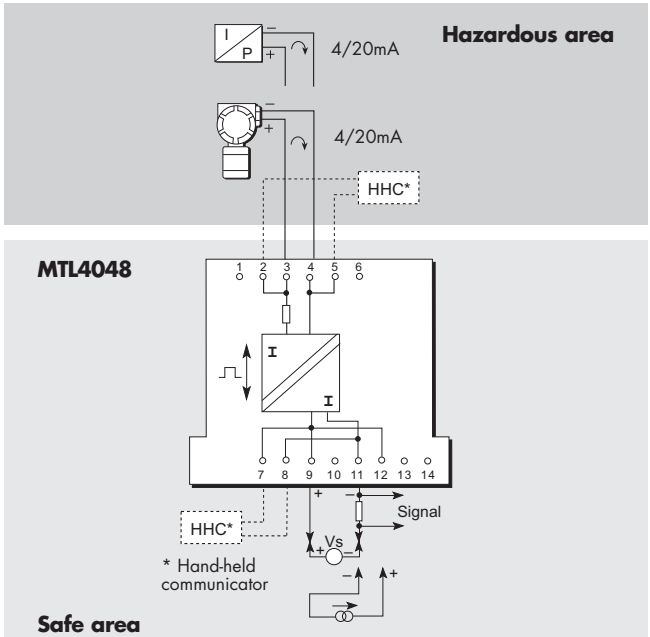
Terminal	Function
2	Optional HHC connection +ve
3	Output +ve
4	Output –ve
5	Optional HHC connection –ve
7	Optional HHC connection –ve
8	Optional HHC connection +ve
11	Input –ve
12	Input +ve
13	Supply –ve
14	Supply +ve

Figure 6.20: MTL4046 Series isolating drivers



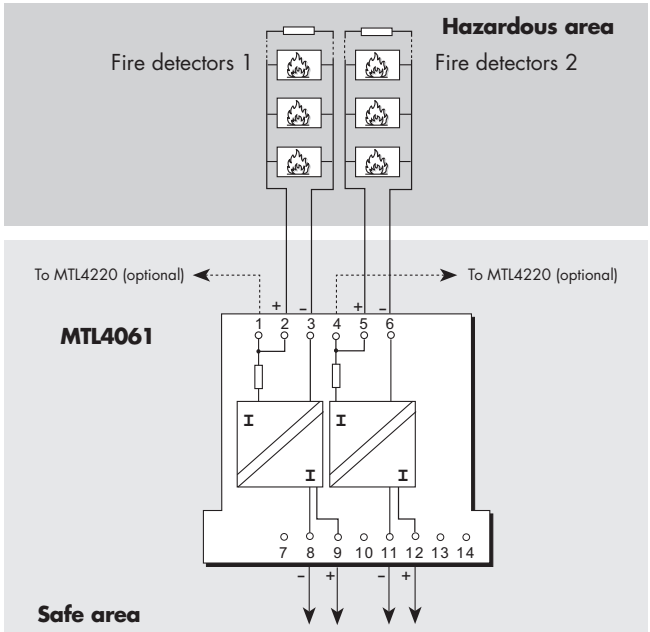
Terminal	Function
2	Tx supply +ve
3	Optional HHC connection +ve
4	Optional HHC connection –ve
5	Tx supply –ve
7	Optional HHC connection +ve
8	Optional HHC connection –ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.21: MTL4047 repeater power supply



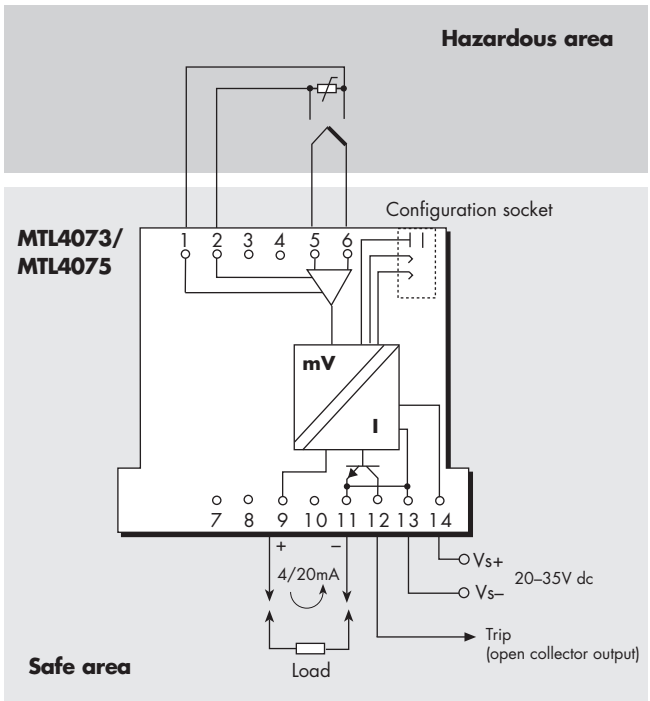
Terminal	Function
2	Optional HHC connection +ve
3	Tx or I/P connection +ve
4	Tx or I/P connection –ve
5	Optional HHC connection –ve
7	Optional HHC connection +ve
8	Optional HHC connection –ve
9	Load connection +ve
11	Controller or load connection –ve
12	Controller connection +ve

Figure 6.22: MTL4048 loop-powered isolator



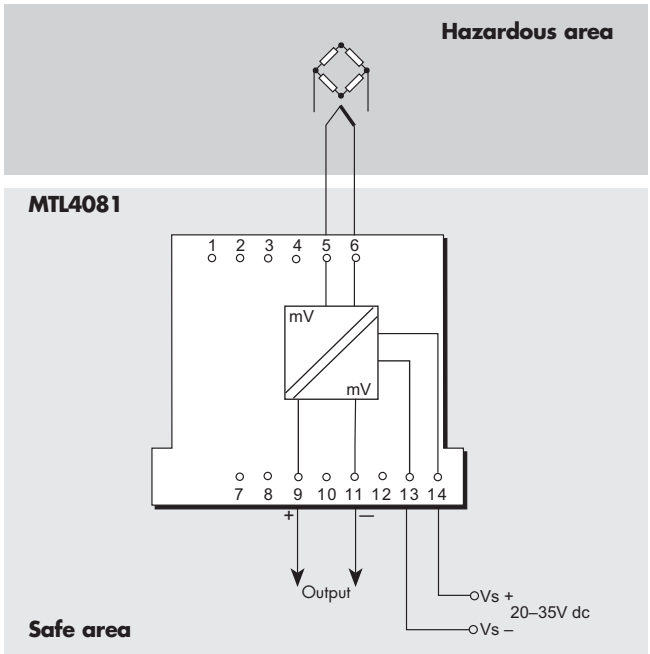
Terminal	Function
1	Optional link from input 1 to MTL4220
2	Output 1 +ve
3	Output 1 –ve
4	Optional link from input 2 to MTL4220
5	Output 2 +ve
6	Output 2 –ve
8	Input 1 –ve
9	Input 1 +ve
11	Input 2 –ve
12	Input 2 +ve

Figure 6.23: MTL4061 2-channel fire and smoke detector interface



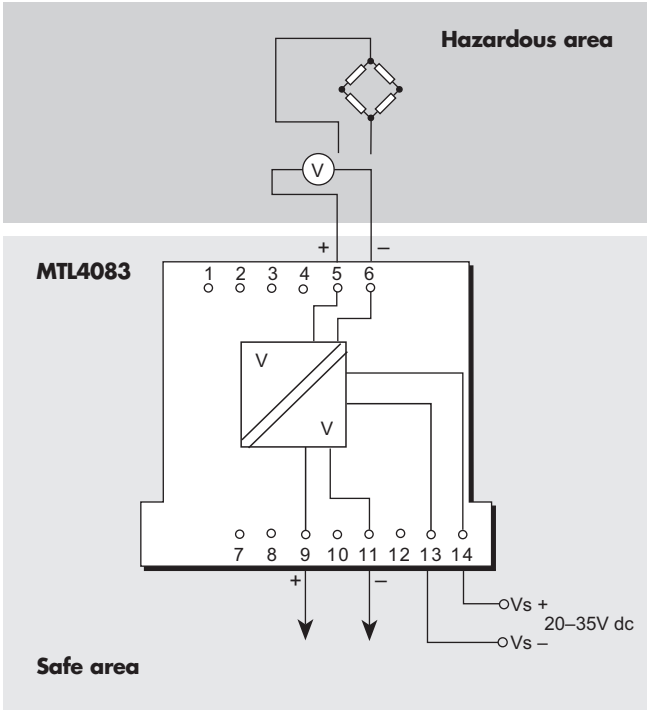
Terminal	Function
1	3-wire RTD input –ve
2	4-wire RTD input +ve
5	THC/EMF/RTD input +ve
6	THC/EMF/RTD input –ve
9	Output +ve
11	Output –ve
12	Trip alarm +ve
13	Supply –ve
14	Supply +ve

Figure 6.24: MTL4073/4075 temperature converter



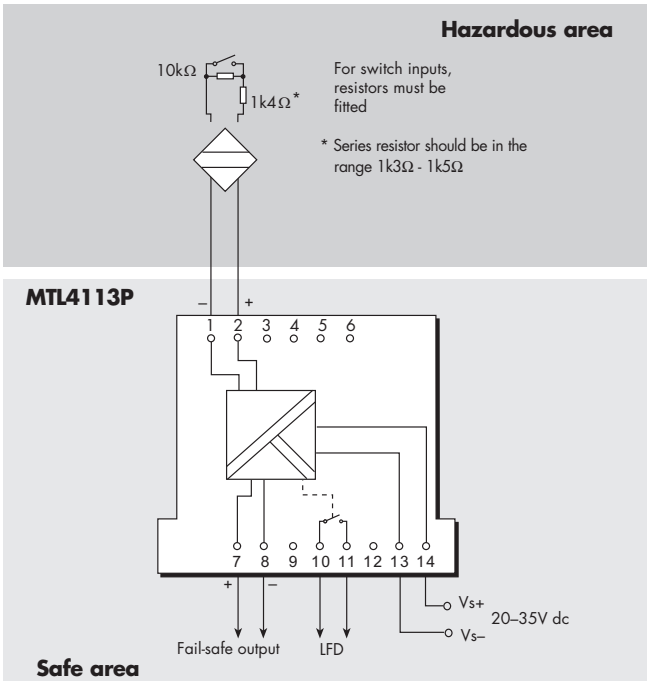
Terminal	Function
5	THC/EMF input +ve
6	THC/EMF input –ve
9	Output +ve
11	Output –ve
13	Supply –ve
14	Supply +ve

Figure 6.25: MTL4081 mV isolator



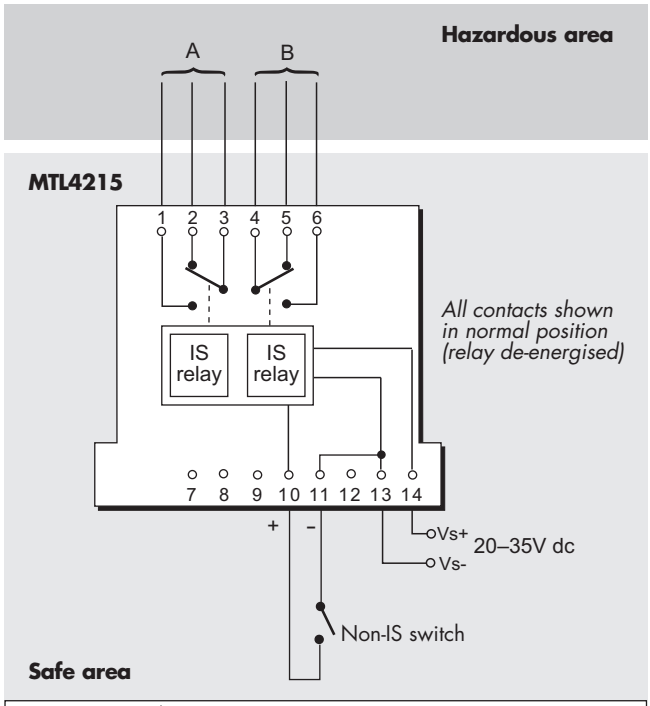
Terminal	Function
5	Voltage input +ve
6	Voltage input –ve
9	Voltage output +ve
11	Voltage output –ve
13	Supply –ve
14	Supply +ve

Figure 6.26: MTL4083 voltage isolator



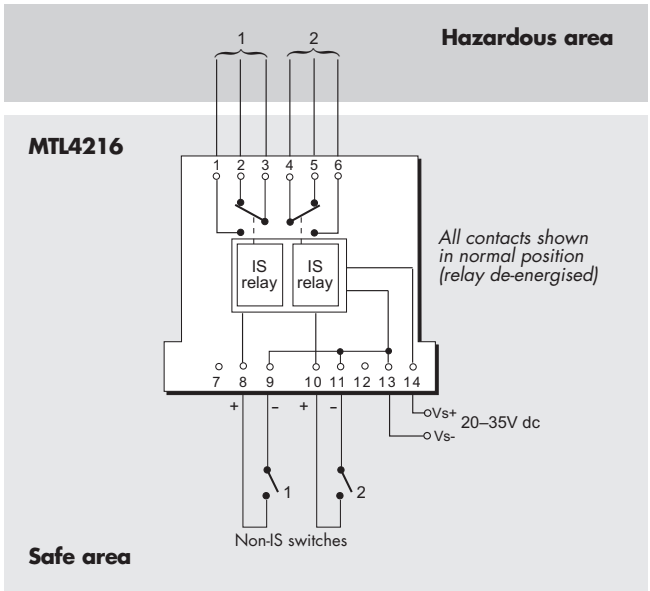
Terminal	Function
1	Input –ve
2	Input +ve
7	Output +ve
8	Output –ve
10	LFD
11	LFD
13	Supply –ve
14	Supply +ve

Figure 6.27: MTL4113P (4114P) proximity detector interface, fail-safe



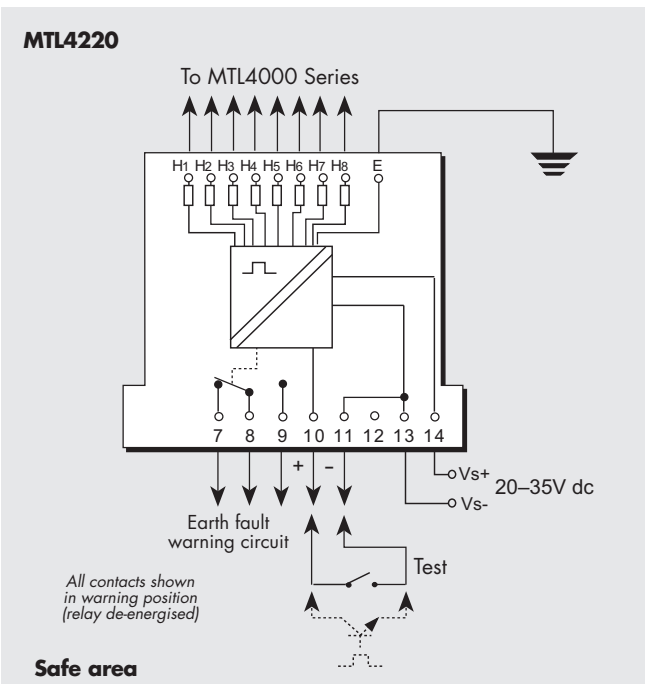
Terminal	Function
1	IS relay output A (normally open)
2	IS relay output A (normally closed)
3	IS relay output A (common)
4	IS relay output B (common)
5	IS relay output B (normally closed)
6	IS relay output B (normally open)
10	Relay control +ve
11	Relay control –ve
13	Supply –ve
14	Supply +ve

Figure 6.28: MTL4215 IS-output switch-operated relay



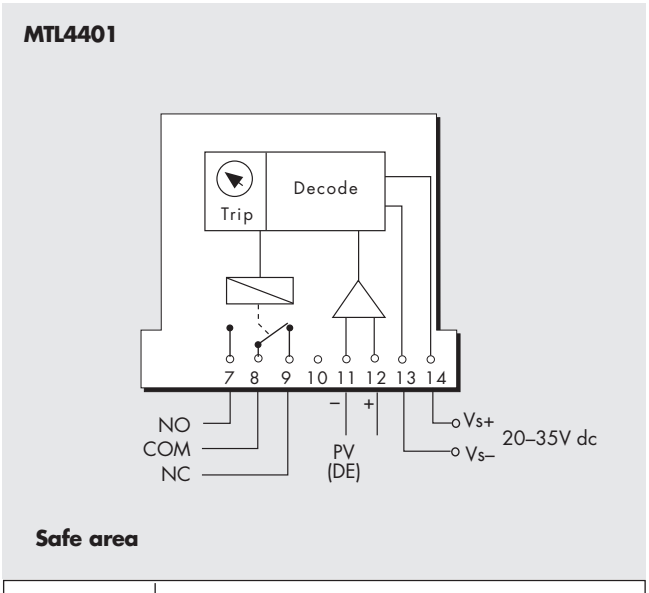
Terminal	Function
1	IS relay output 1 (normally open)
2	IS relay output 1 (normally closed)
3	IS relay output 1 (common)
4	IS relay output 2 (common)
5	IS relay output 2 (normally closed)
6	IS relay output 2 (normally open)
8	Relay 1 control +ve
9	Relay 1 control –ve
10	Relay 2 control +ve
11	Relay 2 control –ve
13	Supply –ve
14	Supply +ve

Figure 6.29: MTL4216 2-channel IS-output switch-operated relay



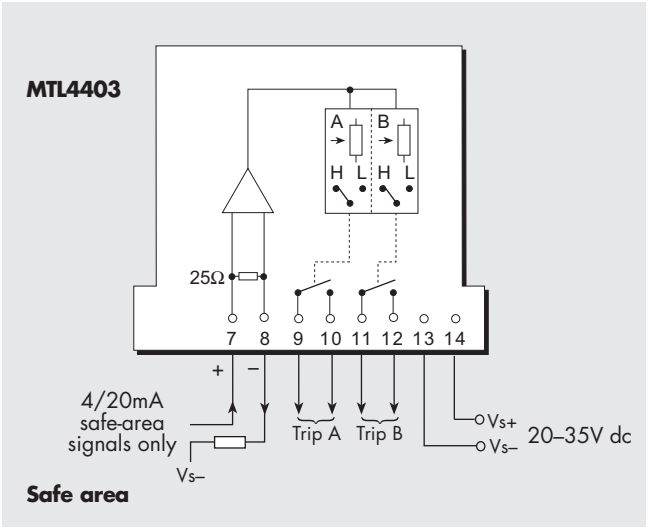
Terminal	Function
H1-H8	Connections to individual MTL4000 Series modules (made through three 3-way plug-in screw-clamp connectors supplied)
E	Earth
7	Earth fault signal (normally closed)
8	Earth fault signal (common)
9	Earth fault signal (normally open)
10	Test +ve
11	Test –ve
13	Supply –ve
14	Supply +ve

Figure 6.30: MTL4220 earth leakage detector



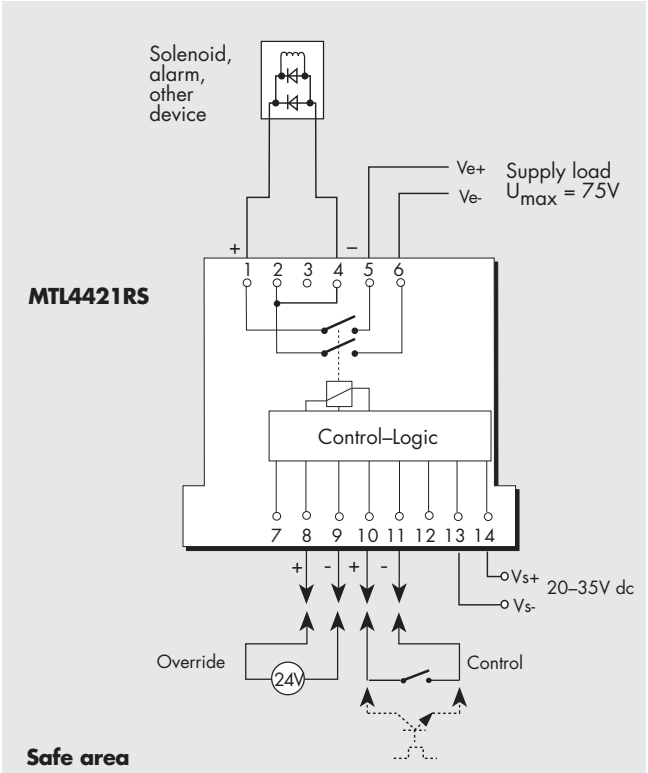
Terminal	Function
7	Relay NO
8	Relay COM
9	Relay NC
10	N/C
11	Input – (DE)
12	Input + (DE)
13	Supply –ve
14	Supply +ve

Figure 6.31: MTL4401 DE Trip amplifier SSI 3000



Terminal	Function
7	Input –ve
8	Input +ve
9	O/P trip A (normally open)
10	O/P trip A (common)
11	O/P trip B (normally open)
12	O/P trip B (common)
13	Supply –ve
14	Supply +ve

Figure 6.32: MTL4403 high-level trip amplifier



Terminal	Function
1	Output +ve
4	Output –ve
5	Supply load +ve
6	Supply load –ve
8	Override +ve
9	Override –ve
10	Control +ve
11	Control –ve
13	Supply –ve
14	Supply +ve

Figure 6.33: MTL4421RS, general purpose switch operated relay

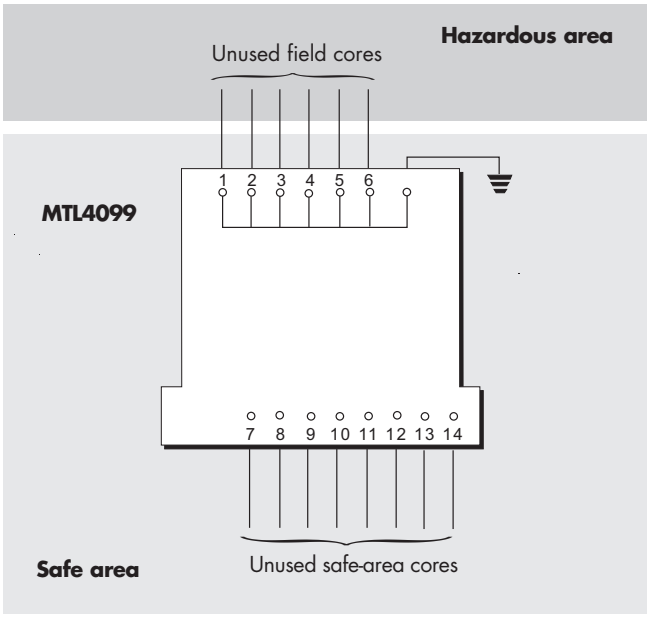


Figure 6.34: MTL4099 dummy isolator

6.2 Backplanes, enclosures and accessories

For part number references, all MTL4000 Series backplanes, enclosures and accessories are listed in this section.

6.2.1 Backplanes

BPM08	8-way backplane, multiway connector
BPM16	16-way backplane, multiway connector
BPM24	24-way backplane, multiway connector
BPS04	4-way backplane, screw-clamp connector
BPS08	8-way backplane, screw-clamp connector
BPS16	16-way backplane, screw-clamp connector
BPS24	24-way backplane, screw-clamp connector

6.2.2 Backplane mounting accessories

DMK01	DIN-rail mounting kit, T- or G-section, (pack of 40) 8- and 16-way backplanes only
SMS01	Surface mounting kit, (pack of 40
HMP24	Horizontal mounting plate and screws for 19-inch rack mounting 24-way backplanes only

6.2.3 Backplane accessories

ERK08	Earth-rail kit for 8-way backplanes
ERK16	Earth-rail kit for 16-way backplanes
TSK08	Tagging-strip kit for 8-way backplanes
TSK16	Tagging-strip kit for 16-way backplanes
TSK24	Tagging-strip kit for 24-way backplanes
ELC56	ELCO 8016, 56-way cable plug kit for use with multiway backplanes One required for each set of 8 modules
FUS08	Spare fuse kit for 8-way backplanes (pack of 10)
FUS16	Spare fuse kit for 16-way backplanes (pack of 10)
FUS24	Spare fuse kit for 24-way backplanes (pack of 10)
MPL01	Blank module position labels (pack of 50)

6.2.4 Enclosures

BX08	8-way enclosure, suitable for one 8-way backplane
BX16	16-way enclosure, suitable for one 16-way backplane
BX32	32-way enclosure, suitable for two 16-way backplanes

6.2.5 Module accessories

CCH01	Hazardous-area crimp connector
CRC01	Large crimps, 14-20AWG, (pack of 100)
CRT01	Crimp tool for CRC01 crimps
CRC02	Small crimps, 18-24AWG, (pack of 100)
CRT02	Crimp tool for CRC02 crimps and power sense connector
CRR01	Crimp removal tool for CRC01, CRC02 and power sense connector crimps
SCC01	Hazardous-area screw-clamp connector
SCJ01	Hazardous-area screw-clamp connector with integral CJC sensor. *For use with MTL4073 for THC inputs needing CJ*

7 Fault finding and routine maintenance

WARNING: On removal, take care that a hazardous-area connector is not laid in a position in which it may inadvertently come into contact with the backplane or with components on the backplane.

7.1 Maintenance precautions

Most Codes of Practice for intrinsic safety permit live maintenance on intrinsically safe devices and systems, provided precautions are taken to preserve the integrity of the device or system. During live maintenance of MTL4000 modules, the hazardous-area connectors which plug into the tops of the modules are likely to be removed while the module itself may also be unplugged from the backplane for replacement.

Of necessity, cables to hazardous-area connectors must be reasonably flexible so that the connectors can be easily plugged into and unplugged from the module tops. On removal, take care that a live connector is not laid in a position in which it may inadvertently be in contact with the backplane or with components on the backplane. Since the backplane is connected to safe-area circuits and is not itself intrinsically safe, this may by-pass the essential segregation between safe-area and hazardous-area circuits. This can be avoided in one of the following ways:–

- **a)** By plugging the connector into an MTL4099 dummy isolator or other uninstalled MTL4000 module directly on removal (but NOT into any other module mounted on the backplane).
- **b)** By providing some form of temporary mechanical method of securing the connector so that it cannot touch the backplane or the safe-area circuits.

7.2 FAULT FINDING

When fault finding, carry out the following steps as far as is necessary:–

7.2.1

Check that one of the backplane power LEDs is ON.

7.2.2

If a power LED is not on, check the power supply fuse and if necessary, change it. Ratings are:–

- **a)** 4/8-way backplanes 1A (Spare fuse kit FUS08)
- **b)** 16-way backplanes 2A (Spare fuse kit FUS16)
- **c)** 24-way backplanes 3.15A (Spare fuse kit FUS24)

7.2.3

Check that all module power LEDs are ON.

For MTL4073 a flashing LED indicates alarm or fault conditions, refer to section 8

Note: *The LED may also flash during intermediate stages of configuration, refer to section 5.4*

7.2.4

Exchange potentially faulty modules for working units by:–

- **a)** Unplugging the hazardous-area connector.
- **b)** Unplugging the module from the backplane.
- **c)** Plugging the replacement unit into the backplane.
- **d)** Replacing the hazardous-area connector.

7.2.5

Potentially faulty modules should be tested in workshop conditions, using the following procedure:–

- **a)** Connect a power supply to a spare BPS backplane (refer to sections 4.4.3 or 4.4.5).
- **b)** Plug the suspect module into any position on the backplane.
- **c)** Carry out the appropriate test procedure described in Section 8 for the particular module

7.3 Routine maintenance

Check the general condition of the installation occasionally to make sure that no deterioration has occurred. Carry out the following at least once every two years and more frequently for particularly harsh environments:–

- **a)** Check that modules are of the types specified in the relevant documentation and that they are mounted in the correct positions on the associated backplanes.
- **b)** Check that modules and hazardous-area connectors are correctly and legibly tagged, that the connectors are plugged into the matching modules and that the tag details given comply with the relevant documentation.
- **c)** Check that modules and hazardous-area connectors are securely plugged into their matching sockets.
- **d)** Check that all connections to the backplane and to the hazardous-area connectors are properly made.
- **e)** Check that connecting cables to backplanes and to hazardous-area connectors are of the specified type and rating, are correctly routed and segregated (particularly in MTL enclosures), and are not frayed or otherwise damaged.
- **f)** Check that cable screens are properly earthed.

Note: *It is strongly recommended that only the tests (described in Section 8) and routine maintenance (described in section 7.3) should be undertaken by users. If a module is faulty, DO NOT attempt to make repairs or modifications as these may affect the intrinsic safety of the module. All faulty units should be returned to the MTL group company or representative from which they were purchased for repair or replacement. Faulty MTL supplied backplanes should also be similarly returned.*

8 TEST PROCEDURES

8.1 General

Potentially faulty modules should be tested in workshop conditions, using the following procedure:–

a) Connect a power supply to a spare BPS backplane (refer to sections 4.4.3 or 4.4.5).

b) Plug the suspect module into any position on the backplane.

c) Carry out the appropriate test procedure described in section 8.2 of this section for the particular module.

d) Take care to remove all test links, test equipment and wiring, etc, when tests are completed.

8.2 Module test procedures

8.2.1 MTL4013

See figure 8.1.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the LED is ON when the input switch is closed, and OFF when the input switch is open.

c) Remove connections and re-connect for channel 2 (ie, terminals 4 and 5 in place of 1 and 2 and terminal 9 in place of 7).

d) Repeat the tests in **b)**.

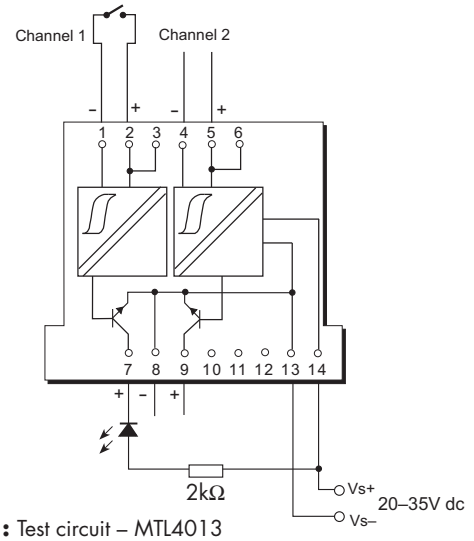


Figure 8.1: Test circuit – MTL4013

8.2.2 MTL4014

See figure 8.2 and table 8.1.

a) Make the safe-area and hazardous-area connections shown.

b) With an ohmmeter, check the status of output contacts according to table 8.1.

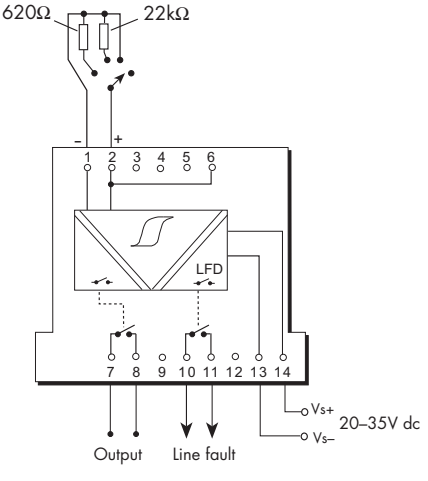


Figure 8.2: Test circuit – MTL4014

Table 8.1: Tests – MTL4014

Input	Output	Line fault
Open circuit	OPEN	OPEN
Short circuit	OPEN	OPEN
620Ω	CLOSED	CLOSED
22kΩ	OPEN	CLOSED

8.2.3 MTL4015

See figure 8.3 and table 8.2.

a) Make the safe-area and hazardous-area connections shown

b) With an ohmeter, check the status of output contacts according to table 8.2

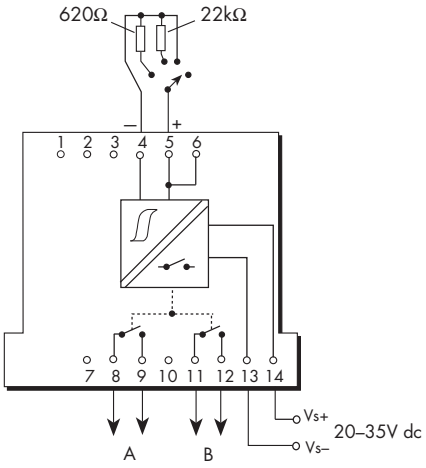


Figure 8.3: Test circuit - MTL4015

8.2.4 MTL4016

See figure 8.4 and table 8.2.

a) Make the safe-area and hazardous-area connections shown for channel 1.

b) With an ohmmeter, check the status of output contacts according to table 8.2.

c) Change the connections to channel 2

d) Repeat the tests in **b)**

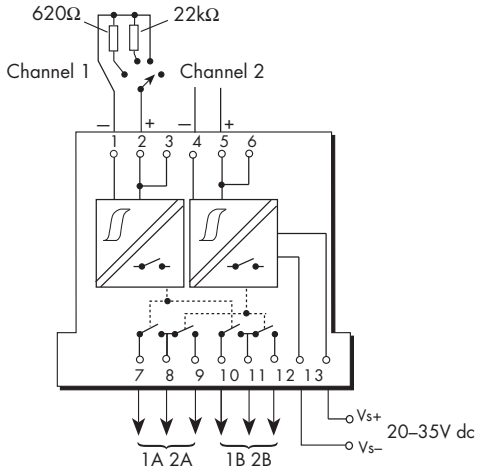


Figure 8.4: Test circuit – MTL4016

Table 8.2: Tests – MTL4015/4016

Input	Output (phase normal)		Output (phase reverse)	
	LFD off	LFD on	LFD off	LFD on
Open circuit	OPEN	OPEN	CLOSED	OPEN
Short circuit	CLOSED	OPEN	OPEN	OPEN
620Ω	CLOSED	CLOSED	OPEN	OPEN
22kΩ	OPEN	OPEN	CLOSED	CLOSED

8.2.5 MTL4017

See figure 8.5 and table 8.3.

a) Make the safe-area and hazardous-area connections shown.

b) With an ohmmeter, check the status of output contacts according to table 8.3 for channels 1 and 2 (connect a 22kΩ resistor across the input of the channel not being tested).

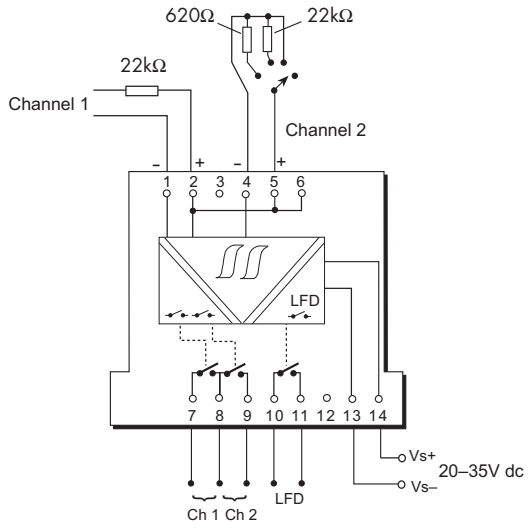


Figure 8.5: Test circuit – MTL4017

Table 8.3: Tests – MTL4017

Input	Output	Line fault
Open circuit	OPEN	OPEN
Short circuit	OPEN	OPEN
620Ω	CLOSED	CLOSED
22kΩ	OPEN	CLOSED

8.2.6 MTL4021

See figure 8.6 and table 8.4.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the output across terminals 1 and 4 turns ON and OFF according to table 8.4.

c) With the output ON, measure an output voltage with no load between 22V and 23V dc.

d) With the output ON, measure the short-circuit current between 50mA and 58mA.

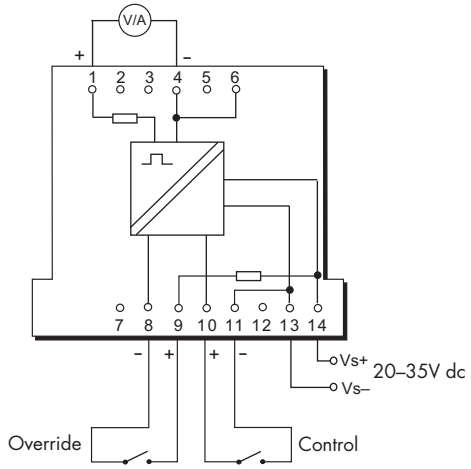


Figure 8.6: Test circuit – MTL4021

Table 8.4: Tests – MTL4021

Control input	Override input	Output state
OPEN	OPEN	OFF
CLOSED	OPEN	ON
OPEN	CLOSED	OFF
CLOSED	CLOSED	OFF

8.2.7 MTL4021S

See figure 8.7 and table 8.5.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the output across terminals 1 and 4 turns ON and OFF according to table 8.5 by applying the appropriate Control and Override inputs.

c) With the output ON, measure an output voltage with no load between 22V and 23V dc.

d) With the output ON, measure the short-circuit current between 50mA and 58mA.

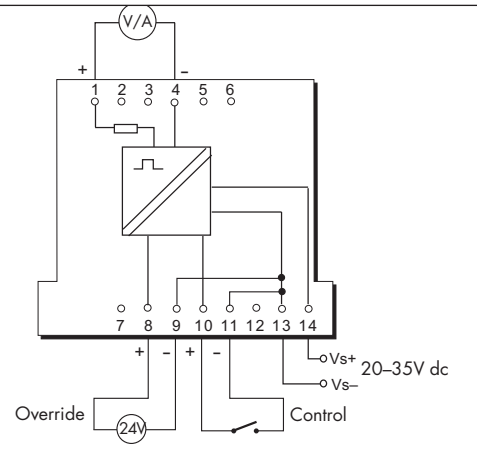


Figure 8.7: Test circuit – MTL4021S

Table 8.5: Tests - MTL4021S

Control input	Override input	Output state
OPEN	>9V	OFF
CLOSED	>9V	ON
OPEN	<2V	OFF
CLOSED	<2V	OFF

8.2.8 MTL4023/MTL4023R

See figure 8.8 and table 8.6.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the output across terminals 1 and 4 turns ON and OFF according to table 8.6.

c) With the output ON, measure an output voltage of >22V with no load and a short-circuit current of >45mA.

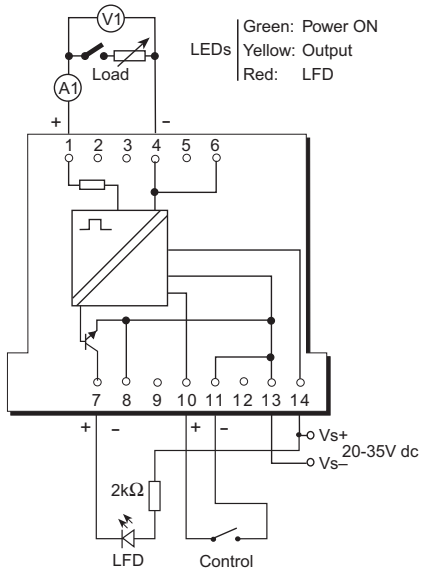


Figure 8.8: Test circuit – MTL4023

Table 8.6: Tests – MTL4023

Control	Load	LED (External LFD) MTL4023	LED (External LFD) MTL4023R	Red LED (LFD)	Yellow LED Output)
CLOSED	2kΩ	ON	OFF	OFF	ON V1>20V
OPEN	2kΩ	ON	OFF	OFF	OFF V1<8.5V
CLOSED	Open	OFF	ON	ON	ON V1>21.6V
OPEN	Open	OFF	ON	ON	OFF V1<8.5V
CLOSED	Shorted	OFF	ON	ON	ON A1>45mA
OPEN	Shorted	OFF	ON	ON	OFF A1=0

8.2.9 MTL4024

See figure 8.9 and table 8.7.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the output across terminals 1 and 4 turns ON and OFF as shown in table 8.7.

c) With the output ON, measure an output voltage of >22V with no load and a short-circuit current of >50mA.

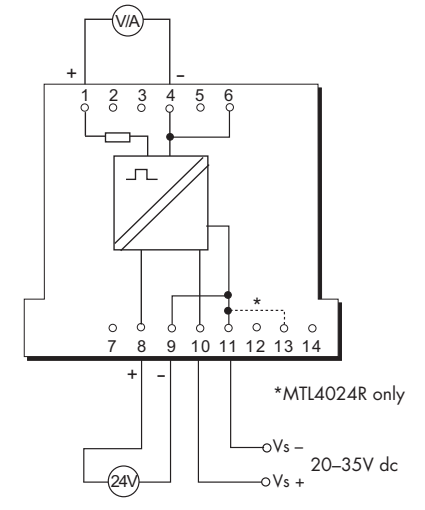


Figure 8.9: Test circuit – MTL4024

Table 8.7: Tests – MTL4024

Vs	Override	Output	Yellow LED
0	24V	0V	OFF
24V	24V	22V	ON
24V	24V	>50mA (shorted)	ON
24V	0V	OFF	OFF

8.2.10 MTL4025

See figure 8.10 and table 8.8.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the output across terminals 1 and 4 turns ON and OFF according to table 8.8.

c) With the output ON, measure an output voltage with no load between 22V and 23V dc.

d) With the output ON, measure the short-circuit current between 50mA and 58mA.

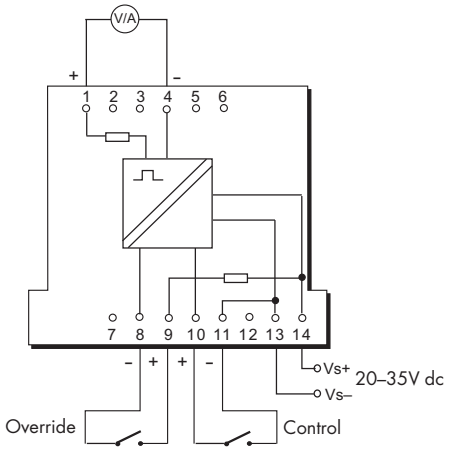


Figure 8.10: Test circuit – MTL4025

Table 8.8: Tests – MTL4025

Control input	Override input	Output state
OPEN	OPEN	OFF
CLOSED	OPEN	ON
OPEN	CLOSED	OFF
CLOSED	CLOSED	OFF

8.2.11 MTL4031

See figure 8.11.

a) Make the safe-area and hazardous-area connections shown.

b) Measure a voltage between pins 2 and 6 of >19V.

c) Vary the potentiometer setting and check that the reading on the voltmeter V1 is <±100mV.

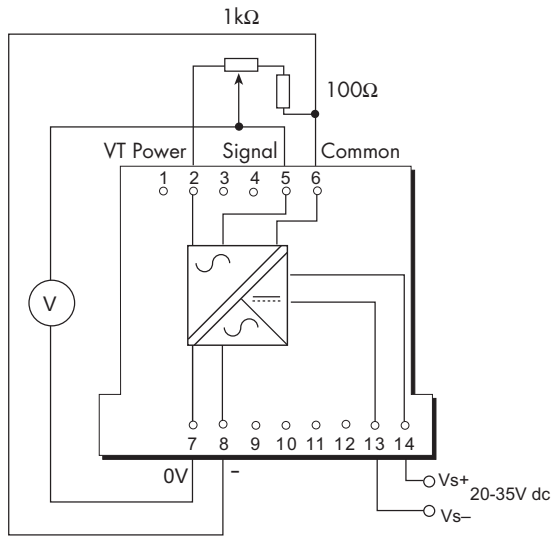


Figure 8.11: Test circuit – MTL4031

8.2.12 MTL4032

See figure 8.12.

a) Make the safe-area and hazardous-area connections shown.

b) With SW2 open, close SW1 and check the yellow LED on the module and the red test LED both come ON.

c) Open SW1, close SW2 and check that both LEDs come ON.

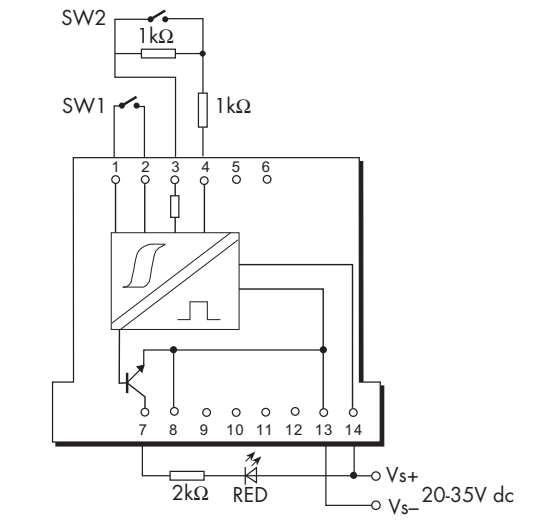


Figure 8.12: Test circuit – MTL4032

8.2.13 MTL4041A

See figure 8.13.

a) Make the safe-area and hazardous-area connections shown

b) Check the ammeter A1 reads <±20µA when the output current through A2 is varied between 4 and 20mA using RV1.

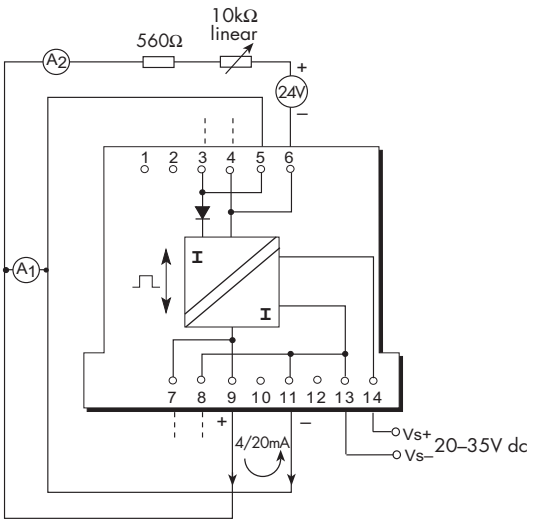


Figure 8.13: Test circuit – MTL4041A

8.2.14 MTL4041B/4041P/4042/4043/4047

See figures 8.14 and 8.15 and table 8.9.

a) Make the safe-area and hazardous-area connections shown

b) Check the ammeter A1 reads <±20µA when the output current is varied between 4 and 20mA using RV1.

c) With the output current (A2) set as specified in table 8.9, check the voltage between pins 2 and 5.

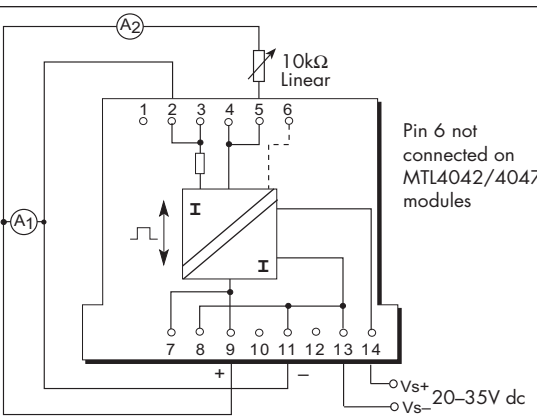


Figure 8.14: Test circuit – MTL4041B/4041P/4042/4047

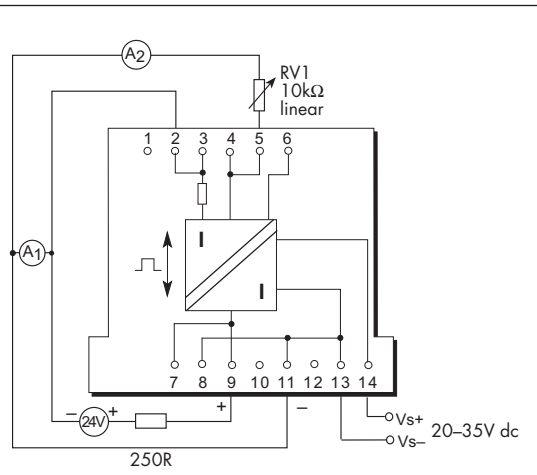


Figure 8.15: Test circuit – MTL4043

Table 8.9: Tests – MTL4041B/4041P/4042/4043/4047

	MTL4041B /4043	MTL4041P	MTL4042	MTL4047
Voltage Pins 2-5	>15.0V at	>16.3V at	>18.0V at	>15.6V at
A2 current	20mA	20mA	20mA	24mA

8.2.15 MTL4044

See figure 8.16

a) Make the safe-area and hazardous-area connections shown

b) Check the ammeter A1 reads <±20µA when the output current is varied between 4 and 20mA using RV1.

c) With the output current (A2) set at 20mA the voltage between pins 2 and 5 should be >15.0V.

d) Repeat the tests on the second channel by reconnecting the ammeters and variable resistance to pins 5, 6, 10 and 11.

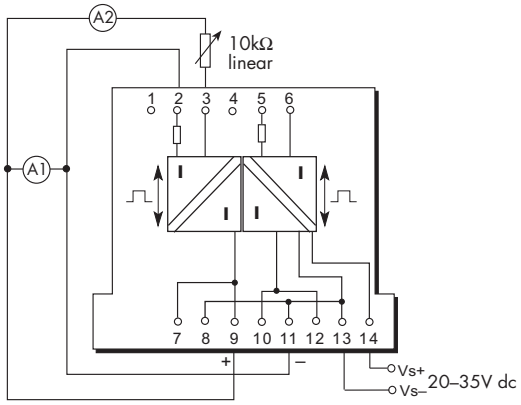


Figure 8.16: Test circuit – MTL4044

8.2.15 MTL4045B/4045C

See figure 8.17.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the reading on ammeter A1 is <20µA when the output current (measured by ammeter A2) is varied between 4 and 20mA using the variable resistance RV1.

Note: *it may be necessary to reverse the connections to ammeter A1 to obtain a reading*

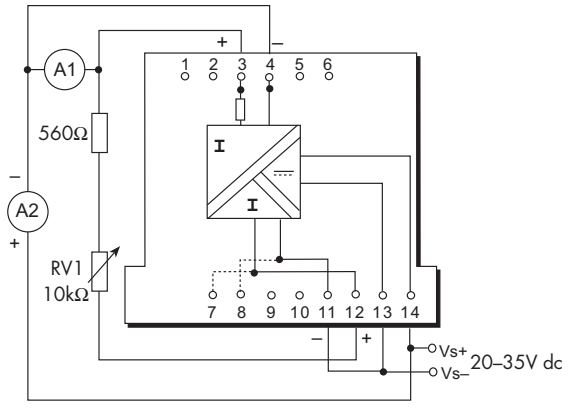


Figure 8.17: Test circuit – MTL4045B/4045C

8.2.16 MTL4046/4046C/4046P

See figure 8.18.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the reading on ammeter A1 is <20µA when the output current (measured by ammeter A2) is varied between 4 and 20mA using the variable resistance RV1.

Note: *it may be necessary to reverse the connections to ammeter A1 to obtain a reading*

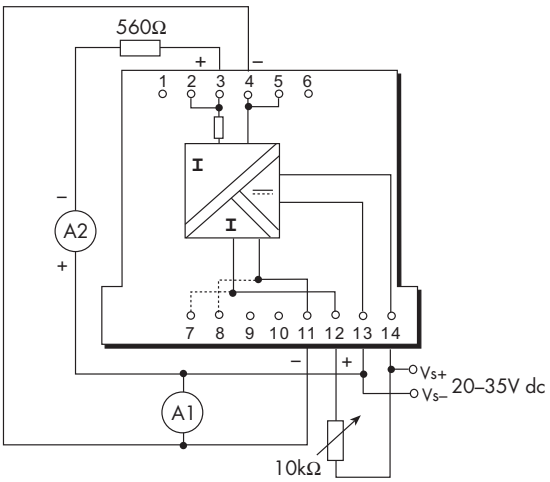


Figure 8.18: Test circuit – MTL4046/4046C/4046P

8.2.17 MTL4048

See figure 8.19.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the reading on ammeter A1 is <200µA when the output current (measured by ammeter A2) is varied between 4 and 20mA using the variable resistance RV1.

Note: *it may be necessary to reverse the connections to ammeter A1 to obtain a reading*

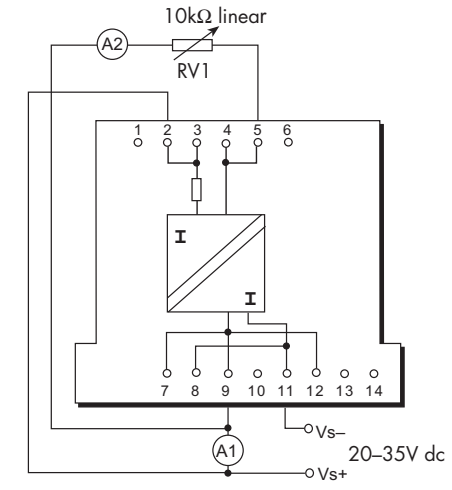


Figure 8.19: Test circuit – MTL4048

8.2.18 MTL4061

See figure 8.20.

a) Make the safe-area and hazardous-area connections shown.

b) Check that the reading on microammeter A1 is <400µA when the loop current (measured by milliammeter A2) is varied between 1 and 40mA using the variable resistance RV1.

c) Repeat the test on the second channel by reconnecting the ammeters and variable resistance to pins 5, 6, 11 and 12.

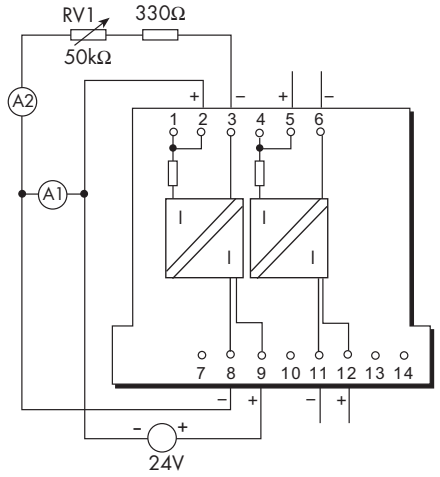


Figure 8.20: Test circuit – MTL4061

8.2.19 MTL4073/4075

See figure 8.21, tables 8.10 and 8.11.

a) Refer to section 5.4 for configuration instructions using an MTL611B/CNF41 combination or PCC73 software.

NB. *If configuring using PCS45, please refer to instructions contained within the software.*

b) With the configurator, verify that the configuration of the module corresponds to the related documentation by selecting **Upload** followed by **Configure – List.**

c) If required, check the operational status by selecting the options provided by the **Monitor** menu on the configurator, eg, **Monitor – Test – Comms** checks the number of messages sent, the number of communication errors and, when an error occurs, displays a message indicating the type.

d) Operational tests that can be carried out are dependant upon the type of sensor and the configuration. See **e-g**) for RTD sensors and **h-j**) for THC/mV sensors.

e) For **RTDs**, a resistance of known value (see figure 8.21 and table 8.10) is connected across the sensor terminals and the configuration sequence **Monitor – Process** used to display the corresponding temperature value (it may be simplest to use a 2-wire RTD to connect individual resistors).

f) The current value should correspond to the displayed temperature value.

g) The effect of the linearisation function can be disabled by selecting **Configure – Input – Linearise** (providing the range of the output current is also changed).

h) For **THCs**, when a suitable mV source is not available, the sensor inputs can be shorted together and the 'temperature' measured by selecting **Monitor – Process**.

i) The measured temperature should be the same as the cold-junction temperature determined by selecting **Monitor – Cj temp**.

j) If a suitable IS mV source (figure 8.15) is available, apply a known mV input value to the sensor terminals and check the output with **Monitor – Process**; disabling the linearistion-to-temperature function by selecting **Configure – Input – Type – mV** and changing the range of output current as shown in table 8.11.

Note: *if a mV source which is NOT classified as IS 'simple apparatus' (ie, with non-energy-storing output terminals) is used, then the tests must be carried out with all the equipment in a safe area.*

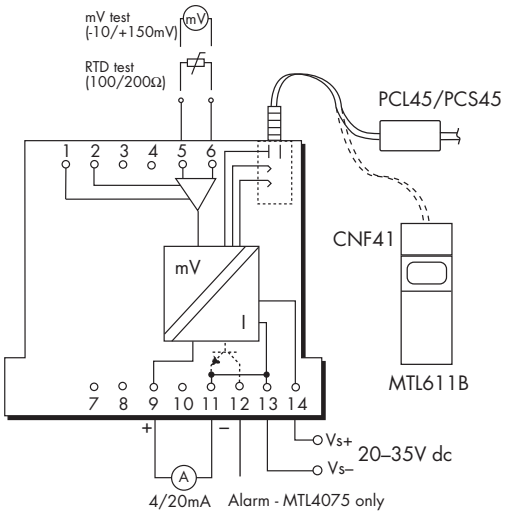


Figure 8.21: Test circuit – MTL4073/4075

Table 8.10: Test values - PT100 (2-, 3-, or 4-wire) RTDs

Configured range: (= 20°C/1mA)	–20°C (4mA)	+300°C (20mA)
Test resistance	**Equiv. temperature**	**Output**
100Ω	0°C	5mA
200Ω	266.4°C	17.32mA

Table 8.11: Test values – THC/mV sources

Configured range: (= 5mV/1mA)	–10mV (4mA)	+70mV (20mA)
Test voltage	**Output**	
–10mV	4mA	
+35mV	13mA	
+70mV	20mA	

8.2.20 MTL4081

See figure 8.22.

a) Make the safe-area and hazardous-area connections shown.
Note: *a millivoltmeter capable of measuring to within 1µV should be used for V1.*

b) Vary RV1 for 0-50mV on the output (V2), V1 should display <0.025mV as RV1 is varied.

c) Break the link and enable the safety drive by setting the switch on top of the module; 'upscale' should drive output >+60mV (V2) and 'downscale' >-60mV.

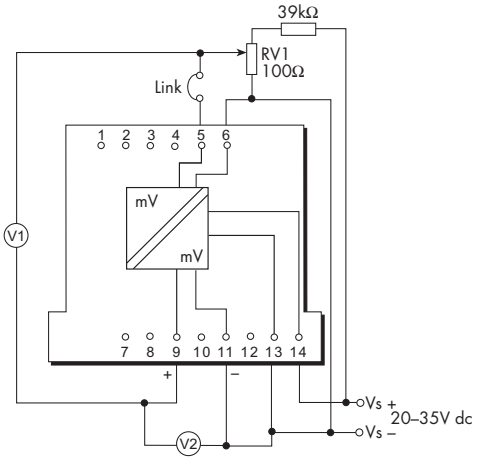


Figure 8.22: Test circuit – MTL4081

8.2.21 MTL4083

See figure 8.23.

a) Make the safe-area and hazardous-area connections shown.

b) Vary RV1 for 0-12V on the output (V2), V1 should display <±5mV as RV1 is varied.

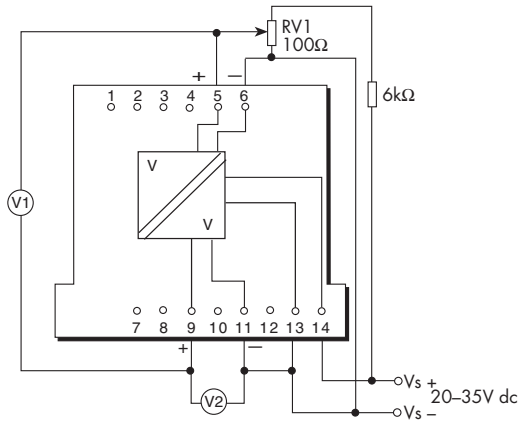


Figure 8.23: Test circuit – MTL4083

8.2.22 MTL4113P

See figure 8.24 and table 8.12.

a) Make the safe-area and hazardous-area connections as shown.

b) With an ohmeter, check the status of the output contacts according to table 8.12.

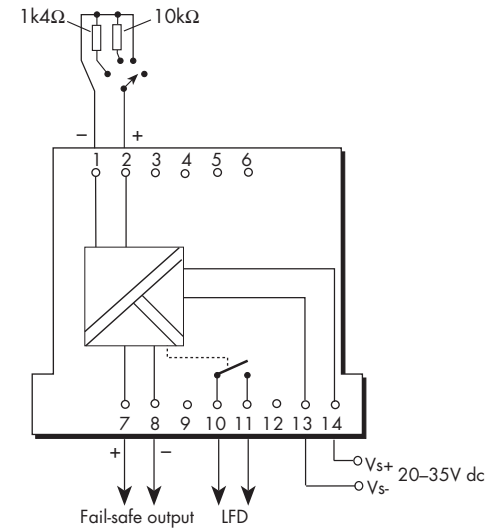


Figure 8.25: Test circuit – MTL4113P

Table 8.12: MTL4113P

Input	Output	Line fault
open circuit	de-energised	open
short-circuit	de-energised	open
1k4Ω	energised	closed
10kΩ	de-energised	closed

8.2.23 MTL4215

a) Apply a short circuit between pins 10 and 11.

b) Check that the yellow LED on top of the module is ON and that there is continuity between pins 1 and 3 and between pins 4 and 6.

c) Remove the short circuit between terminals 10 and 11.

d) Check that the yellow LED is OFF and that there is continuity between pins 2 and 3 and between pins 4 and 5.

e) Remove all links used during the test.

8.2.24 MTL4216

a) Apply a short circuit between pins 8 and 9.

b) Check that the channel 1 yellow LED on top of the module is ON and that there is continuity between pins 1 and 3.

c) Remove the short circuit between terminals 8 and 9.

d) Check that the channel 1 yellow LED is OFF and that there is continuity between pins 2 and 3.

e) Apply a short circuit between pins 10 and 11.

f) Check that the channel 2 yellow LED on top of the module is ON and that there is continuity between pins 4 and 6.

g) Remove the short circuit between terminals 10 and 11.

h) Check that the channel 2 yellow LED is OFF and that there is continuity between pins 4 and 5.

i) Remove all links used during the test.

8.2.25 MTL4220

See figure 8.25.

a) Make the safe-area and hazardous-area connections shown.

b) Connect a 10kΩ resistor between H1 and H8 to E in turn, the corresponding input LED should come ON together with LED1.

c) Remove the 10kΩ resistor.

d) Close the Test switch on pins 10 and 11, within 10s LED1 and all the input LEDs should come ON.

e) Open the Test switch, the module should return to the normal operating mode in <50s.

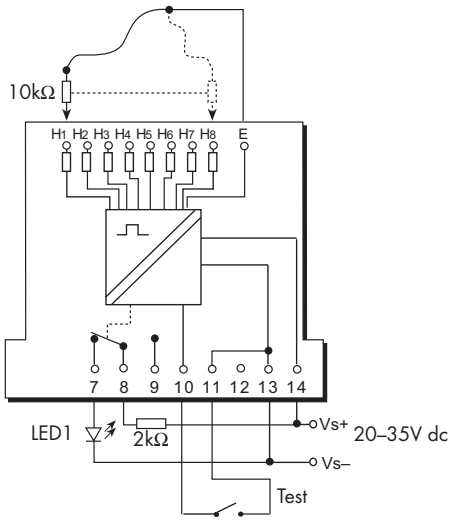


Figure 8.25: Test circuit – MTL4220

8.2.26 MTL4403

See figure 8.26 and tables 8.13 and 8.14.

a) For each trip point,check for current sources of 0mA and 25mA according to table 8.13.

b) For each trip in trun set the current source to 12mA.

c) Adjust the trip pot until the associated LED just extinguishes.

d) Check with sources of 11.5mA and 12.5mA according to table 8.14.

Table 8.13: High and low value checks - MTL4403

	High alarm		Low alarm	
Current	**LED**	**Relay**	**LED**	**Relay**
0mA	ON	Closed	OFF	Open
25mA	OFF	Open	ON	Closed

Table 8.14: Middle-range checks - MTL4403

	High alarm		Low alarm	
Current	**LED**	**Relay**	**LED**	**Relay**
11.5mA	ON	Closed	OFF	Open
12.5mA	OFF	Open	ON	Closed

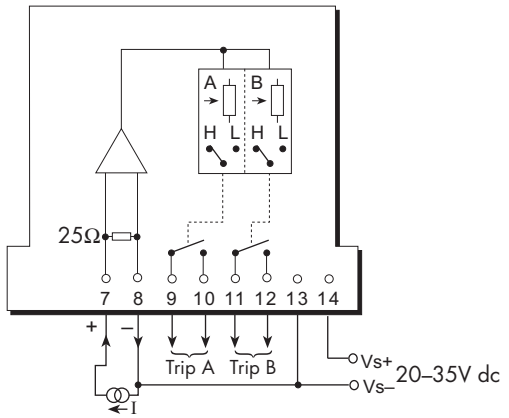


Figure 8.26:–Test circuit - MTL4403

8.2.27 MTL4421RS

See figure 8.27 and table 8.15.

a) Make the connection shown

b) Check that the output across terminals 1 and 4 turns ON and OFF according to table 8.15 by applying the appropriate control and override inputs.

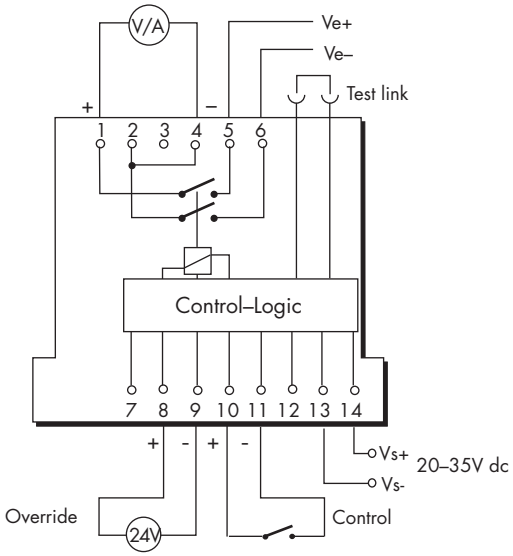


Figure 8.27: Test circuit – MTL4421RS

Table 8.15: Tests – MTL4421RS

Override input	Control input	Output state
0V	closed	OFF
0V	open	ON
24V	closed	OFF
24V	closed	OFF

9 APPENDIX A - ATEX INFORMATION

The Essential Health and Safety Requirements (Annex II) of the EU Directive 94/9/EC [the ATEX Directive - safety of apparatus] requires that the installation manual of all equipment used in hazardous areas shall contain certain information. This annex is included to ensure that this requirement is met. It compliments the information presented in this document and does not conflict with that information. It is only relevant to those locations where the ATEX directives are applicable.

9.1 General

a) In common with all other electrical apparatus installed in hazardous areas, this apparatus must only be installed, operated and maintained by competent personnel. Such personnel shall have undergone training, which included instruction on the various types of protection and installation practices, the relevant rules and regulations, and on the general principles of area classification. Appropriate refresher training shall be given on a regular basis. [See clause 4.2 of EN 60079-17].

b) The apparatus has been designed and manufactured so as to provide protection against all the relevant additional hazards referred to in Annex II of the Directive, such as those in clause 1.2.7.

c) This apparatus has been designed to meet the requirements of associated electrical apparatus in accordance with EN 50020 and EN50014.

9.2 Installation

a) The installation should comply with the appropriate European, national and local regulations, which may include reference to the IEC code of practice IEC 60079-14. In addition particular industries or end users may have specific requirements relating to the safety of their installations and these requirements should also be met. For the majority of installations the Directive 1999/92/EC [the ATEX Directive - safety of installations] is also applicable.

b) This apparatus is an associated electrical apparatus and is normally mounted in a non-hazardous [safe] area. When mounted in a Zone1 location the apparatus must be provided with an enclosure, which offers an additional degree of protection appropriate to the area classification.

c) The apparatus must not be subjected to mechanical and thermal stresses in excess of those permitted in the certification documentation, this manual and the product specification. If necessary the product must be protected by an enclosure to prevent mechanical damage.

d) The apparatus must not be installed in a position where it may be attacked by aggressive substances and must be protected from excessive dust, moisture and other contaniments by an enclosure.

9.3 Inspection and maintenance

a) Inspection and maintenance should be carried out in accordance with European, national and local regulations which may refer to the IEC standard IEC 60079-17. In addition specific industries or end users may have specific requirements which should also be met.

b) Access to the internal circuitry must not be made during operation.

9.4 Repair

a) The products cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer or his authorised agent.

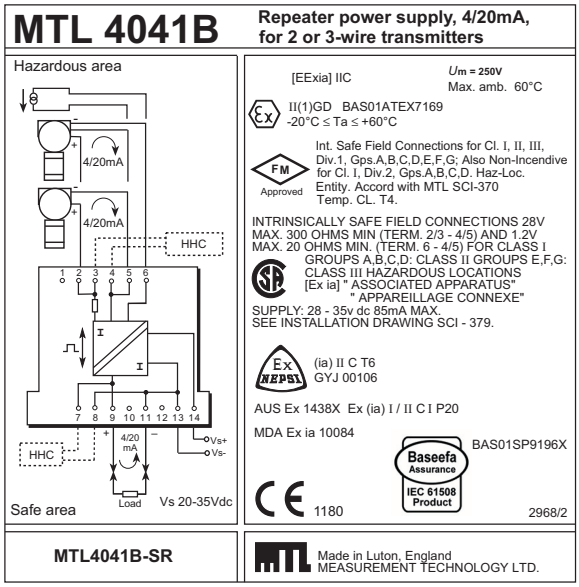
9.5 Marking

a) MTL4000 Series isolators carry approval certificate numbers as detailed in Table 9.2. Each device is also CE marked with the Notified Body Identification Number of 1180 and carries the following information:

   a) Company logo
   b) Company Name and Address
   c) Product Number and Name
   d) Certificate Number
   e) Ex Classification (where applicable)
   f) Schematic diagram
   g) Safety description parameters
   h) Ambient temperature range

This manual applies to products date-marked 2003 or later.

Figure 9.1 - Typical MTL4000 Series isolator label



9.6 Isolator Safety Descriptions

Table 9.1 - MTL4000 safety parameters

Model	Terminals	V	mA	mW	Ω
MTL4013		10.5	14	-	800
MTL4014		10.5	14	-	800
MTL4015		10.5	14	-	800
MTL4016		10.5	14	-	800
MTL4017		10.5	14	-	800
MTL4021		25.5	110	-	232
MTL4021S		25.5	110	-	232
MTL4023		25	147	-	170
MTL4023R		25	147	-	170
MTL4024		25.5	110	-	232
MTL4024R		25.5	110	-	232
MTL4025		25	93	-	269
MTL4031	2 to 6	26.6	94	-	0.66
	5 to 6	non-energy storing apparatus			
MTL4032	2 to 1	10.5	14	-	800
	4 to 3 & 1	28	93	-	300
	3 to 1	non-energy storing apparatus			
	5 to 4 & 1	≤ 28	≤ 94	≤ 660	-
MTL4041A	3 to 4 & 5 to 6	8.6	-	-	diode
MTL4041B	2 to 5 & 6	28	93	-	300
	5 to 6	non-energy storing apparatus			
MTL4041P	2 to 5 & 6	28	116.6	-	240
	5 to 6	non-energy storing apparatus			
MTL4041T	2 & 3 to 4 & 5	22	165	-	134
	4 & 5 to 6	non-energy storing apparatus			
MTL4042	2 to 5	28	187	-	150
MTL4043	2 to 5 & 6	28	93	-	300
	5 to 6	non-energy storing apparatus			
MTL4044	2 to 3 & 5 to 6	28	93	-	300
MTL4044D	2 to 3	28	93	-	300
MTL4045B		28	93	-	300
MTL4045C		28	93	-	300
MTL4046		28	93	-	300
MTL4046C		28	93	-	300
MTL4046P		28	116	-	240
MTL4046S		22	100	-	220
MTL4048		28	93	-	300
MTL4061		28	93	-	300
MTL4073	1 & 2	7.2	8	-	950
	5 & 6	non-energy storing apparatus			
MTL4075	1 to 6	6.6	106	175	-
	5 & 6	±1.1V	4	2	-
MTL4081		1.0	47.8	12	-
MTL4083		16	17	-	950
MTL4099		-	-	-	-
MTL4099N		-	-	-	-
MTL4113P		9.7	30	70	-
MTL4114P		9.7	30	70	-
MTL4215		non-energy storing apparatus			
MTL4216		non-energy storing apparatus			
MTL4220		9	0.14	-	65k
MTL4401		-	-	-	-
MTL4403		-	-	-	-
MTL4421RS		-	-	-	-

Table 9.2 - Approval certificates

Region (Authority) Mines	Australia (NSW M)	Australia (SA)	Canada (CSA)	China (NEPSI)	CIS (VNIIVE)	Czech Republic (FTZU)	Hungary (BKI)	Japan (TIIS)	Korea (KISCO)	Poland (KDB)	UK (BASEEFA to CENELEC-standards)	UK (BASEEFA) Systems (to CENELEC-standards)	USA (FM)
Standard	CMRA67-1982	AS2380.1/7	C22.2 No.157	GB3836-1/-7	EN 50020 GOST22782.5-78	CSN33 0380	MSZEN 50014 MSZEN 50020	New Gijyutukijyun		PN-83/E-8110 PN-84/E-8107	EN 50014(1977) EN 50020(1977)	EN 50039 BS 5501: Pt9 1982	3610 Entity
Approved for	Coal mines	Ex (ia) IIC	Class I, II, III Div.1 Gps A-G	Ex (ia) IIC T6	Ex ia IIC	Ex ia IIC	[EEx ia] IIC EEx ib IIC/IIB	Ex ia IIC	Ex ia IIC	EEx ia IIC	[EEx ia] IIC	EEx ia IIC T4 or T6*	Class I, II, III Div. 1, 2, Grps A-G IS circuits Units can also be sited in Class I, II, III, Div 2 in appropriate enclosures
Model no.	**Certificate/file no.**											** T6 for switches or if the hazardous-area device is suitably certified*	
MTL4013	MDA Ex ia 10084	Ex 1438X	LR36637-63	GYJ00106	D.00C.218	99Ex0770	Ex-97.C.300			95.087W	BAS01ATEX7162	Ex92C2323	J.I. 5W3A4.AX
MTL4014			LR36637-131								BAS01ATEX7164	Ex993C2387	
MTL4015		Ex 1438X	LR36637-49			99Ex0771			97-2548-Q1		BAS01ATEX7163	Ex91C2451	
MTL4016	MDA Ex ia 10084	Ex 1438X	LR36637-49	GYJ00106	D.00C.218	99Ex0771	Ex-97.C.300		97-2548-Q1	95.086W	BAS01ATEX7163	Ex91C2451	J.I. 0W2A6.AX
MTL4017			LR36637-87		D.00C.218					95.085W	BAS01ATEX7164	Ex993C2387	J.I. 4Y5A6.AX
MTL4021	MDA Ex ia 10084	Ex 1438X	LR36637-49	GYJ00106	D.00C.221	99Ex0772	Ex-97.C.300		97-2549-Q1	95.084W	BAS01ATEX7165	Ex92C2002	J.I. 0W2A6.AX
MTL4021S		Ex 1438X				99Ex0772					BAS01ATEX7165	Ex92C2002	J.I. 5Y7A1.AX
MTL4023			LR36637-87							95.083W	BAS01ATEX7166	Ex93C2500	J.I. 4Y5A6.AX
MTL4024			LR36637-131			99Ex0772			97-2549-Q1		BAS01ATEX7165	Ex92C2002	J.I. 5Y7A1.AX
MTL4024R											BAS01ATEX7165		
MTL4025			LR36637-49			99Ex0772				95.084W	BAS01ATEX7165	Ex92C2002	J.I. 0Z6A6.AX
MTL4031											BAS01ATEX7167	Ex94C2266	
MTL4032			LR36637-87		172	99Ex0834					BAS01ATEX7168	Ex94C2175	J.I. 4Y5A7.AX
MTL4041A			1065362								BAS99ATEX7028	Ex99E2029	
MTL4041B	MDA Ex ia 10118	Ex 1438X	LR36637-68	GYJ00106	D.00C.442	99Ex0773	Ex-97.C.300	C13408		95.082W	BAS01ATEX7169	Ex92C2004	J.I. 1X6A4.AX
MTL4041P			LR36637-68							95.082W	BAS01ATEX7169	Ex92C2004	J.I. 4X5A3.AX
MTL4041T											BAS00ATEX7149		
MTL4042											BAS01ATEX7170		J.I. 5Y7A1.AX
MTL4043											BAS01ATEX7171		J.I. 4D0A8.AX
MTL4044			1065362	GYJ00106	D.00C.442						BAS99ATEX7061		
MTL4044D											BAS99ATEX7061		
MTL4045B		Ex 1438X	LR36637-87		D.00C.220†	98Ex0023	Ex-97.C.300		97-2550-Q1	95.080W†	BAS01ATEX7172	Ex93C2479	J.I. 0D7A0.AX
MTL4045C			LR36637-87			98Ex0023			97-2550-Q1		BAS01ATEX7172	Ex93C2479	J.I. 0D7A0.AX
MTL4046			1065362								BAS98ATEX7293	Ex98E2294	
MTL4046C			1065362								BAS98ATEX7293	Ex98E2294	
MTL4046P		Ex 2320X	LR36637-87			97Ex0070				96.472W	BAS01ATEX7173	Ex94C2194	J.I. 4Y5A6.AX
MTL4046S											BAS99ATEX7293	Ex98E2294	
MTL4048						99Ex0774					BAS01ATEX7175	Ex94C2069	
MTL4061							Ex-97.C.300				BAS01ATEX7176	Ex94C2041	
MTL4073		Ex 1438X	LR36637-72	GYJ00106	D.00C.222	99Ex0775	Ex-97.C.300		97-2551-Q1	95.078W	BAS01ATEX7177	Ex93C2174	J.I. 2X8A5.AX
MTL4075											Baseefa05ATEX0065		
MTL4081		Ex 2342X									BAS01ATEX7178		
MTL4083		Ex 3549X	LR36637-87								BAS01ATEX7179	Ex97D2140	J.I.6D1A8.AX
MTL4113P											Baseefa03ATEX0297		
MTL4114P											Baseefa03ATEX0297		
MTL4215										95.079W	BAS01ATEX7180		J.I. 4Y5A7.AX
MTL4216											BAS01ATEX7180		J.I. 5Y7A1.AX
MTL4220											BAS01ATEX7181	Ex95C2291	

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