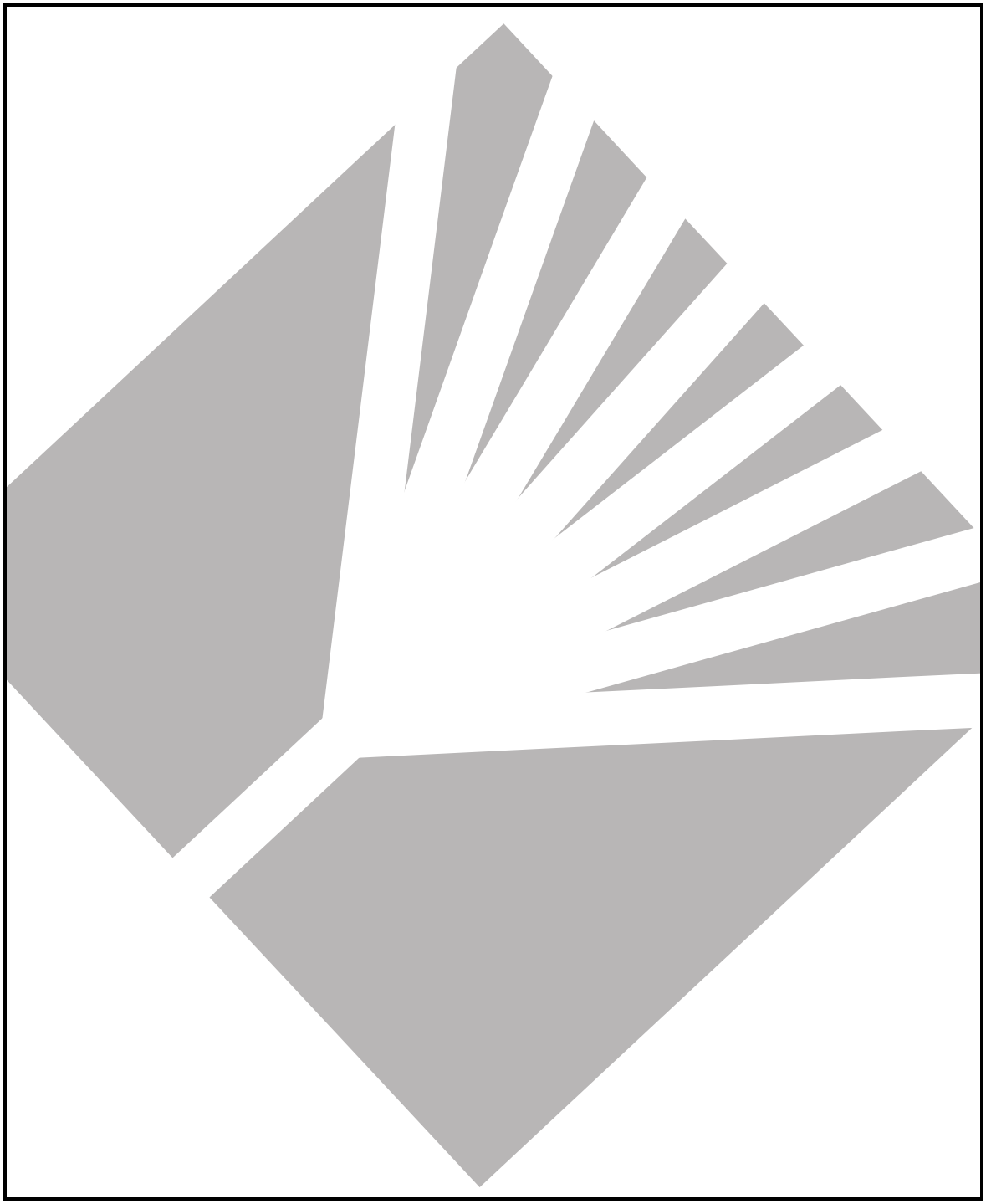
MTL8000

Process I/O for Process Control



Installation Guide

Instruction Manual

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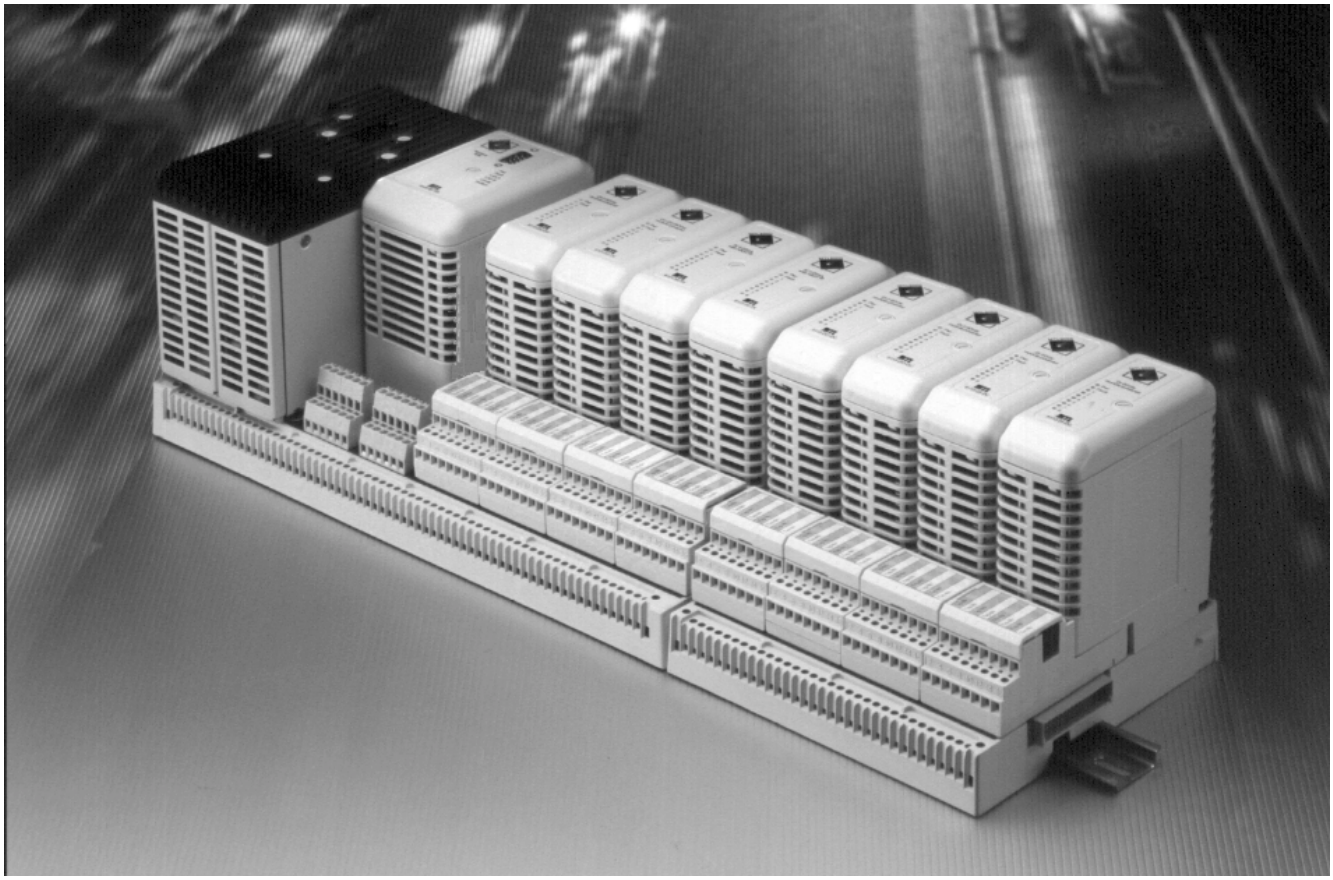


THE MTL8000 SYSTEM

Introduction

MTL8000 is a modular I/O system for the process industry that provides the important interface between the remote field sensors and actuators and the central host or controller. Capable of locating *in the field*, close to the field devices, MTL8000 allows the full benefit of distributed I/O to be realised.

Process I/O

Conventional wiring practice requires individual cable pairs to be wired between each field device and the control room. This arrangement is inflexible, time-consuming and, most of all, costly. Distributed I/O provides more flexibility and reduces installation time and cost. These benefits have been proven in factory automation applications with PLC-type I/O and the same benefits can now be enjoyed in the process control industries with the use of MTL8000 Process I/O.

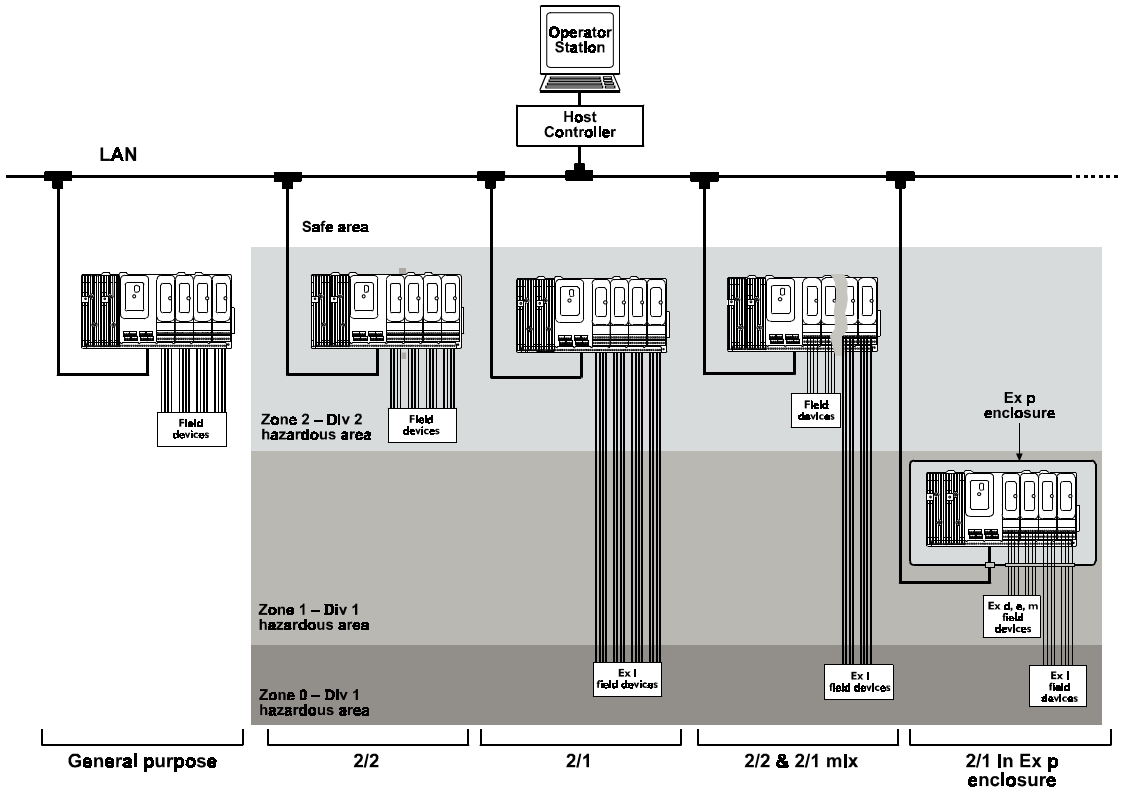
Rugged, easy to maintain and capable of satisfying hazardous area applications, the MTL8000 provides a solution for all process I/O within one family of products. Compatibility with emerging fieldbus types is ensured by a choice of bus interfaces, and many features, normally supplied only by means of add-ons, are engineered into the standard product.

General purpose applications

Process control has applications in many industries: water treatment, steel making, brewing, power generation, etc., all of which can have harsh plant environments. MTL8000 is specifically designed to withstand such environments and these applications are referred to as general purpose.

Hazardous area applications

Industries, such as oil exploration and refining and chemical and pharmaceutical manufacturing have environments that may contain explosive gases or dust and therefore these type of uses are referred to as hazardous area applications. MTL is a world leader in technology for the prevention of explosive hazards and that experience is of major value to users requiring process control equipment for such applications.



Application "code"

The MTL8000 Series may be used for both **general purpose** and **hazardous area** applications. The two applications can be mixed in a single system – and even in a *single* location.

An application "code" has been adopted that helps users to identify the type of MTL8000 Series equipment for their particular application. As well as general purpose, three equipment applications are defined – "**2/2**", "**2/1**" and "**1/1**".

The two numerals (shown left) and their usage have a particular meaning as follows:

2/1

Location of node ⇗ ⇖ **Field wiring location**

e.g. Zone 2 or Division 2 — e.g. Zone 1 or Division 1

- The first figure represents the most hazardous type of area in which the equipment can be **mounted** (without *additional* hazard protection)
- The second figure represents the most hazardous type of area from which the **field wiring** can originate.

The diagram above illustrates these situations and by understanding this terminology, the appropriate type of equipment can be chosen to meet a specific application.

2/2 (& general purpose)

This equipment represents a base level for all applications. It is used for all general purpose work but it has been designed to be mounted in Zone 2 or Division 2 hazard areas and will accept field wiring that originates in the same, or non-hazardous (i.e. safe), areas. **All general purpose applications should use 2/2 products.**

2/1

While still designed for *mounting* in Zone 2 or Division 2 hazardous areas, 2/1 equipment can accept field wiring from Zone 1 or Division 1 hazardous areas. All Zone 1/Div 1 field wiring is protected by **built-in intrinsic safety (IS) interfaces** (see Glossary on page **)**; as a result, the field wiring can even originate in a Zone 0/Div 1 area with total safety. This equipment also may be mounted in an Ex 'p' enclosure for location in a Zone 1 or Div 1 environment.

1/1 (Not covered in this manual)

This represents the highest level of protection and versatility, and permits this 8000 series equipment to be **mounted directly in a Zone 1 or Division 1 hazardous area**. This type of equipment requires particular installation precautions which are detailed in a separate instruction manual.

MTL8000 Components

In order to understand how an MTL8000 node is constructed we will identify the individual parts.

Carriers

Carriers form MTL8000's physical and electrical backbone by providing a mounting onto a flat panel or T- or G-section DIN rail. They support and interconnect the BIM, power supplies, I/O modules and field terminals, and carry the address, data and power lines of the internal bus ('Railbus'). Some carriers provide termination points for LAN and field wiring cable screens and distribute field power to the I/O modules. The available types are described below.

1. Node Services Carrier

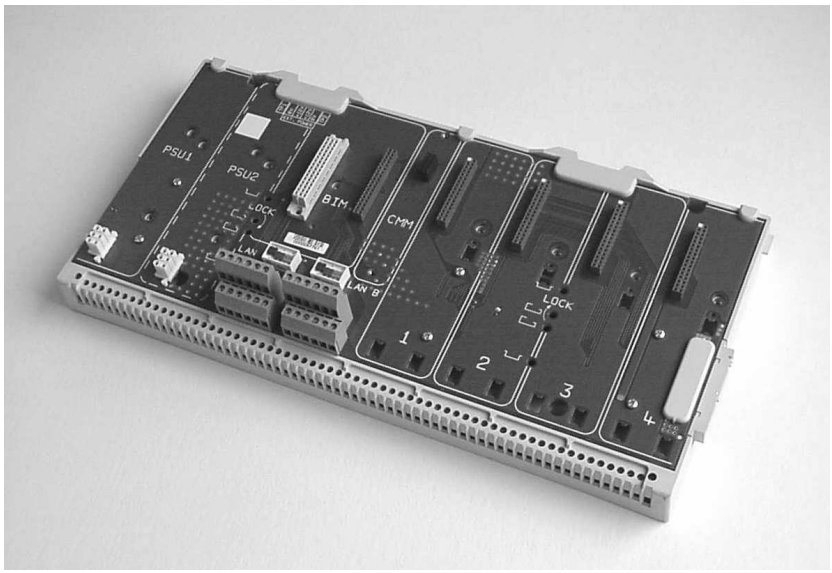
The node services carrier accommodates: a Bus Interface Module, up to two system power supplies and up to four I/O modules. It also accommodates the LAN connections.

Two types are currently available:

- 8711-CA-NS - (Modbus or Profibus-DP)
- 8712-CA-NS - (Profibus-DP)

Used for:

Type	2/2	2/1	Mix
8711-CA-NS			
8712-CA-NS			



Node Services Carrier (Modbus) 8711-CA-NS

2. I/O Module Carriers

These provide a platform for mounting individual I/O modules and their associated field terminals. They carry the internal signal bus for fast communications between modules and provide innovative and time-saving features for powering both the modules and their field wiring. Multi-pin connectors enable carriers to be joined end-to-end in an enclosure without the need for additional wiring.

A terminal rail along the front edge of the carrier accommodates incoming cable screens/shields or protective earth connections.

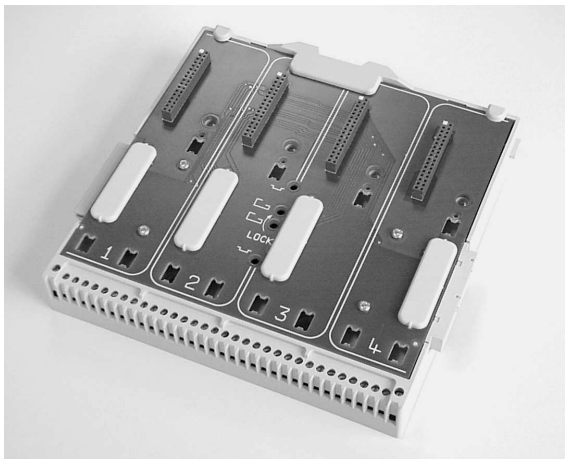
Carriers can be fitted to standard T-section or G-section DIN rail, or may be surface mounted onto a flat panel.

Four types are currently available:

- 8707-CA-08 (8 – 2/2 modules)
- 8710-CA-04 (4 - 2/2 modules)
- 8727-CA-08 (8 - 2/1 modules)
- 8720-CA-04 (4 - 2/1 modules)

Used for:

Type	2/2	2/1	Mix
8707-CA-08			
8710-CA-04			
8727-CA-08			
8720-CA-04			



Carrier, 4-module with earth bar 8710-CA-04

3. BIM Carrier

A Bus Interface Module carrier is an alternative to a Node Services Carrier when on-board power supplies are not required. It is particularly suitable for low cost installations or for an exclusively 2/1 node, where no 2/2 modules are required.

- 8715-CA-BI BIM Carrier

Used for:

Type	2/2	2/1	Mix
8715-CA-BI			

4. Railbus Isolator Carrier

A Railbus Isolator (see page 6) is always included in a node when intrinsically safe (IS) field wiring is in use. This carrier provides a mounting for the Railbus Isolator.

- 8723-CA-RB Railbus Isolator Carrier

Used for:

Type	2/2	2/1	Mix
8723-CA-RB			

5. IS Module Power Supply Carrier

When intrinsically safe (IS) field wiring is in use the I/O modules require d.c. power from a properly protected power supply. This carrier is used to mount one of these power supplies.

- 8724-CA-PS 2/1 Module Power Supply Carrier

Used for:

Type	2/2	2/1	Mix
8724-CA-PS			

6. Carrier Extenders

Where carriers forming a node cannot be joined end-to-end on a single length of DIN rail, carrier extenders enable continuity of power and signal bus through flexible cables.

Carrier extenders are available for 2/2 and 2/1 applications. Different connector types and connector genders prevent 2/2 carrier extenders and 2/1 carrier extenders from being inadvertently linked to each other. The extenders are handed (left and right) to fit the I/O carriers.

2/2 and general purpose carrier extenders:

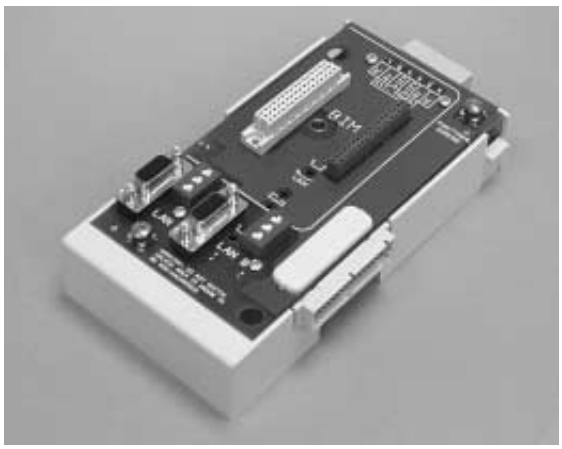
- 8020-CE-RH Carrier Extender
- 8021-CE-LH Carrier Extender

2/1 carrier extenders:

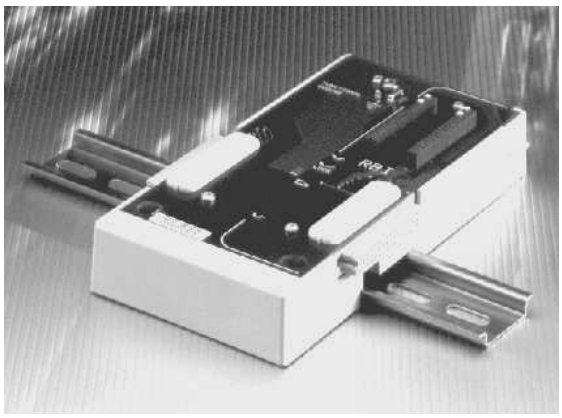
- 8030-CE-RH 2/1 Carrier Extender
- 8031-CE-LH 2/1 Carrier Extender

Used for:

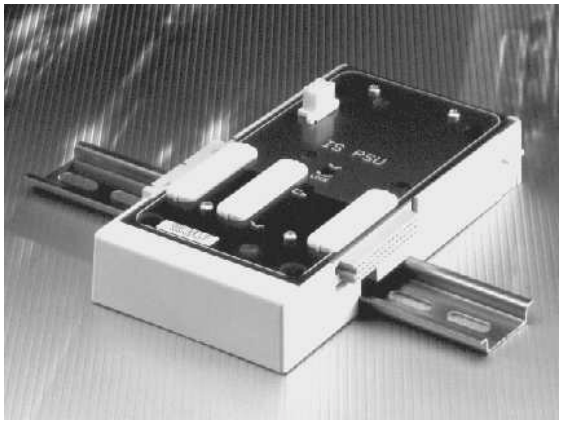
Type	2/2	2/1	Mix
8020-CE-RH			
8021-CE-LH			
8030-CE-RH			
8031-CE-LH			



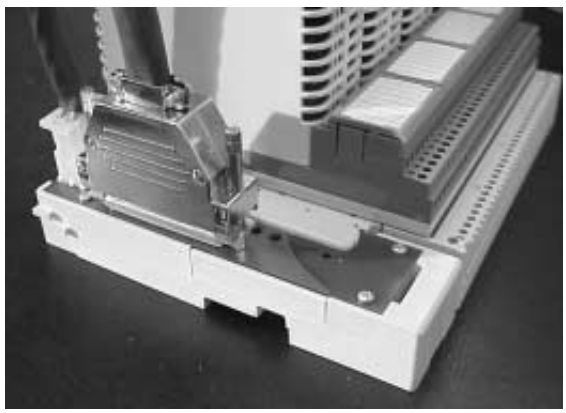
8715-CA-BI BIM Carrier



8723-CA-RB Railbus Isolator Carrier



8724-CA-PS 2/1 Power Supply Carrier



8031-CE-LH 2/1 Carrier extender, left hand (shown with flexible extender cables attached)

Field terminal assemblies

Field terminal assemblies (one per I/O module) snap onto the carrier. These accept field wiring without the need for additional terminals or connections and may be changed easily if damaged in the field.

Field terminal assemblies are colour coded: light-grey for 2/2 and blue for IS applications. A comprehensive mechanical keying system ensures that equipment safety is maintained.

The following field terminals can be used on GP(2/2) carriers:

- 8601-FT-NI (non-incendive)
- 8602-FT-ST (standard)
- 8603-FT-FU (non-incendive fused)
- 8604-FT-FU (fused)
- 8605-FT-TC (4-channel thermocouple)
- 8606-FT-RT (4-channel RTD)
- 8610-FT-NA (non-arcing)
- 8611-FT-FU (non-arcing fused)
- 8615-FT-4W (4-wire transmitter)
- 8617-FT-NI (16-channel)

The following IS field terminals can be used on the 2/1 carriers:

- 8621-FT-IS (standard)
- 8622-FT-IS (loop disconnect)
- 8623-FT-IS (16-channel DI)
- 8624-FT-IS (8-channel DI loop-disconnect)
- 8625-FT-IS (8-channel thermocouple)
- 8626-FT-IS (8-channel RTD)

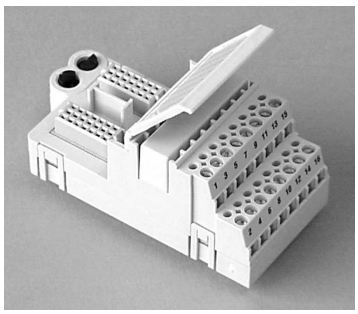
I/O modules

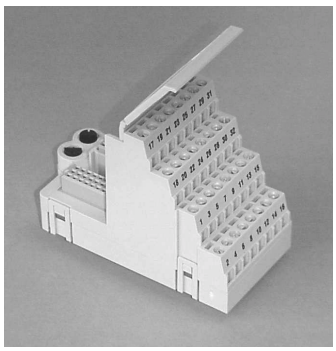
The I/O modules plug in to the field terminal assemblies and the carrier and are locked in place with a securing screw. By this method they automatically pick up the signal bus from the carrier and make a secure connection with the field wiring.

A wide range of I/O functions is available to handle digital and analog field devices of all types, and careful attention to design has achieved a high channel density – between four and sixteen I/O channels in a 42 mm width module.

Another in-built advantage is that no setup is required to establish a network address for a new module as this is automatically determined by its position on the carrier.

Both 2/2 and 2/1 I/O modules are available. The mechanical keying system ensures that general-purpose I/O modules cannot be mounted with an IS field terminal assembly.





Field Terminal Assemblies
(General purpose - top, loop disconnect IS - left, 16 channel - right)

2/1 I/O modules mounted on a carrier with IS field terminals

Railbus Isolator

The 8922-RB-IS Railbus Isolator, mounted on an 8723-CA-RB Railbus Isolator Carrier, provides protective isolation between the IS and non-IS sections of the internal bus ('Railbus') when IS field wiring is in use. The carrier reverses the gender arrangement of the carrier end connectors, so that only carriers for 2/1 I/O modules can be added subsequently in the chain of modules. Similarly, 2/1 carriers can not be fitted to a 2/2 section.

- 8922-RB-IS Railbus Isolator

Used for:

Type	2/2	2/1	Mix
8922-RB-IS			

8922-RB-IS Railbus Isolator
(shown mounted on carrier 8723-CA-RB)

Power Supplies

There are two generic power supplies, general purpose and IS.

Modular Power Supply type 8910-PS-DC converts local 18.5 to 36V d.c. supplies to 12V system power for an MTL8000 node. It plugs onto one of two reserved slots on a Node Services carrier, the second position being for a redundant PSU. The supply's 5A capacity is sufficient to power a typical fully-populated node, including BIM, with a typical mix of 32 I/O modules.

IS Module Power Supply type 8920-PS-DC also takes locally available 18.5 to 36V d.c. power and converts it to 12 V d.c. for powering the 2/1 I/O modules and their field wiring. It also has a 5 A capability and can power between six and sixteen modules depending upon their types and the mix. A number of these supplies can be used to supply all the I/O modules, in a load-sharing arrangement. Where power supply redundancy is required, an additional supply module may be added. Each 8920-PS-DC power supply mounts on its own carrier (8724-CA-PS) that connects in-line with the 2/1 I/O module carriers (only).

Fitting a redundant field power supply ensures that power to the I/O modules, and their field wiring, is maintained in the event of the failure of any one supply module or its local input.

The two power supply types are NOT interchangeable.

- 8910-PS-DC System power supply
- 8920-PS-DC IS Module power supply

Used for:

Type	2/2	2/1	Mix
8910-PS-DC			
8920-PS-DC			

8910-PS-DC System Power Supply

8920-PS-DC IS Module Power Supply

Bus Interface Module

Each MTL8000 node on the LAN uses a Bus Interface Module (BIM) to communicate with the host controller.

Different BIMs allow MTL8000 to operate with popular fieldbus protocols and MTL has appropriate configuration software for each system.

The BIM mounts on a BIM carrier, or the appropriate Node Services carrier, which provides the cable terminations for the LAN being used.

The following versions of the BIM are currently available:

- 8505-BI-MB Modbus BIM
- 8502-BI-DP Profibus DP BIM

Used for:

Type	2/2	2/1	Mix
8505-BI-MB			
8505-BI-DP			

8505-BI-MB - Modbus Bus Interface Module

HART maintenance interface

If any of the I/O modules have HART field devices connected to them, then the 8512-IF-HA can provide a communication link to maintenance software running on a remote PC.

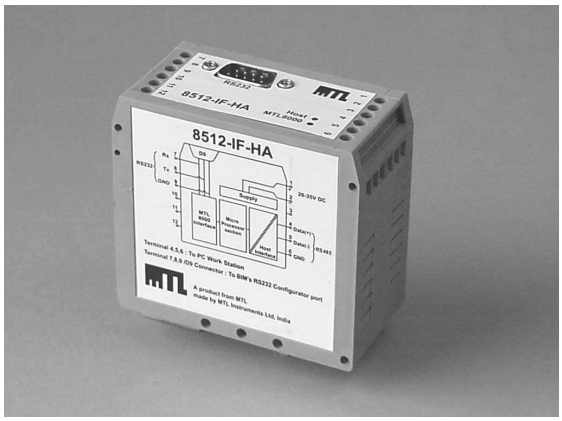
The 8512 mounts on DIN rail, connects to the serial communications port on the BIM and via a serial RS422 or RS485 link to the remote PC.

Note: If the PC does not have an RS422 or RS485 port then a converter will be required to change the signal to RS232 for one of the PC's COM ports.

- 8512-IF-HA HART maintenance interface

Used for:

Type	2/2	2/1	Mix
8512-IF-HA			



8512-IF-HA - HART maintenance Interface

System Design

By the time the equipment is ready for installation, it is assumed that the system has been designed in accordance with the MTL publication AN8000 – MTL8000 System Specifier's Guide. This process will have established which I/O modules and field terminals will be required, or are suitable, for the application based upon the field sensors and actuators that will be wired to the node. Power supply requirements will have been calculated to satisfy the needs of the I/O modules, plus any additional demand for field circuit power. The number of carriers to mount all of the modules will have been calculated and a BIM will have been chosen to suit the control system.

Enclosures

In most cases the MTL8000 equipment will be located out in the process plant and will therefore require some form of protection from the weather and the danger of physical damage.

Enclosures for this purpose can be supplied on request by MTL, but any enclosure that is designed to provide an adequate level of ingress protection and is capable of withstanding physical damage appropriate to the environment will be satisfactory.

Planning

Before beginning installation consider the following points:

- Additional carriers may be required at a later stage. When positioning the trunking and MTL8000 carriers, consider making provision for such extensions or modifications.
- Where possible, when routing the wiring and associated trunking, make generous space allowances for the carriers, carrier extenders and extension cables.
- Make adequate allowance for the working space to trim and insert cable-ends.
- Try to ensure that you have all the required parts to hand before starting.
- Ensure that you have a 3.5 mm flat-bladed screwdriver, a 2 mm flat-bladed screwdriver, and all the necessary tools for mounting the enclosure, DIN rails (if used) and cable trunking. Tools will also be required for preparing cable-ends.

Summary

Installing an MTL8000 node is straight forward. Depending on circumstances and work procedures, a node may be constructed in a wiring shop and then taken on site for installation or fully constructed and installed in-situ.

A typical installation could proceed as follows (greater detail is available in later sections):

1. Install trunking, making allowance for MTL8000 carriers and required clearance for trimming and fitting cable-ends.
2. Install the DIN rails (or if DIN rail mounting is not used, drill mounting holes in the mounting surface).
3. Fit the carriers (and any carrier extenders) to the DIN rails (or fit carriers to the mounting surface).
4. Fit the field terminals.
5. Switch off all power supplies to the node and make safe.
6. Trim field wiring cable-ends and connect into the field terminals (this could also be done after the modules are fitted). Cable-ends should be tagged to identify the associated instrument/actuator.
7. Trim cable ends of power supplies and connect to the relevant terminals.
8. Fit carrier extender cables.
9. Fit the MTL8000 BIM, Power Supply Unit(s) and all other modules.
10. Connect the communication bus wiring to the BIM.

Tools Required

The MTL8000 equipment is designed to be installed with the minimum of tools.

Apart from tools for the mounting and preparation of the enclosure and preparing cable-ends, the only tools required to mount and cable the equipment are:

- A 3.5 mm flat-bladed screwdriver.
- A 2 mm flat-bladed screwdriver.

*** IMPORTANT INFORMATION ***

Health And Safety

General information

Before commencing installation of the equipment:

- Ensure that all installation work is carried out in accordance with all relevant local standards, codes of practice and site regulations and any special requirements stated in this manual.
- Check that the module functions are correct for the applications.
- Take care to avoid damaging the pins at all connector interfaces.
- Ensure that all relevant power supplies have been made SAFE

2/1 installations only – ATEX information

The following information is provided to meet the requirements of EU Directive 94/9/EC – Essential Health and Safety Requirements (Annex II)

Operations

1. The equipment must only be installed, operated and maintained by trained competent personnel.
2. This apparatus has been designed in accordance with EN50014 and EN50020, therefore the apparatus has been designed to meet the requirements of Associate Apparatus for category 'ia'.

Checking and Maintenance

3. The installation and maintenance must be carried out 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 in this manual.
4. Access to the circuitry must not be made during operation.

Installation

5. This product is an associated electrical apparatus and must not be installed in the hazardous area without the provision of further certified hazardous area protection.
6. The product must not be subjected to mechanical and thermal stresses in excess of those permitted in the certification documentation, this manual and the product specification. If necessary the product must be protected by an enclosure to prevent mechanical damage.
7. The product must not be installed in a position where it may be attacked by aggressive substances and must be protected from excessive dust by an enclosure etc.

Repair

8. The product cannot be repaired by the user and must be replaced with an equivalent certified product. Repairs should only be carried out by the manufacturer.

Marking

The following information is provided on the labels:

System marking

A 2/1 node with intrinsically safe field terminals carries an apparatus certificate number of BAS98ATEX7202. The apparatus is also CE marked with the Notified Body Identification Number of 600. This certification information is marked on the Railbus Isolator.

Component marking

I/O Modules (8201, 8204, 8205, 8206 8215, 8220, 8223), Field Terminals (8621, 8622, 8623, 8624, 8625, 8626), 2/1 carriers (8720, 8727), Carrier Extenders (8030, 8031), IS Power Supply and Carrier (8920 and 8724), and Railbus Isolator and Carrier (8922 and 8723)

Company Name and Address

Product Number and Name

Serial Number

Year of Manufacture

Certificate Numbers

8201 = BAS98ATEX7207U

8204 = BAS98ATEX7205U

8205, 8206 = BAS99ATEX7316U

8215 = BAS98ATEX7204U

8220 = BAS98ATEX7206U

8223 = BAS00ATEX7202U

8621,8622,8623,8624,8625,8626 = BAS98ATEX7211U

8720,8727,8030,8031 = BAS98ATEX7210U

8920,8724 = BAS98ATEX7209U

8922,8723 = BAS98ATEX7208U

Equipment Marking

8201, 8204, 8215, 8220 = II [1] G [EEx ia] IIC

8205, 8206, 8223 = II (1) G [EEx ia] IIC

8030, 8031, 8621, 8622, 8623, 8624, 8625, 8626, 8720, 8727, 8920, 8922 = II [1] G [EEx ia]

8723, 8724 = None

Ambient Temperature Range of –40 to +70 degrees Centigrade

Safety Description

8201 U_m = 18 V, U_o = 28 V, I_o = 93 mA, P_o = 0.66 W

8204 U_m = 18 V, U_o = 23.3 V, I_o = 88 mA, P_o = 0.65 W

8205 U_m = 18 V, U_o = 16.4 V, I_o = 79 mA, P_o = 0.33 W (Ch 1,2,3,4,7 & 8)

U_m = 18 V, U_o = 1 V, I_o = 1.1 mA, P_o = 0.33 mW (Ch 5 & 6)

8206 U_m = 18 V, U_o = 16.4 V, I_o = 217 mA, P_o = 0.9 W

8215 U_m = 18 V, U_o = 25 V, I_o = 110 mA, P_o = 0.69 W

8220 U_m = 18 V, U_o = 10.5 V, I_o = 14 mA, P_o = 0.04 W

8223 U_m = 18 V, U_o = 28.5 V, I_o = 93.2 mA or 169 mA at 3.14V, P_o = 0.639 mW

8920 U_m = 250 V

8922 U_m = 250 V

8030,8031,8621,8622,8623,8624,8625,8626,8720,8723,8724,8727 = None

Carrier Extension Cables (8010 to 8019)
These have only the following information:

Company Logo

Product Number (801X-CC-XX)

Year of Manufacture

Certificate Number BAS98ATEX7210U

Field Terminal Connections (8201, 8204, 8205, 8206, 8215, 8220 and 8223)
8201, 8204, 8215 and 8223 must use IS field terminals 8621-FT-IS or 8622-FT-IS

8205 must use IS field terminal 8625-FT-IS

8206 must use IS field terminal 8626-FT-IS

8220 must use IS field terminals 8623-FT-IS or 8624-FT-IS

See Appendix 3 on page 50 for field terminal connection information

Schedule of Limitations

The attention of the customer/installer/user is drawn to the fact that the component certificates (i.e. those ending in "U") have a Schedule of Limitations, but that these limitations are fully met by designing the system as described in the System Specifier's Guide (AN8000) and assembling it as described in this document.

The Schedules of Limitations for the certificates are provided below, listed under their individual certificate numbers.

7202U

1. Each group of circuits, forming an output channel, must be considered as a separate intrinsically safe circuit which must be segregated from all other circuits by the requirements of Table 4 of EN 50020.
2. This module must be mounted with suitable connection facilities such that the output connectors are provided with a degree of protection of at least IP20.
3. Plugs and sockets for external connection must be designed such that incorrect connections or interchangeability with inappropriate field connections is prevented.
4. This module must be segregated from any other Non-IS or IS circuits, by the Requirements of Table 4 of EN 50020:1994.

7204U / 7205U / 7206U / 7207U

1. Each output channel must be considered as a separate intrinsically safe circuit which must be segregated from all other circuits by the requirements of Table 4 of EN 50020.
2. This module must be mounted with suitable connection facilities such that the output connectors are provided with a degree of protection of at least IP20.
3. Plugs and sockets for external connection must be designed such that incorrect connections or interchangeability with inappropriate field connections is prevented.
4. This module must be segregated from any other Non-IS or IS circuits, by the Requirements of Table 4 of EN 50020:1994.

7208U

1. The 8922-RB-IS Railbus Isolator output voltage requires further voltage and current limitation before it can be connected within an Intrinsically Safe Circuit.
2. This module must be segregated from any other Non-IS or IS circuits, by the Requirements of Table 4 of EN 50020:1994.

7209U

1. The 8920-PS-DC IS System Power Supply Module output voltage requires further voltage and current limitation before it can be connected within an Intrinsically Safe Circuit.
2. The 8920-PS-DC IS System Power Supply module and the 8724-CA-PS IS Module Power Supply Carrier must be mounted with suitable connection facilities such that the output connectors are provided with a degree of protection of at least IP20.
3. IS Module Power Supply Carrier must be segregated from any other Non-IS or IS circuits.

7210U

1. The 87XX Module Carriers must be installed with either a complete set of I/O modules or 8420-BK-MO Module Blanking Covers such that the carrier has a degree of protection of at least IP20.
2. This module must be segregated from any other Non-IS or IS circuits, by the Requirements of Table 4 of EN 50020:1994.

7211U

1. The maximum input/output voltage for the terminals must not exceed 30V.

When the 8625-FT-IS Thermocouple Field Terminals and the 8626-FT-IS RTD Field Terminals are used, the effect of segregation limitations for 30V within the terminals, should be considered on the combined output parameters for the assembly.

7316U

1. Each output channel must be considered as a separate intrinsically safe circuit. This Limitation does not apply to the 8206-TI-IS, 8 Channel IS RTD Input Module.
2. This module must be mounted with suitable connection facilities such that the output connectors are provided with a degree of protection of at least IP20.
3. Plugs and sockets for external connection must be designed such that incorrect connections or interchangeability with inappropriate field connections is prevented.
4. This module must be segregated from any other Non-IS or IS circuits, by the Requirements of Table 4 of EN 50020:1994.

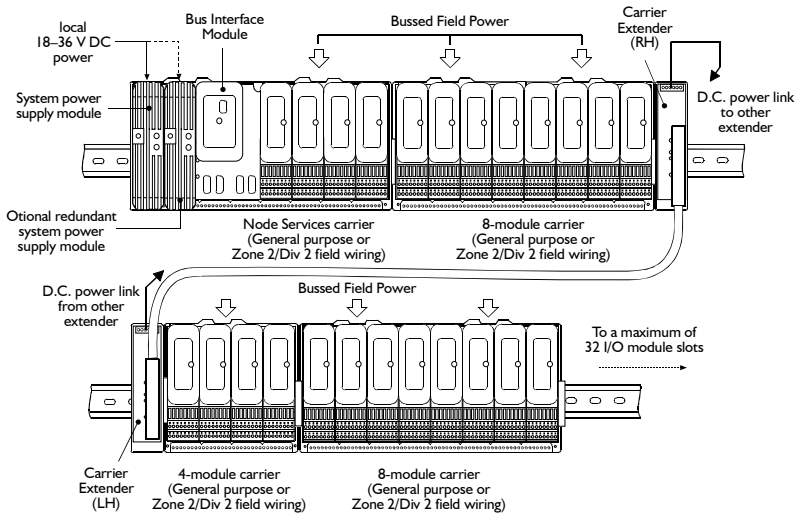
THE SYSTEM TYPES

Before beginning to assemble the physical system the user must be aware of the type of system that is being installed. The assembly process can be a little different for each of the following types of installation.

a) General purpose (GP)
b) 2/2 system
c) 2/1 system with intrinsically safe field wiring
d) Combined 2/2 and 2/1 systems

There follows a brief description of how these types are implemented. Detailed information is provided, beginning at the section titled "The Installation Process".

a) General purpose (GP)



An MTL8000 node for use in a general purpose environment should look similar to the installation shown above. The installation may be larger or smaller but most of the component parts shown above will be used.

Starting from the top left, a Node Services carrier is present fitted with one or two power supplies, a BIM and four I/O modules. Further I/O modules follow on an 8-module I/O carrier. Because the mounting enclosure is not wide enough to continue the line of carriers and modules, the above installation uses a pair of carrier extenders, a right-hand version followed by a left-hand version, to extend the run of carriers onto a second section of DIN rail below the first. A flexible cable carrying the Railbus signals links the two together and power supplies are maintained through cables connected to the screw terminals.

Additional I/O module carriers are then fitted after these extenders. This approach can be continued until the node limit of 32 I/O modules is reached.

Power for the modules is derived from the supplies on the Node Services carrier or from local, well regulated, 12V bulk power supplies. Power for field wiring can be distributed using the Bussed Field Power (BFP) system available on the MTL8000. Connections for the BFP will be found on the rear/top edge of the I/O carriers.

b) 2/2 system

This is very similar to the general purpose installation described above. The same diagram shows the key features for this installation but some of the field terminals may have been specified as non-incendive or non-arcing to comply with safety regulations for the field wiring. This has no effect on the installation process.

c) 2/1 system with intrinsically safe field wiring

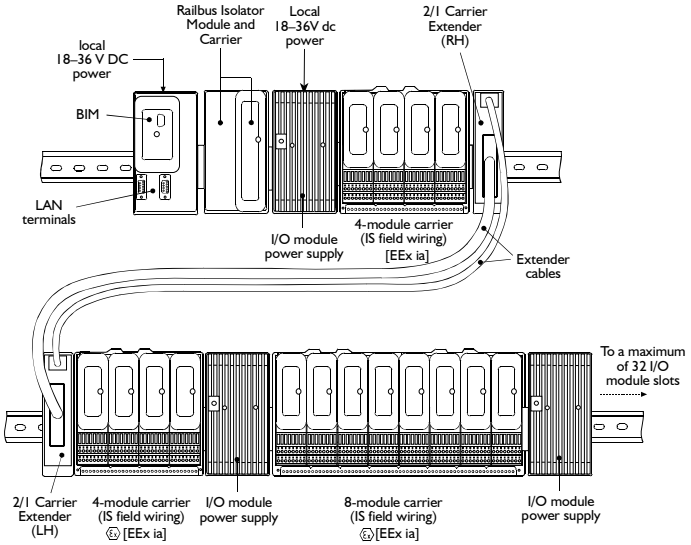


Fig a) A 2/1 node using a BIM carrier

Referring to fig a), a BIM carrier (8715-CA-BI) is used to mount the BIM and to accept the local area network (LAN) connections. Power for the BIM is provided by a locally available 12V supply. Next is a very important element of the installation, the Railbus Isolator.

The Railbus Isolator mounts on its own carrier and provides the essential isolation for the Railbus supplying the I/O modules that have intrinsically safe field wiring. By installing the carrier for the Railbus Isolator the gender of the multi-pin Railbus connector is reversed, this prevents the use of 2/2 module carriers after the Isolator because they cannot connect to this reversed connector type. 2/1 I/O module carriers may now be connected as required, up to the node limit of 32 I/O modules.

Like the general purpose and 2/2 system, carrier extenders may be used to continue the module carriers on a separate DIN rail but specific 2/1 carrier extenders and multicore cables must be used for this purpose; 2/2 versions will not fit.

D.C. power for the BIM, and the Railbus Isolator must be provided from a local, well regulated, 12V bulk power supply.

Power for the 2/1 I/O modules can be provided by the 8920-PS-DC power supply units. These must be distributed down the chain, as shown above, not grouped together. This is explained further, later in this manual.

Note: There is no Bussed Field Power facility on the 2/1 I/O module carriers

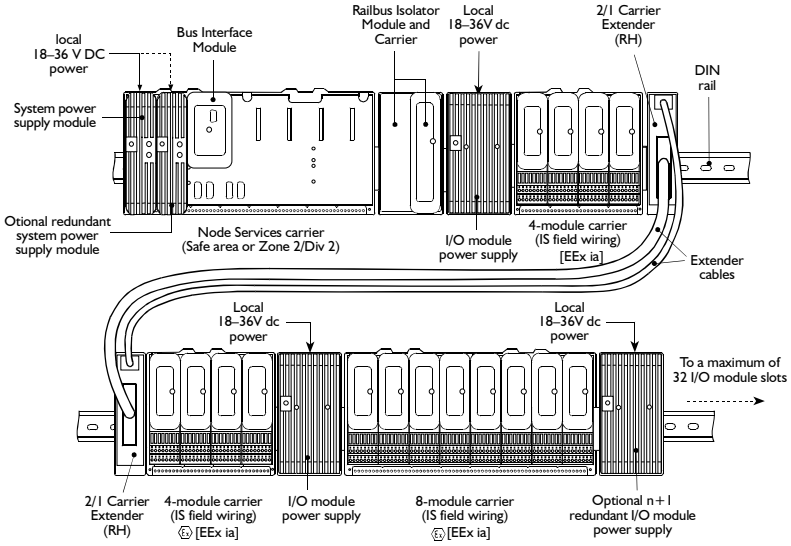
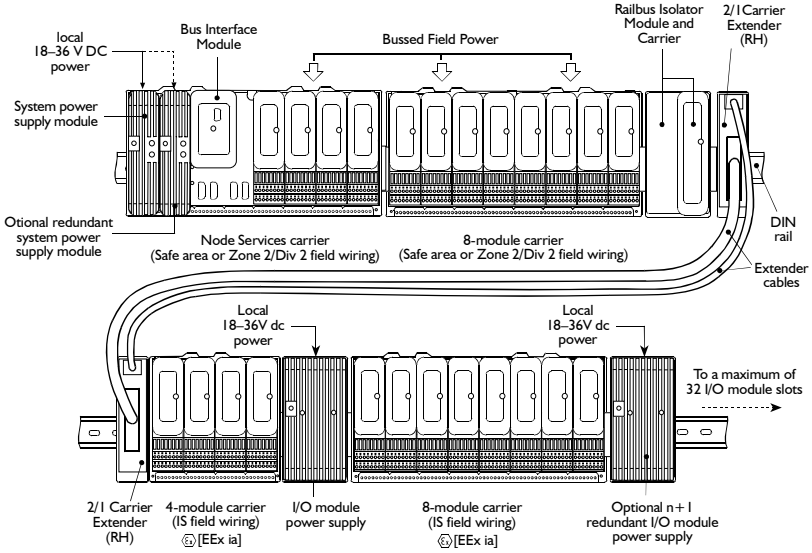


Fig b) A 2/1 node using a Node Services carrier and 8910 system power supply module(s)

d) Combined 2/2 and 2/1 systems



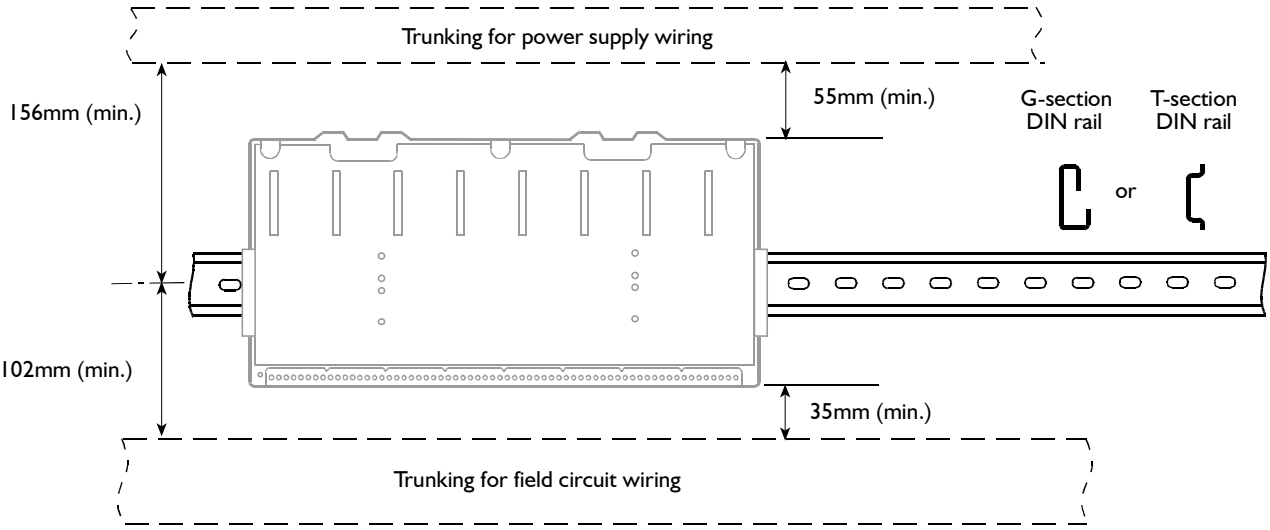
Some nodes require a combination of 2/2 and 2/1 MTL8000 equipment. To achieve this, the 2/2 equipment must be installed first in accordance with the method outlined in section b). The node will start therefore with a Node Services carrier carrying the BIM and any necessary power supply modules. Continue with 2/2 I/O module carriers until all of the 2/2 modules have been accommodated.

A Railbus Isolator must then be placed at the end of the 2/2 section before 2/1 I/O module carriers can be installed. The Isolator provides the necessary protection for the IS field wiring that will follow. At this point follow the instructions provided for the installation of a 2/1 node.

Continue the installation using 2/1 I/O modules on appropriate 2/1 carriers, with the required 8920-PS-DC power supplies spaced at suitable intervals along the chain of modules.

Carrier extenders may be required in order to fit the equipment into the enclosure. The appropriate extenders (2/2 or 2/1) must be used to suit the carriers involved. 2/1 carrier extenders can not be used until a Railbus Isolator carrier has been placed in the line of carriers.

Note: Do not attempt to fit additional 2/2 carriers and modules to the end of a line of 2/1 carriers.



THE INSTALLATION PROCESS

Fitting DIN rail

Carriers may be mounted on T-section or G-section DIN rail.

T-section

15 mm depth rail is recommended when it is the only means of support in the enclosure. The recommended spacing for rail fixings is shown in the table.

If 7.5 mm rail is used, it must be mounted on a back panel with no spacers between the rail and the panel. Care should be taken to ensure that the screw heads of the fixings for this rail type do not interfere with the carrier mountings.

The recommended spacing for rail fixings is shown in the table.

G - section

Care should be taken to ensure that the fixings for this rail type do not interfere with the carrier mountings. The recommended spacing for rail fixings is shown in the table. See also the information below on cable trunking.

Distance between rail fixings

These recommended figures assume full loading of the rail.

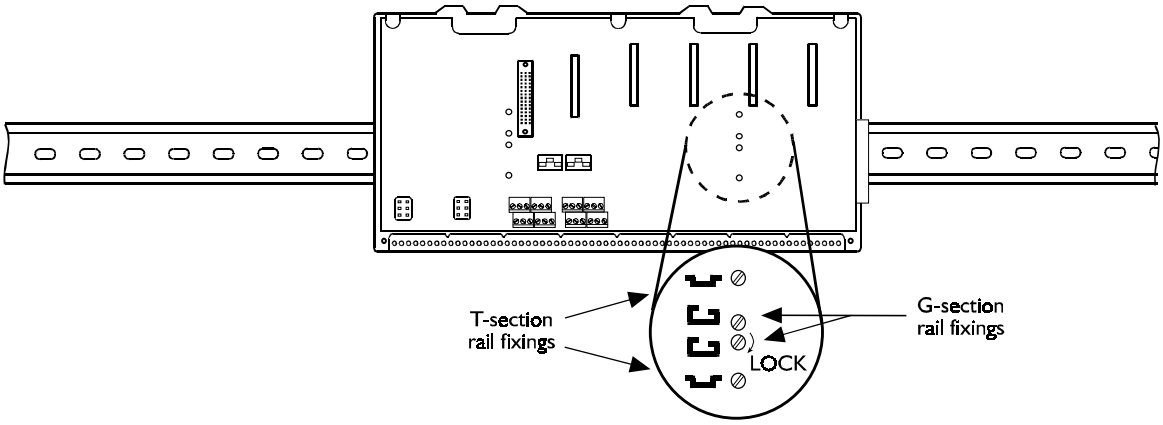
Rail Type	Distance between fixings (max.)
G - section	500 mm
T - section 7.5 mm	150 mm (see notes)
T - section 15 mm	500 mm

Fitting Cable Trunking

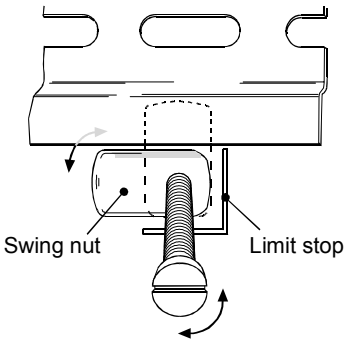
Cable trunking is recommended for management of the power supply and field wiring. Space for this trunking must be considered when installing the DIN-rail.

See the diagram above for the recommended minimum spacing between a carrier and any adjacent cable trunking. The extra spacing for the power supply cabling allows for the insertion and removal of power connectors.

See also Appendix 2 (page 49) which illustrates two of the possible configuration options for the trunking layout.



Screw and swing nut fixing method



Attention!

Maximum torque for swing-nut fixing screws

= 10 Nm (7.5 ft-lb)

Note: The spacing between each carrier is 3.0 mm

Mounting ALL carrier types

Fixing to DIN rail

'Screw and swing nut' fixings are used to fix the carriers to the DIN rail (see left). The nut rotates to fit underneath the edge of the DIN rail and further tightening of the screw pulls the nut up against the rail.

These fixings are contained within the bodies of the carriers, and access to the screw head is through the holes in the PCB (see diagram above). The outer two screws are used for T-section rail, and the inner two for G-section.

IMPORTANT - BEFORE MOUNTING THE CARRIER:

Give each of the required screws <u>two</u> 360° turns, anticlockwise, with a screwdriver.
(This will ensure that the nuts on the underside of the carrier have swung out of the way and are sufficiently retracted.)

- Ensure that the carrier is correctly orientated and then locate it on the rail.
- **Press the carrier to the DIN rail** while tightening the fixing screws - do not exceed torque shown here (left).

The dimensions for each carrier type are given in Appendix 1.

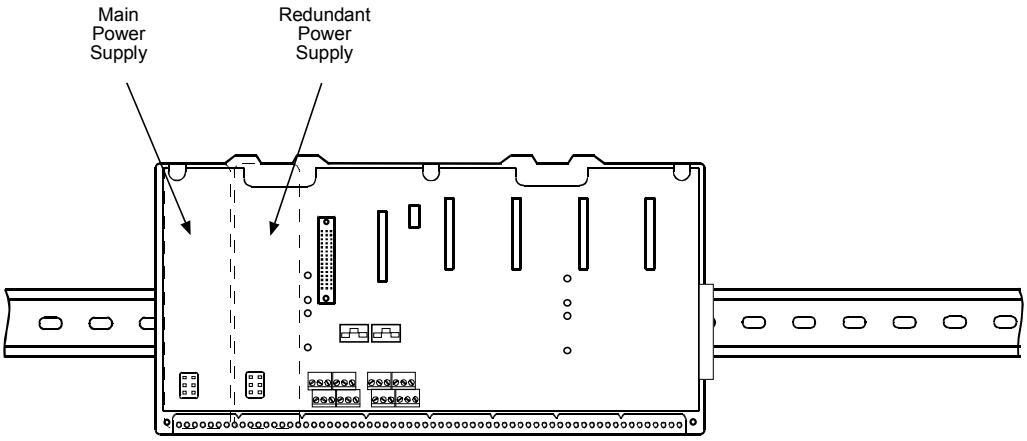
Fixing to flat panel

Prepare fixing holes in the panel. Drilling dimensions are given in Appendix 1.

- Mount a flat washer on an M4 screw of the required length, and insert one of these in each mounting hole - a total of 4 per carrier.
- Ensure that the carrier is correctly orientated and then place it in position.
- Tighten the fixing screws to attach it securely.

When mounting carriers:

- If using HART maintenance module 8512-IF-HA, leave space (~ 50 mm) on the DIN rail to the left of the BIM's carrier to mount this module.
- Ensure that adjacent carriers have their Railbus multi-pin plug and socket fully engaged before tightening the fixing screws.



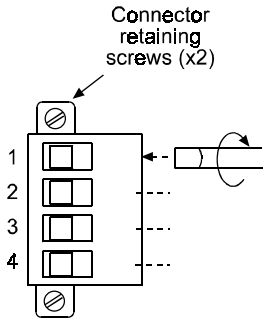
Power Supplies

2/2 and general purpose applications

One or two Power Supply Modules - type 8910-PS-DC - can be fitted to a Node Services Carrier (8711-CA-NS or 8712-CA-NS) to provide a 12V dc supply for the Railbus. Alternatively, a well regulated, external 12V ± 0.5V bulk power supply may be used (see page 20 for details).

Note: The 8910-PS-DC power supplies (or external 12V bulk power supply if used) must be fed from a source of power providing double insulation, or its equivalent, between the mains supply system and the node. See also the section titled "Electrical Configuration of MTL8000" in the Wiring and Cabling Guidelines on page 39.

8910-PS-DC power supply module input connections



Terminal No.	Polarity
1	+
2	+
3	–
4	–

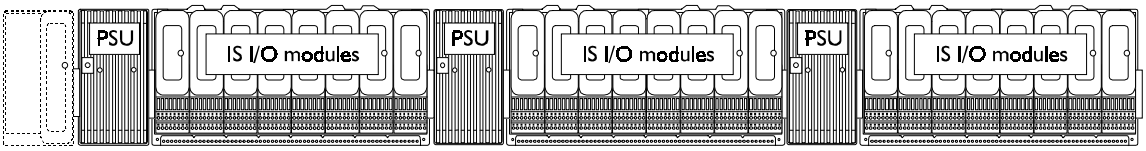
Using 8910-PS-DC Power Supply Modules (2/2 and GP sections ONLY)

When using the 8910-PS-DC Power Supply Module to power the Railbus the first, (or main), power supply will be fitted in the position shown above. If a redundant 8910-PS-DC is used, for additional security, then it can be fitted alongside.

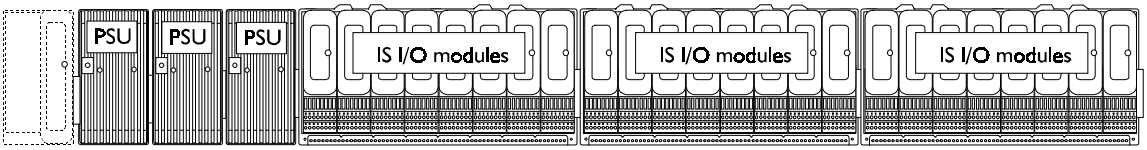
The 8910-PS-DC Power Supply Module operates with a locally supplied 18.5 - 36 V dc supply. This is supplied to the module via a removable connector located on the top edge of the unit.

Prepare the connector(s) as follows:

- Trim back the insulation of each conductor by 6 mm, or 8 mm if using crimp ferrules.
- Check terminal assignments with table (left) and secure wires in connector(s).
- If the power supply modules are not being fitted at this stage, secure the connectors out of the way until required.



RIGHT ✓



WRONG ✗

Power Supplies (continued)

2/1 applications

Using 8920-PS-DC IS Module Power Supplies (2/1 applications ONLY)

8920-PS-DC Power Supply modules are used to power 2/1 I/O modules and should be fitted as shown above. Before this type of power supplies can be installed a Railbus Isolator must first be fitted (shown dotted above).

After the first one, further 8920-PS-DC supplies may be fitted anywhere in the 2/1 section to satisfy power requirements. They should be distributed throughout the chain, not grouped together, as the diagram above shows. A further PSU could also be added at the end of the chain to provide redundancy in the event of the failure of one of the other supplies.

The 8920-PS-DC Power Supply Module operates with a locally supplied 18.5 – 36 V dc supply. This will connect to the module via a removable connector at the top of the unit.

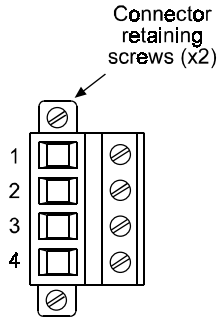
The 8920-PS-DC connector and its terminal assignments are shown here.

The number of 8920-PS-DC modules that will be required depends upon the number of modules fitted and their types. Use the AN8000 - System Specifier's Guide to determine the system requirements.

Prepare the connector(s) as follows:

- Trim back the insulation of each conductor by 6 mm, or 8 mm if using crimp ferrules.
- Check terminal assignments with table (left) and secure wires in connector(s).
- If the power supply modules are not being fitted at this stage, secure the connectors out of the way until required.

8920-PS-DC
IS module power supply input connections

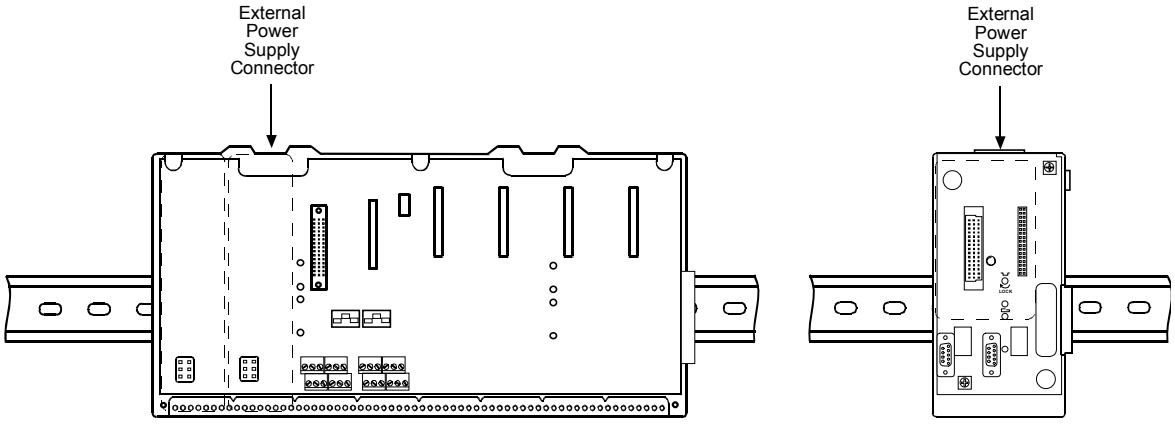


Terminal No.	Polarity
1	+
2	+
3	–
4	–

Mixed 2/2 and 2/1 applications

If the system has both general purpose (2/2) and IS field wiring then the general purpose (2/2) section should be powered as described on the previous page and the IS field wiring section powered in accordance with the methods described above.

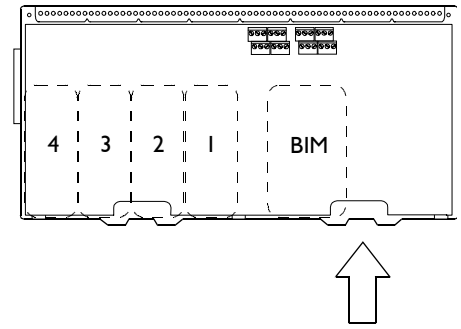
A Railbus Isolator must, of course, be fitted between the sections to provide the necessary isolation and to reverse the gender of the carrier connectors.

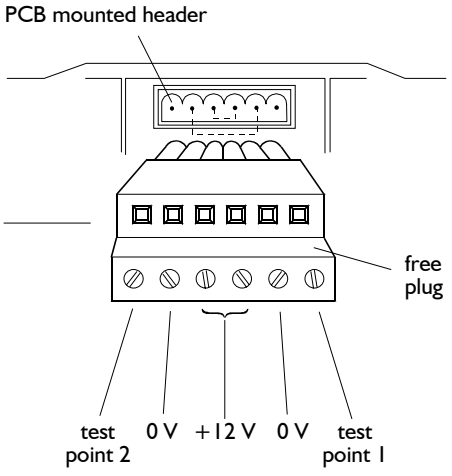


Node Services Carrier
e.g. 8711 & 8712

BIM Carrier
8715

External supply connection on Node Services carriers





Terminal	8711/8712	8715
1	Test point 1	N.C.
2	0 V	0 V
3	12 V	12 V
4	12 V	12 V
5	0 V	0 V
6	Test point 2	N.C.

Power Supplies (continued)

Using External Power Supply

External bulk power supplies can be used instead of MTL8000 power supply units to supply the BIM and any general purpose (2/2) I/O modules.

An external bulk power supply must be able to provide a stable 12 ± 0.5 V while delivering sufficient current to power the equipment attached to it. The required current should be calculated by summing the current requirements for the individual modules. See MTL publication AN8000 – System Specifier's Guide for the current consumption figures of the individual modules.

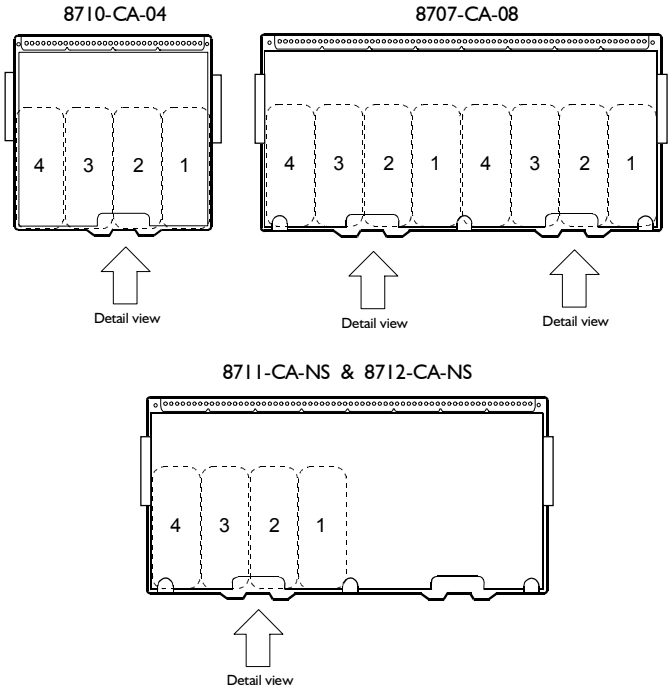
A separate header connector (see left) is provided at the top/rear of carrier types 8711-CA-NS, 8712-CA-NS and 8715-CA-BI.

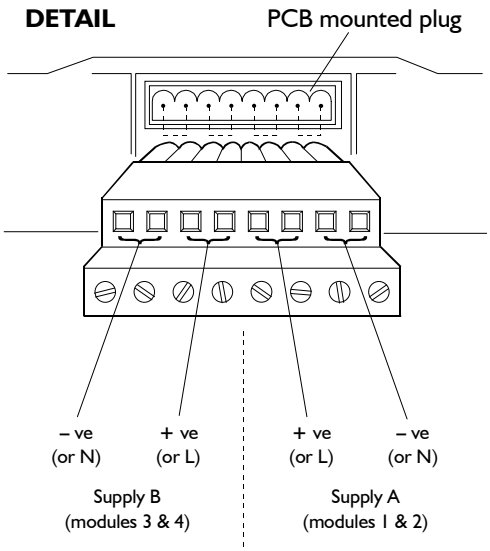
Wire the free plug as follows:

- Trim back the insulation of each conductor by 6 mm, or 8 mm if using crimp ferrules
- Check terminal assignments against diagram and table (left)
- Insert each conductor in turn and tighten the locking screw. Overtightening or applying excessive pressure to the screw terminal is unnecessary and could cause damage to the connector.

Carrier earthing/bonding point

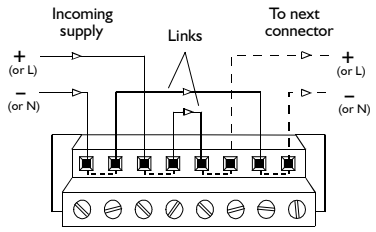
To earth/ground the carrier, connect a wire link from one of the 0 V plug terminals directly to the earth bar of the enclosure.



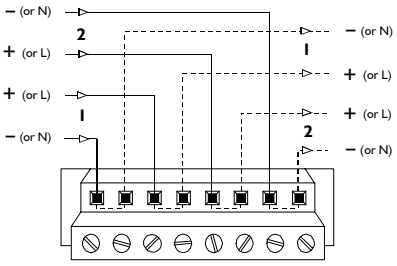


Note

In the diagrams below, the four broken lines linking adjacent terminals indicate links that exist on the PCB.



Single external field supply



Two external field supplies

Bussed Field Power (GP and 2/2 systems only)

Bussed Field Power enables field circuit power to be available direct from the field terminals, thus a simple supply rail connection at the rear of the carrier makes power available to a range of field terminals. This overcomes the inconvenient wiring arrangements associated with some I/O module systems. The system is capable of handling voltages of up to 230 V AC (nominal) to the field circuits (depending upon the I/O modules in use).

If its datasheet indicates that a module requires an additional power rail for the field circuit then this can be provided using the connector(s) at the top/rear edge of the carrier.

A single connector can provide two independent power rails, each rail supplying two modules. Viewing the carrier as shown above, Supply A will feed the two modules to the right of the connector (1 & 2) and Supply B will feed the two modules to the left (3 & 4). The second terminal for each connection enables the supply to be looped onwards.

The eight module carrier has two of these connectors on its rear edge; the four module and the Node Services carrier have only one.

Wiring single external field supply to other modules

When using a single power supply the connector may be wired to loop the supply to the other half of the connector, and even loop it to another connector on the same carrier or an adjacent one.

If all four modules require the same supply, loop the connections onto the other half of the connector as shown.

The power supply may be further looped to another connector if it is capable of supplying sufficient current.

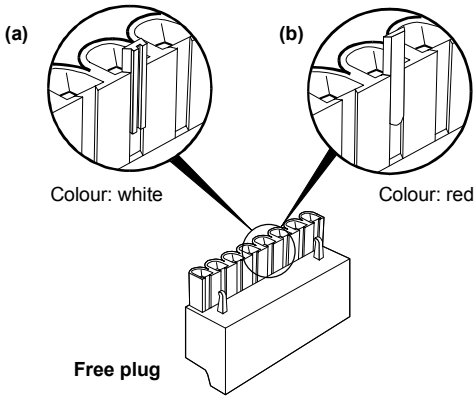
Wiring two external field supplies to other modules

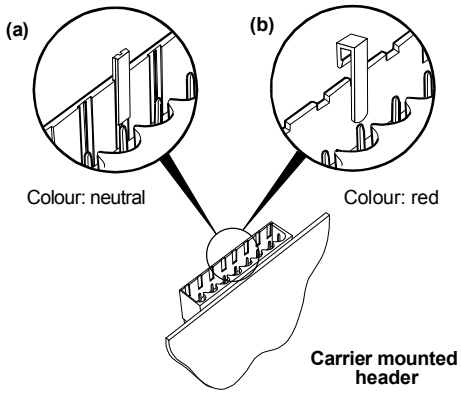
When two separate supplies are available on one connector, they can be looped to a second connector as shown.

Connector wiring

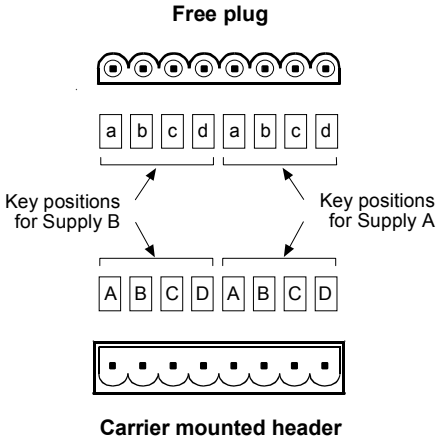
The connector must be wired before it is plugged into the carrier.

- Trim back the insulation of each conductor by 15 mm
- Check pin assignments
- Insert each conductor in turn and tighten the connector screw. Overtightening or applying excessive pressure to the screw terminal is unnecessary and could damage the connector.





Key positions



A possible keying code

Bussed Field Power Supply Voltage		Code
24 V DC	Header	A B C -
	Plug	- - - d
115 V AC	Header	A B - D
	Plug	- - c -
230 V AC	Header	A - C D
	Plug	- b - -

Note

A - C D means keys are fitted to positions A, C and D on the carrier mounted header.

Bussed Field Power (continued)

The coding key system

A coding key system is available to prevent the interchange of Bussed Field Power plugs that carry different voltage levels. The user fits one part of the key system to the header on the carrier and the other to the free plug (see above).

As two different supplies or voltages can be provided on one plug, i.e. supply A for modules 1& 2 and supply B for modules 3 & 4, appropriate code keys should be fitted to each half of the plug and header.

The keying code chosen by the user should uniquely identify the different voltages that will be applied to the header.

The combination of keys in the plug and header (left) should also be chosen to ensure that a free plug cannot be plugged into the wrong header on the carrier. The plug and header will not connect if the same lettered keys are opposite each other, e.g. 'A' opposite 'a' will not allow them to connect.

As an aid, a suggested code is shown here (below left) that will uniquely identify the three most commonly used supply voltages, but bear in mind that the choice of key codes, and even the *use* of key coding altogether, is entirely at the discretion of the user.

Fitting coding keys

The plug and header can be either of two types, each having a particular coding key design. The illustrations at the top of the page show the types, (a) and (b), for both the free plug and the fixed header. The two should not be mixed, i.e. a type (a) plug should not be used with a type (b) header. The keys are supplied on their own plastic tool for ease of insertion.

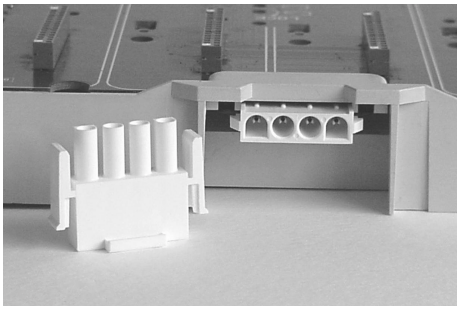
- Identify the key's positions for the code that you have chosen.
- Using the insertion tool, slide the appropriate key into the appropriate position on the free plug.
- When it is in place, separate it from the insertion tool by bending the tool backwards and forwards until the key breaks away from the insertion tool.
- Repeat the process on the fixed header using the keys for the header.

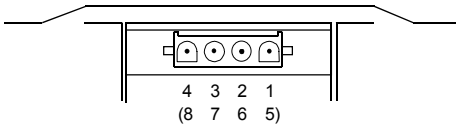
Note

There is no potential hazard from exposed Bussed Field Power pins on the carrier, as they carry no supply voltage.

Earth leakage connection pins

(view of PCB mounted header and free plug)





Pin numbers refer to module numbers on the carrier.

Earth Leakage connections (2/1 systems only)

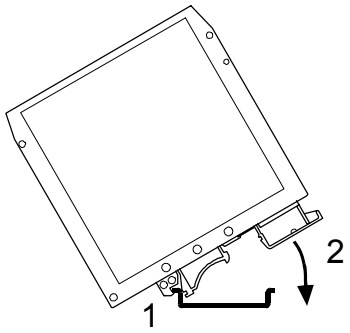
2/1 I/O module carriers have connections for earth leakage detection equipment. The 8720-CA-IS four module carrier has one four pin connector and the 8727-CA-IS eight module carrier has two four pin connectors. Each pin has a direct connection to the earth reference of one module.

The PCB mounted header connectors are located at the top/rear of the carrier (in place of the bussed field power connections that are provided on the 2/2 module carriers). A free plug with a simple locking mechanism provides the connection to the detector circuitry.

Earth leakage monitoring

Earth leakage can be detected by connecting an earth leakage monitoring device, such as MTL2220 or similar, to the individual pins. This type of monitor measures the resistance between the floating ground of the module and the system ground; if it falls below a threshold, e.g. 10kΩ, an alarm sequence can be initiated.

Mounting 8512-IF-HA module



HART interface module

The 8512-IF-HA is an interface module that links HART field devices to a PC running instrument management software. It connects to the BIM's communications port, then relays the signals via an RS485 communications link with the remote PC.

The module should be located adjacent to the carrier on which the BIM is mounted. It has a built-in mounting bracket to attach it to T- or G-section DIN rail.

Identify the edge of the module that has terminals 1–6 and tilt it (forward/downward) by approximately 30° and locate it over one edge of the DIN rail (**1**). See diagram on left. When located, the module can be rotated back (**2**) until the module's bracket locks into the other edge of the rail.

To remove the module, use a screwdriver to lever the "release tab" outwards until the module is released from the DIN rail in the reverse of the mounting procedure.

Connecting the LAN wiring

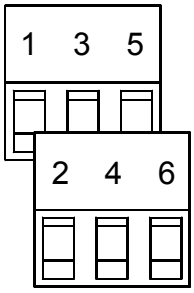
The wiring of the LAN depends upon which of the three types of BIM carrier is being used.

- 8711-CA-NS – Node Services carrier (Modbus applications)
- 8712-CA-NS – Node Services carrier (Profibus-DP applications)
- 8715-CA-BI – BIM carrier (Modbus or Profibus-DP applications)

8711-CA-NS Node Services carrier

On the 8711-CA-NS Node Services carrier there are two sets of connectors for each LAN. The two sets are connected in parallel via the circuit board, (1 to 1, 2 to 2, etc.) which permit the LAN to be looped-on to the next node from the second connection set.

8711-CA-NS Node Services carrier



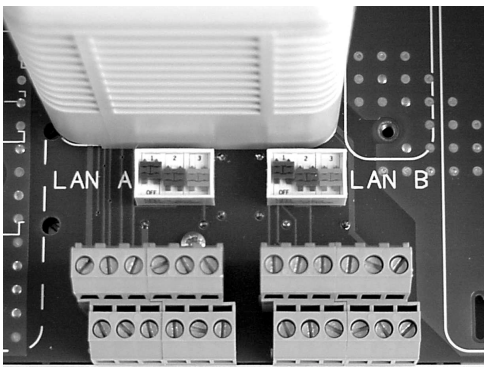
The 8711-CA-NS carrier will accept RS422/485 4- or 2-wire connections. In either case, there is also the facility to terminate the cables with 220Ω resistors and also to apply a biasing voltage to the interface to reduce the effect of line noise.

Terminating, or applying bias to the interface, is selected with the DIL switches on the carrier. The connection information that follows applies to either LAN. The terminal assignments are shown in the table on the left and the terminal numbering is shown in the diagram above it.

The 4-wire method uses terminals 1 - 4. The 2-wire method can use either the Tx+ and Tx– (terminals 2 and 4) or, the Rx+ and the Rx– (1 and 3) as these terminals are commoned through the action of the DIL switch.

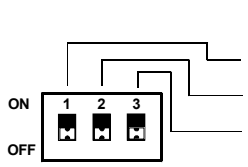
Screw terminal connections (x2)

Terminal #	LAN connections
1	Rx +
2	Tx +
3	Rx –
4	Tx –
5	Gnd
6	(cable screen/ shield)



Setting the modes for the LAN interface

The carrier has DIL switches on the circuit board beside each set of terminals to set-up the LAN (see picture). Each of the switches has a specific purpose, defined below.



SW	Function	OFF	ON
1.	4-wire/2-wire select	4-wire	2-wire
2.	Termination select	None	Terminated
3.	Bias select	None	Biased*

* Switch 2 must be in ON position also

Switch 1 – 4-wire or 2-wire setting

Set this switch to suit the type of LAN wiring. If a 4-wire LAN is being used, put the switch in the OFF position. For a 2-wire implementation, put the switch in the ON position.

Switch 2 – Apply termination

If the carrier is the last, or only, node on the LAN, this switch can be used to apply a termination to minimise signal reflections on the line. Normally, this is not necessary but if signal errors are noticed, a termination can often help.

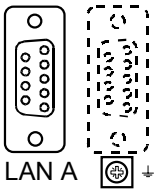
When the switch is moved to ON, a 220Ω termination is placed across the RxD+ and RxD– signal lines. This terminates the Rx line in 4-wire mode, or the common Tx/Rx line when in 2-wire mode.

If the carrier is one of a continuing run of nodes then the switch should be left in the OFF position.

Switch 3 – Apply bias (to a terminated LAN)

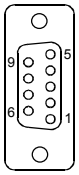
If the environment has an unusually high level of electrical noise, this switch can add dc bias to the LAN in order to lift the wanted signal above the noise level.

Bias can only be added to a terminated LAN, so **Switch 2** must also be in the ON position.



Terminal provided on carrier
(Note: Second terminal available only on early versions of carrier)

LAN terminal pin locations



Terminal pins	LAN Connections
1	Shield/protective ground
3	**RxD/TxD +**
4	RTS +
5	DGND (0V)
6	VP (5V)
8	**RxD/TxD –**

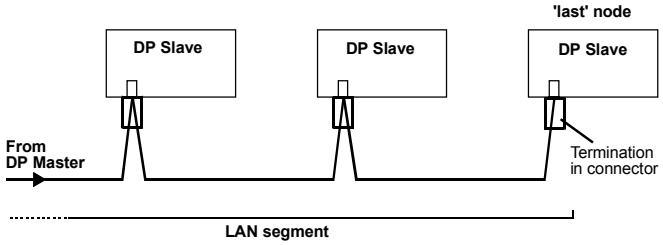
8712-CA-NS Node Services carrier

This Profibus-DP carrier uses a 9-pin, sub-D connector for an RS485 2-wire interface.

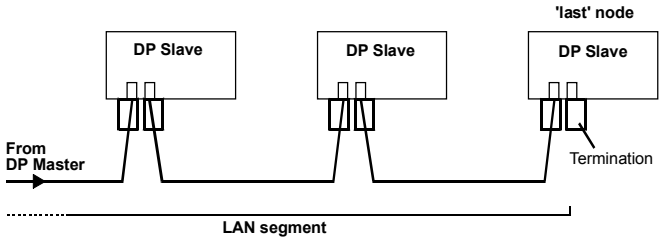
A single female connector is provided on the carrier as the male connector on the cable should provide the means to loop the LAN onward for further nodes, as shown in (a) below. By these means, disconnecting the cable from the carrier will not interfere with the operation of the LAN. The free connector should also contain an optional termination that can be switched in for the last node in the chain.

Note: Earlier carriers had two adjacent connectors wired in parallel, so that the LAN could loop in to the carrier on one connector and out of the carrier on the other, as shown in (b) below. However, in these circumstances, disconnection of the cable from the carrier interrupted LAN operation.

A separate grounding terminal is provided with the LAN connection for terminating cable screens/shields. This is in addition to the ground connection on pin 1 of the connector.



(a) Single connector per carrier (termination in cable connector)



(b) "Daisy chaining" found on earlier carrier type

LAN terminal assignments

The 2-wire assignments are shown here (left).

Only pins 3 and 8 are required for connecting the standard RS485 2-wire bus.

If the environment has an unusually high level of electrical noise, then bias can be applied to the network to lift the wanted signal out of the noise induced by the interference.

A 5V supply, via a 390Ω resistor, is available from pin 6. This enables a user to apply bias to the network. If the necessary resistors are fitted in the cable being connected, then the biasing voltage is automatically applied to the LAN.

Modbus terminal assignments

LAN A and LAN B

Terminal pins	4-wire	2-wire
1*	Shield/protec -tive ground	Shield/protec -tive ground
2	RxD+	RxD+/TxD+
3	TxD+	**RxD+/TxD+**
4	*RxD–*	*RxD+/TxD+*
5	GND (0V)	GND (0V)
6	V_T	V_T
7	RxD–	RxD–/TxD–
8	TxD–	**RxD–/TxD–**
9	NC	NC

* This pin is also tied to the Functional Ground terminal (CON6) located beside the LAN A connector.

Profibus-DP terminal assignments

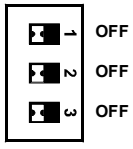
LAN A only

Terminal pins	Profibus-DP 2-wire
1*	Shield/protec -tive ground
2	NC
3	**RxD+/TxD+**
4	NA†
5	GND (0V)
6	V_P
7	NA†
8	**RxD–/TxD–**
9	NC

* This pin is also tied to the Functional Ground terminal (CON6) located beside the LAN A connector.

† These terminals are not normally available for use. They may be carrying RTS+ signals.

Profibus-SP switch setting (LAN A)

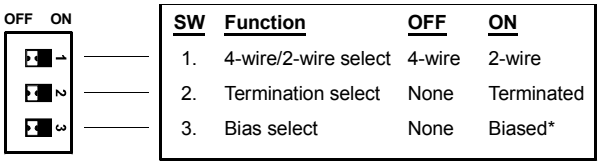


8715-CA-BI BIM carrier

The 8715-CA-BI BIM carrier can accommodate Modbus or Profibus-DP communications. It has two LAN connections, LAN A and LAN B, to provide redundancy for Modbus. Only one, LAN A, is used for Profibus-DP.

Modbus applications

Modbus installations can use 2-wire or 4-wire RS422/485. The required implementation is set up using the DIL switches, positioned beside the 9-pin, D-type connectors. The switches can also be used to install a terminating resistor and LAN biasing, if required.



SW	Function	OFF	ON
1.	4-wire/2-wire select	4-wire	2-wire
2.	Termination select	None	Terminated
3.	Bias select	None	Biased*

* Switch 2 must be in ON position also

Switch 1 – 4-wire or 2-wire setting

Set this switch to suit the type of LAN wiring. If a 4-wire LAN is being used, put the switch in the OFF position. For a 2-wire implementation, put the switch in the ON position.

Switch 2 – Apply termination

If the carrier is the last, or only, node on the LAN, this switch can be used to apply a termination to minimise signal reflections on the line. Normally, this is not necessary but if signal errors are noticed, a termination can often help.

When the switch is moved to ON, a 220Ω termination is placed across the RxD+ and RxD– signal lines. This terminates the Rx line in 4-wire mode, or the common Tx/Rx line when in 2-wire mode. If the carrier is one of a continuing run of nodes then the switch should be left in the OFF position.

Switch 3 – Apply bias (to a terminated LAN)

If the environment has an unusually high level of electrical noise, this switch can add dc bias to the LAN in order to lift the wanted signal above the noise level.

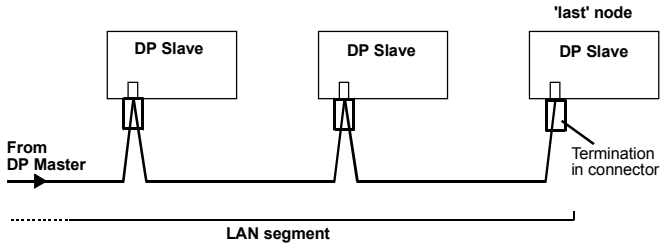
A 220Ω termination is required across the LAN for the bias to be applied; so Switch 2 must be in the ON position, or an external terminating resistor must be in place.

Profibus-DP applications

Only LAN A is used for Profibus-DP applications. The 9-pin, sub-D connector provides an RS485 2-wire interface.

A single female connector is provided on the carrier as the male connector on the cable should provide the means to loop the LAN onward for further nodes, as shown in (a) below. By these means, disconnecting the cable from the carrier will not interfere with the operation of the LAN. The free connector should also contain an optional termination that can be switched in for the last node in the chain.

An extra grounding terminal is provided with the LAN A connection for terminating cable screens/shields. This is connected internally to the ground connection on pin 1 of the connector.



(a) Single connector per carrier (termination in cable connector)

DIL switch

The switch setting for Profibus-DP operation is as shown on the left. Switch 1 is unimportant and can be set ON or OFF, but switches 2 and 3 must be set to OFF to avoid terminations and bias being applied. All terminating and biasing must occur in the free cable-plug carrying the LAN wiring.

Recommended Cable Type

The recommended bus line, for use up to the maximum bus speed (12 Mbaud), is defined in EN 50170 and is known as type A. The parameters of the type A are as follows:

Parameter	**Line A**
Impedance	135 to 165 Ω
Capacitance per unit length	< 30 pF/m
Loop resistance	110 Ω/km
Signal attenuation over total length of line section	9 dB max.
Core diameter	0.64 mm
Core cross-section	< 0.34 mm^2

This cable should be twisted-pair (1x2, 2x2 or 4x4 lines) with copper shielding braid. It is recommended that the red wire be used for signal B (TxD/RxD positive – pin 3) and the green for signal A (TxD/RxD negative – pin 8).

Cable shielding

Use only cable that has a braided shield of at least 80% density. Ground the shielding braid at each node. In areas of particularly high levels of interference, use a cable that also has a shielding foil. The shield(s) should then be grounded via the connector body and case. A ground connection for the cable shield, which can further reduce EMC emission, is provided on the 8712-CA-NS and 8715-CA-BI carriers. Where ground loop currents cause problems, the inter-node ground (i.e. the cable shielding braid) can be augmented by a separate, low resistance earth cable to divert the ground loop current.

Special requirements for data rates higher than 1.5 Mbaud

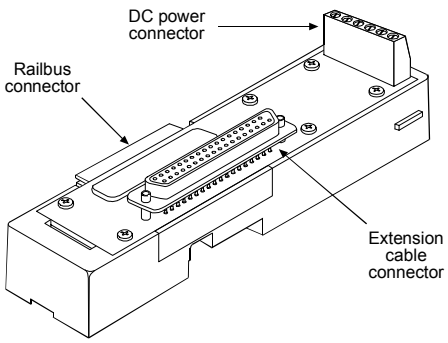
For baud rates in excess of 1.5 Mbaud, special connectors with built-in inductors are required. The inductors compensate for the cable capacitance at higher data rates. Details of suitable connector types can be obtained from the PROFIBUS User Organisation.

For these higher baud rates, ‘spurs’ or ‘stub-lines’ from the LAN should NOT be used. At data rates of 12 Mbaud, if more than one station is required at a location then a minimum cable length of 1 metre (approx. 3 feet) must be used between them.

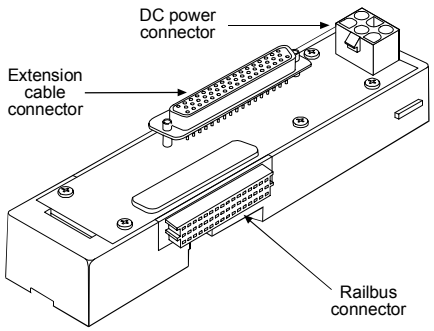
Cable Termination

The cable terminations, which are generally provided in the cable connectors, require power (5V) from the device and this should be applied at all times. The 8712-CA-NS carrier provides power for the cable termination.

Each LAN segment should be terminated at both ends. Sub-D connectors designed for use with PROFIBUS have a termination built in and a slide-switch is provided to add or remove it from the circuit.



General purpose and 2/2 carrier extender (Right-hand)



IS (2/1) carrier extender (Left-hand)

Carrier Extenders

Carrier extenders maintain the internal signal and power bus connections between the carriers when space does not allow the current line of carriers to be continued.

Right-hand and Left-hand versions

Different carrier extenders must be used for 2/2 and 2/1 sections to accommodate the different end-connector genders of their carriers. The extenders are available in a right or left hand versions, which relates to the end of the carrier to which they are fitted. The right hand extender is fitted to the end of the line of carriers that requires extending. The left hand one attaches to the 'new' line of carriers that requires the signal and power feed.

2/2 Carrier Extender – Right hand	8020-CE-RH
2/2 Carrier Extender – Left hand	8021-CE-LH
2/1 Carrier Extender – Right hand	8030-CE-RH
2/1 Carrier Extender – Left hand	8031-CE-LH

2/2 extenders have 37-way connectors while the 2/1 extenders have 50-way connectors. This prevents the two types from being accidentally cross connected.

A flexible cable is used to connect a pair of Cable Extenders and thus maintain the bus connection. Extender cables for both application types are available in three lengths, with the following part numbers:

	General purpose and 2/2 applications	**2/1 applications**
Carrier extension cable, 0.35m	8001-CC-35	8011-CC-35
Carrier extension cable, 0.85m	8002-CC-85	8012-CC-85
Carrier extension cable, 1.2m	8003-CC-12	8013-CC-12

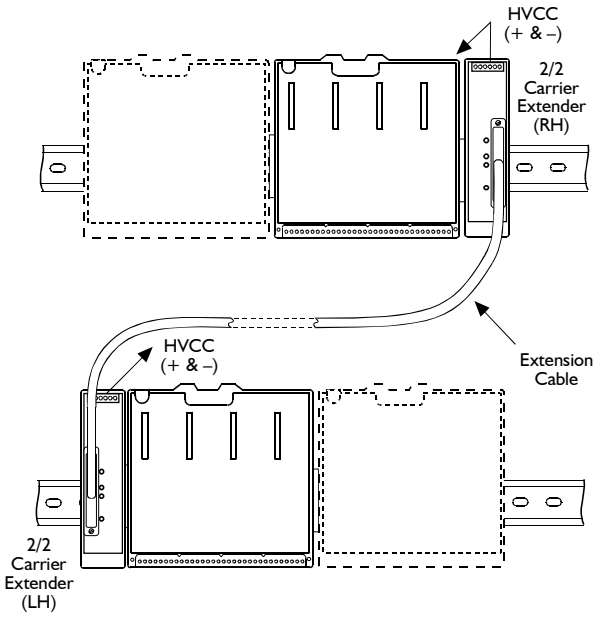
2/1 applications use a prepared cable to link the d.c. power between the carrier extenders. These are available in lengths to match the 801x cable types above. The 2/2 extenders use ordinary wire links.

2/1 Power extension cable, 0.35m	8016-CC-35
2/1 Power extension cable, 0.85m	8017-CC-85
2/1 Power extension cable, 1.2m	8018-CC-12

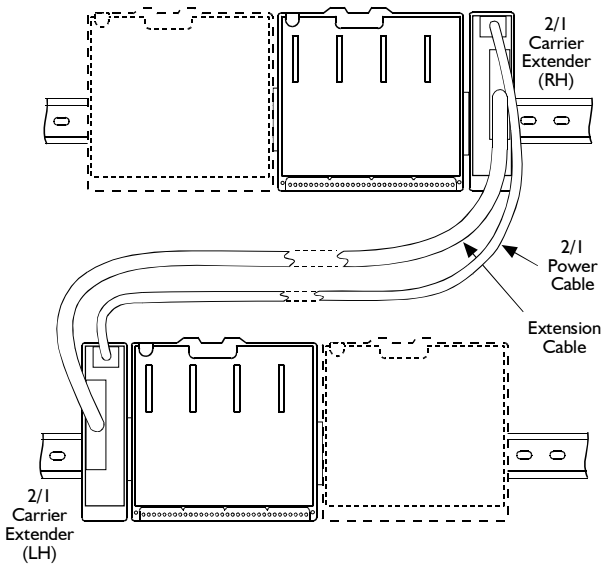
The signal and power cables for 2/1 applications are also available in sets as follows:

Length	**Set Part No.**	**Comprising**
0.35 m	8032-CC-35	8011-CC-35 + 8016-CC-35
0.85 m	8033-CC-85	8012-CC-85 + 8017-CC-85
1.2 m	8034-CC-12	8013-CC-12 + 8018-CC-12

Caution: Ensure that no undue strain is placed on extender cables/wiring when installed and that extender cables/wiring are secured with suitable cable clips or routed through adjacent trunking.



Using 2/2 cable extenders



Using 2/1 cable extenders

Fitting Carrier Extenders and Railbus Cables

- Choose extenders (2/2 or 2/1, left or right hand, to suit the application)
- Mount each extender in the correct position on the DIN rail (engaging its multi-pin connector with that of the carrier)
- Tighten fixing screws on extenders
- Select a standard cable length (see previous page) that will interconnect the two extenders.
- Ensuring the connector genders are correctly orientated, attach cable to extenders and secure their connector fixing screws.

Fitting Carrier Extender D.C. Power Cables

2/2 Sections

The 2/2 Railbus 12 V supply connection is continued via screw-terminal blocks on the carrier extenders must be connected to each other. The following table identifies the terminal connections. Note that the –ve connections cross from terminals 1 & 2 (8020) to terminals 5 & 6 (8021)

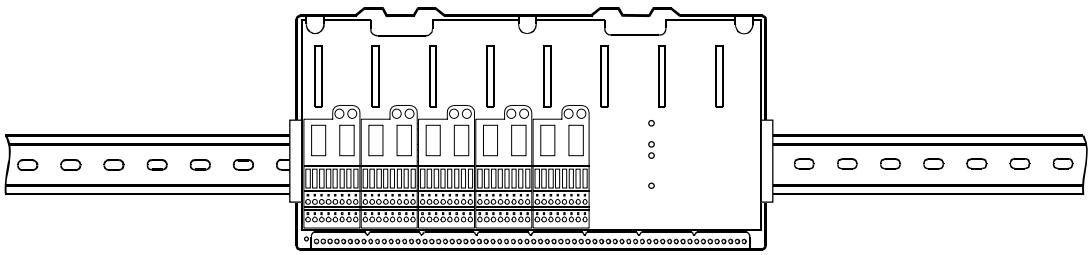
	Terminal number					
Extender type	**1**	**2**	**3**	**4**	**5**	**6**
8020-CE-RH	HVCC –	HVCC –	HVCC +	HVCC +	SGND	SGND
8021-CE-LH	SGND	SGND	HVCC +	HVCC +	HVCC –	HVCC –

- Identify the extender type (RH or LH) and its the terminal block
- Trim back the insulation of each conductor by 6 mm, or 8 mm if the wires are to be fitted with crimp ferrules.
- Check terminal numbering. (see above).
- Insert each conductor according to the terminal numbering and tighten the screw (clockwise). Do not overtighten or apply excessive pressure to the terminal or damage could occur.

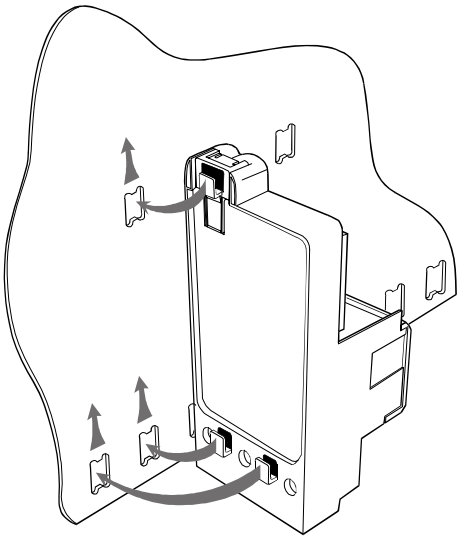
2/1 Sections

The 2/1 Railbus 12V supply extension is carried on a prepared cable that has 6-way connectors (see previous page).

- Select one of the standard cable lengths to interconnect the two extenders.
- Ensuring the connectors are correctly orientated, push cable connector onto extender connector until locking mechanism engages.



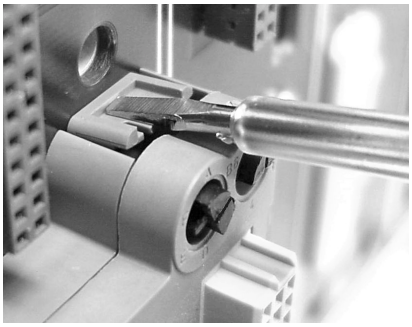
Mounting a field terminal



Note

Earlier field terminals did not have the locking mechanism. These were removed by pressing the terminal to the circuit board, then sliding it towards the edge of the carrier before removal.

Operating locking mechanism



Installation and removal of Field Terminals

The Field Terminals must be fitted onto the carrier before the modules can be installed. We recommend that you decide on your keying system and set the locating key position of each field terminal (and its associated module) prior to fitting.

Ensure that you use the appropriate field terminal, i.e. 2/2 or 2/1. See IMPORTANT note below.

To fit a field terminal to the carrier

- Locate the lugs in the holes provided on the PCB
- Press the assembly flat onto the carrier
- Slide it towards the middle of the carrier until it clicks into place

To remove a field terminal (see also Note on left)

- To release the locking mechanism at the rear of the terminal, use a screwdriver, or similar tool, to push the spring catch towards the carrier circuit board. (See photograph).
- With the catch depressed, slide the terminal towards the edge of the carrier until it reaches a stop.
- Release the catch then lift (without tilting) the terminal out of the fixing holes.

Field Terminal types

A range of terminal types is available to suit different I/O applications, and the correct one should be chosen to suit the module with which it works. Some combinations are prohibited and the reasons for this are discussed in the later section entitled “Compatibility of Field Terminal and I/O Module”.

IMPORTANT

The installer MUST be aware of the essential difference between the following two types of field terminal:

2/2 - *Grey* plastic housing - this is the standard type

2/1 - *Blue* plastic housing

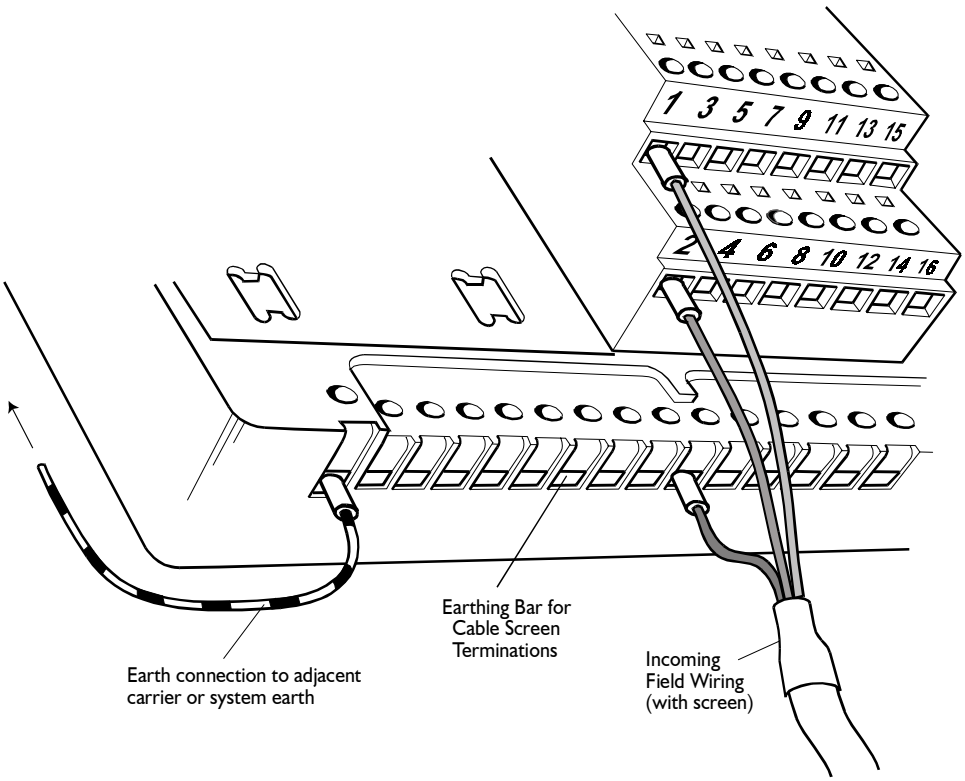
The 2/1 type should be used if any part of the field circuit enters a hazardous area that conforms to Zone 1/ Zone 0 (European) or a Division 1(US) classification. Appropriate carriers, I/O modules, power supplies etc. must also be used in such circumstances.

Further choices depend upon the type of field device. For example, there are specific ones for use with analog input THCs (thermocouples) and RTDs and also 16-channel DI modules. See the datasheets for further information.

Tagging Strip

A tagging strip is supplied with the field terminal assembly to assist with the identification of the field circuit connections. The strip has a ‘dovetail’ fitting tab to attach it to the field assembly, and once fitted it may be raised to obtain access to any field wiring fuses, or lowered and latched, to display the wiring identities.

The identity strip locates in the face of the tagging strip and a clear plastic cover is used to protect it.



Field Circuit Wiring

Field Terminal wiring diagrams

See Appendix 3 for details of the wiring for the individual field terminals.

Cable Termination

Field wiring is usually organised in pairs and a pair of cable ends will be wired into the Terminal Block one above the other. If I/O connections do not conform to this refer to the module datasheet.

As the connections are stepped, the lower wire (i.e. even numbered terminals) should be cut 12 mm shorter than the upper one.

- Trim back the insulation on each conductor by 6 mm, unless crimp ferrules are being fitted, in which case the conductor length should be 8 mm
- Check for correct terminal number
- Insert each conductor, according to the terminal numbering, and tighten the screw. Overtightening or applying excessive pressure to the screw terminal is unnecessary and could damage the connector.
- If a signal cable has a screen then this may be terminated in the same way to the earth bar on the front edge of the carrier. See below.

Note: The screen at the field end should be left unterminated.

Carrier Earth Bar

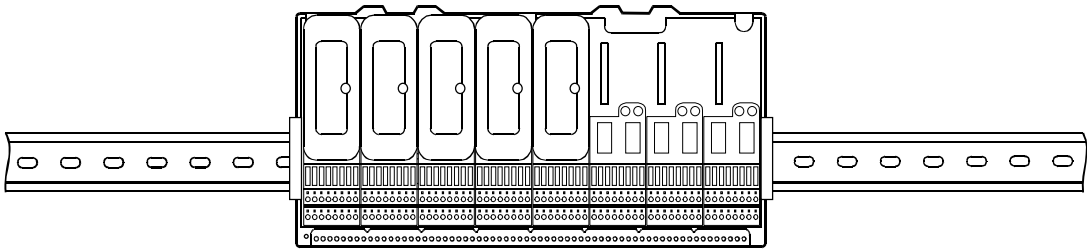
The front edge of the carrier, adjacent to the field terminals, contains an earthing bar with screw terminals for the purpose of terminating cable screens, or protective mains earths from field wiring.

Although there is a connection point for every channel they are not always directly below the corresponding channel connection point. However, they are arranged in groups of eight, and therefore easily recognisable.

An additional terminal is provided at each end of the earth bar for interlinking carrier earths, or for connecting them to a central earth point.

See also Earthing / grounding practice on page 43.

Note: The earth bar is **not** connected between carriers by the multi-pin connector.



Fitting I/O modules

Once the field terminal assembly is installed, the I/O module can be mounted.

The installer **MUST** be aware of the following two classifications of I/O module:

- 2/2 - **Grey** plastic moulding with **black** legend
- 2/1 - **Grey** plastic moulding with **blue** legend

The 2/1 type **must** be used if the associated field wiring, instruments and actuators are located, without any further protection, within a hazardous area that conforms to Zone 1 (European) or a Division 1(US) classification. An appropriate field terminal must also be used in conjunction with the I/O module.

To fit an I/O Module to the carrier

- Confirm that the module is compatible with the field terminal (see next page)
- Locate the module on the carrier and field terminal connectors
- Push the module onto the connectors until it is fully seated
- Lock in place with the retaining screw. Do not overtighten otherwise damage could occur. The maximum torque is shown here (left).

Warning

Maximum torque for module retaining screw

= 0.11 Nm (1 in-lb)

NEVER attempt to force a module into place on the carrier or field terminal. this can damage the connector pins which may result in hazardous equipment. If a module does not appear to fit correctly, check the module type again and confirm it is the correct type to suit the field terminal and carrier.

Vacant I/O Module slots

2/2 (general purpose) carrier

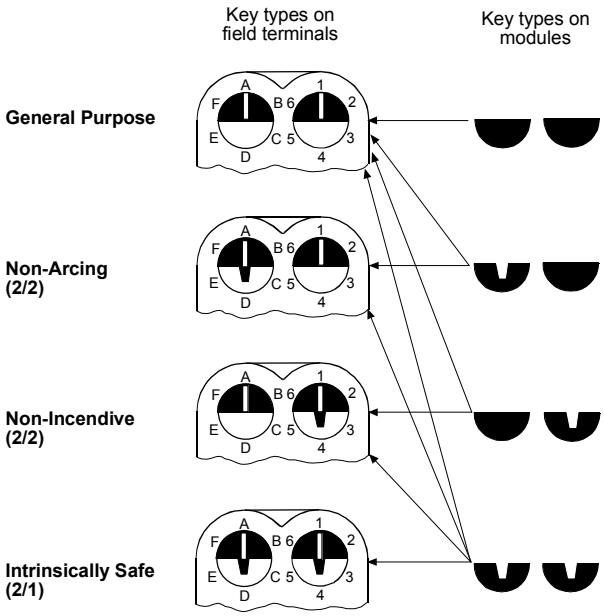
I/O module slots can be left unoccupied, with or without field terminals fitted.

2/1 carrier

IMPORTANT - if any slot on a 2/1 carrier is not occupied by a module then:

- any field terminal fitted in the slot must be removed
- the vacant slot MUST be covered with an 8420-BK-MO module blanking cover
- use the retaining screw to hold it in place.

Recognising the different field terminal and module types from their key codes



Notes

1. The field terminal keys are all shown in the A1 position for illustration only. It is a valid setting only for the general purpose field terminal.
2. The arrows indicate which module types will fit on the respective field terminals. e.g. all module types will fit any of the general purpose field terminals.

I/O Module and Field Terminal Keying

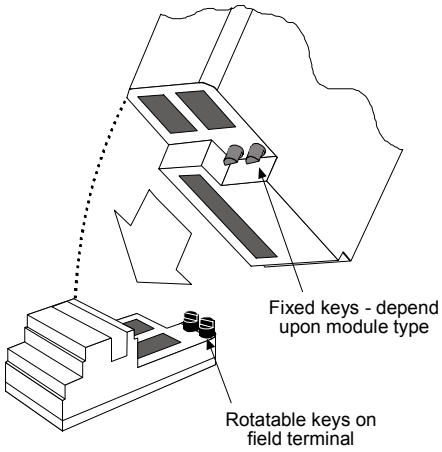
Compatibility of Field Terminal and I/O Module

Certain combinations of field terminal and module *are intended to be incompatible*, because:

a) field voltages applied to some terminals could damage certain modules, and vice versa,

b) unsuitable modules must not be fitted for hazardous area use

The following two mechanical methods are employed to prevent a module being fitted to a field terminal assembly that is unsuitable for it.



1. Rotary keys

This method protects modules and field circuits from the application of voltages and currents incompatible with their function, and uses a pair of 'D-shaped', rotatable keys.

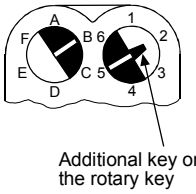
During installation the installer sets the keys on the field terminal to match the module code. When the keys on the module are correctly set, they engage with the keys on the field terminal.

The module is coded during manufacture and no further action is required of the installer.

2. Additional keyways on the rotary keys

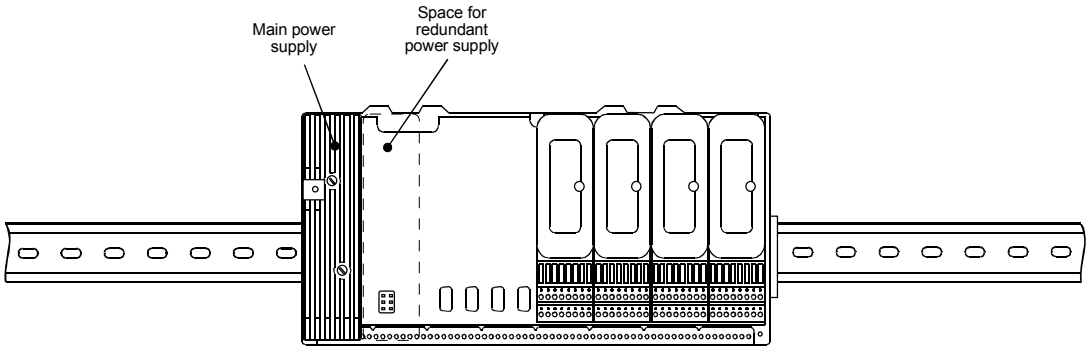
In addition to the basic rotary keys a further key-and-keyway combination is employed to prevent inadvertent fitting of unsuitable modules to field terminals when hazardous-area field wiring is employed. The additional *keys* are located on the rotary D-shaped keys and the *keyways* on the fixed D-shaped keys on the module. **These do not require any form of setting** and will be present, or not, depending upon the type of field terminal, and module, used. (The diagram at the top of the page shows the different types of field terminal and module.)

Non-incendive field terminal - set to B5



To set the rotatable keys

- Obtain the field terminal code from the label on the side of the module
- Using a screwdriver, set the two rotatable keys on the field terminal to match the code



Mounting the Power Supply Modules

2/2 sections

If an external, bulk power supply is being used to power the node the installer can move to page 35, without further reference to this one.

The 8910-PS-DC Power Supply Module should be fitted at this stage. The supply cable for the module should have been prepared earlier in the installation, see page 18, when a free connector will have been wired to bring the locally provided, nominally, 24 V supply to the module.

- Mount the module and secure it with the built-in fixing screws. The main 8910 module should be mounted in the first position on the Node Services Carrier, and the redundant module – if used – in the second position (see above).

  Note: this is recommended to minimise radiated heat but, if the designer or installer has a specific need, they may be interchanged.

- Insert the free socket into the plug in the top of the 8910-PS-DC Power Supply Module and use its securing screws to retain it.

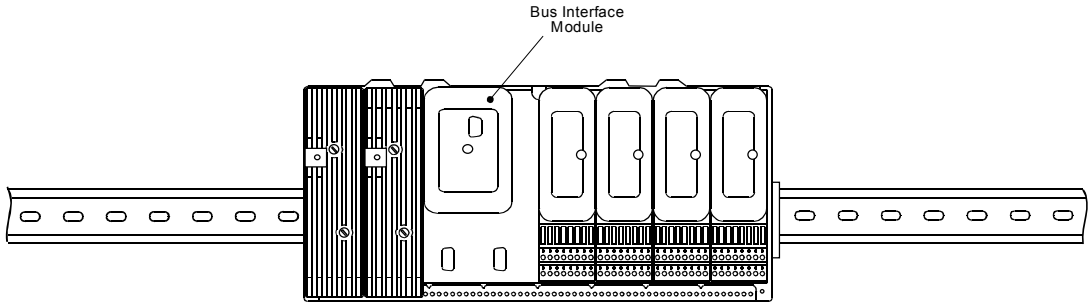
The redundant power supply module is fitted in its location in the same way.

IS Section

Any 8920-PS-DC IS Power Supply Module(s) should be fitted onto their carrier(s) (8724-CA-PS) at this stage. The supply cable for each module should have been prepared earlier in the installation, see page 18, when a free connector will have been wired to bring the, locally provided, nominal 24 V supply to the module.

- Mount the module and secure it to its carrier with the built-in fixing screws.
- Insert the free socket into the plug in the top/rear of the 8920-PS-DC Power Supply Module and use its securing screws to retain it.

Repeat this method for any other 8920-PS-DC modules - if required.



Fitting the Bus Interface Module

The Bus Interface Module, or BIM, is installed on its carrier in the same way as the I/O modules, by locating it on the carrier bus connector and using its locking screw to hold it in place.

Configuring the BIM

The BIM is configured using the MTL Configurator software running on a PC. The PC connects to the BIM through a 9-way, sub-miniature D-type connector located on the front of the module using a special cable. Alternatively, the Modbus BIM, may be configured remotely across the secondary network that connects to the LAN B port.

The BIM configuration process is explained in detail in the MTL publication **INM8455** - BIM Configuration Software manual.

Installing the HART interface module

Mount the interface module as described on page 23.

The module is supplied with a cable, fitted with 9-pin D-type connectors which can be used to connect its serial RS232 interface to the configuration port on the BIM.

The BIM requires a specific configuration when using the 8512. Refer to the manual INM8512 for further details on setting up the HART interface.

WIRING AND CABLING GUIDELINES

Installation and cable routing guidelines

Inside a building

To avoid interaction of signals and the influence of power spikes when laying cables and wiring inside a building, EMC rules for minimum clearances between adjacent cabling should be observed.

How to use the tables

The tables shown here should help the user chose the correct method of dealing with cables of various types. The most common signal and power cable types are listed below and an uppercase (capital) letter is assigned to each type. Similarly, the methods of laying cables are listed and a lowercase (small) letter assigned to them. Use these letters to work out the handling method as follows:

1. Choose the two cable types that need to be laid from the list of **Cable types** and note their assigned letters
2. In the **Cross reference table,** choose a column using one of the letters and a row using the other letter
3. Where the row and column intersect is a lower case letter
4. Look up the method of cable laying using this letter

Cable types

A Bus signals, shielded

(Modbus, PROFIBUS, etc.)

B Data signals, shielded

(PG, OP printers, metering inputs, etc.)

C Analog signals, shielded

D DC voltage (≤ 60 V), non-shielded

E Process signals (≤ 25 V), shielded

F AC voltage (≤ 25 V), non-shielded

G Monitors (coaxial cables)

H DC voltage (> 60 V and ≤ 400 V) non-shielded

J AC voltage (> 25 V and ≤ 400 V) non-shielded

K DC and AC voltage (> 400 V) non-shielded

Cross reference table

	A	B	C	D	E	F	G	H	J	K
A	a	a	a	a	a	a	a	b	b	c
B	a	a	a	a	a	a	a	b	b	c
C	a	a	a	a	a	a	a	b	b	c
D	a	a	a	a	a	a	a	b	b	c
E	a	a	a	a	a	a	a	b	b	c
F	a	a	a	a	a	a	a	b	b	c
G	a	a	a	a	a	a	a	b	b	c
H	b	b	b	b	b	b	b	a	a	c
J	b	b	b	b	b	b	b	a	a	c
K	c	c	c	c	c	c	c	c	c	c

Cable laying method

a In common bundles or ducts

b In separate bundles or ducts (no minimum clearance specified)

c • Inside a cabinet

in separate bundles or ducts (no minimum clearance specified)

• Outside a cabinet

(on separate tracks with a clearance of at least 10 cm)

Outside a building

The same rules that apply to wiring and cabling *inside* a building will apply to wiring *outside* of a building; however, some additional rules should also be observed:

- Cables should be laid on metal cable trays
- The trays should be electrically connected (preferably at the joints)
- The metal trays should be electrically grounded
- Appropriate measures should be taken, both inside and outside a building, to protect installations from lightning strikes (see page 40 & 41)

Cable types and their termination

The following table gives guidelines on cables and terminations for field wiring, bussed field power and system power.

Cable types and preparation	**Field cables**	**Bussed field power**	**System power**
Solid	Not recommended	Not recommended	Not recommended
Flexible			
Without ferrules	0.25 mm^2 to 2.5 mm^2	2.5 mm^2	2.5 mm^2
With ferrules	0.25 mm^2 to 1.5 mm^2	1.5 mm^2	
Maximum insulation diameter	3.1 mm	3.8 mm	3.8 mm
Stripping length			
Without ferrules	6 mm	15 mm	11 mm
With ferrules	8 mm	15 mm	11 mm
Recommended ferrules (to DIN 46228)			
Without insulated shroud	Type A 5 – 7 mm	Type A 10 – 12 mm	Type A 10 – 12 mm
With insulated shroud	Type E up to 6 mm	Type E up to 6 mm	–

Cables for LAN connections

Node Services carrier type 8711-CA-NS uses screw terminals for the LAN connections. The screw terminals can accept the following conductor sizes of twisted pair cables:

Single stranded: 0.14 mm^2 to 4 mm^2 with a nominal size of 2.5 mm^2

Multi-stranded: 0.14 mm^2 to 2.5 mm^2

Typically, for such applications - depending upon speeds and distances involved - a twisted pair cable of 22 AWG and 150 ohm/km resistance would be selected. This corresponds to a Belden cable of type 9182.

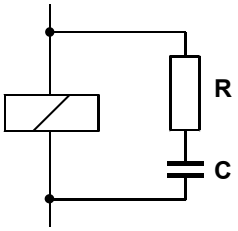
The level of mechanical protection, e.g. steel wire armouring or resilient plastic sheathing, will generally be determined by local site standards and codes of practice.

Protective circuits for Inductive Field Devices

Discrete inputs and outputs may be subjected to induced overvoltages when inductive field devices (e.g. relay coils and contactors) are being switched, or monitored, by them. A typical application might be when an "Emergency Stop" function is wired in series with critical electrical loads. It is advisable that the following protective measures be taken to avoid damage to modules.

Protecting DC discrete input circuits

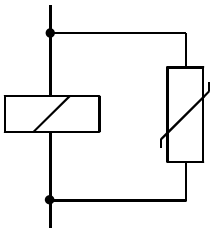
When discrete inputs are used to sense a contact closure in a field device, some form of arc suppression should be used *at the contact* of the field device. This could be an R-C suppression network (figure a) - sometimes referred to as a "snubber" - or a varistor (figure b). Sizing of the suppression component(s) is load dependent and reference should be made to the manufacturers literature. If manufacturer's information is not available see the notes below on R-C suppression.



a) R-C suppression network

Protecting DC discrete output circuits

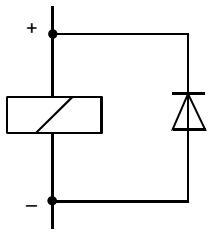
While MTL8000 dc output modules have their own built-in protection it is recommended that some additional form of suppression is added at the field device to avoid EMC problems from the field wiring. A reverse diode (figure c) or an R-C suppressor (see figure a) is often used to protect a relay coil when being switched in a dc circuit.



b) varistor suppression network

AC discrete output circuits

All of the ac discrete output modules in the MTL8000 series use a zero-crossing technique for switching their outputs which greatly reduces the production of voltage spikes when switching inductive loads. The use of additional external suppression circuits is unlikely to be required.



c) diode suppression network

Calculating values for R-C suppression components

If manufacturer's information is not available the following suggestions may be used to calculate resistor and capacitor values for suppression networks. (The calculations are all based on units of volts and amperes.)

For dc applications:

R (ohms) is sized as $R = V_{dc} \div I_{load}$

C (μF) is sized as $C = I_{load} \times 0.5$

For example, when switching 24 V dc with a 500 mA steady state load

$R = 24 \div 0.5 = 48\ \Omega$

$C = 0.5 \times 0.5 = 0.25\ \mu F$

For ac applications:

R (ohms) is sized as $R = V_{rms} \div 0.5$

C is sized as 0.5 μF per VA of steady state load

For example, when switching 120 V ac with a 500 mA steady state load

$R = 120 \div 0.5 = 240\ \Omega$

$C = 0.5 \times 120 \times 0.5 = 30\ \mu F$

The rating of these devices should be calculated on the basis of the applied voltages and the load current being switched. If you are in any doubt about choosing these components you are advised to consult MTL or one of our local representatives.

Electrical Configuration of MTL8000

The wiring of power sources, sensors and actuators will differ according to whether the modules are “sourcing” or “sinking” and whether the external power supplies are grounded or ungrounded.

This section discusses the more important rules and practices for electrical configuration of the MTL8000 equipment within **non-hazardous** environments.

Special Notes:

In all cases a means of isolating the power supplies from the primary source of power MUST be provided as shown in figure a) below.

If the primary source is a three-phase system, all power supplies to a node MUST be connected to the same phase.

All sources of System Power MUST provide double insulation (or its equivalent) for up to 250V rms between input and output circuits.

The two sources of power encountered in an MTL8000 system node are 1) System Power and 2) Bussed Field Power.

1) System Power

This is a 12 V dc supply for all the node’s electronic circuitry and is distributed via the carrier backplanes. It supplies the Bus Interface module and all the input and output modules, including thermocouples and RTDs.

Warning - As mentioned earlier, electrical installation of the MTL8000 must always comply with all relevant local standards, codes of practice and site regulations. Additional rules will apply if the MTL8000 is being used in hazardous environments (i.e. explosive gas or dust).

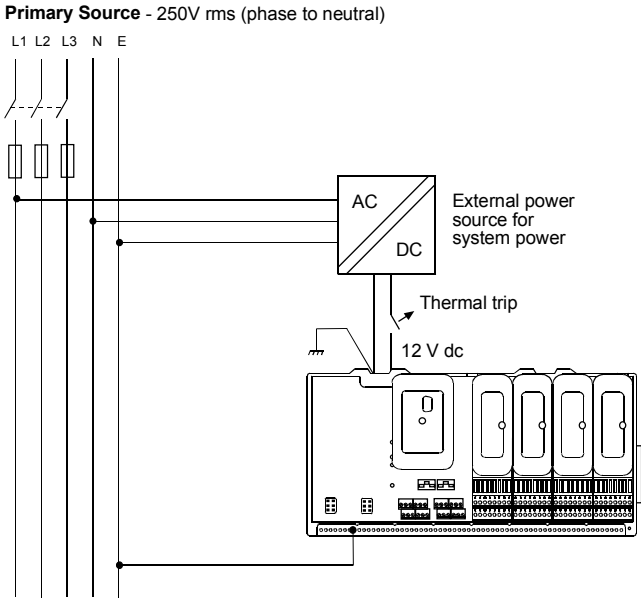
If the field wiring originates in, or passes through, a hazardous environment then the type of equipment installed, and the wiring practices used, will be very different and the user is referred to alternative installation guides which deal with these practices.

Carrier-based power supply

The supply is normally provided by a specific MTL8000 module type 8910-PS-DC which accepts an 18.5V to 36 V (24 V dc - nominal) dc input supply. The input for the supply should be rated in excess of 5 A to enable the power supply to deliver 12 V at 4.9 A. The 8910-PS-DC power module also incorporates sufficient supply conditioning to make any external RFI protection unnecessary.

External power supply

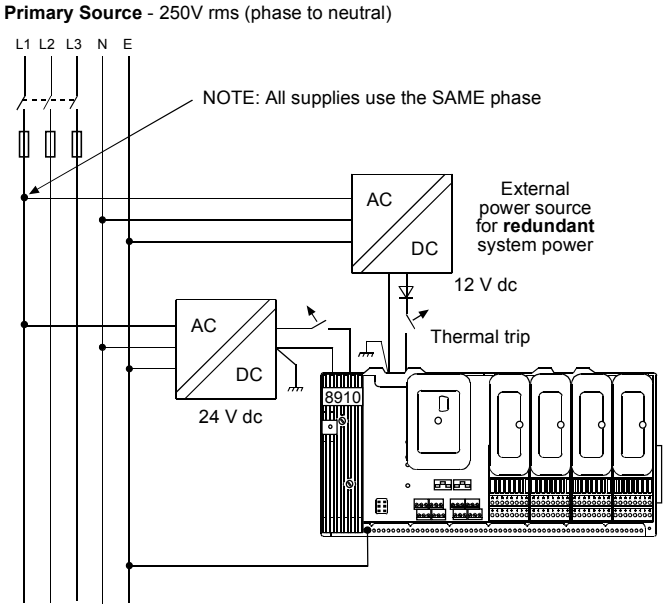
The same power can also be supplied from a regulated external power source of 12 V dc - see figure a) below. At full load (5A) the ripple on the supply output should not exceed 50 mV peak to peak over a dc to 20 kHz frequency range and 180 mV from 20 kHz up to 20 MHz. A current limit, in the form of an overload disconnect trip, must also be incorporated in the supply output.



a) External power source connection

Redundant supplies

External system power can also be used to provide redundancy for the 8910-PS-DC module power supply output. A diode in series with the supply output wiring (see figure b) aids power sharing.



b) Redundant external power source for system power

Note: The output voltage of the external source needs to be set so that, at least, 50 mA of power is drawn from it under normal working conditions. This ensures that the diode is kept forward biased for instantaneous transfer to the external supply in the event of the module power supply failing.

Two external power sources can also be made redundant. The ratings for these supplies would be based on the guidelines explained above and the user must install all diode arrangements for power sharing and switching.

System Power Grounding

The output ground (-ve rail) of an external system power source and the 8910-PS-DC supply become commoned at the Railbus. However, the 24 V supply for the 8910-PS-DC does *not* share the same ground and must be kept independent (see figure b).

Emergency Stop devices

These are required when wiring is based on IEC 204. In this event, the emergency stop must control ALL supplies to the system.

Lightning (surge) protection

Lightning protection may also be used. Telematic Limited[1] make a range of compact, lightning protection devices that are very well suited to this application.

[1] Telematic Limited is also part of The MTL Instruments Group plc. Contact MTL for details.

2) Bussed Field Power (BFP)

This is required to power field devices when using "sourcing" type digital input and output modules, i.e. 8110, 8112, 8114, 8115 and 8116. It is also used to power transmitters and analog outputs when used with analog module types 8101, 8104.

Note: 24 V dc Bussed Field Power must be available for the 4–20mA, input and output modules, because part of the internal circuit is driven from this power source.

As has been mentioned previously, Bussed Field Power is common to pairs of modules, but it can differ in voltage from pair to pair depending on the module type - 115 V ac and 230 V ac being other options. The supply rating should be based on the total expected load current for each voltage type, with sufficient tolerance for anticipated surge currents.

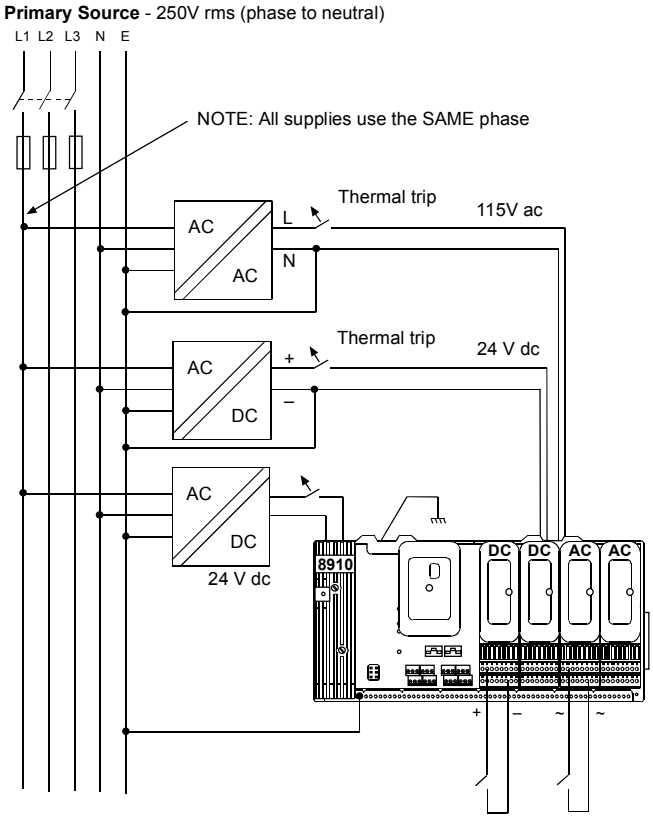
RFI protection

Depending upon the type of environment in which the equipment is installed, protection from electromagnetic interference on the Bussed Field Power lines may be required.

Protection may be required either on the supply input or on individual module field wiring.

Lightning (surge) protection

The Bussed Field Power source is completely isolated from the Railbus power, and also the system ground. It is therefore recommended that adequate lightning protection be provided when appropriate.



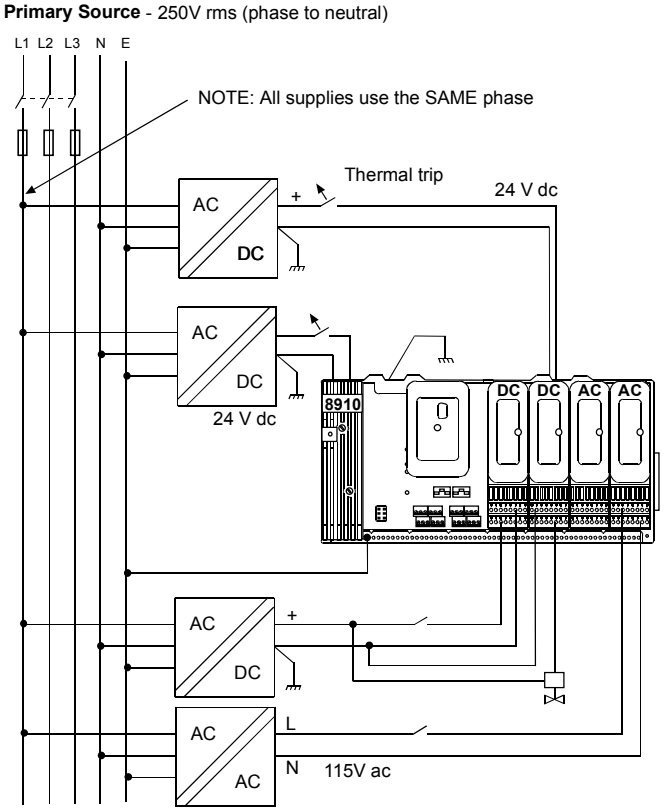
c) Grounded Power Supply (for "sourcing" I/O) - showing non-isolated inputs/outputs

Electrical Connection to the 8000

The MTL8000 can use grounded or ungrounded power supplies. The electrical connections for both types of supplies are illustrated in figures c) and d) respectively.

If the secondary side is ungrounded, circuit breakers or fuses are required in each pole of the supply line for the external system supply or for the BFP. If the secondary is grounded, then single pole protection is sufficient. Ratings for the breakers or fuses will depend on the total load current in each circuit.

Connection of "sourcing" or "sinking" modules to grounded supplies requires special care. This is particularly true when the equipment is mounted in a Zone 2 or Div. 2 area with inputs from a Zone 2,1 or 0 or a Div. 2 or 1 area. When using MTL8000 equipment in these areas appropriate standards must be consulted. For the zone 2 area, MTL publishes a code of practice. CENELEC also define the practices to be followed when mounting equipment in such zones.



d) Ungrounded Power Supply (for "sinking" I/O) - showing isolated inputs / outputs

Supply Isolation

Electrical isolation from the ac supply is recommended, but not essential, for grounded circuits. For *ungrounded* circuits, electrical isolation is essential.

(See also the section "Power Supplies" beginning on page 18.)

Isolated inputs allow the MTL8000 I/O to be used for dc inputs and outputs with a separate reference voltage, or for grounded sensors used a long way from the system and where equipotential binding is not possible. They are also used for ac load circuits and for dc load circuits where the positive rail is grounded (e.g. battery circuits).

EARTHING / GROUNDING PRACTICE

A few precautions in earthing/grounding are necessary when installing the MTL8000 equipment. Consult the diagram on the following page for further details.

Earthing / Grounding in field enclosure

A field enclosure normally has a metal backplane to which the contents are attached and which has a good, low impedance connection to ground. ***This represents the most effective ground plane for all internal ground connections***. For greatest safety and highest performance, connections to the backplane should be short – ideally less than 15 cm/6 inches – and low impedance – through using suitably heavy-gauge copper wire.

If the enclosure does not use an internal backplane then it should contain a low impedance grounding/earth bar as a "star" point for all internal ground connections.

External Power Supplies

Bulk power supplies are usually accommodated outside of the field enclosure and are often located in a central building for distributed around the plant.

Such supplies should have a good, low impedance earth connection at their origin, before distribution around the site, and should NOT be earthed or grounded again at an 8000 node.

Bussed Field Power

Adequate protection against short-circuit of a BFP output by means of a suitably rated fuse or electronic current limitation should be provided. Failure to do so could result in long-term, undetected ground faults or damage to the power supply and wiring.

Carrier grounding bars

The integral grounding bars in the I/O module carriers should be used to provide a termination point for protective grounds or screens/shields of field device wiring. Where protective grounds for heavy current field devices and screens/shields of signal cables are required within a node, they should be connected to grounding bars of separate carriers (see diagram). Separate connections to the system ground are recommended to avoid invasion of signal grounds by fault currents in heavy current apparatus, although adjacent carriers which share the same type of field wiring may be linked at the carrier ends.

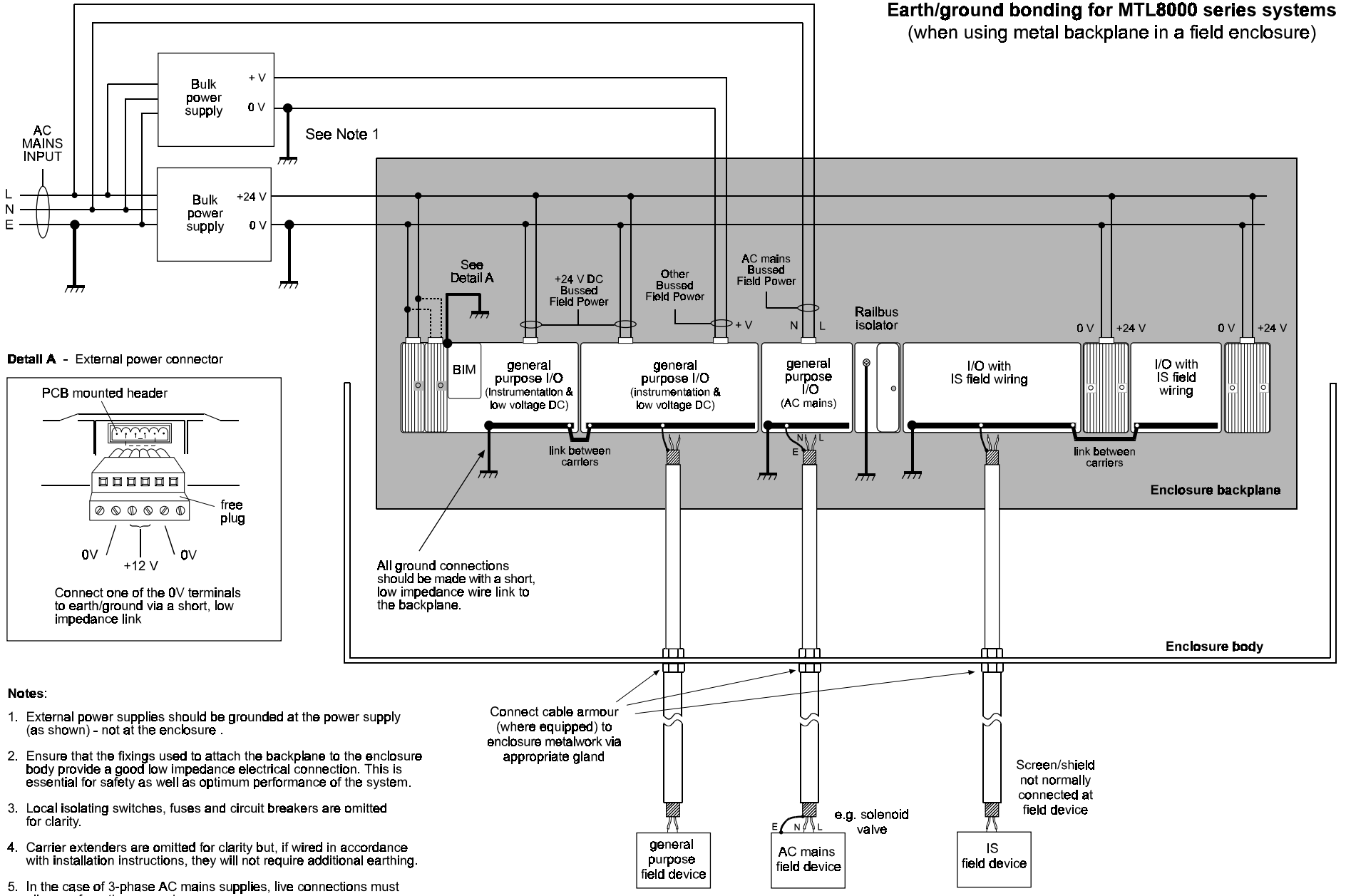
Intrinsically safe field wiring

Screens/shields for intrinsically safe (IS) field wiring may be connected to the grounding bar of IS I/O module carriers. The connection between IS carriers and the main system earthing point must be made via a separate cable, and must not share a current path with any non-intrinsically safe wiring. Adjacent IS carriers may be linked at the carrier ends.

Railbus Isolator grounding stud

The grounding stud on the Railbus Isolator carrier does NOT form part of the intrinsically safe protection of the MTL8000 node but provides a connection point for a link to a low impedance ground.

Earth/ground bonding for MTL8000 series systems
(when using metal backplane in a field enclosure)

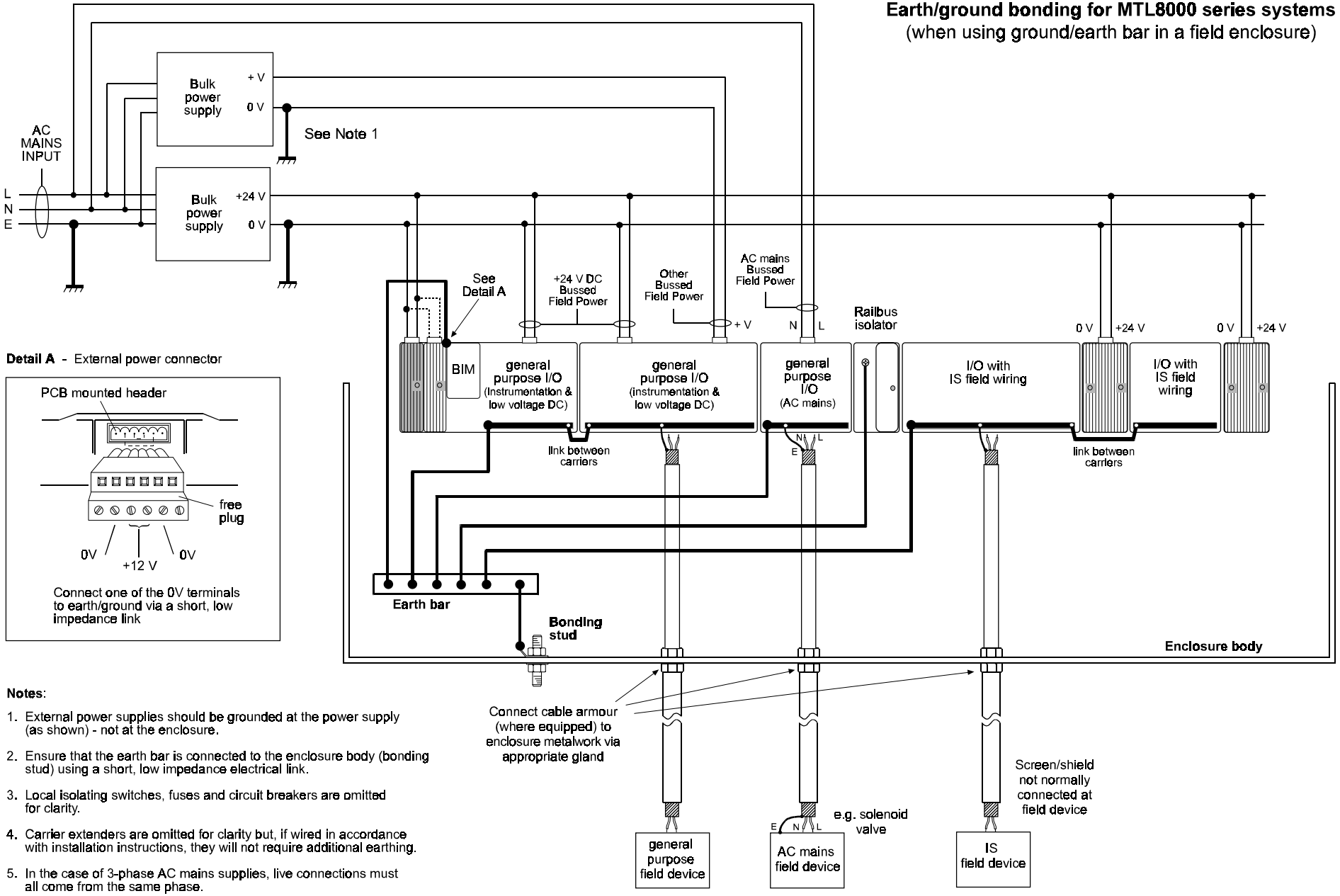


Detail A - External power connector

Notes:

1. External power supplies should be grounded at the power supply (as shown) - not at the enclosure .
2. Ensure that the fixings used to attach the backplane to the enclosure body provide a good low impedance electrical connection. This is essential for safety as well as optimum performance of the system.
3. Local isolating switches, fuses and circuit breakers are omitted for clarity.
4. Carrier extenders are omitted for clarity but, if wired in accordance with installation instructions, they will not require additional earthing.
5. In the case of 3-phase AC mains supplies, live connections must all come from the same phase.

Earth/ground bonding for MTL8000 series systems
(when using ground/earth bar in a field enclosure)



Detail A - External power connector

Notes:

1. External power supplies should be grounded at the power supply (as shown) - not at the enclosure.
2. Ensure that the earth bar is connected to the enclosure body (bonding stud) using a short, low impedance electrical link.
3. Local isolating switches, fuses and circuit breakers are omitted for clarity.
4. Carrier extenders are omitted for clarity but, if wired in accordance with installation instructions, they will not require additional earthing.
5. In the case of 3-phase AC mains supplies, live connections must all come from the same phase.

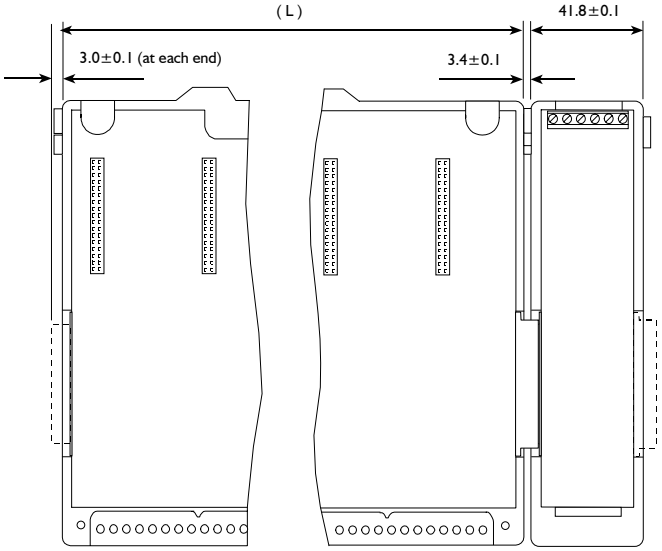
MAINTENANCE

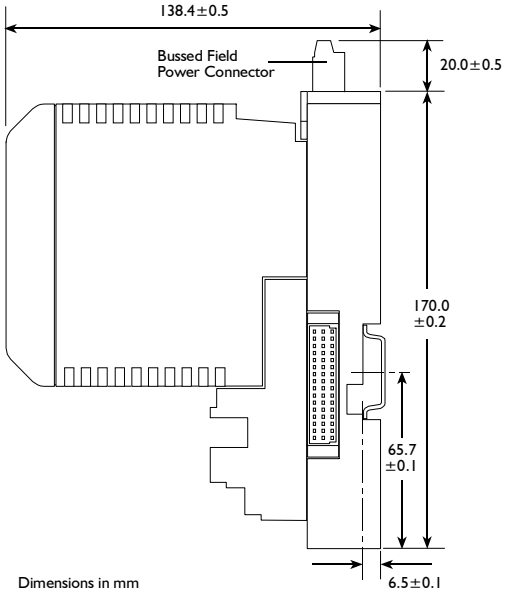
Fuses

The only user-replaceable fuses in MTL8000 Series products are those used in the fused Field Terminals. These fuses are marked with their rating and only replacements of the same rating may be used. Replacements are available from Measurement Technology Limited either directly or via their agents.

All other fuses are located inside the products and specialist equipment is necessary to effect their replacement. Products suspected of having damaged internal fuses (or any other internal fault) should be returned to Measurement Technology Limited, or one of their agents, for repair.

APPENDIX 1 Mounting Dimensions





The width (W) of the carrier depends upon the type chosen.

Part No.	Carrier type	W (mm)
8711-CA-NS 8712-CA-NS	Node Services carriers	336.0+0.2
8707-CA-08 8727-CA-08	8 I/O module carriers	336.0+0.2
8710-CA-04 8720-CA-04	4 I/O module carriers	168.0+0.2
8723-CA-RB	Railbus Isolator	86.0+0.2
8724-CA-PS	IS Power Supply	86.0+0.2
8020-CE-RH 8021-CE-LH 8030-CE-RH 8031-CE-LH	Carrier extender	41.8+0.1

These dimensions do not take into account the draft angle on the carrier mouldings, consequently, the base dimensions will be slightly greater. However, for calculating the length of a chain of carriers, use the dimensions from the table above for each carrier, then *add 3 mm for each gap* between the carriers and *3 mm for each connector* at the end(s) of a chain.

The overall width of individual carriers can be calculated as follows:

Node Services carrier (i.e. BIM and I/O modules) – 1 connector

Overall width = W + 3.0 mm

I/O module carrier (4- or 8-way) – 2 connectors

Overall width = W + 2 x 3.0 mm

Railbus Isolator/ IS Power Supply carrier – 2 connectors

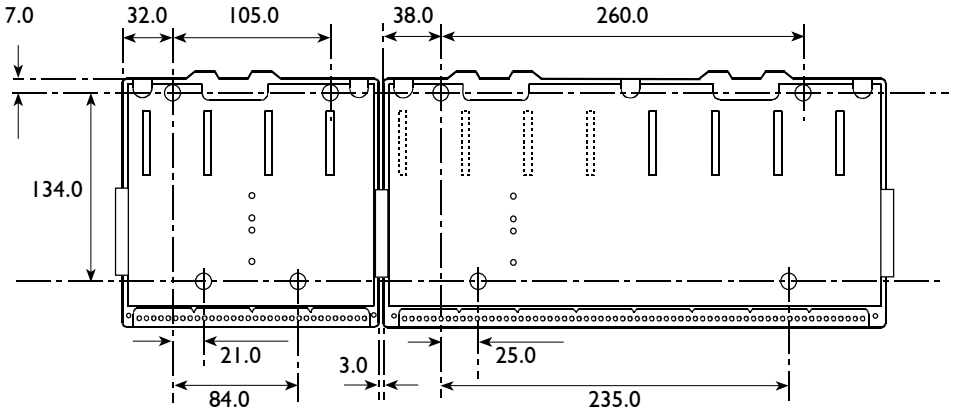
Overall width = W + 2 x 3.0 mm

Carrier extender – 1 connector

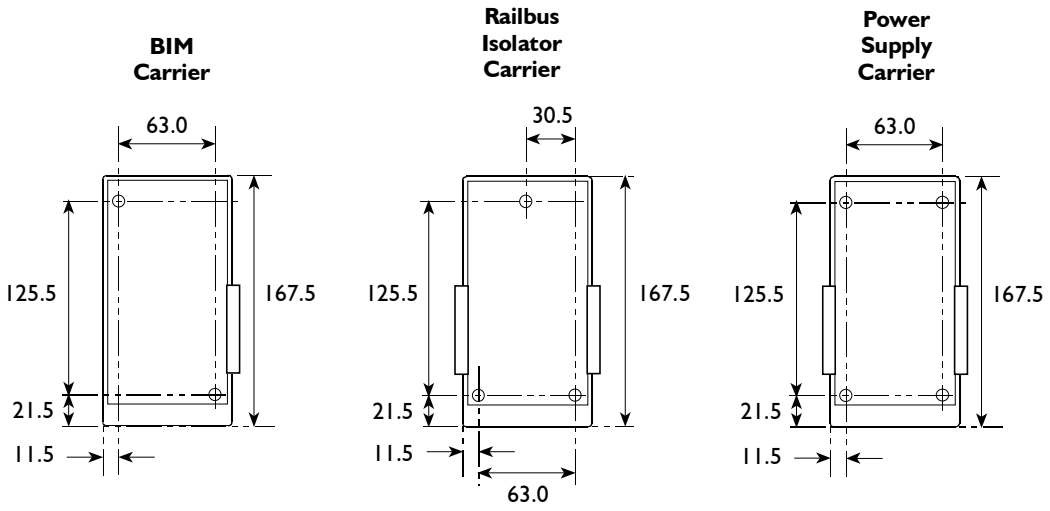
Overall width = W + 3.0 mm

Panel mounting holes

I/O module carriers – 4-way, 8-way and Node Services



BIM, Railbus Isolator and IS module power supply carriers

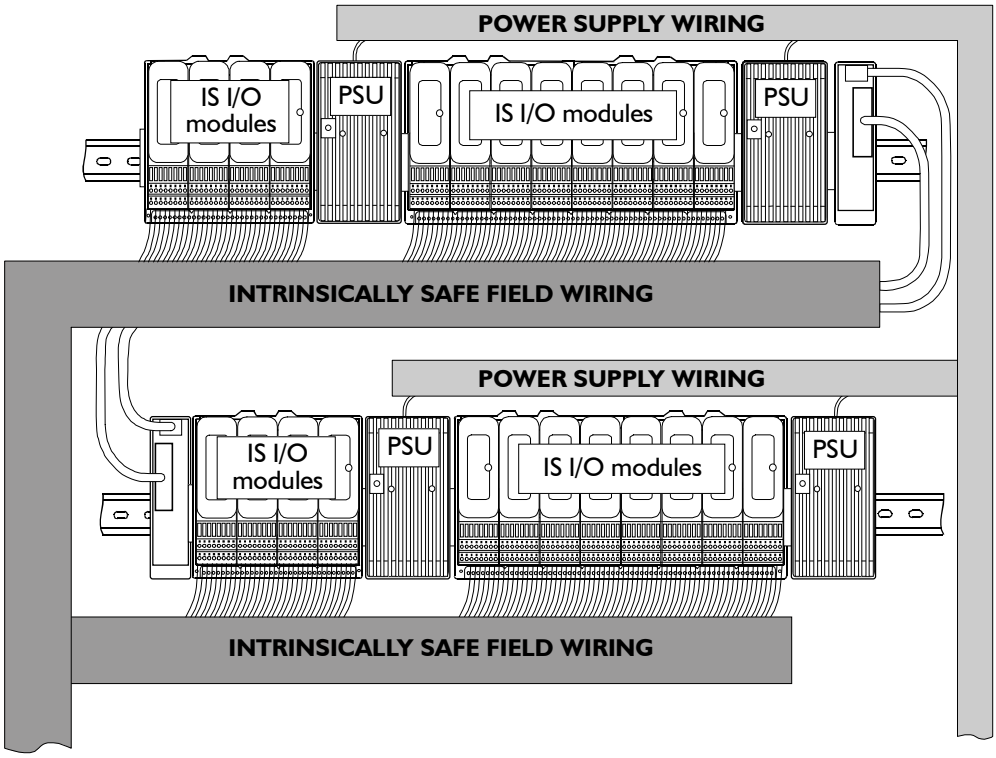


Mounting holes:
Holes through circuit board Ø 9.2
" " carrier base Ø 4.4

Thickness of base = 2.0

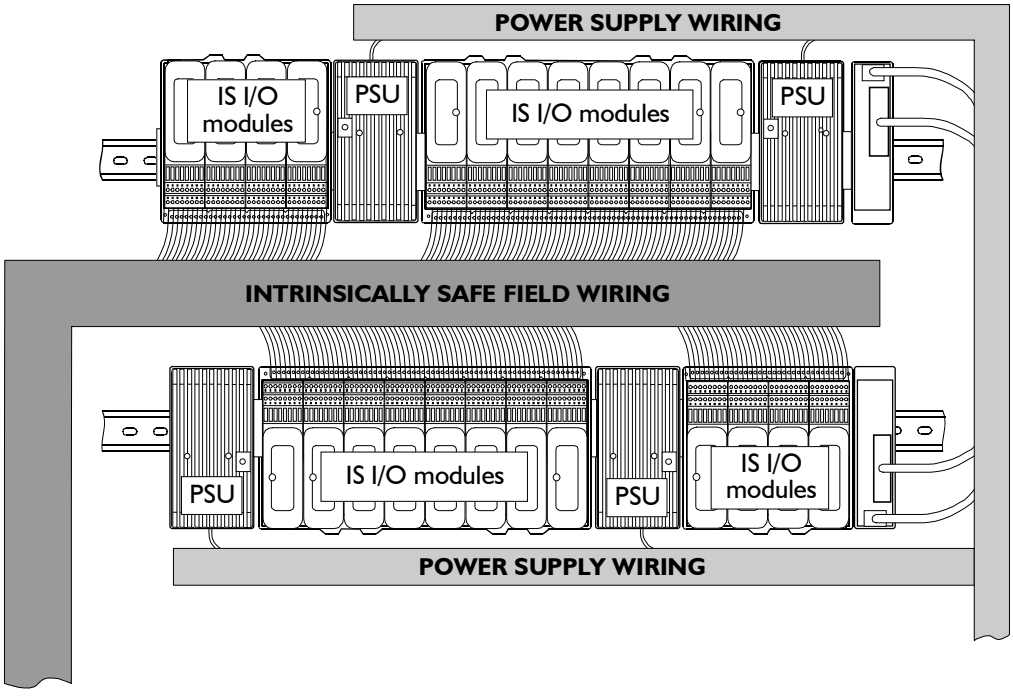
APPENDIX 2
Trunking Options

Arrangement #1: - All I/O modules in same orientation



Notes
1. 2/1 (IS) carrier extender cables may be run in either IS or non-IS trunking (as shown).
2. 2/2 carrier extender cables should NOT be routed in IS trunking.
3. The drawings show 2/1 (IS) field wiring, but non-IS field wiring could also be installed in the ways shown here - i.e. same orientation or facing each other.

Arrangement #2: - I/O modules facing each other



APPENDIX 3

Field Terminal connection diagrams

Identify the terminal type in the table, then refer to the appropriate diagram for connection details.

Terminal type	Diagram No.
8601-FT-NI	1
8602-FT-ST	1
8603-FT-FU	1
8604-FT-FU	1
8605-FT-TC	2
8606-FT-RT (2-wire)	3
8606-FT-RT (3-wire)	4
8606-FT-RT (4-wire)	5
8610-FT-NA	1
8611-FT-FU	1
8615-FT-4W	1
8617-FT-NI	6
8621-FT-IS	1 or 7*
8622-FT-IS	1 or 7*
8623-FT-IS	6
8624-FT-IS	1
8625-FT-IS	8
8626-FT- IS (2-wire)	9
8626-FT- IS (3-wire)	10
8626-FT- IS (4-wire)	11

Wired as diagram 7 when used with 8215-DO-IS module.

Diagram 1

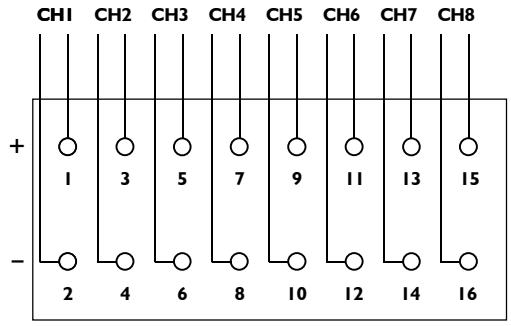


Diagram 2

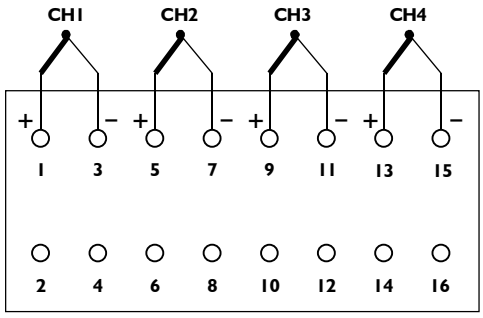


Diagram 3

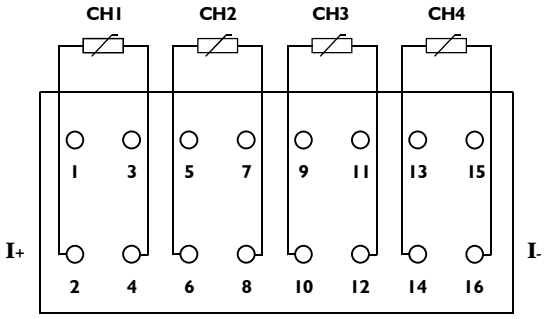


Diagram 4

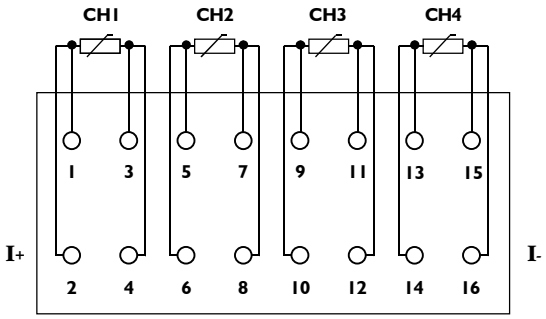


Diagram 5

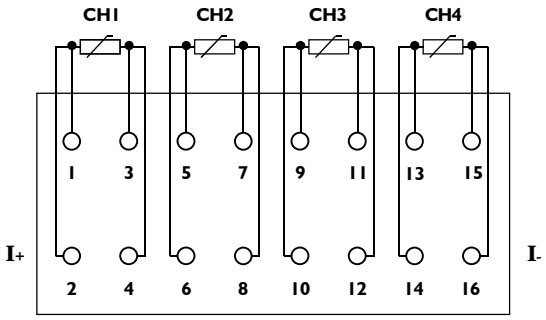


Diagram 6

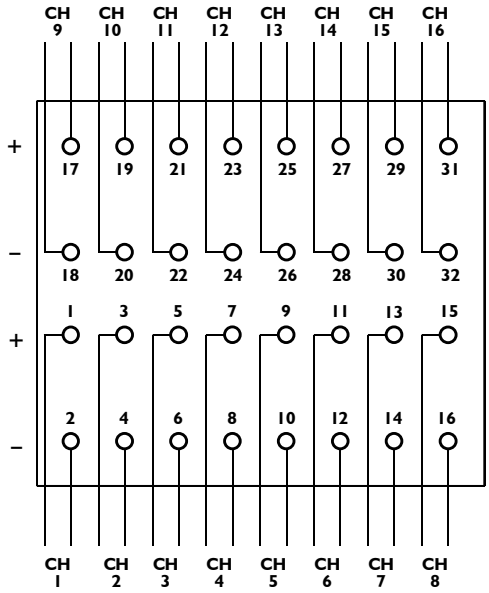


Diagram 7

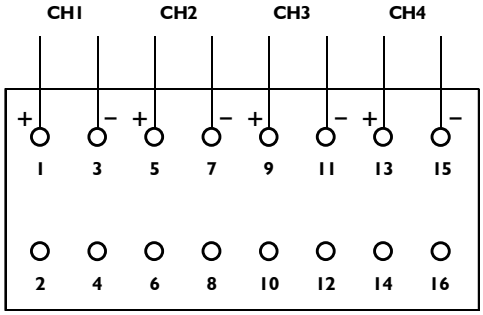


Diagram 8

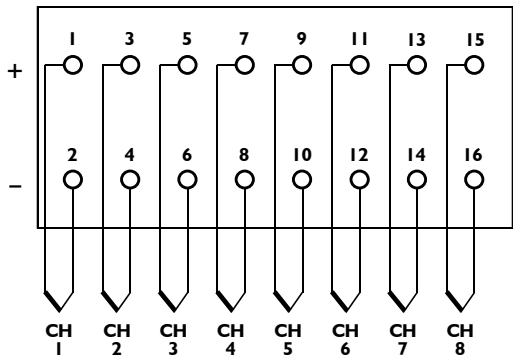


Diagram 9

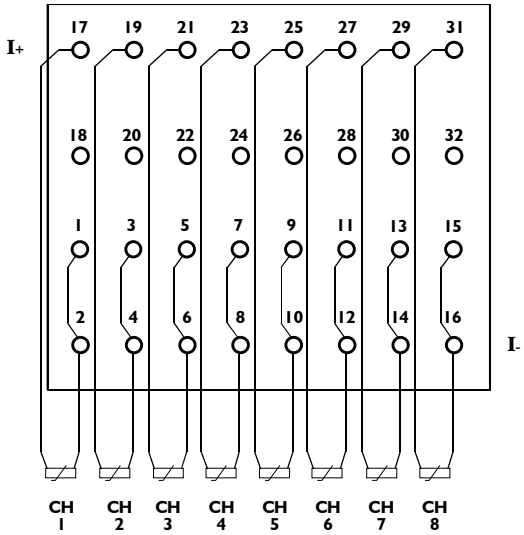


Diagram 10

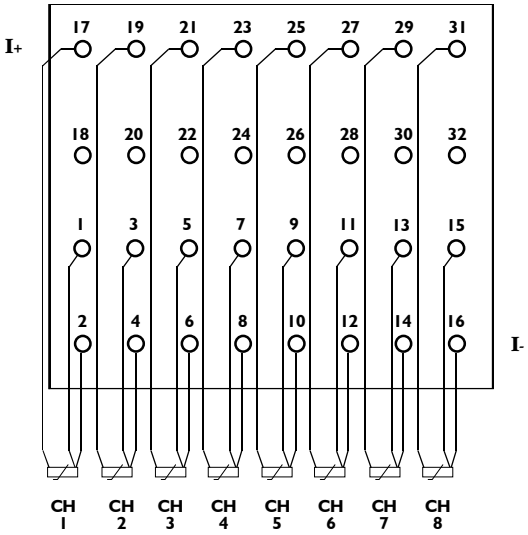
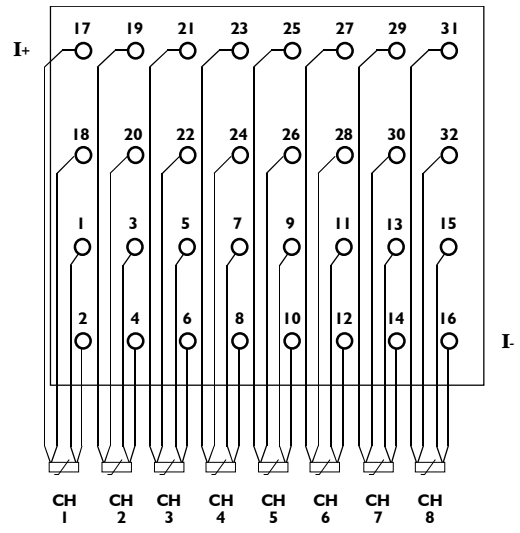


Diagram 11



APPENDIX 4

Glossary of Terms

Some of the terms used in this manual may be unfamiliar to the reader. The following glossary is intended as a very brief introduction to some of them.

Bussed Field Power - BFP

Certain field circuits require electrical power for them to operated correctly, and the MTL8000 series I/O modules can provide this power directly at the field terminal assembly using a technique called Bussed Field Power. Connectors are provided at the top/rear of 2/2 carriers and the power is then routed directly to one or more field terminal assemblies as required. This avoids extra power supply wiring at the field terminals.

Intrinsic Safety - IS

Intrinsic safety is a circuit protection technique used in I/O applications where there is a risk of explosive atmospheres. The IS components restrict the electrical energy available to the area thus preventing sparks that might be capable of igniting the combustible atmosphere.

n+1 redundancy

This is a redundancy technique that employs one additional unit, working in parallel, to take over the function of the failed unit without switching or any other intervention.

Railbus

This is both a digital signal ‘bus’ that carries control information between the BIM and the I/O modules, and a power supply bus that distributes the 12V dc supply rail to all of the modules. It is distributed, physically, to the modules via the carrier printed circuit board, and continues from one carrier to the next via multipin connectors.

Railbus Isolator

When IS and non-IS field wiring is accommodated at a single node, an isolating barrier is required between the two sections to prevent fault voltages being carried to the IS section via the Railbus. The Railbus Isolator provides galvanic isolation between the two sections.

APPENDIX 5

Additional literature

The following MTL literature is related to the instructions provided in this manual and is available upon request.

CDIO-1	MTL Process I/O Catalogue – CD version
INM8455	BIM Configuration Software Manual
INM8502	Profibus-DP BIM - Instruction Manual
INM8505	Modbus BIM - Instruction Manual
INM8512	HART Interface module – Instruction Manual
SSG8002	System Specification Guide – Modular I/O
AN8001	Code of practice - Selection, installation and maintenance of MTL8000 systems in Zone 2 hazardous areas
AN8002	Modbus Communications Manual
AN8004	Using DC outputs with inductive loads
AN8006	Live maintenance of an MTL8000 Series 2/1 node located in a pressurised enclosure

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Printed in the EU (06/01)