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MTL5000 Series
isolating interface units



Instruction Manual

INM5000

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CONTENTS

Page

1 INTRODUCTION 1

2 DESCRIPTION 1

3 INSTALLATION 1

3.1 Installing unenclosed isolators 1

4 ACCESSORIES 4

4.1 MTL5000 power bus - Installation and use 4

4.2 Earth rail and tagging accessories 4

5 DX ENCLOSURES 7

5.1 Environmental conditions 8

5.2 Mounting 9

5.3 Accessories in enclosures 11

5.4 IS warning label 11

6 UNIT DESCRIPTIONS, SETTING-UP, CONNECTIONS AND TESTING 11

6.1 MTL5011 single-pole relay single-channel switch/proximity detector with phase reversal (Discontinued use MTL5011B) 11

6.2 MTL5011B single-pole changeover relay single-channel switch/proximity detector with line fault detection and phase reversal 12

6.3 MTL5012 solid-state single-channel switch/proximity detector with line fault detection and phase reversal 12

6.4 MTL5014 single-pole changeover relay single-channel dual-output switch/proximity detector with line fault detection and phase reversal 13

6.5 MTL5015 solid-state two-channel switch/proximity detector with line fault detection and phase reversal 14

6.6 MTL5016 single-pole relay two-channel switch/proximity detector with phase reversal (Discontinued, use MTL5018) 15

6.7 MTL5017 single-pole relay two-channel switch/proximity detector with line fault detection and phase reversal 15

6.8 MTL5018 single-pole, changeover relay, two-channel, switch/proximity detector with line fault detection and phase reversal 16

6.9 MTL5018AC single-pole, changeover relay, two-channel, switch/proximity detector with line fault detection and phase reversal 16

6.10 MTL5021 loop-powered solenoid/alarm driver, IIC 17

6.11 MTL5022 loop-powered solenoid/alarm driver, IIB 18

6.12 MTL5023 solenoid/alarm driver with line fault detection and phase reversal 18

6.13 MTL5024 solenoid/alarm driver, logic drive with phase reversal 19

6.14 MTL5025 low-current loop-powered solenoid/alarm driver, IIC 19

6.15 MTL5031 vibration transducer interface 19

6.16 MTL5032 pulse isolator 20

6.17 MTL5040 2-channel 4 to 20mA loop isolator 21

6.18 MTL5041/42 repeater power supplies 21

6.19 MTL5043 repeater power supply dual output, 4 to 20mA for 2-wire transmitters 22

6.20 MTL5044 repeater power supply 22

6.21 MTL5045/46 isolating drivers 23

6.22 MTL5048 analogue input/output, loop-powered isolator 23

6.23 MTL5049 two-channel isolating driver 24

6.24 MTL5051 serial data comms isolator 24

6.25 MTL5053 isolator/power supply for 31.25kbit/s fieldbuses 25

6.26 MTL5061 two-channel loop-powered fire/smoke detector interface 26

6.27 MTL5074 temperature converters, THC or RTD input 26

6.28 MTL5081 millivolt isolator 27

6.29 MTL5082 resistance isolator 28

6.30 MTL5099 dummy isolator 28

6.31 MTL5113P fail-safe switch/proximity detector interface 29

6.32 MTL5314 trip amplifier for 2– or 3– 2 wire transmitters 29

6.33 MTL5344 Repeater power supply 31

6.34 MTL5349 two-channel isolating driver 31

6.35 MTL5991 24V dc power supply 32

6.36 MTL5995 fieldbus power supply for 31.25kbit/s fieldbuses 32

6.37 FBTI-IS fieldbus terminator 33

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7 MAINTENANCE 34
7.1 Routine maintenance 34
7.2 Enclosures 34

8 OTHER USEFUL DOCUMENTATION 34

9 APPENDIX A - INSTRUCTIONS FOR MTL5500 SERIES 35
9.1 MTL5521 rotational speed monitor 35
9.2 MTL5531 voltage/current converter 36
9.3 MTL5536 potentiometer converter 36

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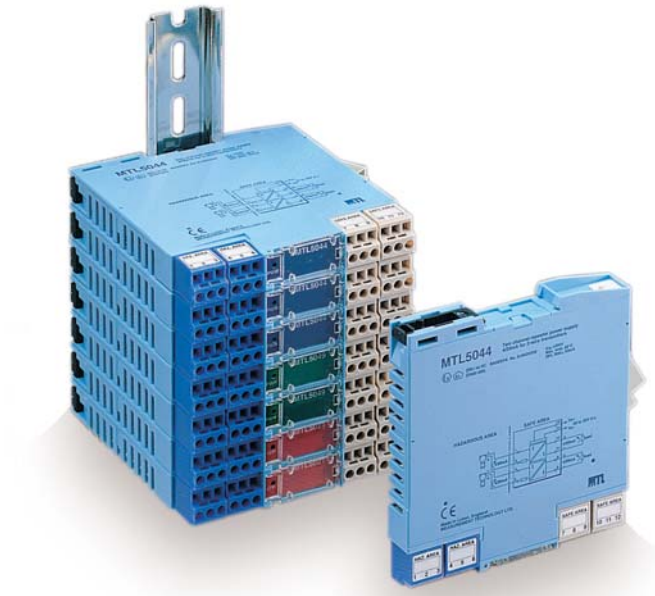


Figure 1.1: MTL5000 Series isolators

WARNING

This manual describes the use and installation of safety equipment. This equipment must be installed, operated and maintained only by trained competent personnel and in accordance with all appropriate international, national and local standard codes of practice and site regulations for intrinsically safe apparatus and in accordance with the instructions contained here.

ATEX

If the country of installation is governed by the Essential Health and Safety Requirements (Annex II) of the EU Directive 94/9/EC [the ATEX Directive - safety of apparatus] then **MTL** document **INA5000** must be consulted before installation.

CERTIFICATION DATA

The MTL web site *http://www.mtl-inst.com* contains documentation regarding intrinsic safety certification for many locations around the world. Consult this data for information relevant to your local certifying authority.

REPAIR

These products **MUST NOT be repaired**. Faulty or damaged products must be replaced with an equivalent certified product.

1 INTRODUCTION

This instruction manual explains how to install, connect, test and maintain MTL5000 Series isolating interface units (isolators).

2 DESCRIPTION

MTL5000 Series isolators provide intrinsically safe (IS) communication and signal conditioning for a wide range of hazardous-area devices. Total ac and dc isolation exists between input, output and power supply on separately powered units, and between input and output on loop-powered units. No IS earth is required. DIN-rail mounting and plug-in signal and power connectors simplify installation and maintenance. Units are powered from a 20 to 35V dc supply, or, in some cases, from the signal itself.

3 INSTALLATION

Mount all MTL5000 Series isolators on low-profile (7mm) or high-profile (15mm) type T35 (top-hat) DIN-rail to EN50022, BS5584, DIN46277. This is available from MTL, in 1 metre lengths (THR2 DIN rail). Install isolators within the safe area unless they are enclosed in approved flameproof, pressurised or purged enclosures and ensure that the local environment is clean and free of dirt and dust. Note the ambient temperature considerations of section 3.1.7.

It is recommended that, in normal practice, the DIN rail is earthed to ensure personnel safety in the event of mains being put accidentally on the rail.

3.1 Installing unenclosed isolators

On new installations, if isolators are mounted in several rows orcolumns, mount alternate rows or columns so that units face in opposite directions. This allows safe- and hazardous-area wiring looms to be shared.

See figure 3.1 for isolator dimensions.

***Note**: All MTL products are tested for electrical safety to EN 61010 to comply with the EC Low Voltage Directive*

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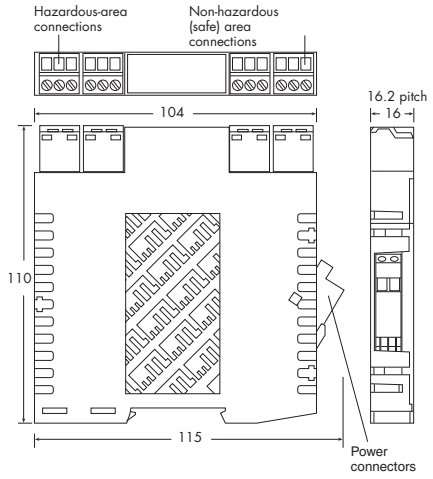


Figure 3.1: Dimensions of MTL5000 Series isolators

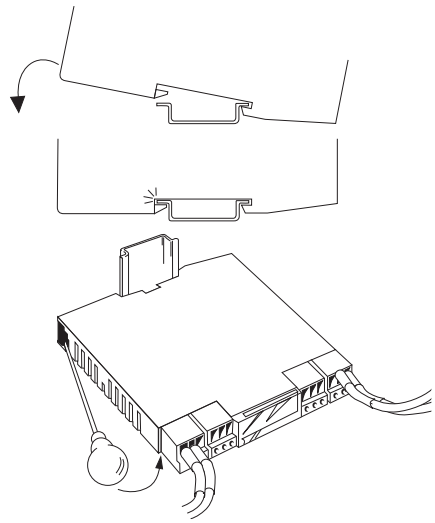


Figure 3.2: DIN rail – mounting and removing isolators

3.1.1 Mounting isolators on DIN rail

Clip isolators onto type T35 DIN rail as shown in figure 3.2, with the blue signal plugs facing towards the hazardous-area wiring.To remove an isolator from the rail, insert a screwdriver blade into the clip as shown and lever the clip gently outwards; pivot the isolator off the rail. Allow a maximum mounting pitch of 16.2mm for each unit.

3.1.2 Wiring up isolators

Each unit is supplied with the appropriate number and type of safe- and hazardous-area connectors (see figure 3.3), as dicatated by the terminals used and the type of power supply. Loop-powered devices do not require power connectors. Depending on the installation, it may be easier to wire up isolators with power and signal plugs either in place or removed. Either way, allow sufficient free cable to permit plugs to be removed easily for future maintenance and/or replacement purposes. See section 6 for individual unit wiring instructions.

Note: *Units for use with 31.25kbit/s fieldbuses may require additional terminators to be fitted. See section 6.33 for details of MTL's FBT1 fieldbus terminator.*

Signal and power conductors

Removable signal and power plugs are fitted with screw clamp terminals. Note that the conductors should be between 14 and 24 AWG (1.6 and 0.5mm dia) in size. Signal plugs, located on top of the modules, are mechanically keyed to fit in only one position. They are

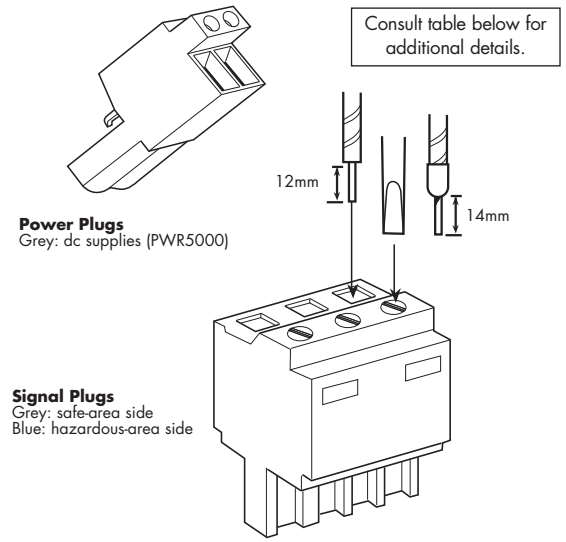


Figure 3.3: Removable power and signal plugs

coloured grey, for safe-area connections, and blue, for hazardous-area connections.

For externally powered units, a power plug slots into the socket at terminals 13 and 14 on the safe-area side of each module. The socket is coloured blue if the unit is dc powered. Power plugs are coloured grey, for plugging into the blue sockets of dc powered units.

Making connections

a) Trim back the insulation of conductors by 12mm.
b) Check the terminal assignments shown in section 6 or on the side label of the unit.
c) Insert conductors according to the terminal assignments and tighten screws.

If the wires are to be fitted with crimp ferrules, the following is a list of those recommended with required trim lengths for each:

**2- to 3-week lead time*

Plug type	Entry	Wire size (mm2)	Metal tube length (mm)	Trim length (mm)	Recommended ferrules
Signal	Twin	2x1.5	12	14	Cembre PKET 1512
Signal	Single	0.75	12	14	Weidmuller 902591
Signal	Single	1.0	12	14	Cembre PKC112
Signal	Single	1.0	12	14	Phoenix Contact AI 1-12 RD (3200674)*
Signal	Single	1.5	12	14	Cembre PKE1518†
Signal	Single	2.5	12	14	Cembre PKE2518†
Power	Twin	2x0.75	10	12	Cembre PKET7510
Power	Twin	2x0.75	10	12	AMP (non-preferred) 966144-5
Power	Twin	2x1.0	10	12	Phoenix Contact AI-TWIN 2X 1-10 RD
Power	Single	0.75	10	12	AMP 966067-0
Power	Single	1.0	10	12	Phoenix Contact AI 1-10 RD

† These ferrules have 18mm length metal tubes which should be cut to 12mm after crimping

Note: *Smaller section wire than that stated can often be successfully used if the crimping is good.*

Crimp tool: Phoenix Contact Crimpfox UD6 part number 1204436

Finishing

Wire up individual isolators in accordance with wiring schedules. Daisy-chain power supply connections between individual power plugs or use the power bus (see section 4.1).

Segregate hazardous- and safe-area wiring into separate trunking or looms wherever possible to avoid errors and maintain a tidy installation.

Use an MTL5099 dummy isolator to provide termination and earthing for unused cores from the hazardous area.

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3.1.3 Phase reversal

Switch(es) to change the phase of the output(s) relative to the input(s) are provided on the top labels of some of the MTL5000 Series modules and on the base of others. The following applies:

MTL5011B, 5014 and 5018: Phase reversal switch on top label

PR switch setting	Hazardous-area input(s)	Output relay(s)
Off	<1.2mA	De-energised
Off	>2.1mA	Energised
On	<1.2mA	Energised
On	>2.1mA	De-energised

MTL5017: Phase reversal switch on base of module

PR switch setting	Hazardous-area input(s)	Output relay(s)
o ← (off)	<1.2mA	De-energised
o ← (off)	>2.1mA	Energised
→ + (on)	<1.2mA	Energised
→ + (on)	>2.1mA	De-energised

MTL5012 and 5015: Phase reversal switch on top label

PR switch setting	Hazardous-area input(s)	Solid-state output(s)
Off	<1.2mA	Non-conducting
Off	>2.1mA	Conducting
On	<1.2mA	Conducting
On	>2.1mA	Non-conducting

MTL5023 and 5024: Phase reversal switch on base of module

PR switch setting	Safe-area control	Hazardous-area output
o ← (off)	CTRL+Ve >4.5V above CTRL-Ve	Enabled
o ← (off)	CTRL+Ve <1.4V above CTRL-Ve	Disabled
→ + (on)	CTRL+Ve >4.5V above CTRL-Ve	Disabled
→ + (on)	CTRL+Ve <1.4V above CTRL-Ve	Enabled

Positions for base-located switches are set as shown in figure 3.4.

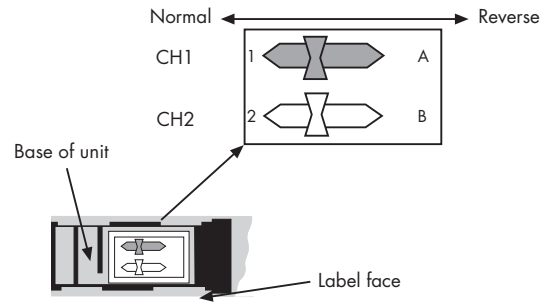


Figure 3.4: Phase reversal switch on base of units

3.1.4 Line fault detection (LFD)

Line fault detection on hazardous-area sensor lines (open circuit or short circuit) is provided on some MTL5000 Series modules.

Note: *resistors must be fitted when using the LFD facility with a contact input: 500Ω to 1kΩ in series with switch and 20kΩ to 25kΩ in parallel with switch.*

For hazardous-area inputs conforming to NAMUR/DIN 19234, a line fault condition is indicated as follows:

Open circuit condition if hazardous-area current <50µA
Line integrity (no open circuit) if hazardous-area current >350µA
Short circuit condition if hazardous-area load <100Ω
Line integrity (no short circuit) if hazardous-area load >360Ω

Note: *the open circuit window (between 350µA and 50µA) is not hysteresis, all MTL5000 Series modules with inputs conforming to NAMUR/DIN 19234 will switch between open and complete circuit conditions within these limits.*

Note: *the short circuit window (between 100Ω and 360Ω) is not hysteresis, all MTL5000 Series modules with inputs conforming to NAMUR/DIN 19234 will switch between open and complete circuit conditions within these limits.*

Modules with LFD and inputs conforming to NAMUR/DIN 19234:

MTL5011B, 5014* and 5018: LFD enable switch on top label

LFD switch setting	Hazardous-area input(s)	Output relay(s)
On	<50µA	De-energised
On	>350µA	Energised
On	>360Ω	Energised
On	<100Ω	De-energised

* The MTL5014 has a Slave/LFD output relay arrangement (see module description in section 6).

MTL5012 and 5015: LFD enable switch on top label

LFD switch setting	Hazardous-area input(s)	Solid-state output(s)
On	<50µA	Non-conducting
On	>350µA	Conducting
On	>360Ω	Conducting
On	<100Ω	Non-conducting

MTL5017: LFD permanently enabled

Hazardous-area input (either channel)	Line-fault-detect relay
<50µA	De-energised
>350µA	Energised
>360Ω	Energised
<100Ω	De-energised

Other modules with LFD facility

MTL5023 solenoid/alarm driver: LFD automatic

Hazardous-area load	Solid-state LFD output
<50Ω	Non-conducting
>7kΩ	Non-conducting

MTL5046 isolating driver: LFD automatic

Hazardous-area load	Safe-area input
<50Ω	High impedance (>150kΩ)
>90Ω	Normal operation

Note: The safe-area circuit impedance will increase with hazardous-area load and will rise >150kΩ for the 'open circuit' line fault.

MTL5113x: LFD automatic

Hazardous-area input	LFD output
< 50µA (open-circuit)	de-energised
> 6.6mA (short-circuit)	de-energised

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3.1.5. Relay outputs

Reactive loads on all units with relays should be adequately suppressed.Changeover relay outputs are provided on the following units: MTL5011B, MTL5014, MTL5018 and MTL5314. In order to achieve maximum contact life, a minimum switching current of 10mA at ≥5V is recommended.

3.1.6 Earth leakage detection

An MTL4220 earth leakage detector can be used with a number of MTL5000 Series units to detect hazardous-area earth faults which can then be rectified without needing to shut down the loop ('no-fail' operation). On units with a single-channel input, the MTL4220 is connected to terminal 3 and on units with two-channel inputs, to terminals 3 and 6. Units which can be used with an MTL4220 are:

MTL5011B	MTL5012	MTL5014	MTL5015
MTL5017	MTL5018	MTL5021	MTL5022
MTL5023	MTL5024	MTL5025	MTL5061

N.B. HAZ1-3 or HAZ4-6 connectors are required.

3.1.7 Ambient temperature considerations

Ambient temperature limits for unenclosed MTL5000 Series isolators are from -20°C to +60°C with units close-packed.

4 ACCESSORIES

4.1 MTL5000 power bus - Installation and use

4.1.1 MTL5000 Series power bus

Power bus kits provide facilities for linking the power supply terminals (13 and 14) of up to 32 installed MTL5000 Series units to a standard 24V power supply. Buses consist of chains of power plugs and are available in different lengths to suit various numbers of modules as follows:

Number of modules	Kit ID code (contains grey power plugs for 24V dc supply)
1 to 8	PB-8T
9 to 16	PB-16T
17 to 24	PB-24T
25 to 32	PB-32T

4.1.2. Installation

4.1.2.1 Check to make sure the bus length is correct for the number of modules involved.

4.1.2.2 If the number of modules is less than the maximum number the chain will support, cut off the surplus power plugs at the tail end of the chain - leaving a 'new' tail end.

4.1.2.3 Insert power plugs into the power terminals on the safe-area side of each module in sequence.

4.1.2.4 Connect the power supply source to the tail end of the chain (using the insulation displacement connectors (Scotchloks) provided if required).

Notes: *1. To reduce the risk of excessive voltage drop or over-current, DO NOT connect power buses in series.*

2. Surplus sections can be used (and, if required) connected together provided the cut ends are safely terminated and/or connected together. Use single ferrules with a crimp tool or insulation displacement connectors (Scotchloks). Suitable ferrules and connectors are provided with the kits.

4.2 Earth rail and tagging accessories

This section explains how to specify and assemble earth rail and tagging strip accessories for the MTL5000 Series.

The accessories consist of mounting brackets, earth rails, tagging strips and associated parts. They provide facilities for earthing, terminating cable screens and tagging (identifying) the positions of individual units.

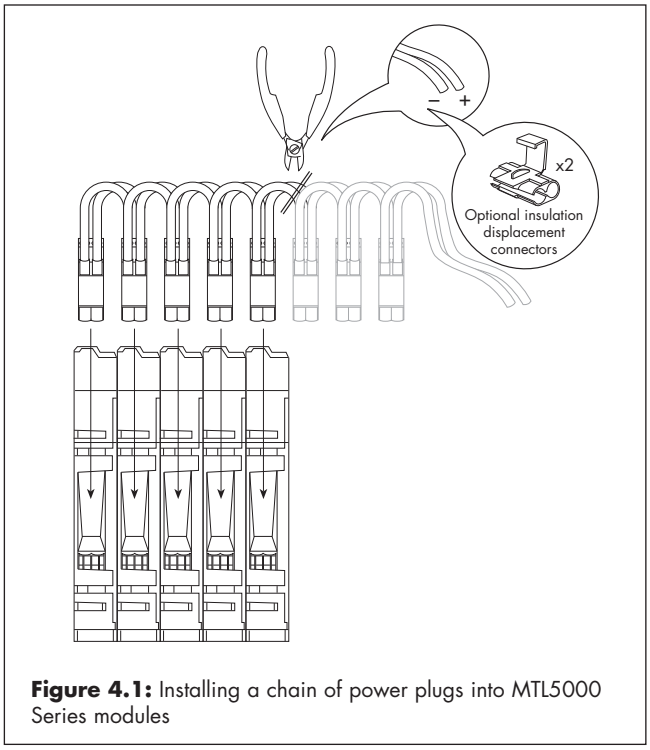


Figure 4.1: Installing a chain of power plugs into MTL5000 Series modules

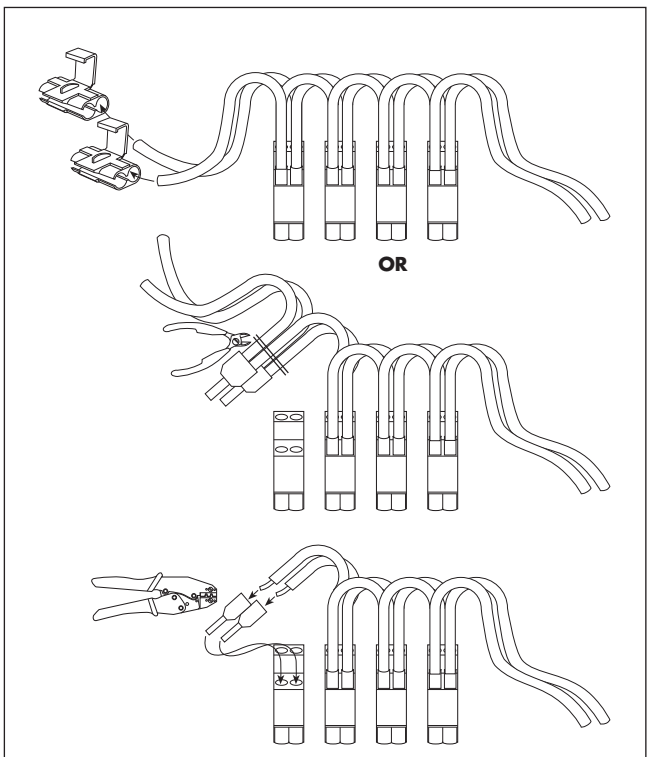


Figure 4.2: Using crimp ferrules or insulation displacement connectors (Scotchloks) to terminate cut ends

4.2.1 Parts list

IMB57 Insulating mounting block (figure 4.5)

One required at each end of a tagging strip/earth rail. Suitable for low-profile (7.5mm) and high-profile (15mm) symmetrical DIN rail.

ERB57S Earth-rail bracket, straight (figure 4.6)

Nickel-plated; supplied with two push fasteners, one earth-rail clamp (14mm, 35mm^2) and one earth cable clamp (10mm, 16mm^2).

Note: *ERB57S is the preferred choice of earth-rail bracket. It is usually fitted in the upper slot on insulating mounting block IMB57.*

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*Where the earth rail is required to be positioned at a lower height and to allow access to the IMB57 mounting screws, the straight earth-rail bracket ERB57S can be inserted in the lower slot, but only **after** insulating mounting blocks IMB57 are clamped to the DIN rail. This may not be possible if, for example, trunking is fitted. In this case, fit offset earth-rail bracket ERB57O (see figure 4.7) in the upper slot: the mounting blocks can then be fitted in a restricted space with this bracket already fitted.*

ERB57O Earth-rail bracket, offset (figure 4.7)

Nickel-plated; supplied with two push fasteners, one earth-rail clamp (14mm, 35mm2) and one earth cable clamp (10mm, 16mm2).

ERL7 Earth rail, 1m length (figure 4.8)

Nickel-plated; may be cut to length.

TAG57 Tagging strip, 1m length (figure 4.9)

Cut to size. Supplied with tagging strip label.

TGL57 Tagging strip labels, set of 10 x 0.5m

Spares replacement, for use with TAG57 tagging strip.

MS010 DIN rail module spacer, 10mm, pack of 5 (figure 4.10)

Grey spacer, one required between each MTL5995 and any adjacent module on a DIN rail, to provide 10mm air-circulation space between modules.

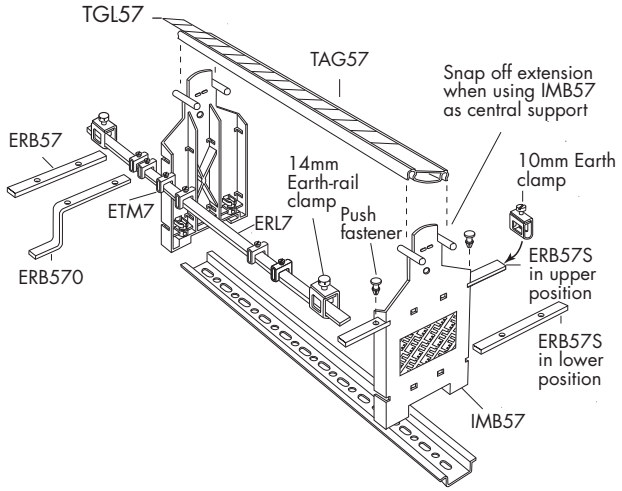


Figure 4.3: Assembly drawing showing part numbers

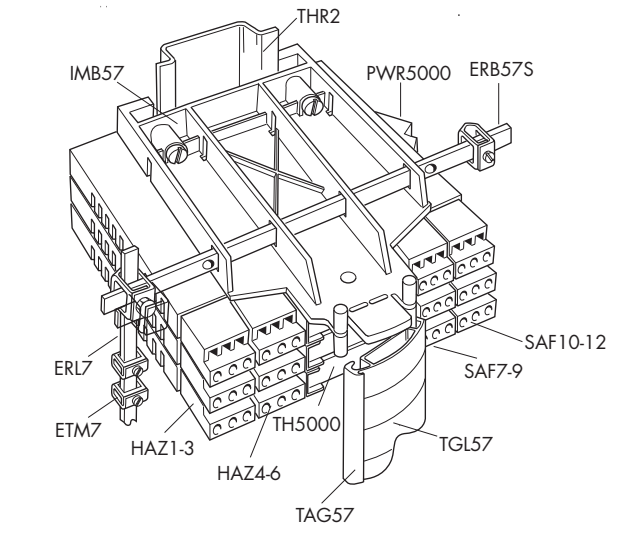


Figure 4.4: Mounting details

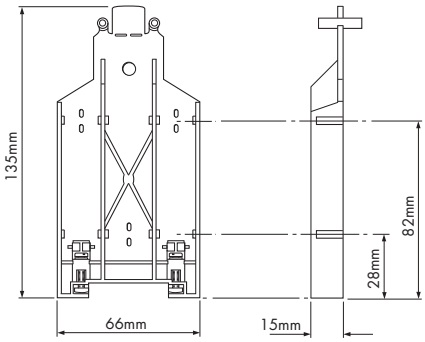


Figure 4.5: IMB57 Insulating mounting block

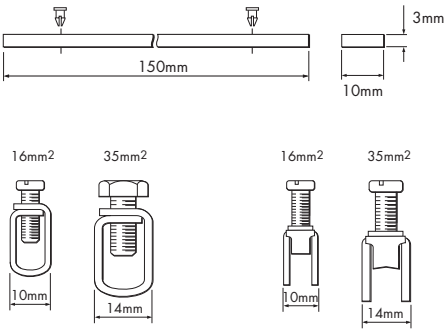


Figure 4.6: ERB57S Earth-rail bracket, straight (end-on view), and clamps

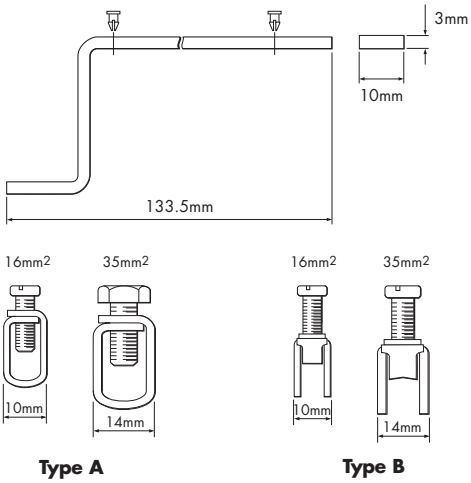


Figure 4.7: ERB57O Earth-rail bracket, offset (end-on view), and clamps

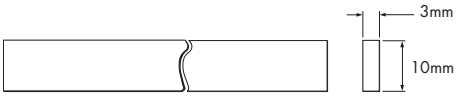


Figure 4.8: ERL7 Earth-rail, 1m length



Figure 4.9: TAG57 Tagging strip,1m length

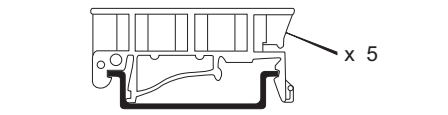


Figure 4.10: MS010 DIN rail module spacers

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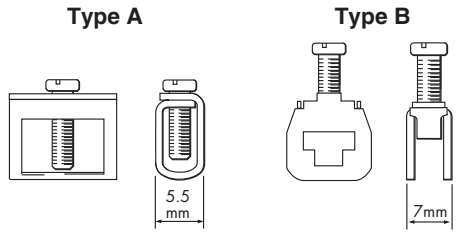


Figure 4.11: ETM7 Earth terminal

ETM7 Earth terminal, bag of 50 (figure 4.11)

For terminating cable screens and 0V returns on the ERL7 earth rail. For cables ≤ 4mm².

TH5000 Tag holder

Spares replacement.

Connectors

Spares replacement: HAZ1-3, HAZ4-6, HAZ-CJC, PWR5000, SAF7-9, SAF10-12 (SAF1-3 and SAF4-6 grey connectors, also available for use in safe-area applications).

4.2.2 Assembly

4.2.2.1 Fitting earth rails

a) *In upper position*

Before fitting insulating mounting blocks IMB57, check that the swing nuts in the base of each unit are turned back into the moulding. Locate the mounting blocks on the DIN rail in the chosen position and tighten the screws (see figure 4.12). Check that the swing nuts rotate correctly to locate underneath the flanges of the DIN rail.

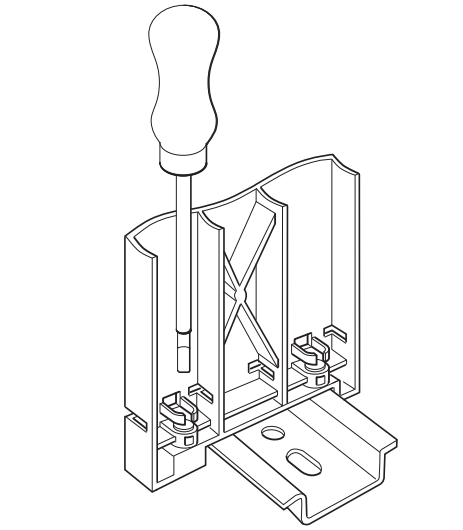


Figure 4.12: Fitting IMB57

Slide a straight earth-rail bracket ERB57S into the upper slot in each mounting block. Push two plastic push fasteners into each bracket to locate the brackets in the mounting blocks.

Cut earth rail ERL7 to the length needed. Slide the required number of ETM7 earth terminals (5mm or 7mm wide) onto the rail. Clamp each end of the earth rail to earth-rail brackets ERB57S using the terminal clamps (14mm, 35mm²) supplied. Fit an earth clamp (10mm, 16mm²) to the free end of each earth-rail bracket.

Note: *For lengths of earth-rail greater than 500mm,*

provide additional support by installing a third IMB57 mounting block and earth-rail bracket, mid-way between the end mounting blocks. Snap out the perforated extension between the lugs on this mounting block if a continuous tagging strip is to be fitted (see figure 4.3).

b) *In lower position*, where at least 150mm clearance exists on one side, measured from the edge of the mounting block.

As for a), but slide earth-rail brackets ERB57S into the lower slots in each mounting block.

c) *In lower position, where there is insufficient clearance to fit earth-rail brackets ERB57S.*

As for a), but slide offset earth-rail brackets ERB57O into the upper slot in each mounting block before assembling the mounting blocks to the DIN rail. ERB57S brackets cannot be used because they obscure the mounting blocks' fixing screws.

4.2.2.2 Fitting tagging strips

Assemble mounting blocks IMB57 to the DIN rail as above. Cut TAG57 tagging strip and label to the length needed, and insert label so that the appropriate side is visible. Clip the strip onto the lugs on the mounting blocks. Hinge up the strip to provide access to the tops of the isolators.

Note: *If necessary, provide additional support for long lengths of tagging strip by installing an extra IMB57 mounting block mid-way between the end mounting blocks. Snap out the perforated extension between the lugs on this mounting block.*

4.2.3 Completed assemblies

Figure 4.13(below) illustrates a complete assembly of MTL5000 isolators using the accessories mentioned above.

The broken-line boxes either side of the assembly represent cable trunking, and the accompanying dimensions represent the minimum spacing between trunking and assemblies.

For further information on the use of the accessories please refer to the relevant MTL customer drawings listed in section 8.

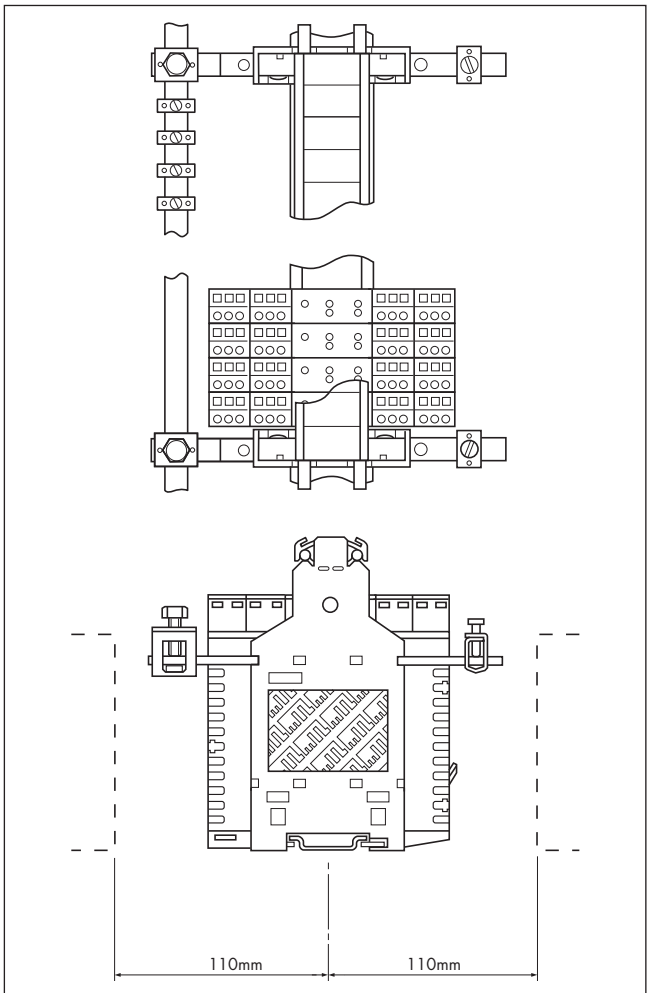


Figure 4.13: MTL5000 Series - complete assembly

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5 DX ENCLOSURES

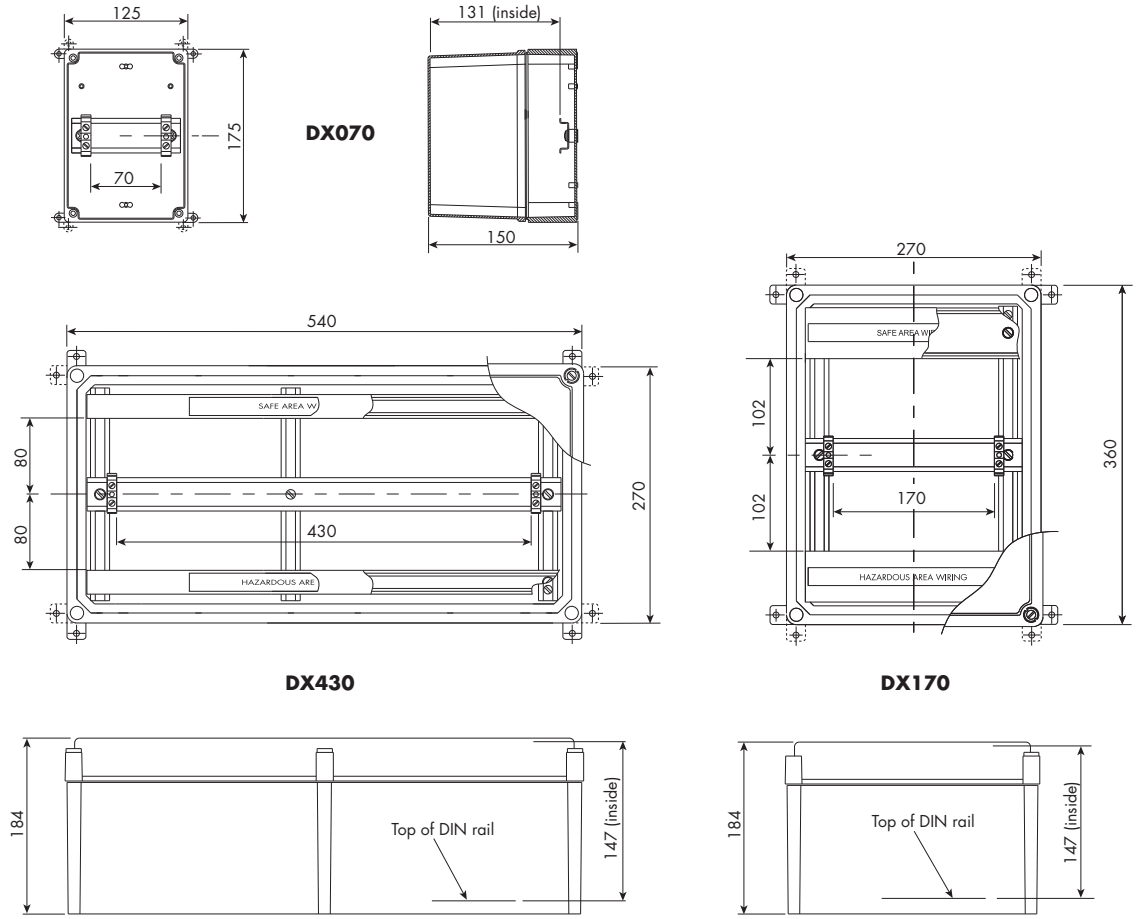


Figure 5.1: MTL's DX range of enclosures

Enclosures are usually selected on the basis of the number of units they will accommodate and table 5.1 shows the capacity of each of the enclosures. Figures 5.2 to 5.4 show each type of enclosure containing MTL5000 modules.

Enclosure	MTL5000 isolators 16.2 mm mounting pitch
DX070	4 (2*)
DX170	10 (8*)
DX430	26 (24*)

Table 5.1: DX range of enclosures - module capacities

** Use these figures when two IMB57 mounting brackets for tagging/earth-rail accessories are included*

Note: *The user should be aware that some workshop preparation may be required for the cable gland plates before the enclosure is ready for on-site installation.*

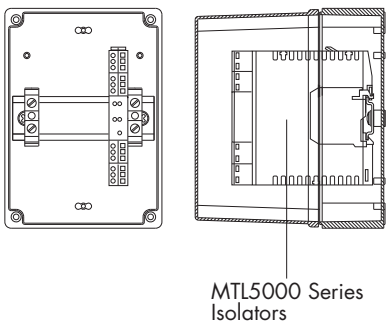


Figure 5.2: DX070 enclosure showing MTL5000 modules mounted

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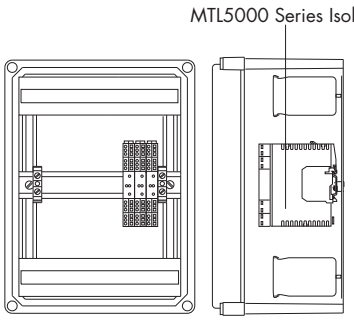


Figure 5.3: DX170 enclosure showing MTL5000 modules mounted

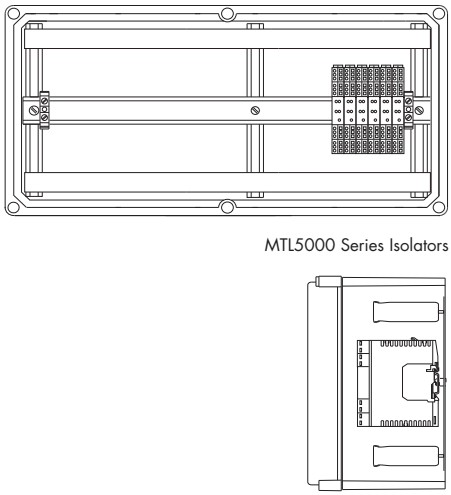


Figure 5.4: DX430 enclosure showing MTL5000 modules mounted

5.1 Environmental conditions

Environmental conditions that should be taken into account when installing DX enclosures include:-

	See section
Maximum ambient temperature limits	5.1.1
Storage temperatures	5.1.2
Humidity	5.1.3
Corrosion resistance	5.1.4
Flammability	5.1.5
Impact resistance	5.1.6
Chemical resistance	5.1.7

5.1.1 Maximum outside enclosure temperature limits

The maximum outside enclosure temperature depends upon the total power dissipated by the installed modules which, in turn, depends upon their number and type. It can also be influenced by the Authority whose standards may need to be applied to the system, e.g. BASEEFA (CENELEC), Factory Mutual Research Corporation, Canadian Standards Association.

Figure 5.5 shows, in graphical form, the maximum outside enclosure temperatures (T_{MO}) for given levels of power dissipation.

The graph was derived from the following equation and should be used to calculate accurately the suitability of any particular mix of modules.

$T_{MO} = 60°C - \delta T$

where $\delta T = k_1 \times P$

P = total power (watts) dissipated by modules in an enclosure

k_1 = is a dissipation constant for a given enclosure and module series. Select the relevant value from table 5.2.

(60°C is the temperature inside the enclosure)

Table 5.2: Dissipation constant k_1 for enclosures (°C/watt)

	DX070	DX170	DX430
MTL5000	4.03	1.88	0.82

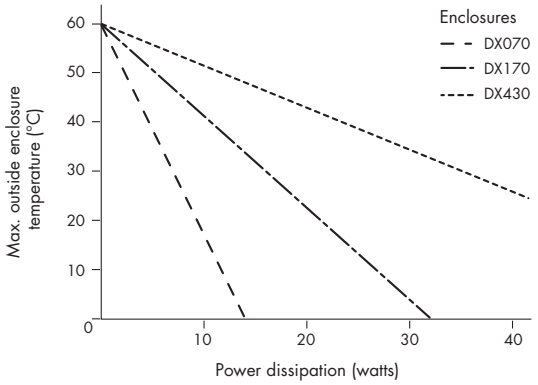


Figure 5.5: Graph depicting outside enclosure temperature limits for DX enclosures used with MTL5000 Series isolators

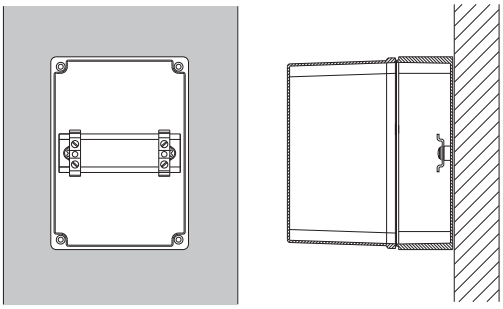


Figure 5.6: Optimum orientation for wall-mounted enclosure

Orientation of the enclosures is also important - the optimum position being on a vertical surface with the internal DIN-rail horizontal as shown in figure 5.6. Any other position can reduce the maximum allowable ambient temperature by up to 5°C.

Examples

Tables 5.3 and 5.4 list likely combinations of MTL5000 Series modules in the three enclosure types and indicate the acceptable maximum permitted outside enclosure temperature for these based on the graph in figure 5.5. See the specifications included in the latest version of MTL's IS catalogue for the power dissipation figures of individual MTL5000 Series modules.

5.1.2 Storage temperatures

Storage temperatures are safe within the range -40°C to +80°C.

5.1.3 Humidity limits

Safe humidity limits are within the range 5 to 95% RH.

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Table 5.3: Typical mix of MTL5000 Series modules

Enclosure	Modules installed	Power dissipation of modules in watts (P)	Maximum outside enclosure temp. (T_{MO})°C
DX070	2xMTL5011B + 2xMTL5044	(2x0.75) + (2x1.5) = 4.5	41.9
DX170	5xMTL5011B + 5xMTL5044	(5x0.75) + (5x1.5) = 11.25	38.9
DX430	13xMTL5011B + 13xMTL5044	(13x0.75) + (13x1.5) = 29.25	36.0

Table 5.4: Power versus maximum outside enclosure temperature

Enclosure	Number of installed modules	k_1 °C/watt	Power dissipation of modules in watts (P)	Maximum outside enclosure temp. (T_{MO}) °C
DX070	4	4.03	4.0	43.9
	4	4.03	6.0	35.8
DX170	10	1.88	10.0	41.2
	10	1.88	15.0	31.8
DX430	26	0.82	21.6	42.3
	26	0.82	39.0	28.0

5.1.4 Corrosion resistance
The effect of corrosion on DX enclosures is negligible.

5.1.5 Flammability rating
The flammable properties of the materials used in the construction of the enclosures are well understood by manufacturers and ratings have been established to a number of standards. One of the better known standards is the Underwriter's Laboratory standard UL 94 and the ratings for the enclosure materials are given as:

Materials	UL94 rating
Polycarbonate (all lids)	V2/V0
Polycarbonate with glass reinforcement (DX070 base)	V1/V0
Polyester with glass reinforcement (DX170 & DX430 bases)	V0

Items made from similar materials are well established as suitable for use in process I/O marshalling areas.

5.1.6 Impact resistance
The enclosure designs have been tested to an impact resistance of greater than 2 Joules which exceeds the BS EN 61010-1 requirements of 0.5 Joules.

5.1.7 Chemical resistance
The overall chemical resistance of the enclosures is limited by the resistance of the transparent polycarbonate lid. The glass-reinforced polycarbonate/polyester (GRP) bases have a higher resistance than plain polycarbonate. Table 5.5 lists qualitative evaluations of resistance to a variety of chemical agents.

5.2 Mounting

5.2.1 General
These instructions are concerned solely with mounting the DX enclosures. Instructions for wiring and testing individual modules within the enclosures are provided in Section 6.

Sufficient space is provided within the enclosures to accommodate tagging and earth-rail accessories but this is at the expense of a reduction in the number of modules that can be fitted.

5.2.2 Location and orientation
5.2.2.1 Location
The DX enclosures are intended for safe (non-hazardous) area use.

In N. America or Canada (because the enclosures are rated NEMA 4X) they can be used in Class 1, Division 2 (gases) location, but check with local requirements and ensure all cable entries also conform. In this case, an additional warning label will be required on or near the enclosure warning that the MTL5000 interfaces must not be removed unless the area is known to be non-hazardous. The enclosures are NOT suitable for Class II or III, Division 2 hazardous locations.

5.2.2.2 Orientation
As noted earlier (see section 5.1.1 and figure 5.6), for optimum temperature performance the enclosures should be mounted on a vertical surface with the internal DIN rail horizontal.

5.2.3 Mounting details
See figures 5.7 to 5.9 for the dimensions and mounting hole distances, etc., of the three DX enclosures. The recommended method of mounting-described here-uses the four wall-mounting lugs supplied with each enclosure. An alternative method of mounting is by direct attachment to the mounting surface through the corner holes.

Note: *When the wall-mounting lugs are used to attach the enclosures, the overall depth of the enclosure is increased by an additional 3.3 mm (DX070) or 7 mm (DX170 and DX430).*

a) At each of the four corner fixing holes, insert one of the screws provided and use it to attach a fixing lug to the base of the enclosure.

b) Each lug can be used in one of two positions as shown in figures 5.7 to 5.9.

c) Attach the lugs to the mounting surface with suitable fasteners.

d) Diameters of fixing holes in lugs are 5.5mm (DX070) and 7.0mm (DX170 and DX430)

e) Appropriate fixing hole distances are shown in figures 5.7 to 5.9.

Table 5.5: Qualitative evaluations of resistance to various chemical agents

Chemical agents	Qualitative evaluation of resistance
Salt water; neutral salts; acids (low concentrations); hydraulic oil	Excellent
Alcohols	Very good
Acids (high concentrations); alkalis (low concentrations); petrol; cooling fluids	Good
Alkalis (high concentrations); solvents.	Poor

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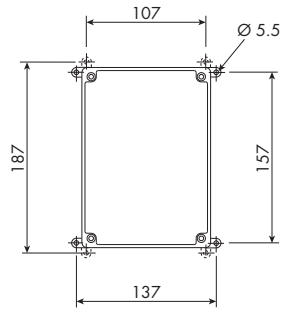


Figure 5.7: Dimensions and location of fixing holes - DX070

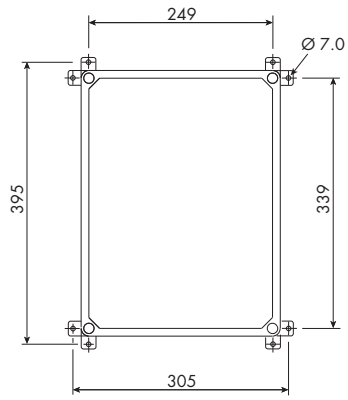


Figure 5.8: Dimensions and location of fixing holes - DX170

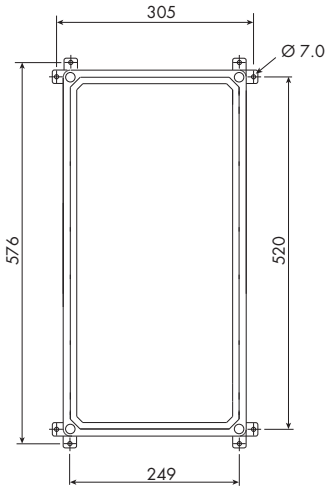


Figure 5.9: Dimensions and location of fixing holes - DX430

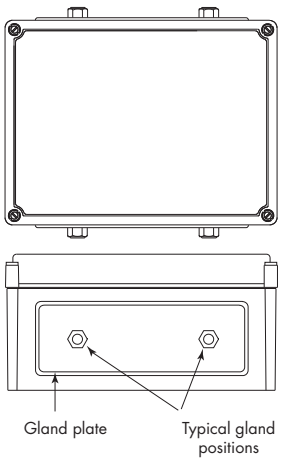


Figure 5.10: Cable gland plate locations on a DX170 enclosure

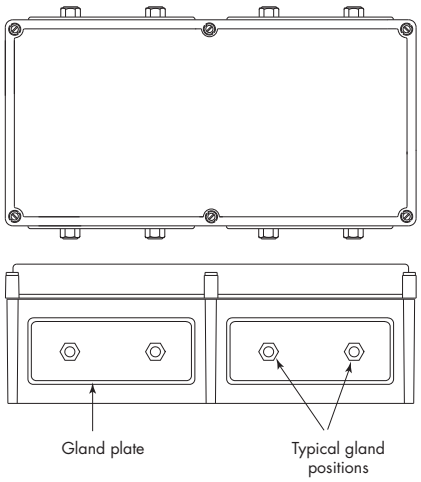


Figure 5.11: Cable gland plate locations on a DX430 enclosure

5.2.4 Cable glanding

All cables into the enclosures must be glanded to IP65 standards to maintain this rating for the enclosure as a whole. Cable glands and gland plates are not supplied. Glanding requirements vary for each enclosure as follows:

DX070

On the DX070, 'knockout' holes are provided, in two different sizes (15.5 mm and 21 mm), on the side faces of the base. See table 5.7 for recommended cable glands.

Note: *The enclosure may have three or four knockout holes on each side depending on the manufacturer. Consequently, there may be a choice of either six or eight positions for cable glands.*

DX170

The DX170 can accommodate one gland plate on each side - see figure 5.10 for details. Table 5.6 lists suppliers of suitable gland plate kits and Table 5.7 lists recommended glands.

DX430

The DX430 can accommodate two gland plates on each side - see figure 5.11 for details. Table 5.6 lists suppliers of suitable gland plate kits and Table 5.7 lists recommended glands.

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Table 5.6: Recommended gland plate kits for DX170 and DX430 enclosures.

Manufacturer/agent	Manufacturer's part number	
	Enclosure DX170	Enclosure DX430
Bowthorpe Hellermann	TL-27/360	TL-27/270
Sarel	21128	21127

Sarel (UK) *Tel+44 (0)1793 514774*
Bowthorpe Hellermann (UK) *Tel +44 (0)1922 458151*

Table 5.7: Recommended cable glands for use with DX enclosures.

Gland thread size	Cable sizes (mm)	Gland plate hole size (mm)	Weidmuller part nos.		Sarel part nos.	
			Gland	Locknut	Gland	Locknut
PG9	5 to 8	15.2	951891	952216	08871	08881
PG13,5	8 to 13	20.4	951893	952218	08873	08883

Weidmuller (UK) *Tel +44 (0)1795 580999*
Sarel (UK) *Tel +44 (0)1793 514774*

5.3 Accessories in enclosures

Apart from mounting, there are some other installation details which should be considered before adding the appropriate interface modules and making the necessary cabling connections.

A range of accessories is available to accompany the MTL5000 units (see section 4). Further details of these accessories are provided in product sheet EPS57ACC and instruction manual INM57ACC but the following points should be observed.

5.3.1 Insulating mounting block (IMB57)

A pair of these can be attached to the DIN rail, at either end of the modules, to provide a mounting for earth rails. Use of mounting blocks will reduce the space available for isolator modules.

5.3.2 Earth rails (ERL7)

Earth rail is produced in 1 metre lengths and will require cutting to length before mounting. ERL7 earth rails can be mounted either side of the modules but are typically mounted on the hazardous side of the DIN rail.

5.3.3 Tagging strip (TAG57 and TGL57)

Tagging strip is produced in 1 metre lengths and will require cutting to length before mounting. Similarly, the labels will require cutting to fit the tagging strip.

5.4 IS warning label

A 'Take Care' IS warning label is provided inside each enclosure. This should be attached to the inside of the transparent lid when its orientation has been established.

6 UNIT DESCRIPTIONS, SETTING-UP, CONNECTIONS AND TESTING

For each MTL5000 Series unit, this section describes the function (briefly), the setting-up procedure, wiring connections and includes a simple functional test. For a fuller functional description and a detailed technical specification, refer to the appropriate entry in MTL's current IS catalogue.

The functional tests can be carried out during commissioning or later, for fault finding. If a fault is suspected, first check that the power LED is lit (not applicable to loop-powered devices). If necessary, check that all signal and power plugs are properly inserted, that no wires are loose and that the unit is mounted correctly. If operation is still suspect, carry out the tests. They establish whether power supplies are connected properly and whether the isolator is operating correctly. Please return units that fail these tests to the supplier.

WARNING

When disconnecting units for testing, take care to segregate hazardous- and safe-area cables. Short circuit hazardous-area cable cores to an IS earth or insulate and secure the ends. Insulate and secure safe-area cables. If testing 'in situ' note that the test equipment used MUST be intrinsically safe.

6.1 MTL5011 single-pole relay single-channel switch/proximity detector with phase reversal (Discontinued use MTL5011B)

The MTL5011 enables a safe-area load to be relay-controlled by a switch or proximity detector located in a hazardous area. Output phase reversal (see 3.1.3) is provided.

6.1.1 Wiring connections

See figure 6.1 for wiring connections.

Note: *Reactive loads must be adequately suppressed*

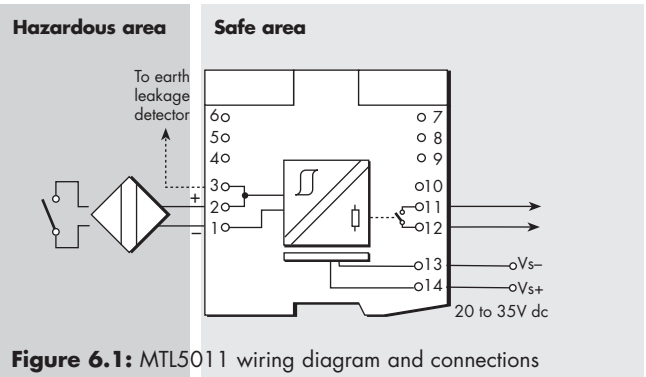


Figure 6.1: MTL5011 wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
3	Earth leakage detection
11	Output
12	Output
13	Supply –ve
14	Supply +ve

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6.1.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.2 and check status LEDs and relay contacts as follows:

Input switch	Phase reverse switch	Status LED	Relay contacts
Closed	Normal	On	Closed
Closed	Reverse	Off	Open
Open	Normal	Off	Open
Open	Reverse	On	Closed

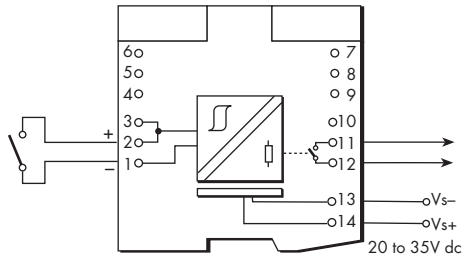


Figure 6.2: Test circuit for MTL5011

6.2 MTL5011B single-pole changeover relay single-channel switch/ proximity detector with line fault detection and phase reversal

The MTL5011B is similar to the MTL5011 but with added line fault detection (LFD) facilities.

6.2.1 Wiring connections

See figure 6.3 for wiring connections.

Note: *Reactive loads must be adequately suppressed.*

6.2.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

Input line faults (open- or short-circuit) are indicated by an LED and the de-energising of the output relay. LFD is enabled/disabled by a switch located on top of the module. Note that if the LFD facility is enabled for switch inputs, the resistors shown in figures 6.3 and 6.4 MUST be fitted.

6.2.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.4 and check the status of the output contacts as shown in table 6.1

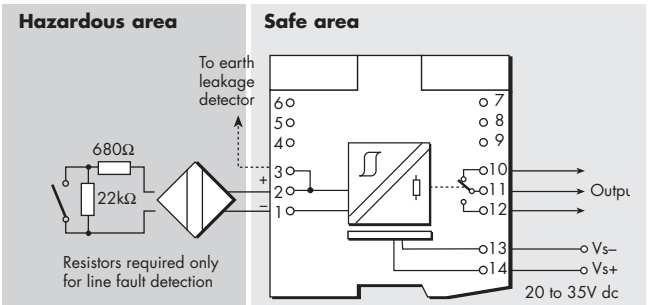


Figure 6.3: MTL5011B wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
3	Earth leakage detection
10	Normally-closed contact
11	Common
12	Normally-open contact
13	Supply –ve
14	Supply +ve

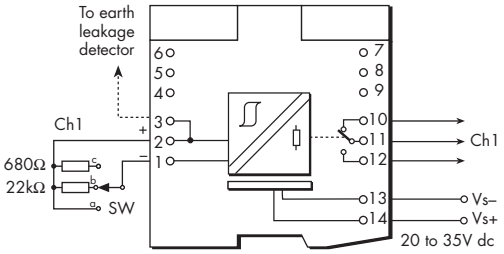


Figure 6.4: Test circuit for MTL5011B

6.3 MTL5012 solid-state single-channel switch/proximity detector with line fault detection and phase reversal

The MTL5012 enables a safe-area load to be controlled, through a solid-state output, by a switch or proximity detector in a hazardous area. Line fault detection (LFD) and output phase reversal (see 3.1.3) facilities are included.

Table 6.1

Phase reverse switch	Line fault detection	Input switch (SW)	Output relay (11-12)	Output relay (10-11)	Channel LED (yellow)	Line fault LED (red)
Normal	Off	a	Closed	Open	On	Off
Reverse	Off	a	Open	Closed	Off	Off
Reverse	Off	Open	Closed	Open	On	Off
Normal	On	Open	Open	Closed	Off	On
Normal	On	a	Open	Closed	On	On
Normal	On	b	Open	Closed	Off	Off
Normal	On	c	Closed	Open	On	Off

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6.3.1 Wiring connections

See figure 6.5 for wiring connections.

6.3.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

Input line faults (open- or short-circuit) are indicated by an LED and the non-conducting of the output. LFD is enabled/disabled by a switch located on top of the module. Note that if the LFD facility is enabled for switch inputs, the resistors shown in figures 6.5 and 6.6 MUST be fitted.

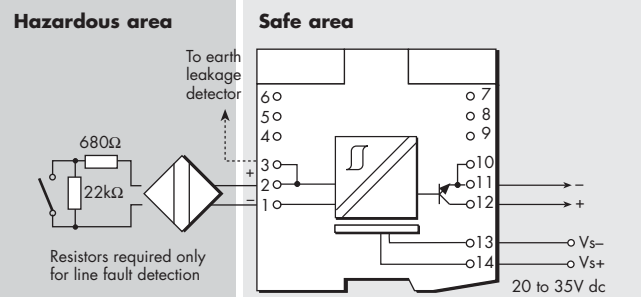


Figure 6.5: MTL5012 wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
3	Earth leakage detection
10 &11	Output –ve
12	Output +ve
13	Supply –ve
14	Supply +ve

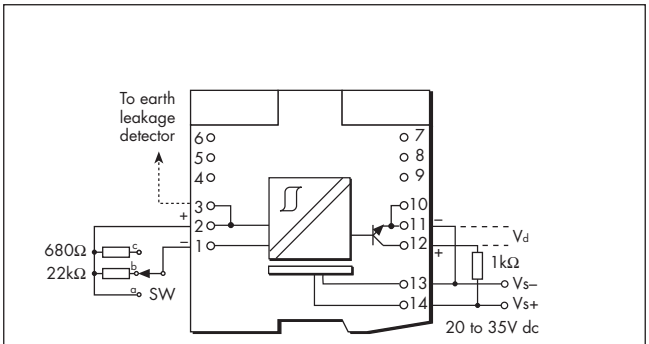


Figure 6.6: Test circuit for MTL5012

6.3.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.6 and check as shown in table 6.2

6.4 MTL5014 single-pole changeover relay single-channel dual-output switch/proximity detector with line fault detection and phase reversal

The MTL5014 enables two safe-area loads to be relay-controlled by a single hazardous-area switch or proximity detector. Phase reversal (see 3.1.3 and figure 6.8), line fault detection and slave/line fault monitoring configurations are possible.

6.4.1 Wiring connections

See figure 6.7 for wiring connections

Note: *Reactive loads must be adequately suppressed.*

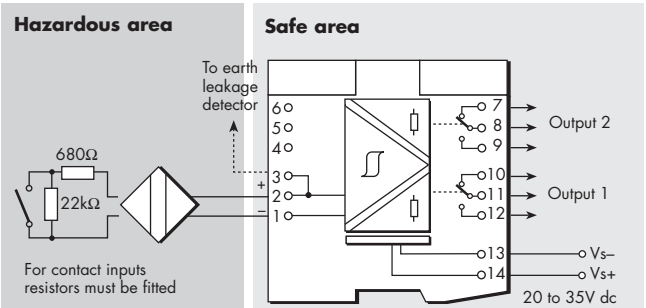


Figure 6.7: MTL5014 wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
3	Earth leakage detection
7	Normally closed (output 2)
8	Common (output 2)
9	Normally open (output 2)
10	Normally closed (output 1)
11	Common (output 1)
12	Normally open (output 1)
13	Supply –ve
14	Supply +ve

Table 6.2

Phase reverse switch	Line fault detection	Input switch (SW)	Output status (11-12)	Channel status LED (yellow)	Line fault LED (red)
Normal	Off	a	V_d < 4V	On	Off
Reverse	Off	I_{sc} = 7–9mA	$V_d = V_S$	Off	Off
Reverse	Off	Open	V_d < 4V	On	Off
Normal	On	V_{oc} = 7V5–9V5	$V_d = V_S$	Off	On
Normal	On	a	$V_d = V_S$	Off	On
Normal	On	c	V_d < 4V	On	Off
Normal	On	b	$V_d = V_S$	Off	Off

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6.4.2 Outputs

The output 1 relay reflects the status of the input and may be configured to operate in reverse phase (PR) or with line-fault detection (LF). The output 2 relay may be configured either to follow (slave mode) output 1 or as a line-integrity monitor (LFD) (see 6.4.3).

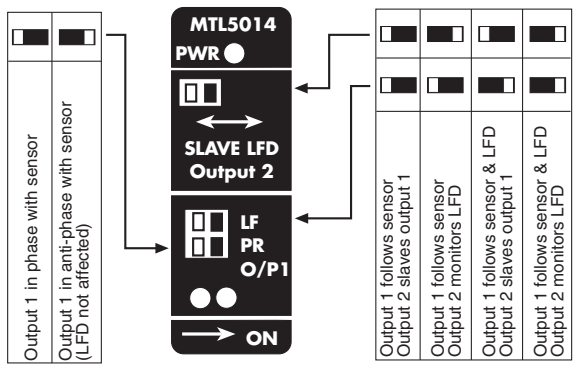


Figure 6.8: Top label of MTL5014 with explanation of switch positions

6.4.3 Line fault detection

(See section 3.1.4 for definition of a line fault)

Line-fault detection and the operational mode of output 2 (ie slave to output 1 or LFD) are selected by switches located on the top of the module (see figure 6.8).

When LFD is selected for output 2 and there is a line fault in the sensor circuit the output 2 relay is de-energised (providing an alarm output). When LF is selected for output 1, the output 1 relay is de-energised if there is a line fault in the sensor circuit. Note that resistors must be fitted when using LFD with a contact input; 500Ω to 1kΩ in series, and 20kΩ to 25kΩ in parallel with the switch.

6.4.4 Testing

Make the relevant safe- and hazardous-area connections shown in figure 6.9 for the tests listed in table 6.3. (Figure 6.8 shows the switch positions for configuring output 2 slave/LFD, output 1 line fault (LF) and phase reversal (PR)).

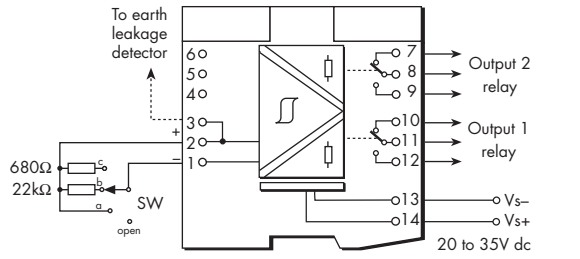


Figure 6.9: Test circuit for MTL:5014

6.5 MTL5015 solid-state two-channel switch/proximity detector with line fault detection and phase reversal

The MTL5015 enables each of two safe-area loads to be controlled, through a solid-state output, by a switch or proximity detector in a hazardous area. Line fault detection (LFD) and output phase reversal (see 3.1.3) facilities are included.

6.5.1 Wiring connections

See figure 6.10 for wiring connections.

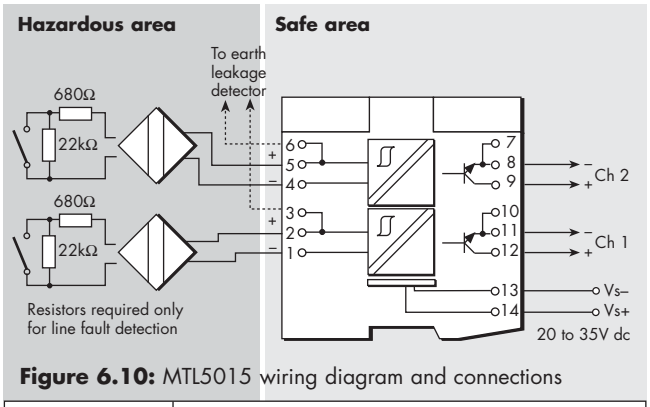


Figure 6.10: MTL5015 wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
3	Earth leakage detection
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
6	Earth leakage detection
8	Output –ve (Ch 2)
9	Output +ve (Ch 2)
11	Output –ve (Ch 1)
12	Output +ve (Ch 1)
13	Supply –ve
14	Supply +ve

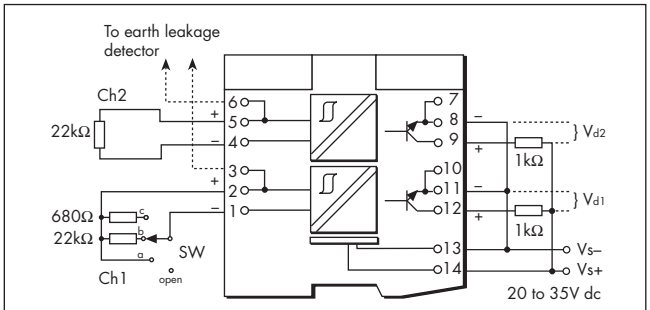


Figure 6.11: Test circuit for MTL5015

Table 6.3

Test	Phase reverse switch (PR)	Line fault detection (LF)	Slave (LFD)	Input test switch position (terminals 1 & 2)	Output 1 relay (11-12)	Output 2 relay (9-8)	Status LED (yellow)	Fault LED (red)
1	Normal	Off	LFD	(a) i.e. short-circuit	Closed	Open	On	On
2	Reverse	Off	LFD	(a) short-circuit (I_{sc}=7–9mA)	Open	Open	Off	On
3	Normal	On	Slave	(a) short-circuit	Open	Open	Off	On
4	Normal	Off	Slave	(a) short-circuit	Closed	Closed	On	Off
5	Normal	Off	Slave	open-circuit (V_{OC}=7V5–9V5)	Open	Open	Off	Off
6	Normal	On	Slave	open-circuit	Open	Open	Off	On
7	Normal	Off	LFD	(b) 22kΩ	Open	Closed	Off	Off
8	Normal	Off	LFD	(c) 680Ω	Closed	Closed	On	Off

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Table 6.4

Phase reverse switch	Line fault detection	Input switch (SW)	Output status (11-12, 8-9)	Channel status LED (yellow)	Line fault LED (red)
Normal	Off	a	V_d<4V	On	Off
Reverse	Off	a	V_d=V_S	Off	Off
Reverse	Off	open	V_d<4V	On	Off
Normal	On	open	V_d=V_S	Off	On
Normal	On	a	V_d=V_S	Off	On
Normal	On	c	V_d<4V	On	Off
Normal	On	b	V_d=V_S	Off	Off

6.5.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

On both channels, input line faults (open- or short-circuit) are indicated by an LED and the de-energising of the output. LFD is enabled/disabled by switches located on top of the module. Note that if the LFD facility is enabled for switch inputs, the resistors shown in figures 6.10 and 6.11 MUST be fitted.

6.5.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.11 and check the status of the output contacts for each channel in turn (with a 22kΩ resistor connected to the other channel) as shown in table 6.4.

6.6 MTL5016 single-pole relay two-channel switch/proximity detector with phase reversal (Discontinued, use MTL5018)

The MTL5016 enables two safe-area loads to be relay-controlled by two switches or proximity detectors located in a hazardous area. Output phase reversal (see 3.1.3) is provided.

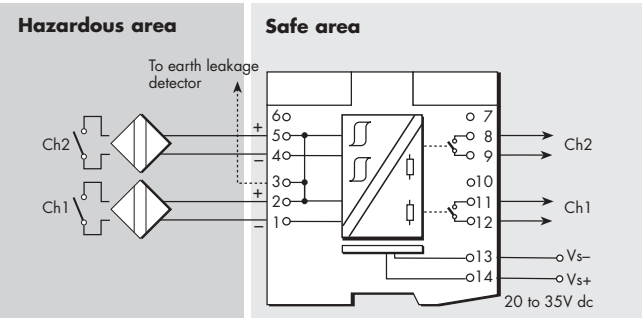


Figure 6.12: MTL5016 wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
3	Earth leakage detection
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
8	Output (Ch 2)
9	Output (Ch 2)
11	Output (Ch 1)
12	Output (Ch 1)
13	Supply –ve
14	Supply +ve

6.6.1 Wiring connections

See figure 6.12 for wiring connections.

Note: *Reactive loads must be adequately suppressed.*

6.6.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.13 and check status LEDs and relay contacts as in table 6.5.

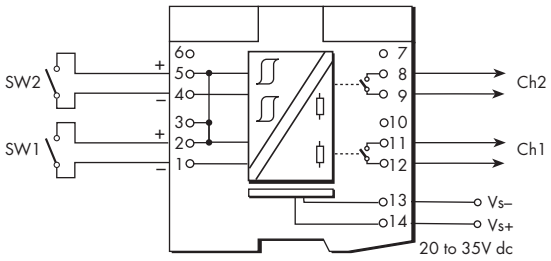


Figure 6.13: Test circuit for MTL5016

6.7 MTL5017 single-pole relay two-channel switch/proximity detector with line fault detection and phase reversal

The MTL5017 is similar to the MTL5018 but with the addition of line fault detection facilities.

6.7.1 Wiring connections

See figure 6.14 for wiring connections.

Note: *Reactive loads must be adequately suppressed.*

6.7.2 Line fault detection

(See section 3.1.4 for definition of a line-fault)

Line faults de-energise a dedicated line fault detect relay (between terminals 7 and 10) to provide an alarm facility and are indicated by an LED. Each channel relay will also de-energise (open) when a line fault exists on that channel. LFD is automatic. Note that for switch inputs the resistors shown in figures 6.14 and 6.15 MUST be fitted for correct LFD operation.

Table 6.5

Input switch (ch 1)	Input switch (ch 2)	Phase reverse switch (ch 1)	Phase reverse switch (ch 2)	Channel 1 status LED (yellow)	Channel 2 status LED (yellow)	Relay contacts (ch 1)	Relay contacts (ch 2)
Closed	Open	Normal	Normal	On	Off	Closed	Open
Closed	Closed	Normal	Normal	On	On	Closed	Closed
Closed	Closed	Reverse	Reverse	Off	Off	Open	Open
Open	Open	Reverse	Reverse	On	On	Closed	Closed

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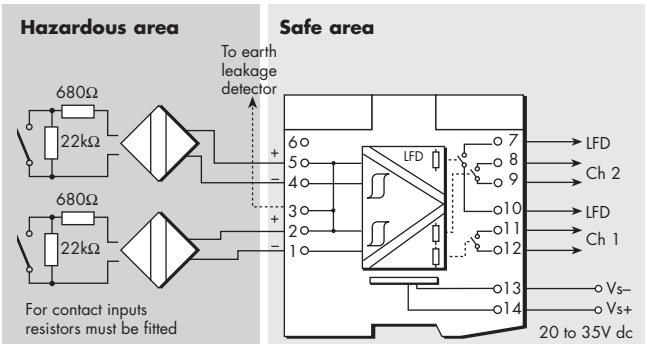


Figure 6.14: MTL5017 wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
3	Earth leakage detection
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
7	Line fault detection
8	Output (Ch 2)
9	Output (Ch 2)
10	Line fault detection
11	Output (Ch 1)
12	Output (Ch 1)
13	Supply –ve
14	Supply +ve

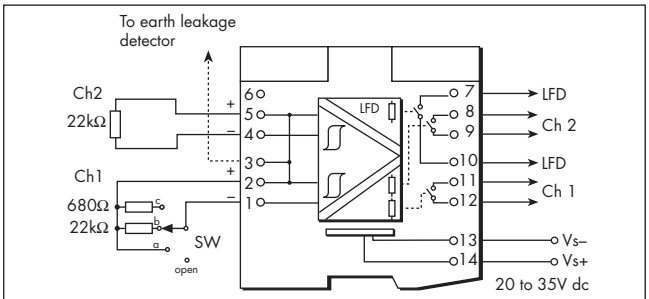


Figure 6.15: Test circuit for MTL5017

6.7.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.15 and check the status of the output contacts for each channel in turn (with a 22kΩ resistor connected to the other channel) as shown in table 6.6.

Table 6.6

Input	Output relay (11-12, 8-9)	Line-fault relay (7 & 10)
Open-circuit	Open	Open
Short-circuit	Closed	Open
680Ω	Closed	Closed
22kΩ	Open	Closed

6.8 MTL5018 single-pole, changeover relay, two-channel, switch/proximity detector with line fault detection and phase reversal

The MTL5018 modules enable each of two safe-area loads to be relay-controlled by switches or proximity detectors in a hazardous area. Line fault detection (LFD) and output phase reversal (see 3.1.3) facilities are included.

6.8.1 Wiring connections

See figure 6.16 for wiring connections.
Note: *Reactive loads must be adequately suppressed.*

6.8.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

On each channel, input line faults (open- or short-circuit) are indicated by an LED and the de-energising of the output.

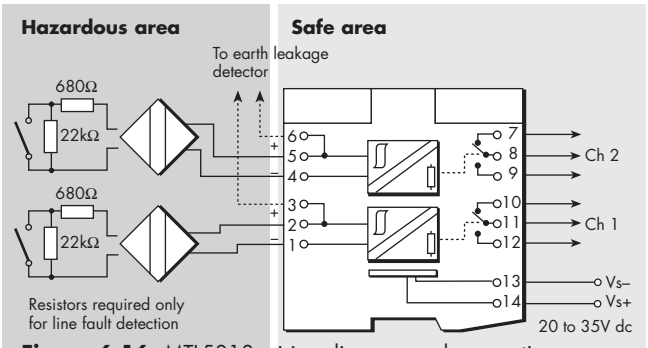


Figure 6.16: MTL5018 wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
3	Earth leakage detection
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
6	Earth leakage detection
7	Normally-closed contact (Ch 2)
8	Common (Ch 2)
9	Normally-open contact (Ch 2)
10	Normally-closed contact (Ch 1)
11	Common (Ch 1)
12	Normally-open contact (Ch 1)
13	Supply –ve
14	Supply +ve

LFD is enabled/disabled by switches located on the top of the module. Note that if the LFD facility is enabled for switch inputs, the resistors shown in figures 6.16 and 6.17 MUST be fitted.

6.8.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.17 and check the status of the output contacts for each channel in turn (with a 22kΩ resistor connected to the other channel) as shown in table 6.7.

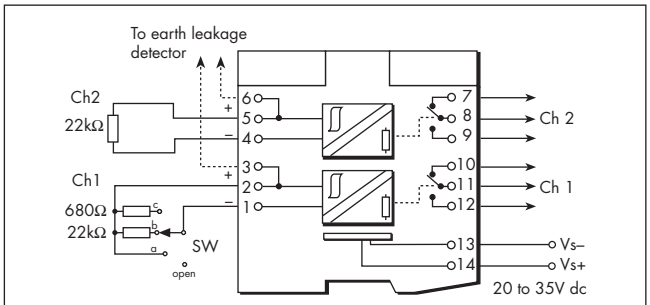


Figure 6.17: Test circuit for MTL5018

6.9 MTL5018AC single-pole, changeover relay, two-channel, switch/proximity detector with line fault detection and phase reversal

The MTL5018AC modules enable each of two safe-area loads to be relay-controlled by switches or proximity detectors in a hazardous area. Line fault detection (LFD) and output phase reversal facilities are included (see section 3.1.3).

6.9.1 Wiring connections

See figure 6.18 for wiring connections.

Note: *Reactive loads must be adequately suppressed.*

6.9.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

On each channel, input line faults (open- or short-circuit) are indicated by an LED and the de-energising of the output. LFD is enabled/disabled by switches located on the top of the module.

Note *that if the LFD facility is enabled for switch inputs, the resistors shown in figures 6.18 and 6.19 MUST be fitted.*

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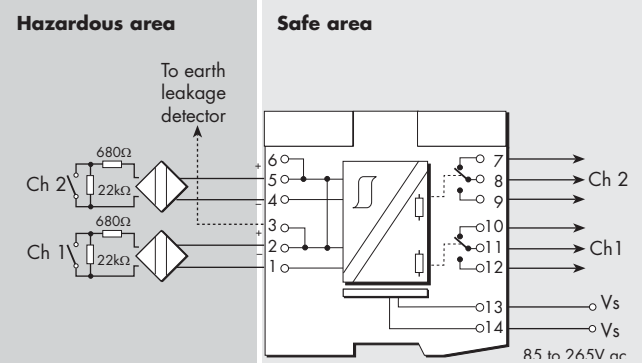


Figure 6.18: MTL5018AC wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
3	Earth leakage detection
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
6	Earth leakage detection
7	Normally-closed contact (Ch 2)
8	Common (Ch 2)
9	Normally-open contact (Ch 2)
10	Normally-closed contact (Ch 1)
11	Common (Ch 1)
12	Normally-open contact (Ch 1)
13	Supply N
14	Supply L

6.9.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.19, and check the status of the output contacts for each channel in turn (with a 22kΩ resistor connected to the other channel) as shown in table 6.7.

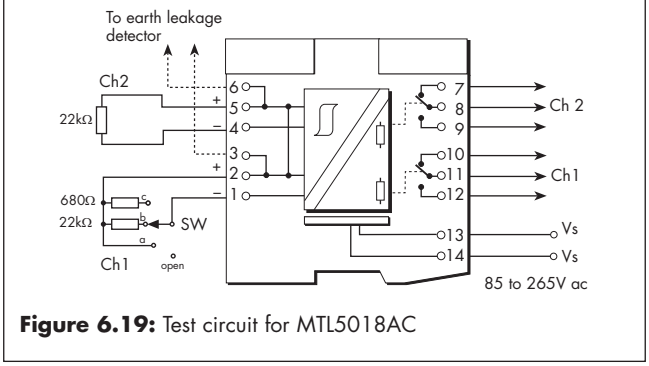


Figure 6.19: Test circuit for MTL5018AC

6.10 MTL5021 loop-powered solenoid/alarm driver, IIC

The MTL5021 enables a device located in the hazardous area to be controlled by a switch located in the safe area. Suitable for IIC applications.

610.1 Wiring connections

See figure 6.20 for wiring connections.

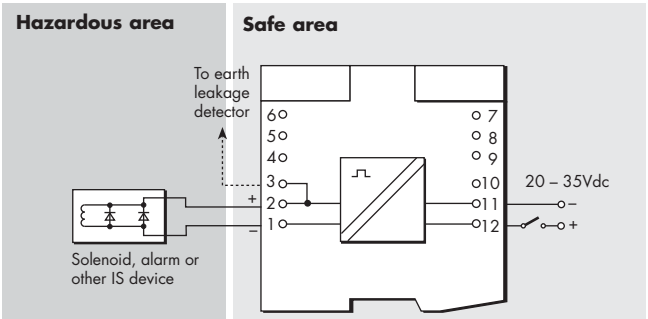


Figure 6.20: MTL5021 wiring diagram and connections

Terminal	Function
1	Output –ve
2	Output +ve
3	Earth leakage detection
11	Supply –ve
12	Supply +ve

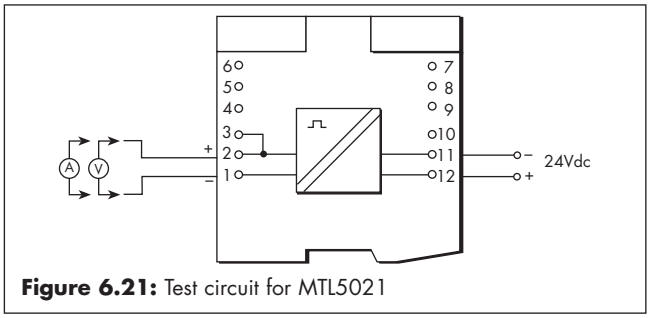


Figure 6.21: Test circuit for MTL5021

6.10.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.19, apply 24V to terminals 11 and 12 and, with no load, check voltage and short-circuit current levels at terminals 1 and 2 as follows:

Input voltage (terminals 11 & 12)	Status LED	Output voltage (terminals 1 & 2)	Short-circuit current (terminals 1 & 2)
24V dc	On	22 to 24V	—
24V dc	On	—	45 to 52mA

Table 6.7

Phase reverse switch	Line fault detection	Input switch (SW)	Output relay (11-12, 8-9)	Output relay (10-11, 7-8)	Channel status LED (yellow)	Line fault LED (red)
Normal	Off	a	Closed	Open	On	Off
Reverse	Off	I_{sc} = 7 – 9mA	Open	Closed	Off	Off
Reverse	Off	Open	Closed	Open	Off	Off
Normal	On	V_{oc} = 7.5 – 9.5V	Open	Closed	Off	On
Normal	On	a	Open	Closed	Off	On
Normal	On	b	Open	Closed	Off	Off
Normal	On	c	Closed	Open	On	Off

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6.11 MTL5022 loop-powered solenoid/alarm driver, IIB

The MTL5022 enables a device located in the hazardous area to be controlled by a switch located in the safe area. Suitable for IIA and IIB applications.

6.11.1 Wiring connections

See figure 6.22 for wiring connections.

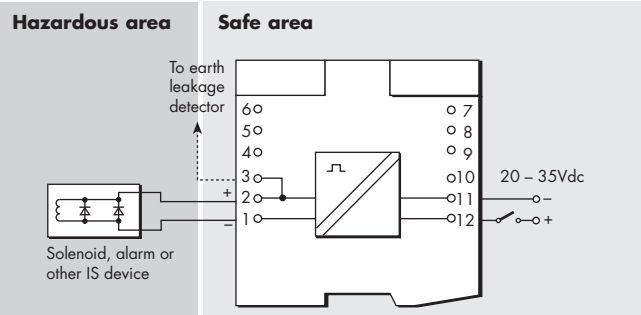


Figure 6.22: MTL5022 wiring diagrm and connections

Terminal	Function
1	Output –ve
2	Output +ve
3	Earth leakage detection
11	Supply –ve
12	Supply +ve

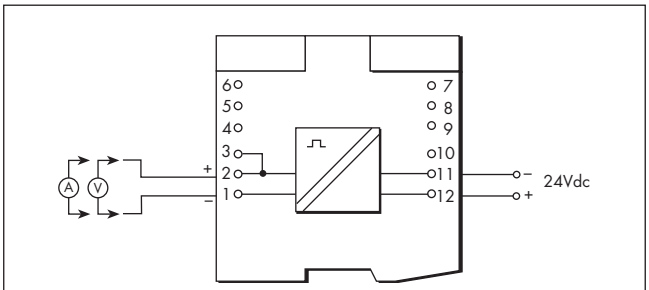


Figure 6.23: Test circuit for MTL5022

6.11.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.23, apply 24V to terminals 11 and 12 and, with no load, check voltage and short-circuit current levels at terminals 1 and 2 as follows

Input voltage (terminals 11 & 12)	Status LED yellow	Output voltage (terminals 1 & 2)	Short-circuit current (terminals 1 & 2)
24V dc	On	22 to 24V	–
24V dc	On	–	61 to 70mA

6.12 MTL5023 solenoid/alarm driver with line fault detection and phase reversal

The MTL5023 enables a device located in the hazardous area to be controlled by a volt-free contact or logic signal located in the safe area. Line fault detection (LFD) and output phase reversal (see 3.1.3) facilities are included.

6.12.1 Wiring connections

See figure 6.24 for wiring connections.

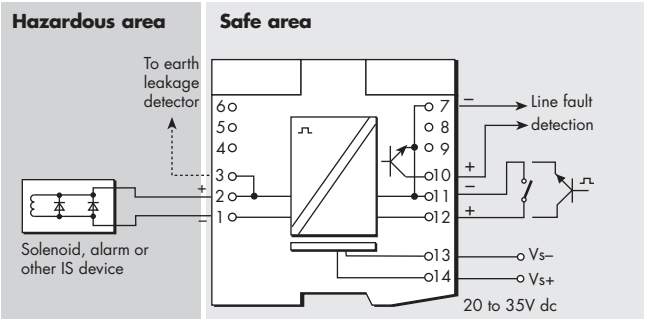


Figure 6.24: MTL5023 wiring diagram and connections

Terminal	Function
1	Output –ve
2	Output +ve
3	Earth leakage detection
7	Line fault signal -ve
10	Line fault signal +ve
11	Control –ve
12	Control +ve
13	Supply –ve
14	Supply +ve

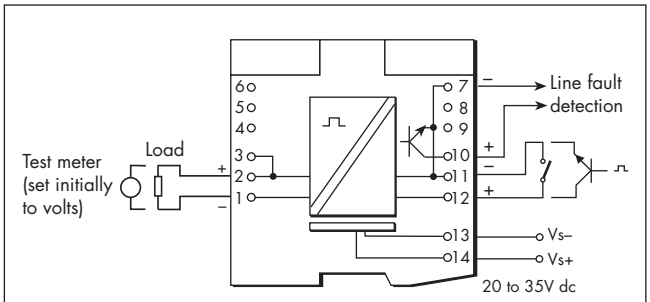


Figure 6.25: Test circuit for MTL5023

6.12.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

Hazardous-area line faults are signalled to the safe area by an LED and a solid-state switch which de-energises when a line is open- or short-circuited.

6.12.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.25 and carry out the voltage and current checks as shown in table 6.8.

Table 6.8

Input switch SW1 (terminals 11 & 12)	Load	Phase reverse switch	LFD LED (red)	Status LED (yellow)	Output voltage (terminals 1 & 2)	Output current (terminals 1 & 2)
Closed	2kΩ	Normal	Off	On	>19.5V	–
Open	2kΩ	Normal	Off	Off	<4.5V	–
Closed	15kΩ	Normal	On	On	>21.0V	–
Open	15kΩ	Normal	On	Off	<7.0V	–
Closed	Short-circuit	Normal	On	On	–	>45mA
Open	Short-circuit	Normal	On	Off	–	<6mA
Closed	Short-circuit	Reverse	On	Off	–	<6mA

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6.13 MTL5024 solenoid/alarm driver, logic drive with phase reversal

The MTL5024 enables an on/off device located in a hazardous area to be controlled by a volt-free contact or logic signal located in t he safe area. Output phase reversal (see 3.1.3) facilities are included.

6.13.1 Wiring connections

See figure 6.26 for wiring connections.

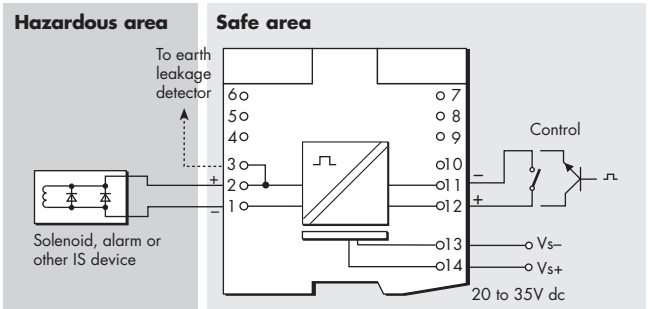


Figure 6.26: MTL5024 wiring diagram and connections

Terminal	Function
1	Output –ve
2	Output +ve
3	Earth leakage detection
11	Control –ve
12	Control +ve
13	Supply –ve
14	Supply +ve

6.13.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.27 and carry out the following output voltage and short-circuit current checks:

SW1 (terminals 11 & 12)	Phase setting	Status LED	Output voltage (terminals1 & 2)	Output current (terminals 1 & 2)
Closed	Normal	On	22 to 24V	—
Closed	Normal	On	—	45 to 52mA
Closed	Reverse	On	—	<6mA

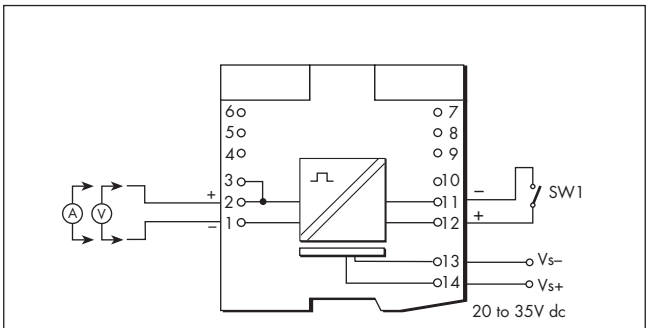


Figure 6.27: Test circuit for MTL5024

6.14 MTL5025 low-current loop-powered solenoid/alarm driver, IIC

The MTL5025 enables an on/off device located in a hazardous area to be controlled by a switch or voltage change in a safe area.

6.14.1 Wiring connections

See figure 6.28 for wiring connections.

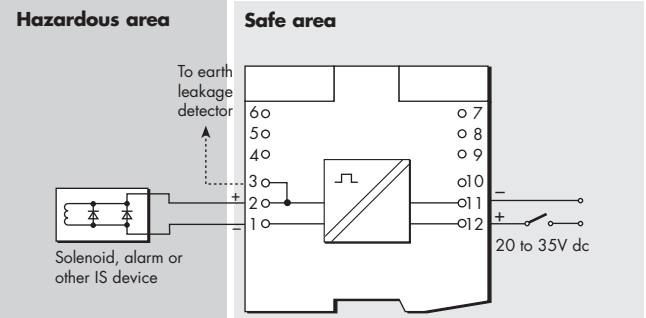


Figure 6.28: MTL5025 wiring diagram and connections

Terminal	Function
1	Output –ve
2	Output +ve
3	Earth leakage detection
11	Supply –ve
12	Supply +ve

6.14 .2 Testing

Make the safe- and hazardous-area connections shown in figure 6.29 and carry out the following output voltage and short-circuit current checks:

Input voltage (terminals 11 & 12)	Status LED	Output voltage (terminals 1 & 2)	Output current (terminals 1 & 2)
24V	On	22 to 24V	–
24V	On	–	45 to 52mA

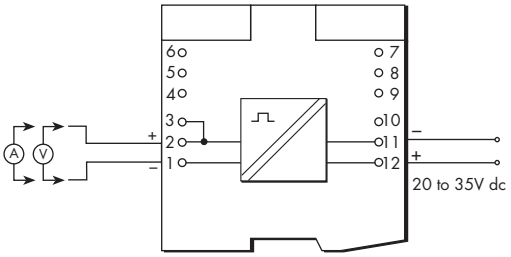


Figure 6.29: Test circuit for MTL5025

6.15 MTL5031 vibration transducer interface

The MTL5031 repeats the signal from a vibration sensor in a hazardous area to a monitoring system in a safe area.

6.15.1 Wiring connections

See figure 6.30 for wiring connections.

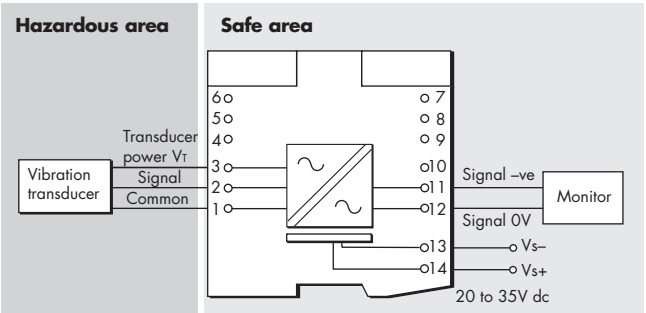


Figure 6.30: MTL5031 wiring diagram and connections

Terminal	Function
1	Common
2	Signal
3	Transducer power V_T
11	Signal –ve
12	Signal 0V
13	Supply –ve
14	Supply +ve

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6.15.2 Testing

Make the safe- and hazardous-area connection shown in figure 6.31.

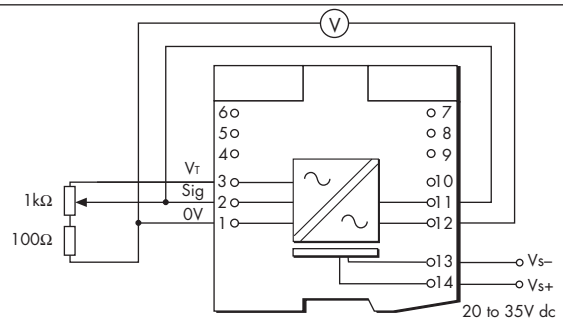


Figure 6.31: Test circuit for MTL5031

Measure the voltage on terminal 3 with respect to terminal 1; this should be >19V. Vary the potentiometer setting and check that the reading on voltmeter V varies by no more than ±100mV.

6.16 MTL5032 pulse isolator

The MTL5032 isolates pulses from a switch, proximity detector, current pulse transmitter or voltage pulse transmitter located in the hazardous area.

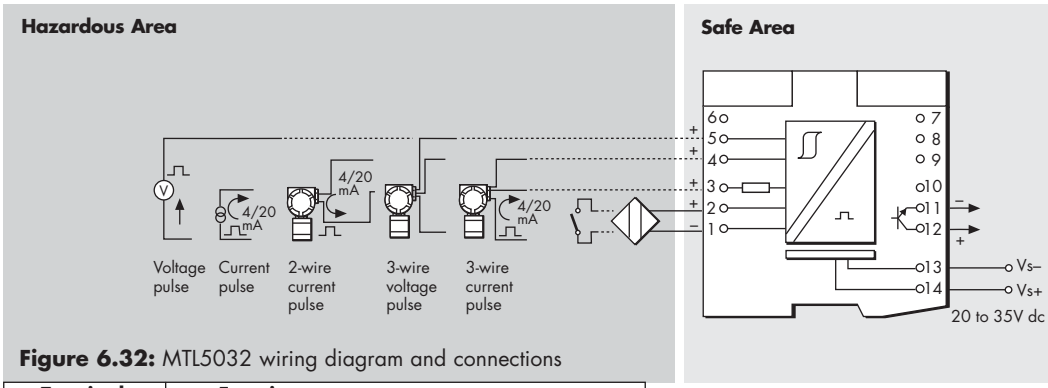


Figure 6.32: MTL5032 wiring diagram and connections

Terminal	Function
1	Common -ve
2	Proximity detector +ve
3	Current +ve
4	Transmitter +ve
5	Voltage +ve
11	Output –ve
12	Output +ve
13	Supply –ve
14	Supply +ve

6.16.1. Wiring connections

See figure 6.32 for wiring connections.

***Note:** When connected to a circuit which requires an external voltage or current input, the output may be connected in parallel with that input in conjunction with a pull-up resistor wired to terminal 12 and connected to an appropriate voltage source. The zero volt of the same voltage source should be referenced back to terminal 11. (Maximum current is 50mA; e.g. resistor value of 510Ω at 24V.)*

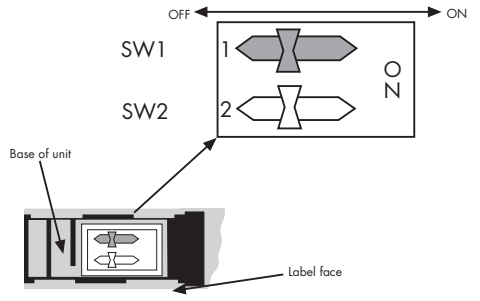


Figure 6.33: Pulse voltage selection switches

6.16.2 Voltage pulse settings

The threshold voltage for the voltage pulse input is set by two switches located on the base of the unit. Referring to figure 6.33, these are set as follows:

Threshold	SW1	SW2
3V	On	On
6V	On	Off
12V	Off	Off

6.16.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.34 and carry out the following checks:

SW1	SW2	Status LED	Test LED (terminal 14)
Closed	Open	On	On
Open	Closed	On	On

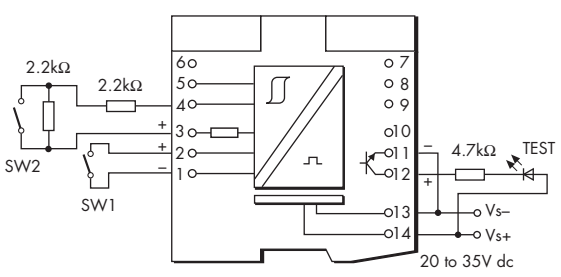


Figure 6.34: Test circuit for MTL5032

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6.17 MTL5040 2-channel 4 to 20mA loop isolator

The MTL5040 provides a fully floating dc supply for energising a conventional 2-wire 4 to 20mA transmitter located in a hazardous area. It also passes on a 4 to 20 mA or 0 to 20mA signal from a controller located in the safe area to a load in the hazardous area.

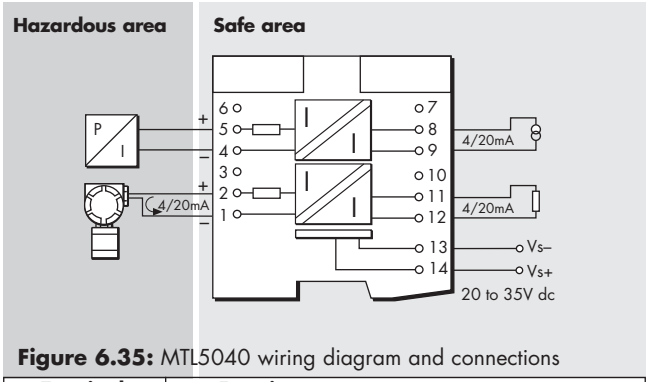


Figure 6.35: MTL5040 wiring diagram and connections

Terminal	Function
1	Input –ve (transmitter), ch 1
2	Input +ve (transmitter), ch 1
4	Output –ve (driver), ch 2
5	Output +ve (driver), ch 2
8	Input -ve (driver), ch 2
9	Input +ve (driver), ch 2
11	Output –ve (transmitter), ch 1
12	Output +ve (transmitter) ch 1
13	Supply –ve
14	Supply +ve

6.17.1 Wiring connections

See figure 6.35 for wiring connections.

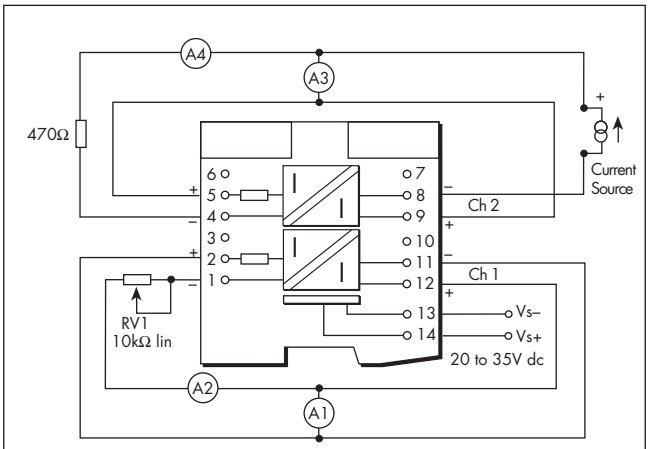


Figure 6.36: Test circuit for MTL5040

6.17.2 Testing

Make the safe and hazardous-area connections shown in figure 6.36 and, using RV1 to vary the output current on channel 1, and using the current source to vary the output current on channel 2, carry out the checks shown in table 6.9

Table 6.9

Output current (A2 for Ch 1 and A4 for Ch 2)	Current reading (A1 for Ch 1 and A3 for Ch 2)	Channel 1 Voltage (terminal 2 with respect to terminal 1)
4 to 20mA	<±20µA	
20mA		>16.5V

6.18 MTL5041/42 repeater power supplies

The MTL5041/42 provide fully-floating dc supplies for energising conventional 2-wire 4 to 20mA transmitters located in a hazardous area. They repeat the current in another floating circuit to drive safe-area loads. The MTL5042 also provides similar facilities for 3-wire transmitters and permits bi-directional transmission of 'smart' digital communication signals superimposed on the 4 to 20mA signal.

Note: *MTL5042 terminals 1 and 3 only support HART® communications in one direction from field device to safe-area connections 11 and 12.*

6.18.1 Wiring connections

See figures 6.37 and 6.38 for wiring connections (MTL5041 and MTL5042 respectively).

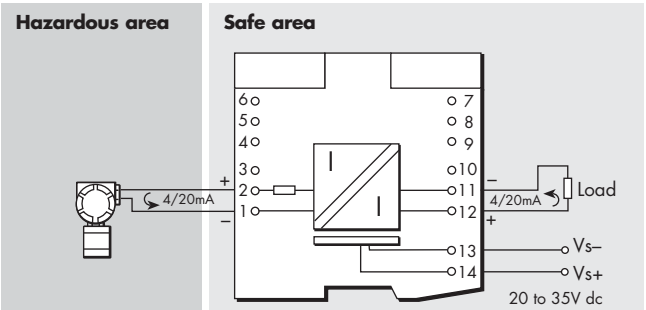


Figure 6.37: MTL5041 wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
11	Output –ve
12	Output +ve
13	Supply –ve
14	Supply +ve

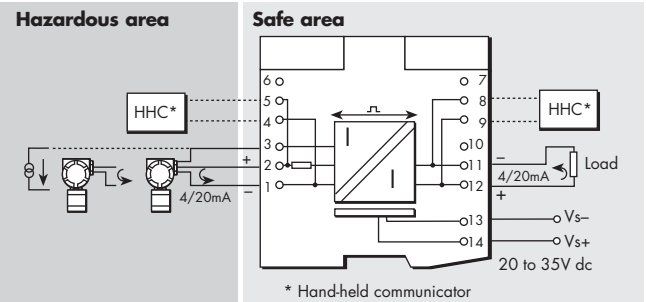


Figure 6.38: MTL5042 wiring diagram and connections

Terminal	Function
1	Current Input
2	Transmitter supply +ve
3	Common
4	Optional HHC -ve
5	Optional HHC +ve
8	Optional HHC -ve
9	Optional HHC +ve
11	Output –ve
12	Output +ve
13	Supply –ve
14	Supply +ve

6.18.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.39 and, using RV1 to vary the output current, carry out the checks shown in table 6.10.

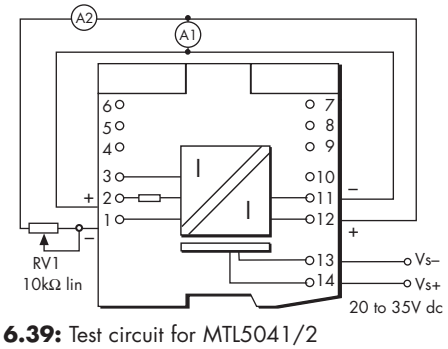


Figure 6.39: Test circuit for MTL5041/2

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Table 6.10

Output current (A2)	Current reading (A1) (MTL5041)	Current reading (A1) (MTL5042)	Voltage (terminal 2 with respect to terminal 1) (MTL5041)	Voltage (terminal 2 with respect to terminal 1) (MTL5042)
4 to 20mA	<±20µA	<±10µA	—	—
20mA	—	—	>16.5V	>16.5V

6.19 MTL5043 repeater power supply dual output, 4 to 20mA for 2-wire transmitters

The MTL5043 provides fully-floating dc supplies for a single conventional 2-wire 4 to 20mA transmitter located in a hazardous area and driving two safe-area loads. The MTL5043 design changed to add HART functionality at the end of 2003.

6.19.1 Wiring connections (earlier non-HART version)

See figure 6.40 for wiring connections.

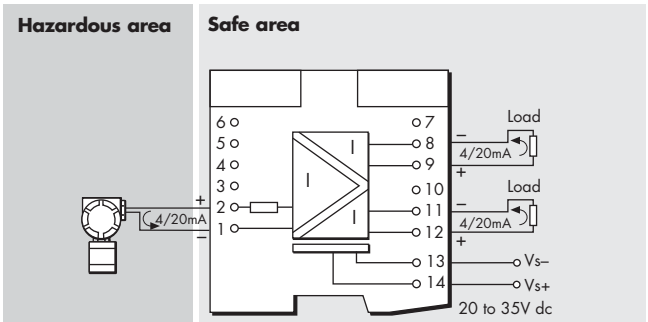


Figure 6.40: MTL5043 wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
8	Output –ve (Ch 2)
9	Output +ve (Ch 2)
11	Output –ve (Ch 1)
12	Output +ve (Ch 1)
13	Supply –ve
14	Supply +ve

6.19.2 Wiring connections (HART version)

See figure 6.41 for wiring connections.

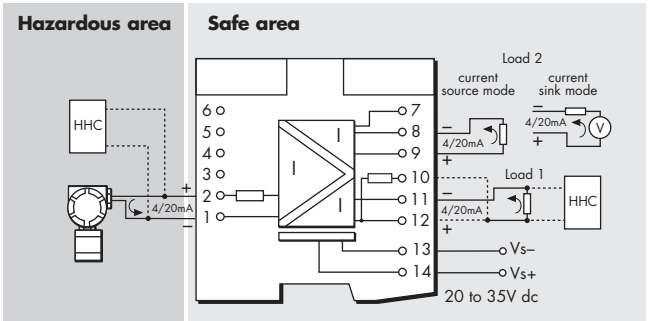


Figure 6.41: MTL5043 wiring diagram and connections

Terminal	Function
1	Input –ve
2	Input +ve
7	Output –ve (Ch 2 passive current sink)
8	Output –ve (Ch 2 active/+ve current sink)
9	Output +ve (Ch 2 active)
10	Output +ve (Ch 1 via 220Ω for HART apps.)
11	Output –ve (Ch 1)
12	Output +ve (Ch 1)
13	Supply –ve
14	Supply +ve

6.19.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.42 and, using RVI to vary the output current, carry out the following checks:

Output current (A2)	Current reading (A1)	Voltage terminal 2 with respect to terminal 1)
4 to 20mA	<±20µA	—
20mA	—	>16.5V

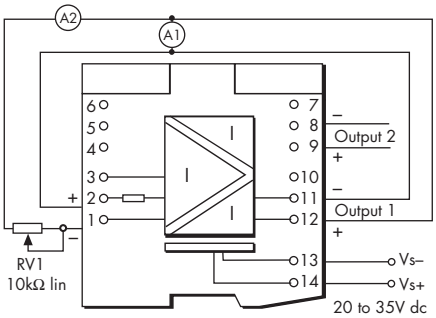


Figure 6.42: Test circuit for MTL5043

6.20 MTL5044 repeater power supply

The MTL5044 provides fully-floating dc supplies for two conventional 2-wire 4 to 20mA transmitters located in a hazardous area and repeating the current in two floating circuits to drive two safe-area loads.

6.20.1 Wiring connections

See figure 6.43 for wiring connections.

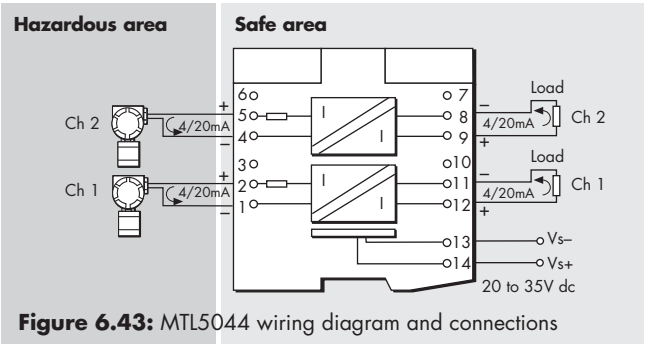


Figure 6.43: MTL5044 wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
8	Output –ve (Ch 2)
9	Output +ve (Ch 2)
11	Output –ve (Ch 1)
12	Output +ve (Ch 1)
13	Supply -ve
14	Supply +ve

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6.20.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.44 and, using RV1 to vary the output current, carry out the following checks, first on channel 1 and then on channel 2:

Output current (A2)	Current reading (A1)	Voltage channel 1 (terminal 2 with respect to terminal 1)	Voltage channel 2 (terminal 5 with respect to terminal 4)
4 to 20mA	<±20µA	–	–
20ma	–	>16.5V	–
20ma	–	–	>16.5V

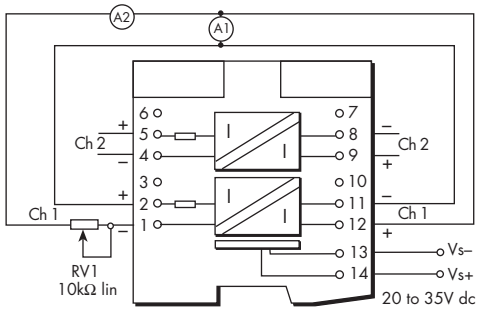


Figure 6.44: Test circuit for MTL5044

6.21 MTL5045/46 isolating drivers

The MTL5045/46 isolate and pass on a 4 to 20mA signal from a controller located in a safe area to a load in a hazardous area. The MTL5046 also permits bi-directional transmission of 'smart' digital communication signals superimposed on the 4 to 20mA signal, and is provided with line fault detection (LFD).

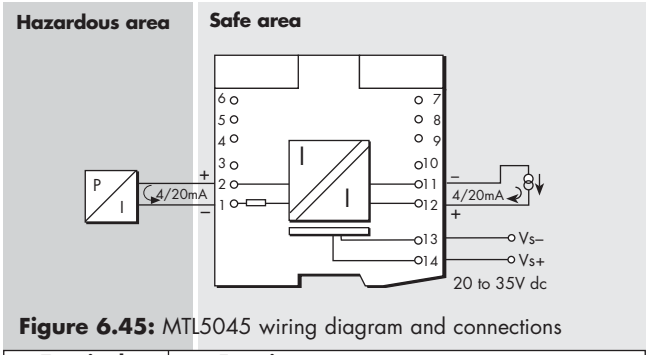


Figure 6.45: MTL5045 wiring diagram and connections

Terminal	Function
1	Output –ve
2	Output +ve
11	Input –ve
12	Input +ve
13	Supply –ve
14	Supply +ve

6.21.1 Wiring connections

See figures 6.45 and 6.46 for wiring connections (MTL5045 and MTL5046 respectively).

6.21.2 Line fault detection (LFD) (MTL5046 only)

(See section 3.1.4 for definition of a line fault)

Line fault detection is signalled by an impedance change in the safe-area loop. When a line fault occurs, the impedance between terminals 11 and 12 is >100kΩ.

6.22.1 Testing

Make the safe and hazardous-area connections shown in figure 6.47 and, using the current source to vary the output current, carry out the checks shown in the table above figure 6.47.

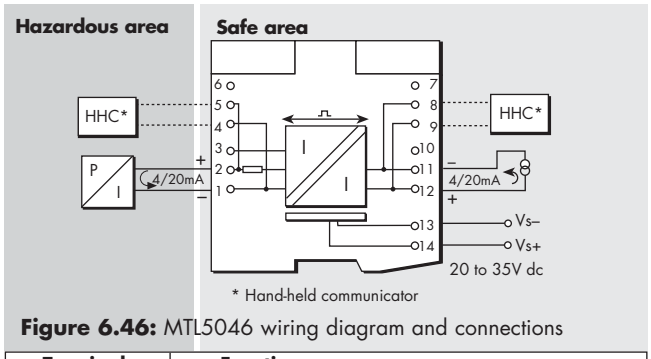


Figure 6.46: MTL5046 wiring diagram and connections

Terminal	Function
1	Output –ve
2	Output +ve
4	Optional HHC -ve
5	Optional HHC +ve
8	Optional HHC -ve
9	Optional HHC +ve
11	Input –ve
12	Input +ve
13	Supply –ve
14	Supply +ve

Output current (A2)	Current reading (A1) (MTL5045)	Current reading (A1) (MTL5046)
4 to 20mA	<±20µA	<±10µA

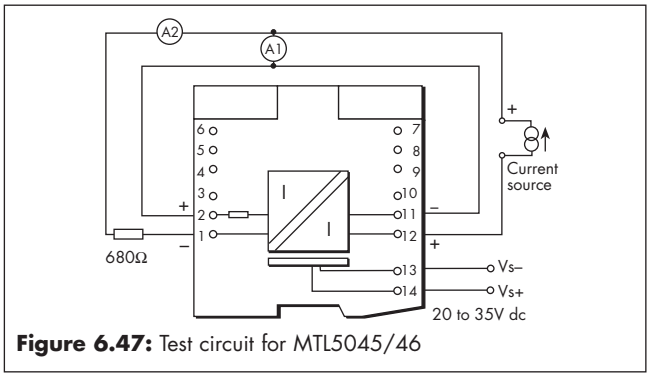


Figure 6.47: Test circuit for MTL5045/46

6.22 MTL5048 analogue input/output, loop-powered isolator

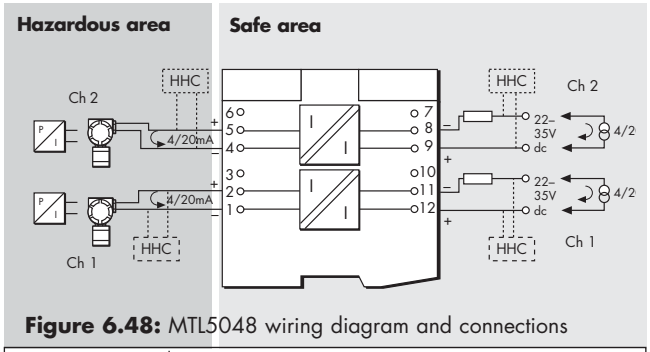


Figure 6.48: MTL5048 wiring diagram and connections

Terminal	Function
1	Tx– or input connection –ve (Ch 1)
2	Tx+ or input connection +ve (Ch 1)
4	Tx– or input connection –ve (Ch 2)
5	Tx+ or input connection +ve (Ch 2)
8	Output –ve or input +ve (Ch 2)
9	Output +ve or Tx supply +ve (Ch 2)
11	Output –ve or input +ve (Ch 1)
12	Output +ve or Tx supply +ve (Ch 1)

The MTL5048 is a dual channel analogue input/output loop-powered isolator being powered from the safe area side. The same current flows in both hazardous and safe-area circuits and can be controlled

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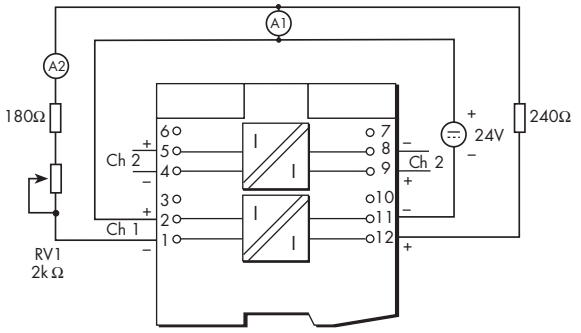


Figure 6.49: Test circuit for MTL5048

from either. For smart two–wire transmitters it provides bi-directional communication signals superimposed on the 4/20mA signal. The MTL5048 can also be used for isolating and passing a 4/20mA signal from the safe area to the hazardous-area. The transmitter can be interrogated either from the operator station or by a hand-held communicator (HHC) for both the channels.The MTL5049 isolates and passes on two 4 to 20mA signals from a controller located in a safe area to two loads in a hazardous area.

6.22.1 Wiring connections

See figure 6.48 for wiring connections.

6.22.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.49 and, using RV1 to vary the output current, carry out the following checks, first on channel 1 and then on channel 2.

Output current (A2)	Current reading (A1)
4 to 20mA	<±80µA

6.23 MTL5049 two-channel isolating driver

The MTL5049 isolates and passes on two 4 to 20mA signals from a controller located in a safe area to two loads in a hazardous area.

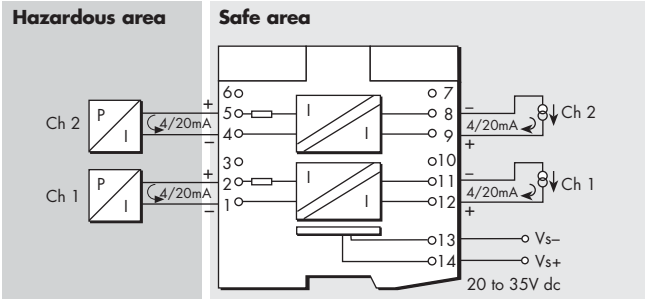


Figure 6.50: MTL5049 wiring diagram and connections

Terminal	Function
1	Output –ve (Ch 1)
2	Output +ve (Ch 1)
4	Output -ve (Ch 2)
5	Output +ve (Ch 2)
8	Input -ve (Ch 2)
9	Input +ve (Ch 2)
11	Input –ve (Ch 1)
12	Input +ve (Ch 1)
13	Supply –ve
14	Supply +ve

6.23.1 Wiring connections

See figure 6.50 for wiring connections.

6.23.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.51 and, using the current source to vary the output current, carry out the following checks, first on channel 1 and then on channel 2.

Output current	Current reading (A1)
4 to 20mA	<±20µA

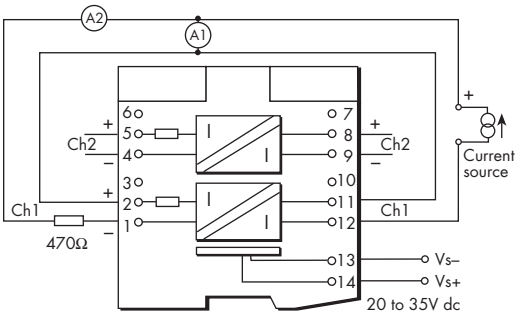


Figure 6.51: Test circuit for MTL5049

6.24 MTL5051 serial data comms isolator

The MTL5051provides either bi-directional serial data communications from a computer system in a safe area to instrumentation in a hazardous area or data communications across a hazardous area. It is used to provide a fully floating dc supply for, and serial data communications to MTL640 text displays and MTL650 series text and graphics terminals or to other IS and non-IS instrumentation and keyboards.

6.24 .1 Wiring connections

See figures 6.52 and 6.53 and the terminal specifications in tables 6.11 and 6.12 for wiring connections. See also section 6.22.2 on hazardous-area interfacing.

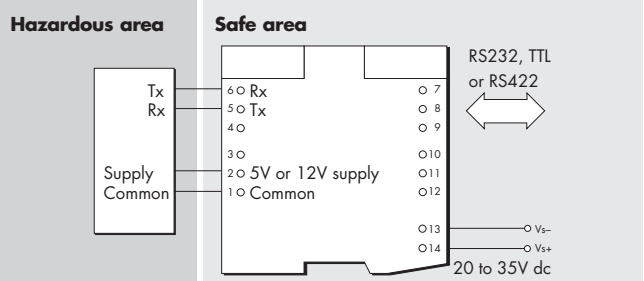


Figure 6.52: MTL5051 wiring diagram (to a hazardous area)

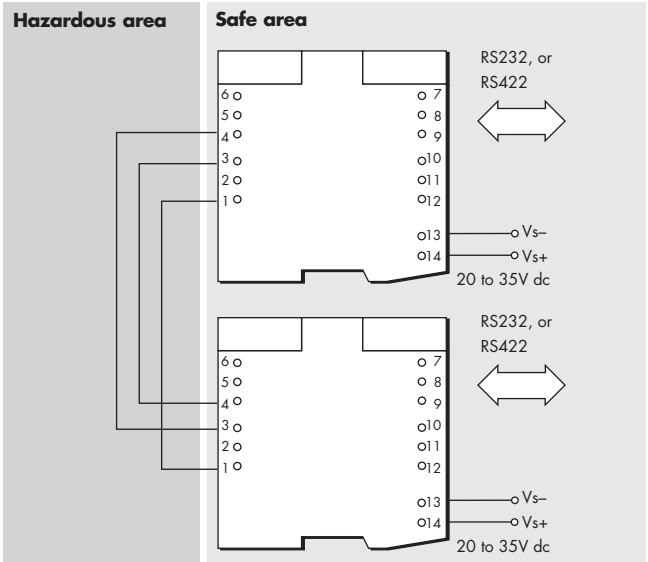


Figure 6.53: MTL5051 wiring diagram (across a hazardous area)

6.24.2 Hazardous-area interfacing

Displays/terminals: For details of interfacing with MTL640 and MTL650 series displays/terminals (as an alternative to the MTL696 communications interface) see the appropriate product instruction manual.

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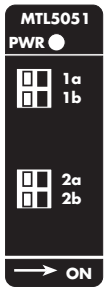


Figure 6.54: Top label, MTL5051

Table 6.11 (see also figure 6.54)

MTL5051 Terminals	MTL640 mode	MTL650 mode	Comms mode	Other IS devices
1	Common	Common	Common	Common
2	V signal	12V	-	5V/12V
3	I return	Rx	Rx	-
4	-	Tx	Tx	-
5	-	-	-	Tx
6	-	-	-	Rx
Switch				
1a	On	Off	Off	Off
1b	On	On	On	Off/On

Table 6.12 (see also figure 6.52)

Terminals	RS232 mode	TTL mode	RS422 mode
7	-	-	Rx -
8	-	-	Rx+
9	-	Tx	Tx+
10	Tx	-	Tx-
11	Common	Common	Common
12	Rx	Rx	-
13	Supply -ve	Supply -ve	Supply -ve
14	Supply +ve	Supply +ve	Supply +v
Switch			
2a	Off	On	On
2b	On	Off	Off

Across hazardous areas: For communication across hazardous areas MTL5051 devices are used in pairs to transfer bi-directional full-duplex data across hazardous areas, as shown in figure 6.53. Current switching is used to minimise the bandwidth-limiting effects of long cables.

The maximum baud rate in this mode is the lesser of 19.2k baud or the cable-related rate produced by the following formula.

Remote signalling baud rate formula, for back-to-back mode across a hazardous area:

max baud rate = $K/(RxCxL^2)$

where K = 0.25 (constant)

R = cable resistance (Ω/m)

C = cable capacitance (F/m)

L = length (m)

For example, with a 2km cable of 100pF/m capacitance and 40mΩ/m resistance, the maximum baud rate = $0.25/(40m\Omega \times 100pF \times 2km^2)$ = 15k baud. This assumes that the cable is 2 cores plus screen, with the screen used for the 'common' connection.

RS232-level devices: Communication with RS232-level interfaces, such as a suitably certified IS keyboard, mouse, etc, is achieved by using one or more MTL5051 units as required by the IS device.(TTL level interfaces are accommodated by the TTL compatibility of RS232 receivers.)

The supply to IS equipment at terminal 2 can be set to either 5V or 12V, by a switch located on top of the unit, as follows:

+12V mode 12.0V ±5% (load <23mA)

+12V mode 8.0V min (load >23mA to <50mA)

+5V mode5.6V ±5% (load >23mA to <50mA)

Note: *the normal RS232 limitations of bandwidth versus cable length are applicable. As a rule of thumb, speed (baud) x length (metres) <150,000.*

6.24.3 Testing

Remove all safe- and hazardous-area connections and apply 24V dc to terminals 13 and 14 as shown in figure 6.55. Check that the green power LED (on top of the unit) is on. Put all switches in the On position. With no load, check for nominal current of 60mA ±5mA at terminal 14. Correct operation of the communication modes is indicated by signals received and/or transmitted.

6.25 MTL5053 isolator/power supply for 31.25kbit/s fieldbuses

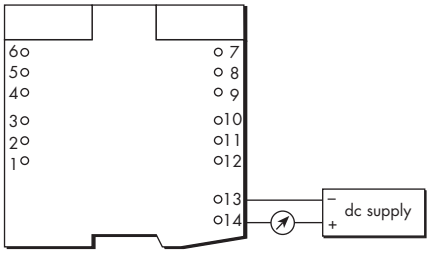


Figure 6.55: Test circuit for MTL5051

The MTL5053 has been specifically developed to extend 31.25kbit/s (H1) fieldbus networks into hazardous areas. It provides power, communication and IS isolation to devices powered through the signal conductors. The MTL5053 complies with the requirements of Fieldbus Foundation™ specified power supply Type 133 (IS power supply).

To comply with fieldbus standards, each bus must be terminated at both ends. MTL's FBT1-IS or FCS-MBT fieldbus terminators (see section 6.33) can be supplied for this purpose or, for installations in which the safe-area bus length is small, the MTL5053 includes an internal safe-area terminator which is enabled by a switch located on the top of the unit.

For network and termination criteria, check applicable fieldbus standards and specification *IEC 61158-2, ISA-S50.02 for 31.25kbit/s fieldbus systems, Foundation™ Fieldbus 31.25kbit/s Physical Layer Profile Specification FF-816* and MTL's Application Brief AB002.)

6.25.1 Wiring connections

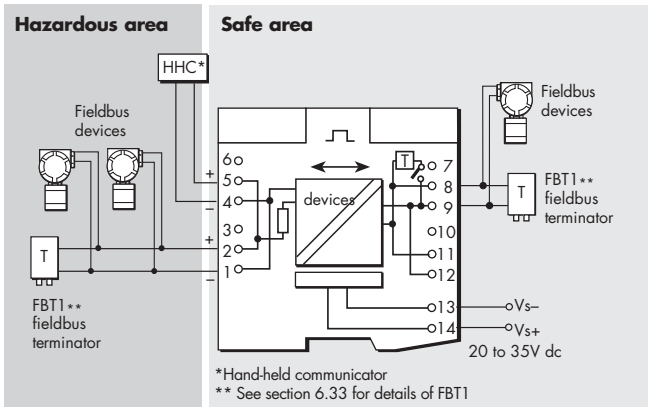


Figure 6.56: MTL5053 wiring diagram and connections

Terminal	Function
1	Hazardous-area fieldbus device(s) connection –ve
2	Hazardous-area fieldbus device(s) connection +ve
4	Optional HHC connection –ve
5	Optional HHC connection +ve
8 & 11	Safe-area fieldbus device(s) connection –ve
9 & 12	Safe-area fieldbus device(s) connection +ve
13	Supply –ve
14	Supply +ve

See figure 6.56 for wiring connections and refer to MTL's Application Brief AB002. ***Note:*** *To assist the process of terminating cable screens, screw terminals have been provided in terminal positions 3 and 6 and 7 and 10. Please note, however, that there is no internal connection for these terminals so they are not earthed.*

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6.25.2 Testing

Make the safe and hazardous-area connections shown in figure 6.56 and, substituting appropriate resistors at R_{test}, carry out the following checks.

R_{test}	Voltage across terminals 2 and 1 (V_1)
Open-circuit	17.8 < V_1 <19V
220Ω	11.5V <V_1 <13.5V
10Ω	V_1 <5V

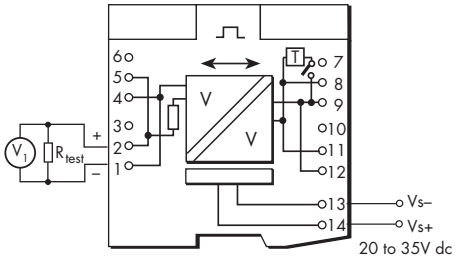


Figure 6.57 : Test circuit for MTL5053



Figure 6.58: Top label, MTL5053

6.26 MTL5061 two-channel loop-powered fire/smoke detector interface

The MTL5061 isolates two conventional fire and smoke detectors located in hazardous areas. The triggering of a detector causes a corresponding change in the safe-area circuit. The unit has reverse input polarity, and 'non-fail' earth fault detection on either line can be provided.

6.26.1 Wiring connections

See figure 6.59 for wiring connections.

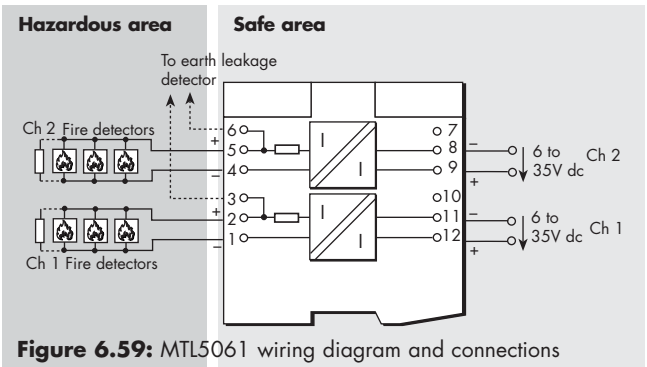


Figure 6.59: MTL5061 wiring diagram and connections

Terminal	Function
1	Output –ve (Ch 1)
2	Output +ve (Ch 1)
3	Earth leakage detection (Ch 1)
4	Output –ve (Ch 2)
5	Output +ve (Ch 2)
6	Earth leakage detection (Ch 2)
8	Input –ve (Ch 2)
9	Input +ve (Ch 2)
11	Input –ve (Ch 1)
12	Input +ve (Ch 1)

6.26.2 'No-fail' earth fault protection

Protection is enabled by connecting earth leakage detectors, such as MTL2220s (not CE marked), to the MTL5061; via terminal 3 or 6, or both. To maintain isolation between the two channels, separate earth leakage detectors are required. If a fault on either line of each channel is detected, the unit continues working.

Note: *The MTL2220 introduces a 100µA, 1Hz ripple to the field circuit.*

6.26.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.60 and, using RV1 to vary the output current, carry out the following check for both channel 1 and channel 2:

Output current (A2)	Current reading (A1)
10 to 40mA	<±400µA

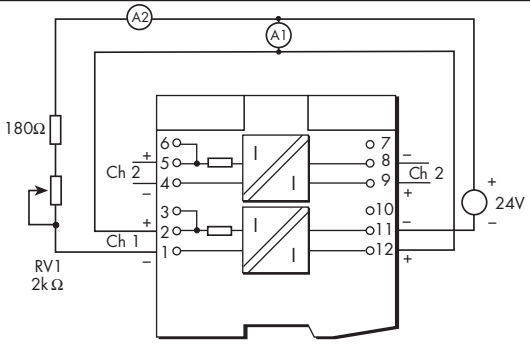


Figure 6.60: Test circuit for MTL5061

6.27 MTL5074 temperature converters, THC or RTD input

The MTL5074 converts low-level signals from temperature sensors located in a hazardous area into 4 to 20mA signals for driving safe-area loads.

Note: The earlier model MTL5073 had an internal link between terminals 11 and 13. The MTL5073 model is discontinued.

6.27.1 Wiring connections

See figure 6.61 for wiring connections.

Note: *for THC inputs requiring cold-junction compensation, a HAZ-CJC hazardous-area connector (with integrated CJC sensor) is required not a HAZ1-3 signal plug.*

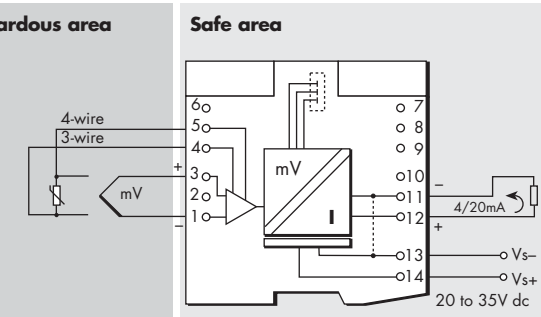


Figure 6.61: MTL5073/74 wiring diagram

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

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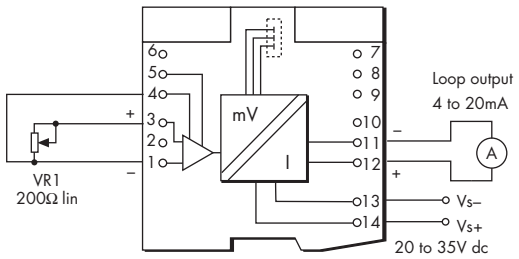
6.27.2 Testing

Default parameters for the MTL5074, unless custom configured by MTL, are:

Input type	3-wire RTD
Linearisation	enabled
Units	°C
Cj compensation	disabled
Damping value	0 sec
Smoothing value	0 sec
Output zero	0°C
Output span	250°C
Tag and description fields	clear
Open circuit alarm	high
Transmitter failure alarm	low
Cj failure alarm	low
Line frequency	50Hz

Note: *the configuration of MTL5074 cannot be changed without the aid of a PCS/PCL45 configurator (see INM073A Connection and Configuration Manual for full details). These devices also enable more comprehensive testing of the converters.*

Make the safe- and hazardous-area connections shown in figure 6.62. Note that the range of the dc ammeter 'A' must be suitable for 4 to 20mA currents and the variable resistor 'R' should have a range of 0-200Ω and, ideally, should be a decade resistance box. Switch on the power supply and check that the green power LED comes on (if it flashes, the unit is incorrectly configured or the test wiring setup is faulty). Check that the loop output current at 'A' varies as the variable resistance at 'R' is altered and check the table below for particular settings (194Ω @250°C and 100Ω @0°C for a PT100 sensor).



Note: The MTL5073 (which is no longer manufactured) had an internal link between terminals 11 and 13.

Figure 6.62: Test circuit for MTL5074

Input resistance (R)	Loop output current (A)	Power LED (green)
194Ω	20mA	On
100Ω	4mA	On
Open circuit	22.25mA	Flashing
Short circuit	22.25mA	Flashing

6.28 MTL5081 millivolt isolator

The MTL5081 takes a low level dc signal from a voltage source in a hazardous area, isolates it and passes it to a receiving instrument located in the safe area. Although used with thermocouples, this unit does not have cold junction compensation facility. It is intended for use with thermocouples utilising external cold junction compensation. When using with thermocouples, in order to minim ise the temperature gradient between the safe- and hazardous-area terminals, it is recommended that the units are mounted on vertical DIN rail (see figure 6.63).

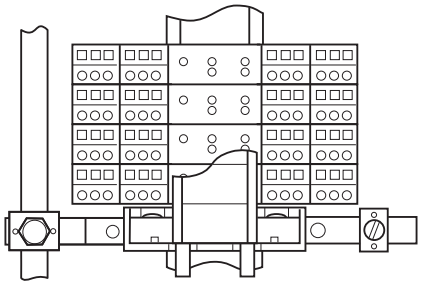


Figure 6.63: MTL5000 Series units mounted on vertical DIN rail

A switch located on top of the module enables or disables a safety drive in the event of thermocouple burnout or cable breakage; a second switch permits the selection of upscale or downscale drive as required.

6.28.1 Safety drive

Please note that the safety drive on the MTL5081 responds to line breakage (an open circuit) or in the event of thermocouple burnout. It does not provide detection of a short circuit. It can, however, be set upscale or downscale. Selection is made by switches located on top of the module (see figure 6.64)

** Note that the above statement Vout = Vin is subject to transfer accuracy and drift specified in the MTL Intrinsic Safety catalogue.*



SAFETY DRIVE ON/OFF	+/-	LINE BREAKAGE	Vout
OFF	N/A	NO	Vin*
OFF	N/A	YES	undetermined
ON	+	NO	Vin*
ON	+	YES	>+100mV
ON	–	NO	Vin*
ON	–	YES	<–100mV

Figure 6.64: Top label of MTL5081 showing positions of safety drive switches and an explanation of their functions

6.28.2 Wiring connections

See figure 6.65 for wiring connections.

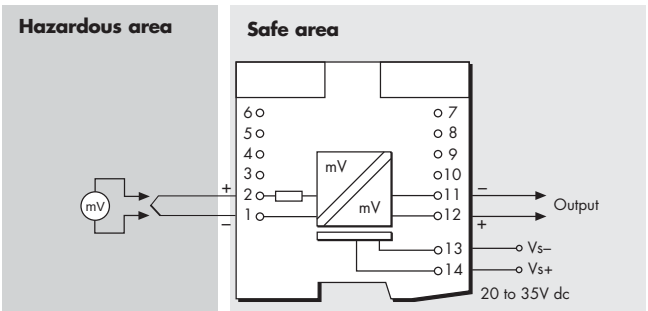


Figure 6.65: MTL5081wiring diagram and connections

Terminal	Function
1	THC/mV input –ve
2	THC/mV input +ve
11	Output –ve
12	Output +ve
13	Supply –ve
14	Supply +ve

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6.28.3 Testing

Make the safe and hazardous-area connections shown in figure 6.66

Note: *A millivoltmeter capable of measuring to within 1µV should be used for V1.*

Carry out the checks shown in table 6.13, using RV1 to vary the output at V2 for the first test.

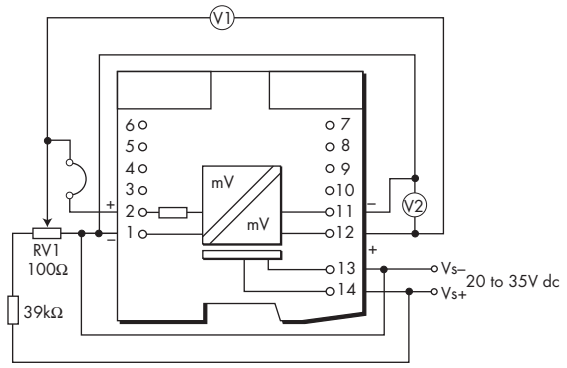


Figure 6.66: Test circuit for MTL5081

Table 6.13

SAFETY DRIVE ON/OFF	+/-	LINK	V1	V2
OFF	N/A	CLOSED	<0.05mV	0 ≤ V2 ≤ 50 mV
ON	+	OPEN	N/A	> +100 mV
ON	-	OPEN	N/A	< -100 mV

6.29 MTL5082 resistance isolator

The MTL5082 connects to a 2-, 3- or 4-wire resistance temperature device (RTD) or other resistance located in a hazardous area, isolates it and repeats the resistance to a monitoring system in the safe area. The module drives upscale in the case of open circuit detection. The number of wires which can be connected on the safe-area side of the unit is independent of the number of wires connected on the hazardous-area side.

The module is intended typically, but not exclusively, for use with Pt100 3-wire RTDs. Switches located on top of the module allow selection of 2-, 3- or 4-wire connection. The MTL5082 is also used as an alternative, non-configurable MTL5074, for use in RTD applications where a resistance input is preferred or needed instead of 4 to 20mA.

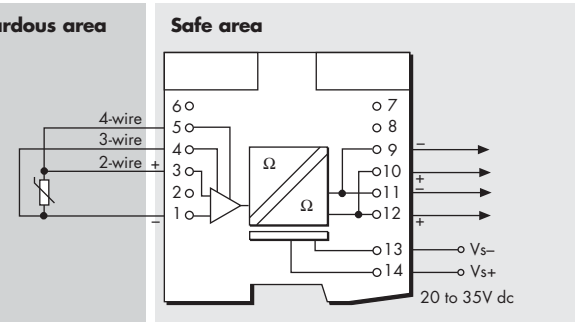


Figure 6.67: MTL5082 wiring diagram and connections

Terminal	Function
1	RTD input –ve
3	RTD input +ve
4	3-wire RTD input –ve
5	4-wire RTD input +ve
9	RTD output –ve
10	RTD output +ve
11	RTD output –ve
12	RTD output +ve
13	Supply –ve
14	Supply +ve

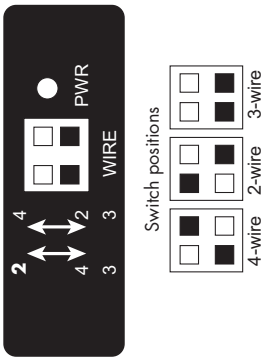


Figure 6.68: Top label, MTL5082, showing positions of configuration switches and switch-position configurations for different input modes

6.29.1 Input mode selection

The unit is factory set for 3-wire RTD mode. To select 2-wire or 4-wire RTD modes, configure the switches located on the top of the unit in accordance with the diagrams in figure 6.68.

6.29.2 Wiring connections

Warning: Check polarity of terminals used for safe-area connections.

Safe-area terminals 9, 10, 11 and 12 are unipolar so it is essential to select a positive terminal on the MTL5082 for connection to the positive of the RTD input card.

See figure 6.67 for wiring connections.

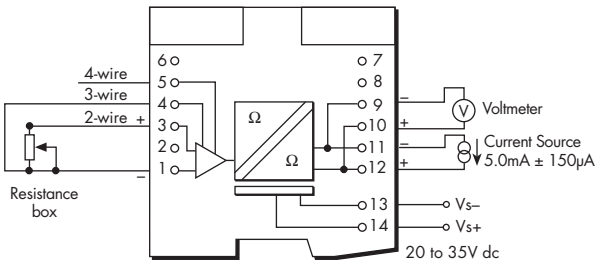


Figure 6.69: Test circuit for MTL5082

6.29.3 Testing

Make the safe- and hazardous-side connections shown in figure 6.69, ensuring that the configuration switches on top of the unit are set to 3-wire RTD input mode (see figure 6.68). Carry out the following tests and checks using a resistance box, with a range of 0 to 400Ω, and a voltmeter, covering the range 47.0mV to 2.100V.

1. Set the resistance box to any value in the range 10Ω to 400Ω, switch on the power supply and check that the green power (PWR) LED comes on and remains steady. If the LED is flashing after 5 seconds, either the test-wiring set-up is faulty or the unit is faulty.
2. Check that the output voltage changes as the input resistance is varied within the range 10Ω to 400Ω.
3. Short circuit the input and check that the output voltage is ≤51.6mV after 5 seconds.
4. Open circuit the input and check that the output voltage is ≤2.071V after 5 seconds and that the green PWR LED is flashing.
5. Set the input resistance to 200Ω and check that the output voltage settles to 1.0V ±32mV.

6.30 MTL5099 dummy isolator

The MTL5099 is used with other MTL5000 Series units to provide termination and earthing facilities for unused cable cores from hazardous areas.

6.30.1 Wiring connections

See figure 6.70 for wiring connections.

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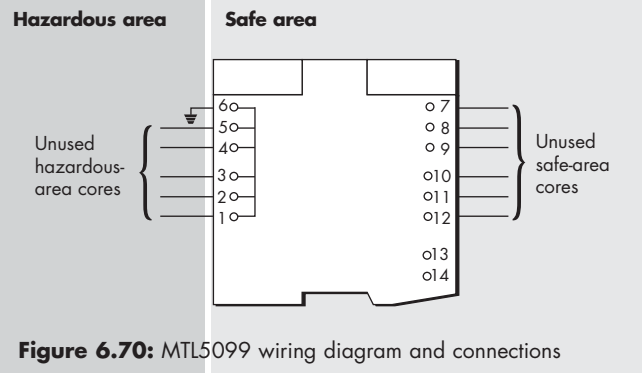


Figure 6.70: MTL5099 wiring diagram and connections

Terminal	Function
1	Hazardous-area core
2	Hazardous-area core
3	Hazardous-area core
4	Hazardous-area core
5	Hazardous-area core
6	Earth
7	Safe-area core
8	Safe-area core
9	Safe-area core
10	Safe-area core
11	Safe-area core
12	Safe-area core

6.31 MTL5113P fail-safe switch/proximity detector interface

With the MTL5113P, a fail-safe switch/proximity detector located in the hazardous area can control an isolated, fail-safe electronic output. The MTL5113P unit also provides line-fault detection alarm contacts.

The MTL5113P is for use with P + F TÜV-approved fail-safe sensors.

Correct operation of fail-safe output and LFD, where applicable, is indicated by amber and red LEDs on top of the unit. Amber is ON when fail-safe output is energised. Red is ON if a line fault is detected. Fail-safe output is OFF if the incorrect sensor current, an open circuit or a short circuit is present in the sensor circuit.

MTL5113P input/output characteristics are shown in table 6.14.

Table 6.14

Input value in sensor circuit	Fail-safe output	Operation	LFD contacts
2.9mA < Is < 3.9mA	ON	Normal	Closed
Is<1.9mA and Is>5.1mA	OFF	Normal	Closed
Is<50µA	OFF	Broken line	Open
Is>66mA	OFF	Shorted line	Open

6.31.1 Wiring connections

See figure 6.71 For wiring connections.

Note: *Switch-type sensors must always be fitted with resistors, as shown.*

** Series resistor should be in the range 1k3Ω - 1k5Ω*

6.31.2 Line fault detection

(See section 3.1.4 for definition of a line fault)

If an input line fault (open- or short-circuit) is detected, a red LED on top of the unit goes ON, the LFD contacts open and the LFD output is de-energised providing an alarm output. The fail-safe output is also de-energised and the amber output status LED on top of the unit goes OFF.

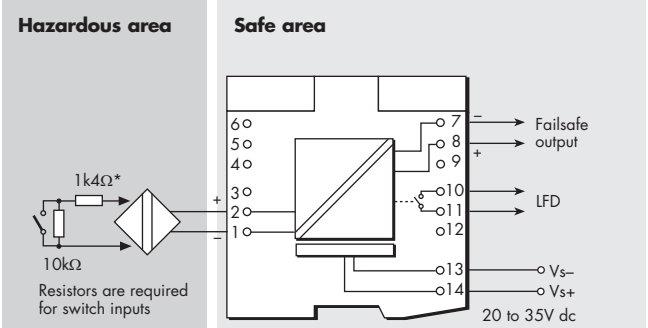


Figure 6.71: MTL5113P wiring diagram and connections

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

6.31.3 Testing

Make the safe- and hazardous-side connections shown in figure 6.72. With an ohmmeter, check that the status of the outputs is as follows:

Input	Fail-safe output	Line fault	
		contacts	output
open-circuit	de-energised	open	de-energised
short-circuit	de-energised	open	de-energised
1k4Ω	energised	closed	energised
10kΩ	de-energised	closed	energised

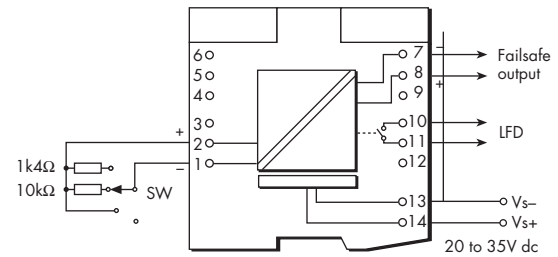


Figure 6.72: Test circuit for MTL5113P

6.32 MTL5314 trip amplifier for 2– or 3– 2 wire transmitters

The MTL5314 connects to a 2– or 3– wire 4 to 2mA transmitter or current source located in the hazardous area. It supplies one or two configurable alarm signals to the safe area via changeover relays. Each relay may be configured individually to signal an alarm condition when the input signal is greater than or less than a pre-set value.

In addition, the MTL5314 can be connected in series to the hazardous-area side of an MTL5042 4 to 20mA repeater power supply (or equivalent device) to provide two trip alarm outputs direct from the transmitter signal (see schematic diagram). Looping the transmitter signal through the MTL 5314 (via terminals 1 and 3) does not affect HART® communications. Terminals 1 and 3 meet clause 5.4 of EN50020: 1994 and have the following parameters: U ≤ 1.5V, I ≤ 0.1A, P ≤ 25mW. They can be connected without further certification into an IS loop with open circuit voltage of not more than 28V. See certificate for further details.

6.32.1 Wiring connections

See figure 6.73 for wiring connections.

If terminals 1 and 3 provide a 4 to 20mA loop to a HART transmitter, HART communication can be superimposed on the 4 to 20mA signal.

Note: *Reactive loads must be adequately suppressed.*

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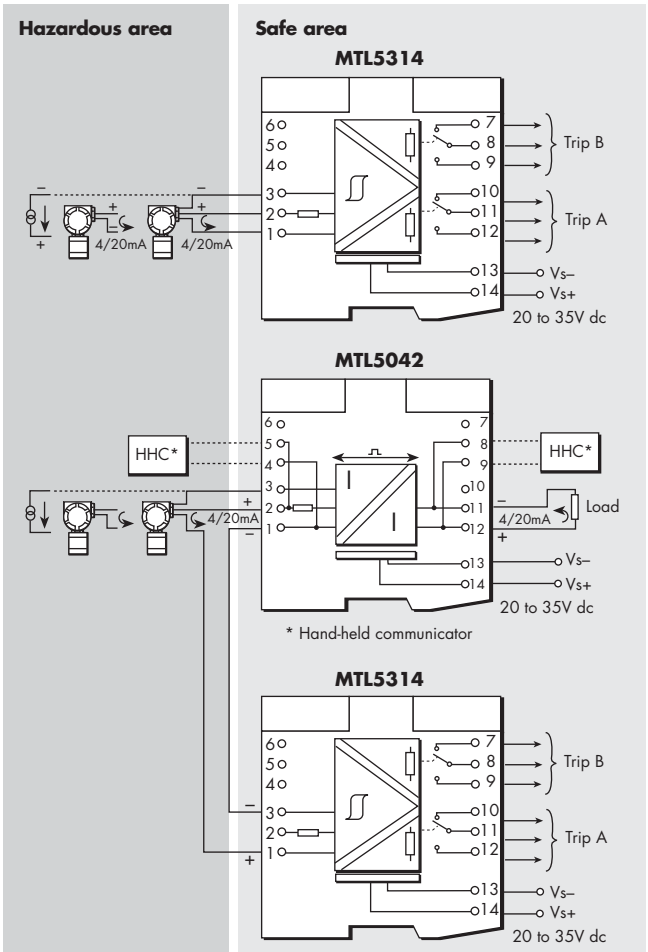


Figure 6.73: MTL5314 wiring diagram and connections

Terminal	Function
1	Current input
2	Transmitter supply +ve
3	Common
7	Trip B (NC)
8	Trip B (COM)
9	Trip B (NO)
10	Trip A (NC)
11	Trip A (COM)
12	Trip A (NO)
13	Supply –ve
14	Supply +ve

6.32.2 Trip calibration

Switches and multiturn potentiometers for setting the trip points are located on top of the unit (see figure 6.74). For each of channels A and B:

i Set trip switch to **H** (high) or **L** (low) as required (see table 6.15 for relay operation).

ii Set input current to the required value for trip-point.

iii Adjust **SET A/SET B** until LED **A/B** is on: then slowly adjust until LED goes out.

iv Relays are energised in normal operation and de-energised when tripped. A lit LED shows the safe condition (not tripped).

Table 6.15

Trip switch A or B	Operation	PWR LED	A or B LED	Relay contacts 11-12 8-9	Relay contacts 10-11 7-8
H (high)	Input >Trip setting	☆	•	open	closed
H (high)	Input <Trip setting	☆	☆	closed	open
L (low)	Input >Trip setting	☆	☆	closed	open
L (low)	Input <Trip setting	☆	•	open	closed
–	–	•	•	open	closed

– = Either option ☆ = LED On • = LED Off

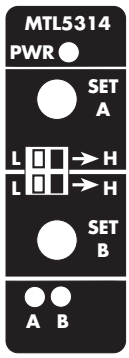


Figure 6.74: Top label, MTL5314, showing positions of trip switches and multiturn potentiometers

6.32.3 Testing

Make the safe- and hazardous-area connections shown in figure 6.75 and carry out the following procedure:

a Set the current source or sink to 12mA

b Adjust each trip potentiometer until the associated LED just extinguishes.

c With sources of 11.5mA and 12.5mA carry out the following checks:

Current	High alarm LED	High alarm Relay 11-12 8-9	High alarm Relay 10-11 7-8	Low alarm LED	Low alarm Relay 11-12 8-9	Low alarm Relay 10 -11 7-8
11.5mA	On	Closed	Open	Off	Open	Closed
12.5mA	Off	Open	Closed	On	Closed	Open

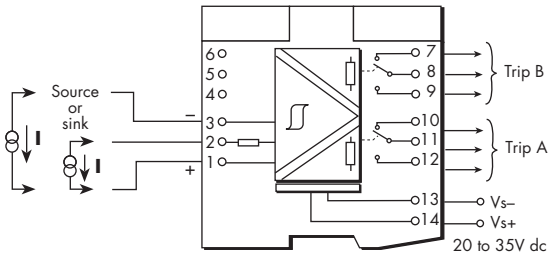


Figure 6.75: Test circuit for MTL5314

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6.33 MTL5344 Repeater power supply

The MTL5344 provides fully-floating dc supplies for two conventional 2-wire 4 to 20mA transmitters located in a hazardous area and repeats the current in two floating circuits to drive two safe-area loads.

Note that although this module is similar in function to the MTL5044, the safety description parameter are very different. Refer to the datasheet and the ATEX certificate available from the MTL website.

6.33.1 Wiring connections

See figure 6.76 for wiring connections.

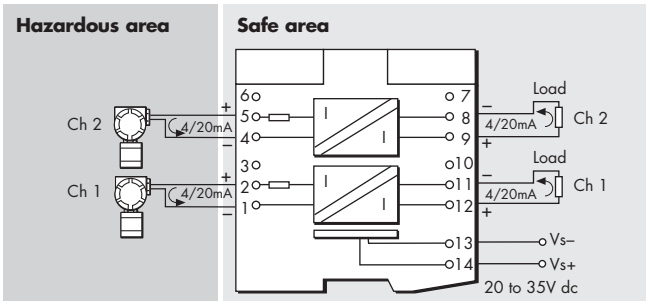


Figure 6.76: MTL5344 wiring diagram and connections

Terminal	Function
1	Input –ve (Ch 1)
2	Input +ve (Ch 1)
4	Input –ve (Ch 2)
5	Input +ve (Ch 2)
8	Output –ve (Ch 2)
9	Output +ve (Ch 2)
11	Output –ve (Ch 1)
12	Output +ve (Ch 1)
13	Supply -ve
14	Supply +ve

6.33.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.77 and, using RV1 to vary the output current, carry out the following checks, first on channel 1 and then on channel 2:

Output current (A2)	Current reading (A1)	Voltage channel 1 (terminal 2 with respect to terminal 1)	Voltage channel 2 (terminal 5 with respect to terminal 4)
4 to 20mA	<±20µA	–	–
20ma	–	>14V	–
20ma	–	–	>14V

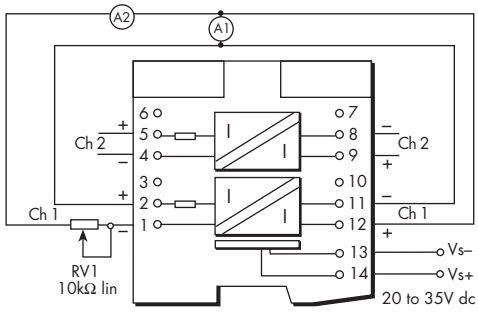


Figure 6.77: Test circuit for MTL5344

6.34 MTL5349 two-channel isolating driver

The MTL5349 isolates and passes on two 4 to 20mA signals from a controller located in a safe area to two loads in a hazardous area.

Note that although this module is similar in function to the MTL5049, the safety description parameter are very different. Refer to the datasheet and the ATEX certificate available from the MTL website.

6.34.1 Wiring connections

See figure 6.78 for wiring connections.

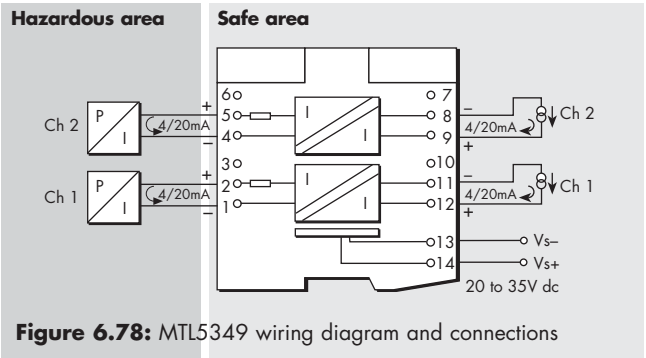


Figure 6.78: MTL5349 wiring diagram and connections

Terminal	Function
1	Output –ve (Ch 1)
2	Output +ve (Ch 1)
4	Output -ve (Ch 2)
5	Output +ve (Ch 2)
8	Input -ve (Ch 2)
9	Input +ve (Ch 2)
11	Input –ve (Ch 1)
12	Input +ve (Ch 1)
13	Supply –ve
14	Supply +ve

6.34.2 Testing

Make the safe- and hazardous-area connections shown in figure 6.79 and, using the current source to vary the output current, carry out the following checks, first on channel 1 and then on channel 2.

Output current	Current reading (A1)
4 to 20mA	<±20µA

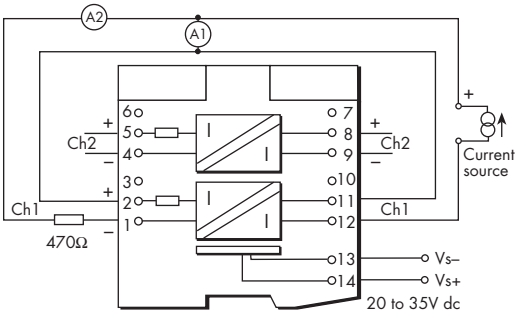


Figure 6.79: Test circuit for MTL5349

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6.35 MTL5991 24V dc power supply

The MTL5991 provides a convenient source of power for MTL5000 Series units in locations where a dc supply is not readily available. The 2A capability at 24V dc is sufficient to drive at least fifteen (15) MTL5000 Series modules, or more in appropriate combinations (see table 6.16), and the wide mains power supply range makes this unit universally applicable.

Table 6.16

MTL5000 unit	Current Drawn mA (Vs=24V)	Maximum number of units
MTL5011B	35	46
MTL5012	30	53
MTL5014	45	36
MTL5015	44	36
MTL5017	50	32
MTL5018	60	27
MTL5023	100	16
MTL5024	100	16
MTL5031	80	20
MTL5032	65	25
MTL5040	95	17
MTL5041	70	23
MTL5042	75	21
MTL5044	110	15
MTL5045	50	32
MTL5046	65	25
MTL5048	40	35
MTL5049	65	25
MTL5051	90	18
MTL5074	68	24
MTL5081	20	80
MTL5082	55	29
MTL5113P	70	23
MTL5314	85	19
MTL5344	122	13
MTL5349	67	24

Note:The maximum current drawn from the load unit is taken at 24V. The maximum current drawn from the MTL5991 was taken to be 1.6A

WARNING

Segregation between hazardous- and safe-area wiring must always be maintained

6.35.1 Wiring connections

See figure 6.80 for wiring connections.

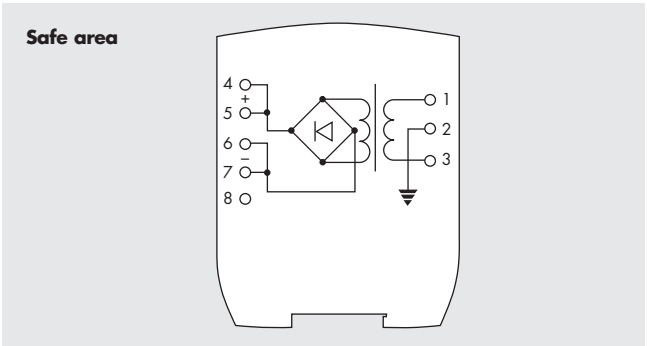


Figure 6.80: MTL5991 wiring diagram and connections

Terminal	Function
1	AC Line
2	Earth
3	AC neutral
4	+24V
5	+24V
6	OV
7	OV
8	Do not use

6.35.2 Testing

Using the terminal assignments shown in figure 6.81, make the following tests and checks.

1. Connect a supply voltage of between 85V and 264V ac to the live and neutral terminals. Check that the voltage measured across these terminals is within the range 85V to 264V ac.
2. With no load connected to the unit's output, measure, in turn, the voltage between terminals 4 and 6 then 5 and 7. Check that the measurements are in the range 23.64V to 24.36V.
3. Connect to the output, a load that draws up to 2A from a supply voltage between 105V and 264V ac, and draws 1.7A when the supply voltage is less than 105V ac. Measure, in turn, the voltage across terminals 4 and 6 and 5 and 7. Check that these measurements are in the range 23.64V to 24.36V with a ripple not greater than 100mV.

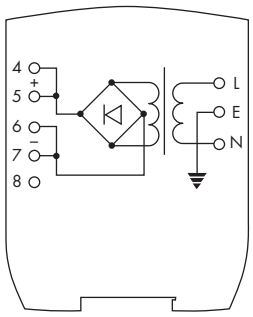


Figure 6.81: Terminal assignments for MTL5991

6.36 MTL5995 fieldbus power supply for 31.25kbit/s fieldbuses

The MTL5995 is a general purpose power supply unit designed for use in 31.25kbit/s (H1) fieldbus systems. The MTL5995 complies with the requirements of Fieldbus Foundation™ power supply Type 131 (non-IS supply intended for feeding an IS barrier).).

To allow adequate heat dissipation under all likely thermal conditions, it is recommended that MTL5995s are installed on DIN rail with a 10mm space between adjacent units. MTL MS010 10mm DIN-rail module spacers are available for this purpose (see section 4.2.1).

To comply with fieldbus standards, each bus must be terminated at both ends. MTL's FBT1-IS or FCS-MBT fieldbus terminators (see section 6.37) can be supplied for this purpose or, for installations in which the MTL5995 is located at one end of the fieldbus trunk, it includes an internal terminator which is enabled by a yellow switch (B) located on the base of the unit (see figure 6.82). A second, red switch (A) in the base of the unit should be kept in the normal mode position.

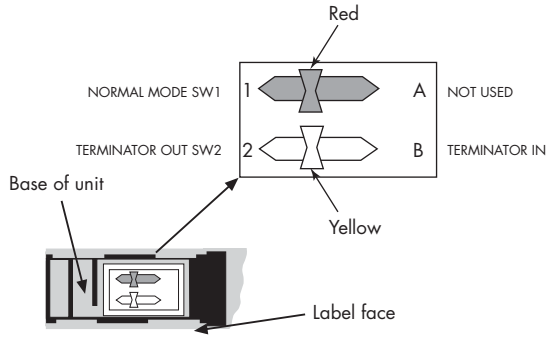


Figure 6.82: Functions of switches on the base of an MTL5995

(For network and termination criteria, see applicable fieldbus standards and specification *IEC 61158-2, ISA-S50.02 for 31.25kbit/s fieldbus systems, Foundation™ Fieldbus 31.25kbit/s Physical Layer Profile Specification FF-816* and MTL's Application Brief AB001.)

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6.36.1 Wiring connections

See figure 6.83 for wiring connections and refer to MTL's Application Brief AB001.

Note: *To assist the process of terminating cable screens, terminals 7 and 10 are linked internally. Please note however that these terminals are not earthed.*

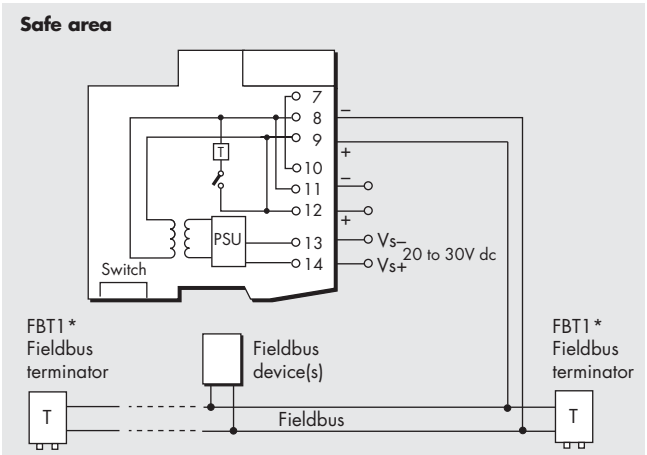


Figure 6.83: MTL5995 wiring diagrams and connections

Terminal	Function
7	Internally linked to 10
8 & 11	Safe-area fieldbus device(s) connection –ve
9 & 12	Safe-area fieldbus device(s) connection +ve
10	Internally linked to 7
13	Supply –ve
14	Supply +ve

***Where supply voltage is 20 to 30V dc, ambient temperature limits are –20°C to 60°C. If supply voltage is 20 to 35V dc, the ambient temperature limits are –20°C to +55°C.*

Table 6.17

R_{test}	Current (I_1)	Voltage across terminals 8 and 9 (V_1)
1.8kΩ	-	$18.6V \le V_1 \le 19.4V$
56Ω 10W	~ 340mA	-
0Ω	< 500mA	-

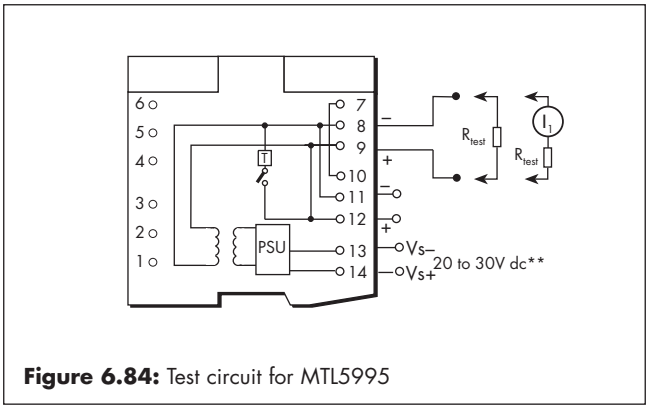


Figure 6.84: Test circuit for MTL5995

***Where supply voltage is 20 to 30V dc, ambient temperature limits are -20°C to 60°C. If supply voltage is 20 to 35V dc, the ambient temperature limits are -20°C to +55°C.*

6.36.2 Testing

Make the safe-area connections shown in figure 6.84 and, substituting appropriate resistors for R_{test}, carry out the checks shown in table 6.17

6.37 FBTI-IS fieldbus terminator

The FBT1-IS is a DIN rail mounting unit that provides the correct termination for fieldbus circuits in either safe or hazardous areas.

The unit is certified for use in Zone 0, IIC, T4 locations, and fully complies with the electrical characteristics requirements of section 22.7.5 of appropriate fieldbus standards. Applicable fieldbus standards and specifications are *IEC61158-2, ISA-S50.02 for 31.25kbit/s fieldbus systems and FOUNDATION™ Fieldbus 31.25kbit/s Physical Layer Profile Specification FF816.*

Additional information on fieldbus termination can be found in *MTL's AB001* and *AB002* application briefs.

6.37.1 Package details

The FBT1-IS terminator is designed for mounting on 35 x 7.5 mm or 35 x 15 mm DIN rail to EN50022.

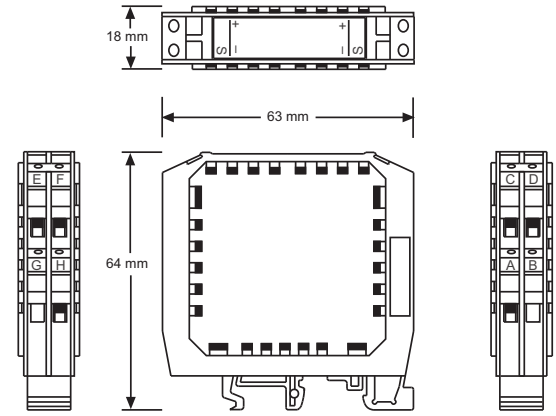


Figure 6.81: Terminator/Spur connector package

6.37.2 Fitting FBT1-IS

Orientate the FBT1-IS as shown in Figure 6.82a and locate it on the DIN rail. Using the DIN rail edge as the pivot point, press down the other end until the package clicks into place on the other side of the rail.

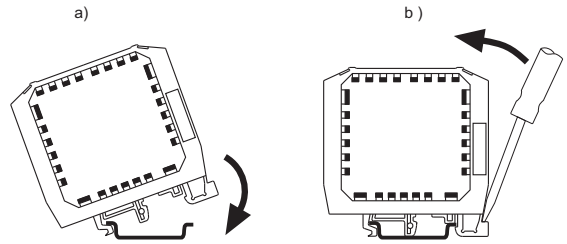


Figure 6.86: a) fitting and b) removal

6.37.3 Removal

Removal requires a screwdriver or similar flat blade. Locate the screwdriver into the slot provided in the fixing bracket on the 'device' side of the spur connector (see Figure 6.86). Carefully lever towards the spur connector body until the mounting is released from the DIN rail and lift it off the rail.



Figure 6.87: Terminal assignments

6.37.4 Connections

The +, - and cable screen (S) connections are indicated in Figure 6.87. The terminals will accept cables with a cross sectional area of up to 4 mm2. A straight blade screwdriver with a maximum blade width of 3.5 mm is required to operate the terminals. The recommended tightening torque is <0.9 Nm.

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7 MAINTENANCE

WARNING

If an isolator is faulty, DO NOT make repairs or modifications as these may affect the intrinsic safety of the unit.

Note: *Limit tests and routine maintenance to those described in this section and section 4. Return any isolator identified as faulty to the MTL group company or representative from which it was purchased, for repair or replacement.*

7.1 Routine maintenance

Occasionally check the general condition of the installation to make sure that no deterioration has occurred. At least once every two years (and more frequently for particularly harsh environments), check that:

- isolators are of the types specified in the relevant documentation;
- isolators and connectors are correctly and legibly tagged, connectors are plugged into the corresponding isolators and tag details given comply with the relevant documentation;
- isolators are securely clipped to the DIN rail;
- all cable connections are properly made to the plugs;
- all plugs are fully inserted;
- all connecting cables are of the specified type and rating, are correctly routed and segregated (particularly when fitted in enclosures), and are not frayed or otherwise damaged;
- all cable screens are properly earthed;
- there is no sign of damage or corrosion.

7.2 Enclosures

The only maintenance needed for enclosures is cleaning and periodic visual inspections. Clean external surfaces only, using soap and water; do not use chemical solvents or proprietary cleaning fluids. Every year (more frequently in harsh environments), inspect enclosures and check that:

- they are attached securely to their mountings;
- any accumulation of water inside has been removed (using the drain plug, if fitted);
- cable gland nuts are tight;
- there are no signs of any damage;
- all connections are properly made.

8 OTHER USEFUL DOCUMENTATION

MTL Hazardous Area Products Catalogue

AB001	Application Brief
AB002	Application Brief
INA5000	DofC and ATEX Safety Instructions
INM073A	Connection and Configuration Manual

Customer drawings

CD5001-30	MTL5000 Power Bus Kits
CD5001-41	MTL5000 Series Tagging and Earth Rail

Accessories

CD5001-42	MTL5000 Tag and Earth Accessories

IEC 61158-2

ISA-S50.02 for 31.25kbit/s fieldbus systems

FOUNDATION™ Fieldbus 31.25kbit/s Physical Layer Profile Specification FF-816

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9 APPENDIX A - INSTRUCTIONS FOR MTL5500 SERIES

9.1 MTL5521 rotational speed monitor

A rotational speed monitor with over- and under-speed monitoring, has proximity detector input, conforming to NAMUR/DIN 19234 standard. Easy configuration is by two push buttons on the top of the unit and the unit has a frequency range of 0.001Hz to 10kHz (0.06 to 600000 min-1). A liquid crystal display on the top of the unit displays the current frequency. The 0/4 to 20mA current output is proportional to the rotational speed, and the unit has SPDT relay output for over- and under-speed indication. Start-up delay is initiated by the closure of a normally open contact. Three power supply versions are available – 24V DC, 115V AC and 230V AC.

9.1.1 Wiring connections

Hazardous-area terminals

5 & 6	NAMUR sensor input connection.
7 & 8	Normally open switch contact for Start-up delay function.

Safe-area terminals

9 & 13	0/4 to 20mA analogue output.
10, 11 & 12	Over- and under-speed relay output.
15 & 16	Power supply connection.

9.1.2 LED indications.

	Pulse indication:
	Yellow - indicates an input pulse
	Red - input circuit fault
Pwr	Supply voltage:
	Green - device is operational
K_1	Limit value relay
	Yellow - relay energized

9.1.3 Mounting instructions

The rotational speed monitor is suitable for either panel or DIN-rail mounting. A minimum spacing of 3.5mm between the modules is required when the modules are mounted horizontally. There is no minimum spacing for vertically mounted units.

9.1.4 Configuration (figures 9.1 and 9.2)

Buttons S1 and S2 on the top of the unit are used to configure the individual parameters of the unit. The required parameter Id, tb etc is selected by pressing S2 until the parameter to be configured is displayed and then, S1 must be pressed and held for approximately 3 seconds. The left decimal will start flashing and the value can then be set, using S1. S2 can then be used to adjust further decimals, the decimal point and the exponent, in turn, returning eventually to the parameters menu.

Note: *The unit does not have internal error detection. Incorrect parameters can lead to malfunction or failure of the device.*

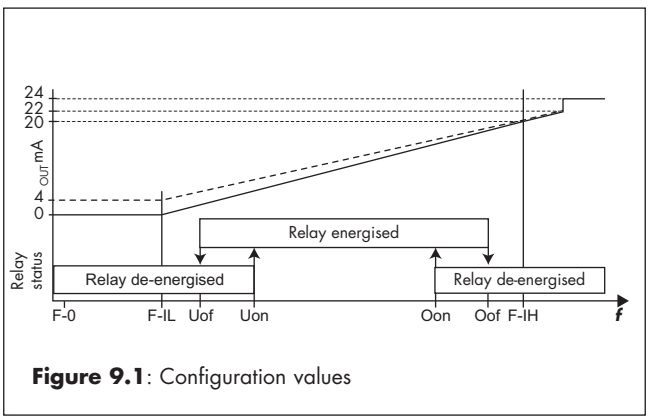


Figure 9.1: Configuration values

Note: *All MTL products are tested for electrical safety to EN 61010 to comply with the EC Low Voltage Directive.*

See also warning on page 1.

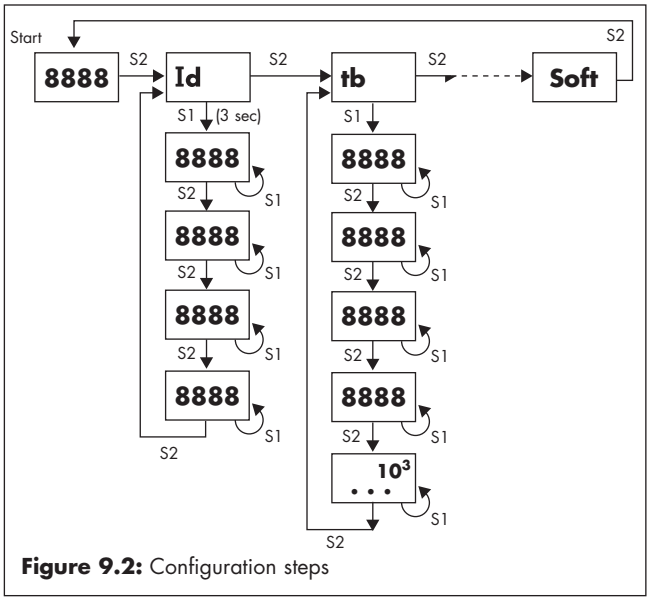


Figure 9.2: Configuration steps

9.1.4.1 Menu parameters

The following parameters can be configured:

id	User-specified identification number.
tb	Time basis. The standard time base setting is frequency (Hz). If other units are required, a conversion factor has to be used. A conversion from Hz to revolutions per minute requires a tb value of 60, the measured rotational speed is then multiplied by the factor tb.
nt	Number of targets. The input frequency is divided by the number of targets, nt.
F-0	Zero speed detection. If the input frequency falls below the value F-0, the LCD display will show '0000'. The value of F-0 must be less than the switching threshold values, F-0<Uof.
Uof	Switch-off threshold for under-speed monitoring. If the input frequency falls below the value Uof, the limit value relay will de-energise.
Uon	Switch-on threshold for under-speed monitoring. If the input frequency rises above the value Uon, the limit value relay will energise (Uof < Uon).
Oon	Switch-on threshold for over-speed monitoring. If the speed falls below the value Oon , the limit value relay will energise.
Oof	Switch-off threshold for over-speed monitoring. If the speed rises above the value Oof, the limit value relay will de-energise (Oon < Oof).

9.1.4.2 Switching thresholds (figure 9.1)

Once the parameters tb and nt have been set, all the threshold values will be in the user-defined units. The difference between the switch-on and switch-off threshold values allows user-defined switching hysteresis to be set. The limit value relay and current output performance are illustrated in figure 9.1.

To deactivate under-speed monitoring set Uof and Uon to 0.To deactivate over-speed monitoring set Oof and Oon to $9999*10^3$.

If both the over- and under-speed monitoring modes are deactivated the relay operates as an alarm relay. If no errors occur during operation, the relay is energized. If an error occurs in the input circuit, the relay de-energizes.

Iout	Output current range: 0 to 20 mA or 4 to 20 mA.
F-IL	The minimum frequency to be indicated by either 0 or 4 mA, depending upon Iout.
F-IH	The maximum frequency for an output current of 20 mA. If F-IL > F-IH the output curve is reversed.
Tc	Filter reaction time in seconds for smoothing the

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current signal. The current output follows the rotational speed change according to the preset time

-Br The value of the output current which indicates a broken wire on the input circuit.

I-Sh The value of the output current indicating a short circuit on the input circuit.

ICM Input circuit monitoring
off - disabled
Br - wire-break monitoring
Sh - short-circuit monitoring
Both - wire-break and short-circuit monitoring

Sud Start-up time delay in seconds. The start-up time delay function is activated when the normally open contacts across terminals 7 and 8 close, energizing the limit value relay for a preset time. Consequently, an under-speed indication is inhibited during system start-up.

Soft Software version number.

9.2 MTL5531 voltage/current converter

Device provides hazardous-area current and voltage inputs (only one to be used at any one time). It has short circuit protected voltage input and active current output. Input, output and power supply are galvanically isolated.

9.2.1 Wiring connections

Hazardous area terminals

1 & 2 Current input (passive).

3 & 4 Voltage input.

Safe area terminals

5 & 6 Output circuit.
MTL5531-xxx Li - active current output.
MTL5531-xxx LU - voltage output.

7 & 8 Power supply connection.

9.2.2 LED indications

Pwr Supply voltage:
(Green indicates that device is operational)

9.2.3 Mounting instructions

The MTL5531 is suitable for either panel or DIN-rail mounting.

9.2.4 Transfer characteristics

	Current input			Voltage input			Output circuit	
	I (mA)	R_I (Ω)	I_{max} (mA)	V	R_i (Ω)	V_{max}		R_L (Ω)
MTL5531-11Li	0/4 to 20	100	< 40	0/2 to 10	50k	< 39	0/4 to 20mA	< 500
MTL5531-11LU	0/4 to 20	100	< 40	0/2 to 10	50k	< 39	0/2 to 10V	> 500
MTL5531-111Li	0 to 20	100	< 40	0 to 10	50k	< 39	4 to 20mA	< 500
MTL5531-112LU	4 to 20	100	< 40	2 to 10	50k	< 39	0 to 10V	> 500
MTL5531-113Li	0 to 10	175	< 40	0 to 5	70k	< 39	4 to 20mA	< 500
MTL5531-115Li	0/2 to 10	175	< 40	0/1 to 5	70k	< 39	0/4 to 20mA	< 500
MTL5531-115LU	0/2 to 10	175	< 40	0/1 to 5	70k	< 39	0/2 to 10V	> 500
MTL5531-119LU	2 to 10	175	< 40	1 to 5	70k	< 39	0 to 10V	> 500

9.3 MTL5536 potentiometer converter

Provides repeat of a potentiometer input through an analogue signal in the safe area. Accepts 3- or 5- wire potentiometer input, 800Ω to20kΩ input range, with line resistance <50Ω. Two output versions are available 0 to 20mA (MTL5536-11Li) or 0 to 10V (MTL5536-11LU). No configuration is required, and input, output and power supply are galvanically isolated.

9.3.1 Wiring connections

Hazardous area terminals

1 & 3 3- and 5- wire potentiometer power.

2 Potentiometer wiper

4 & 5 5-wire potentiometer sense.

Safe area terminals

7 & 8 Output:
MTL5536-11Li : 0 to 20mA output.
MTL5536-11LU : 0 to 10V output

11 & 12 Power supply connection.

9.3.2 LED indications

Pwr Supply voltage:
(Green indicates that device is operational)

9.3.3. 3- or 5-wire operation

3-wire configuration gives high enough accuracy for standard operation. If a higher accuracy is required, or there is a problem with high resistance lines due to long cable runs, then the 5-wire operation is recommended.

9.3.4 Mounting instructions

The MTL5531 is suitable for either panel or DIN-rail mounting

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