

Bus interface modules



LAN connection

An 8000 node uses a Bus Interface Module (BIM) to communicate with the host controller via a local area network (LAN). Different BIMs can be chosen to operate with a range of popular fieldbus protocols. The BIM mounts on a carrier and receives all of its communication and power links from it.

The BIM uses the RS485 communications standard. Other alternatives are RS422, by changing switches (where available) on the carrier, or RS232 by fitting an in-line converter. Switch options sometimes offer alternative methods for terminating the LAN.

Some BIMs also have a second LAN connection to maintain communications in the event of damage occurring to the main communications link. This technique is illustrated (right) for a Modbus host where a second master is shown.

HART management interface

An interface module is available, to link HART devices with the instrument management software. One 8512-IF-HA module is required per BIM. One port connects to the BIM and the other connects, via a daisy-chained RS485 link, to the PC running the software.

Internal 'Railbus' connection

The BIM communicates with the individual I/O modules via 'Railbus' - a proprietary, serial bus. I/O information from the modules is gathered and stored in the BIM for reporting to the host. Similarly, all host commands are interpreted by the BIM and the relevant messages relayed to the I/O modules. In addition to the I/O data, status and diagnostic data is relayed over the same route, to monitor and maintain the health of the I/O system.

Failsafe mode

Under certain abnormal or fault conditions, the BIM will adopt a state known as "failsafe" which, in turn, forces the I/O modules into a similar failsafe state. (See I/O module section). This condition ensures that outputs are put into known states that have been predefined by the user.

Failsafe mode can be induced by a direct instruction from the host or if the BIM receives no communication from the host for a predefined length of time.

Failsafe recovery

The BIM is forced out of failsafe mode by the Master but, before exiting the failsafe state, the BIM will wait until all the I/O modules have been polled, to enable output values to be preconditioned by the Master before the BIM leaves the failsafe state.

Heartbeat

The BIM is capable of detecting a failed application on the host by using a "heartbeat" status signal. The application is expected to supply a signal which toggles between 0 and 1. The Master includes this value with every message to indicate that the application is still in control. This value is echoed by the BIM back to the Master, which must then send a new, opposite, value from the application within a defined period, otherwise the BIM adopts a failsafe state.

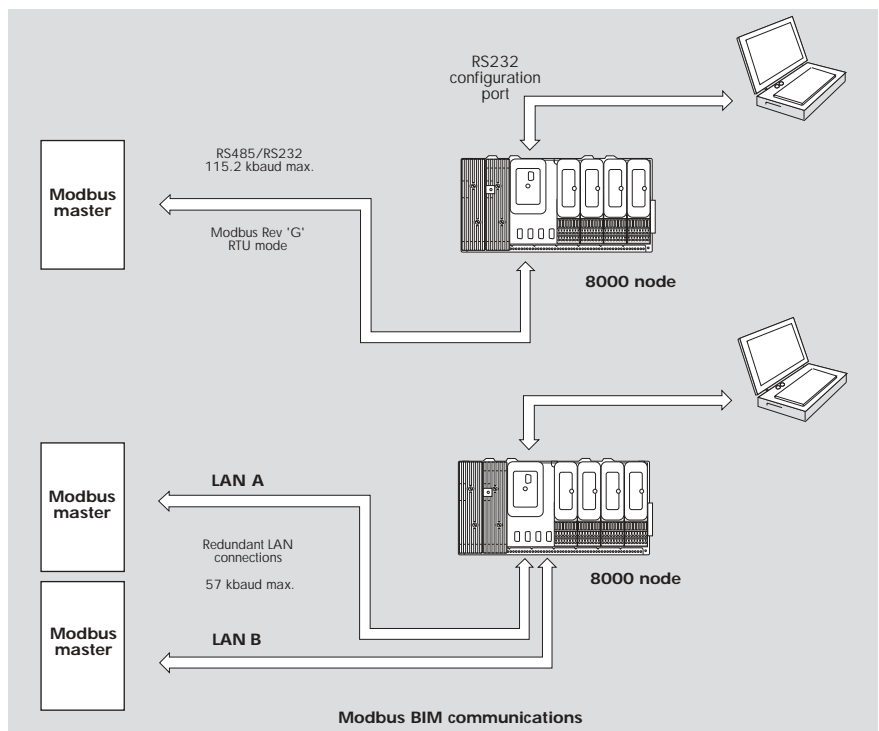
Configuration

When power is first applied to a BIM, it has no information about the system to which it is connected and must therefore be configured. This is achieved using dedicated software (Part No. 8455-SW-CF) that operates on a PC running Windows 95, 98 or NT.

After configuration, the user can store the information in the BIM's non-volatile memory (NVM). At future start-ups, the BIM will recall the configuration data from the NVM.

The configuring PC can be linked to the BIM by one of three methods:

- a) via an RS232 link to the sub-D connector on the BIM or
- b) via the secondary LAN - if available
- c) via "pass-through" messaging over the primary LAN, if available



Profibus protocol

8502-BI-DP

- ◆ links 8000 node to Profibus-DP host LAN
- ◆ supports up to 24 I/O modules
- ◆ HART process & status variables over Profibus-DP
- ◆ extended diagnostics for module and channel status
- ◆ LAN speeds of up to 6 Mbaud
- ◆ non-volatile memory for configuration
- ◆ software configurable via local port or Profibus host
- ◆ HART® maintenance via Comms adaptor

The 8502-BI-DP Bus Interface Module (BIM) provides the communications link between the 8000 series I/O modules and a Profibus-DP host. Its high speed acquisition of data from the modules and LAN operation speeds of up to 6 Mbaud allows the host to respond rapidly to conditions in the control process.

The BIM gathers the data from the I/O modules and makes it available to the host upon request. It is a slave to the Profibus master.

As well as cyclic data exchange, which is required for reading input and writing output data, the BIM supports Profibus Extended Diagnostics for status information. It also supports a number of special features which have been implemented to allow high integrity system operation and in-situ maintenance.

PARAMETERISATION

The 8502 supports parameterisation from the Profibus master. This configures on a "per module" basis, i.e. all the channels on a single module carry the same configuration. The configuration is created in a Profibus configurator using details provided in a GSD file.

This method is fast and enables a configuration to be built based upon "logical" modules which represent the physical modules. Modules are added one at a time to the configuration and parameters are chosen to apply to all the channels of the module.

Logical modules can be selected to provide HART status and process variables in the Profibus-DP cyclic input telegram. In addition, for applications where access to many HART variables is required, the HART "mailbox" can be used. This technique collects HART variable as they are required; saving space in telegrams that are sometimes overworked with data. This method is available only when using parameterisation.

The configuration is passed down from the Profibus master to the BIM at the start of the session. If the system is stopped and re-started, the configuration file is re-transmitted to the BIM.

CONFIGURATION

The alternative to parameterisation is the use of the 8455-SW-CF configuration software. This enables the user to configure individual channels and alarms and store the configuration in the BIM. The configuration can also be saved to the 8510-MO-NS Node Services Module for instant recovery if a BIM has to be replaced.

Configuration by this method uses a different GSD file to the one used for parameterisation and the data frame is based on "data blocks" rather than on a "by module" approach. The 8455 software automatically provides a map of the data created in the telegram to



enable host programmers to identify the data passed.

HART status and process variables can be communicated to the Profibus-DP host in the cyclic input telegram.

I/O & HART data requires space in the DP data frame as shown in the table below.

Data type	Input words	Output Words
Analog data	1 per input channel	1 per output channel
Digital data	1 per input module	1 per output module
HART variable	2 per variable	Not applicable
HART status	1 per channel	Not applicable

The Profibus BIM supports both Standard and Extended Diagnostics. While the Standard Diagnostics provide standard PROFIBUS status information, the Extended Diagnostics provide detailed information relating to the status of the BIM, the health of the modules and the status of I/O channels. Depending on the I/O module type, events such as high and low alarm, open circuit and line fault are detected. Extended Diagnostic messages are generated on detection of an anomaly and also when it is cleared. Use of the diagnostic capability requires suitable support in the host application.

For hosts unable to use diagnostic data in the control algorithm, it is possible to map the diagnostic data into the input dataframe.

HART DEVICE MAINTENANCE

Pass through messaging to HART devices is available via the local configuration port and the 8512 HART Comms interface. This allows multi-dropping of a number of BIMs on an RS485 link to a PC running a wide range of instrument management software.

Profibus protocol

8502-BI-DP

MODULE SPECIFICATION

See also System Specification

LAN INTERFACE

LAN protocol.....PROFIBUS-DP (to EN50170)
Transmission rates9.6, 19.2, 93.75, 187.5, 500 kbaud
and 1.5 and 6 Mbaud
 Maximum bus segment length (metres) depends upon speed.....

Speed (kbaud)	9.6	19.2	93.75	187.5	500	1500	6000
Max. length	1200	1200	1200	1000	400	200	100

(Note: Table applies to cables with an impedance of 135 -165 Ω and a capacitance per unit length that does not exceed 30 pF/m.)

Transmission standard.....RS 485
Isolation

(LAN to Railbus to Power Supply)500 V

Action on software malfunctionmodules go to failsafe

I/O & DIAGNOSTIC DATA

DP Data frame..... Size configurable up to 244 bytes
Input data, including Status word (2 bytes)
244 bytes max
Output data, including Control word (2 bytes)
244 bytes max
Total Input plus Output data296 bytes max
Diagnostic telegram78 bytes

CONFIGURATION

The BIM can be configured using 8455-SW-CF software running on a PC, by parameterisation from a Profibus configurator or by transfer of a configuration from the 8510-NS-MO Node Services Module. The 8510 also has an autoconfiguration option.

Address setting.....Software settable in BIM,
by Profibus "Set Slave Address" command
or by switch setting on 8510-NS-MO module

POWER SUPPLIES

Railbus (12V) current420 mA (typ.)
520 mA (max.@ -40 °C)

MECHANICAL

Module width63 mm
Weight (approx.)350 g

LED INDICATORS

Power (green)

OFF	ON	Flashing
Power fail	Power OK	-

Fault (red)

OFF	ON	Flashing
Normal	Failsafe or fault	-

Comm (yellow)

OFF	ON	Flashing
Internal Comms. Failure	Internal Comms. OK	On power up

LAN A (yellow)

OFF	ON	Flashing
Power OFF	LAN activity	Slow flash = no LAN active

Config, (yellow)

OFF	ON	Flashing
Not defined (i.e. error)	Configurator connected	Configurator not connected

Railbus (yellow)

OFF	ON	Flashing
Railbus Fault	Railbus OK	-

Modbus protocol

8505-BI-MB

- ◆ links 8000 node to Modbus host LAN
- ◆ LAN speeds of up to 115.2 kbaud
- ◆ supports up to 32 I/O modules
- ◆ HART process and status variables via Modbus
- ◆ module status & channel status flags
- ◆ automatic scan optimisation
- ◆ configuration data held in non-volatile memory
- ◆ software configurable via local port or LAN B
- ◆ HART® maintenance via comms adaptor

MODBUS SOFTWARE

The implementation of the Modbus protocol in the 8000 Series is according to Revision G of the Modicon Specification. Only RTU mode is supported.

Communication speeds of up to 115k baud are possible with single LAN systems, 57k baud with twin connections. The LAN node address is set by configuration.

The BIM supports the Modbus function codes that are required to read and write input, output and status data, and also supports a number of special features which have been implemented to allow high integrity system operation and in-situ maintenance.

DUAL LAN OPERATION

While LAN-A is the primary port for host communications, a second host may be connected to LAN-B as either an active or a passive standby in a redundant configuration. This is intended to provide fault tolerance against failure of either the primary host or its associated LAN connection.

Active Standby mode is intended for use with a simple pair of duplicated hosts.* Passive Standby mode is for a "redundant host pair" where Host B is capable of detecting the failure of Host A or LAN-A and taking action to assume active control.

A further mode of operation "Dual Comms" allows two hosts simultaneous read/write privileges. This is appropriate for manual control via duplicate HMI/SCADA workstations.

LAN-B may also be used for remote configuration and maintenance of both an 8000 sub-system and intelligent (HART) field devices connected to the I/O modules.

DIAGNOSTIC AND STATUS INFORMATION

The BIM provides detailed information relating to the status of the BIM, the health of I/O modules and the status of I/O channels. Depending on the I/O module type, information such as high and low alarm, open circuit and line fault is reported.

AUTOMATIC SCAN OPTIMISATION

The gathering of input data from the I/O modules and the issuing of output data to them is not determined by a fixed scan rate. A scan optimisation algorithm is used to gather and distribute data virtually as soon as it becomes available. A maximum scan period can be set for each module to ensure that the data is collected within this defined time period.

*In this mode of operation, writes to outputs are inhibited on the secondary LAN during normal operation but enabled if the BIM detects failure of the primary LAN.



PACKED DATA MAPPING

The dynamic data that is exchanged with the host application is mapped to consecutive memory locations. This eliminates the need for piecemeal read and write commands to separate data locations. A single Modbus read instruction will gather all of the current data from the BIM, resulting in a rapid interchange of information between the node and the host. Writes to the BIM's database can similarly be made with a single command.

HART DEVICE MAINTENANCE

Pass through messaging to HART devices is available via the local configuration port and the 8512 HART Comms interface. This allows multi-dropping of a number of BIMs on an RS485 link to a PC running AMS, Cornerstone™ and other instrument management software.

BUILT-IN NON VOLATILE MEMORY

The BIM contains a section of non volatile memory (NVM) in which the configuration is stored. At switch on, the configuration is copied from NVM into working memory and the BIM can then initialise itself together with the I/O modules.

NODE SERVICES MODULE OPTION

The BIM also supports the use of the 8510-MO-NS - Node Services Module - which can store a BIM's configuration. This enables the BIM to be swapped with another and, at switch on, the configuration from the NSM will be uploaded to the BIM and will overwrite its previous contents.

In addition, the NSM will monitor the dc supplies that power the node. If any power supply fail signal becomes active, the BIM receives a fault signal; a particularly important feature for systems having redundant power supplies. The failed PSU can then be identified quickly and replaced, restoring fault tolerant operation.

AUTOCONFIGURATION

The BIM has an autoconfiguration mode that can be triggered by a software command or by switches on the Node Services Module. This causes the BIM to delete its current configuration and reset the modules to their default values. The BIM then scans the Railbus and creates a new configuration file based upon the module types fitted and using their default values, which is then saved to NVM.

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Modbus protocol

8505-BI-MB

MODULE SPECIFICATION

LAN INTERFACE

Transmission protocolModbus (RTU mode)

Transmission rates1.2 - 115.2 kbits/s

By mode

Single LAN mode115.2 kbit/s (max.)

Passive standby mode115.2 kbit/s (max.)

Active standby mode.....19.2 kbit/s (max.)

Dual comms. mode19.2 kbit/s (max.)

Remote config mode19.2 kbit/s (max.)

Transmission standardRS485 or RS422

Bus Insulation.....500 V

Action on software malfunction

.....Halt CPU / Reset CPU

CONFIGURATION

The BIM can be configured either by using 8455-SW-CF software running on a PC or by transfer of a configuration from the 8510-NS-MO Node Services Module. An autoconfiguration option is also provided.

Address settingsoftware settable in BIM orswitch settable using 8510-NS-MO Node Services Module.

RESPONSE TIMES

Modbus message response time< 4 ms

LED INDICATORS

Power (green)

OFF	ON	Flashing
Power fail	Power OK	-

Fault (red)

OFF	ON	Flashing
Normal	Failsafe or fault	Configuration required

LAN A & LAN B (yellow)

OFF	ON	Flashing
LAN disconnected	Internal Comms. OK	No comms. or fault

Config. (yellow)

OFF	ON	Flashing
Configurator not connected	Configurator connected to local port	Configuring via LAN

Railbus (yellow)

OFF	ON	Flashing
Railbus fault	Railbus OK	-

POWER SUPPLIES

Railbus (12V) current260 mA (typ.)

.....300 mA (max.)

MECHANICAL

Module width63 mm

Weight (approx.).....320 g

See System Specification for other parameters.

MODBUS FUNCTIONS SUPPORTED

Read Coil Status (Function 01)

Reads a range of single-bit flags that show the status of Discrete Output channels. This allows the host to confirm the states to which the BIM has set the Discrete Outputs.

Read Input Status (Function 02)

Reads a range of single-bit flags that show the status of Discrete Input channels. This allows the host to monitor the latest reported state of the Discrete Inputs.

Read Holding Registers (Function 03)

Reads a range of 16-bit registers that contain the status of Analog Outputs. This allows the host to confirm the states to which the BIM has set the Analog Outputs.

Read Input Registers (Function 04)

Reads a range of 16-bit registers that contain the status of Analog Input channels. This allows the host to monitor the latest reported state of the Analog Inputs.

Force Single Coil (Function 05)

Requests the BIM to force a specified coil to a '1' or a '0'. This could be used, for example, to switch a DO channel or make it pulse.

Preset Single Register (Function 06)

Writes a 16-bit value to a specified BIM register - either to set an Analog Output or. to preset a DI counter.

Return Diagnostic Register (Function 08)

Requests that the slave reads the contents of its diagnostic register and returns the binary data values to the master, according to the specified sub-function code; i.e. Return Query Data (00) or Return Diagnostic Register (02)

Force Multiple Coils (Function 15)

Requests the BIM to force a specified range of coils to a '1' or a '0'. This could be used, for example, to switch DO channels or make them pulse.

Preset Multiple Registers (Function 16)

Writes a 16-bit value to a specified range of BIM registers - for example to set Analog Outputs.

Report Slave ID (Function 17)

The Report Slave ID function permits the user to obtain information on the slave type and 'RUN' status.

Configuration Software

8455-SW-CF

- ◆ Windows™ Explorer - style interface
- ◆ used to configure Bus Interface Modules
- ◆ local or remote configuration via LAN
- ◆ dynamic viewing of real-time data
- ◆ single project file for multiple nodes

The 8455 software is one of the methods for configuring Bus Interface Modules (BIMs) in an 8000 Process I/O™ node. It runs on a PC, under the familiar Windows™ operating system. The PC can be linked to the BIM using either a local cable link or via a secondary LAN connection, where available.

The BIM is the interface between the I/O modules and the host controller, and must be configured to permit correct operation. The BIM needs to be told the identity of each I/O module fitted and values of relevant parameters. Parameters must also be defined for LAN communication with the host controller.

PROJECT FILE

The configuration information is contained in a project file. A project file can be created for a single BIM or for multiple BIMs, e.g. on a network, each of which can accommodate up to 32 I/O modules. The configuration information may then be downloaded to the individual BIMs on the network.

USER INTERFACE

The main screen of the Configurator has a conventional Windows Menu and Toolbar display at the top. The main body of the screen is then split to show a "navigation tree" for the network on the left-hand side and the BIM/module parameters on the right.

MODULE ATTRIBUTES & PARAMETERS

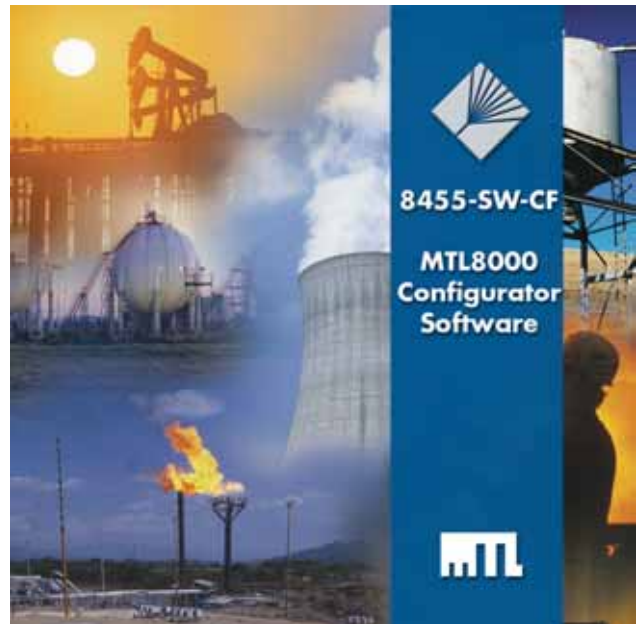
The software can display the hardware and software revision levels of the both the BIM and the I/O modules. Each module has its own set of parameters and these appear with default values when the module is first added to the system. These can then be edited individually to specify the required system.

DYNAMIC DATA

Real-time data is available on-screen if the configuration link (serial or LAN) is in place. The viewable data includes primary variables as well as status parameters. This can be refreshed continually or when the operator requires a screen refresh. When in continuous refresh mode, the time between module data reads can also be viewed. Alternatively, the Configurator can be operated "offline" for simple project file creation.

UPLOAD BIM DATA

Configuration data already contained in a BIM can be uploaded to the Configurator. This can be saved as a PC file and copied to other BIMs. PC files that were created for earlier revisions of the BIM firmware can also be opened and edited for use with the latest versions of the BIM.



OPEN DATABASE STRUCTURE

The Configurator contains a Microsoft® Access open structure database in which the configuration data is held.

SIMPLE TABBED PAGES

The right hand side of the screen contains information on any item that is highlighted in the navigation tree to the left. With the network icon selected, three tabbed pages of information are available (see Fig 1).

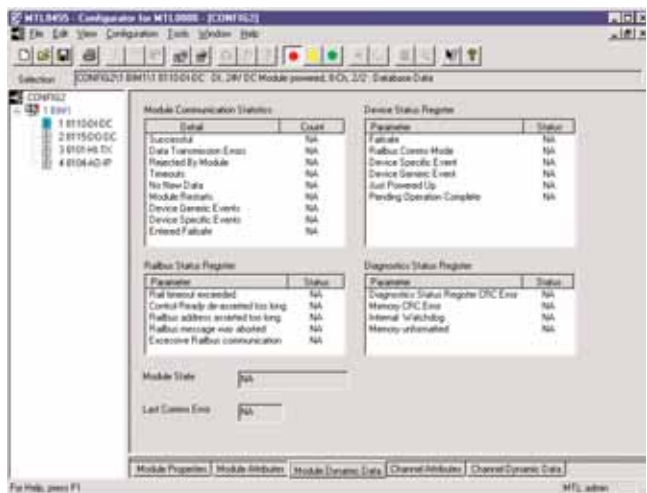


Fig 1 - Configuration file details

These pages define and describe the network protocol, the BIMs that are attached to the network and the details of the project contained in the overall configuration file.

Configuration Software

8455-SW-CF

Selection of the BIM icon in the navigation area reveals five pages of information and settings (see Fig 2) for the BIM. These pages provide information that relate to the selected BIM and its specific network settings and the I/O modules attached to it.

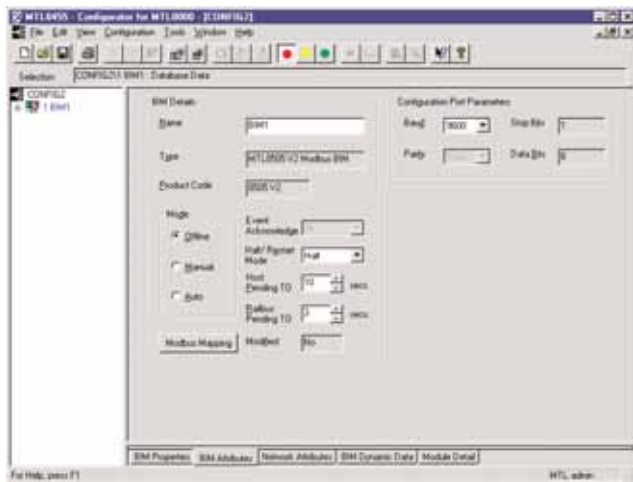


Fig 2 - BIM attributes

Finally, clicking on an I/O module provides a further set of five pages of module information and settings (Fig 3). These pages contain details of the software and hardware revision levels of the chosen module, the condition of its various status flags, the user definable variables and, if connected "live", the current value of each variable.

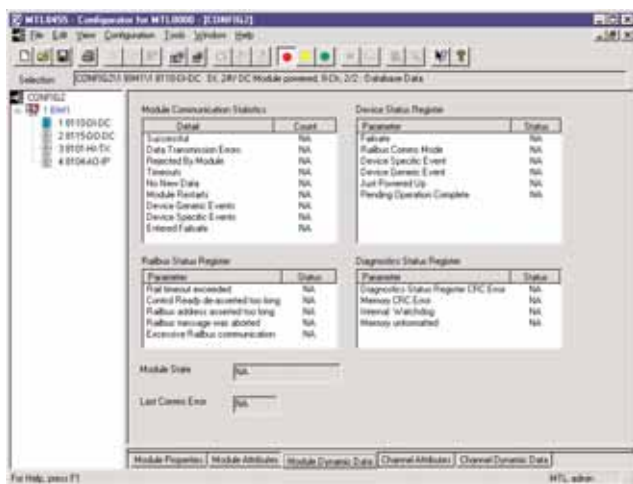


Fig 3 - I/O module dynamic data

All of these pages are provided automatically when a module is added.

PC SYSTEM REQUIREMENTS

- Intel "Pentium®" processor (recommended)
- Microsoft® Windows™ 95, 98, 2000 or NT4 operating system
- RAM capacity – as appropriate for operating system
- At least one available serial port (COM1,2,3 or 4)
- 1 Mb hard disk space + space for user created configuration files

BIM COMMUNICATION PORT SETTINGS

- Speeds 1,200 – 38,400 baud
- Parity..... Odd, Even or None
- Data bits 8
- Stop bits 1
- Protocol SLIP

ASSOCIATED LITERATURE

INM8455 Instruction manual, BIM Configuration Software

TO ORDER

- Configurator with RS232 cable 8455-SW-CF
 - Configurator without RS232 cable 8456-SW-CF
 - RS232 cable 8460-CA-CF
- (The software and any release notes are supplied on a CD ROM.)*

IMPORTANT NOTE:

This software is designed for use with the latest 8505-BIM-B BIM that has version 2.x firmware. It is NOT compatible with version 1 BIMs. However, .csv or .ssf files created for use in version 1 BIMs can be imported to create configuration files for version 2 BIMs.

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Node Services Module

8510-MO-NS

- ◆ stores node configuration
- ◆ retains configuration on BIM swap
- ◆ used to define LAN address of node
- ◆ used to transfer configurations between nodes
- ◆ manages redundant PSU failure

MODULE SPECIFICATION

See also System Specification

INPUTS

8910 PSU signal inputs	2
8913/4 PSU external power fail signal inputs	8
Incoming power fail signal levels	
PSU OK	< 0.5 V @ 10 mA
PSU failed	< 100 μ A @ 12 V DC
Input voltage	\pm 15 V DC (max.)

CONFIGURATION MEMORY

Memory type	serial EEPROM, non-volatile
Data retention period	> 40 years
Write cycles	> 100,000
Configuration read or write time	7.5 s (typ.)
	15 s (max.)

CONFIGURATION SWITCHES (See Fig. A and Table 1)

Write protect (Sw 1)	DIL, on/off
Auto configure (Sw 2 & 3)	DIL (x2), on/off
2/2 only system (Sw 4)	DIL, on/off

ADDRESS SWITCHES (Fig. B)

LAN A address	rotary (x3), 0-9
LAN B offset	rotary (x1), 0-9

Figure A
Configuration switches

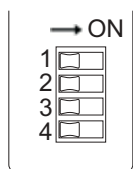


Figure B
Address switches

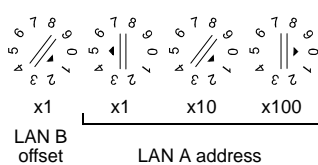
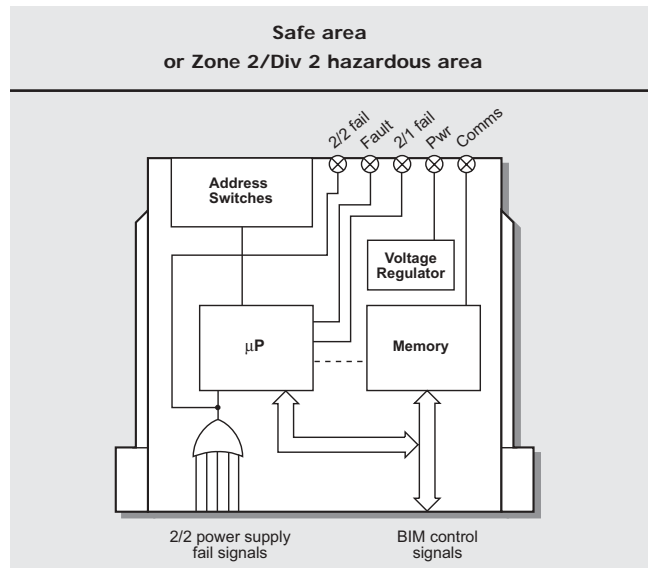


Table 1

Auto config. setting	THC mode	RTD mode
Switch 2	Type K	3-wire Pt100
Switch 3	Type J	4-wire Pt100
Switch 2 & 3	mV	3-wire resistance



LED INDICATORS

Power, Fault, Comms, 2/2 fail, 2/1 fail

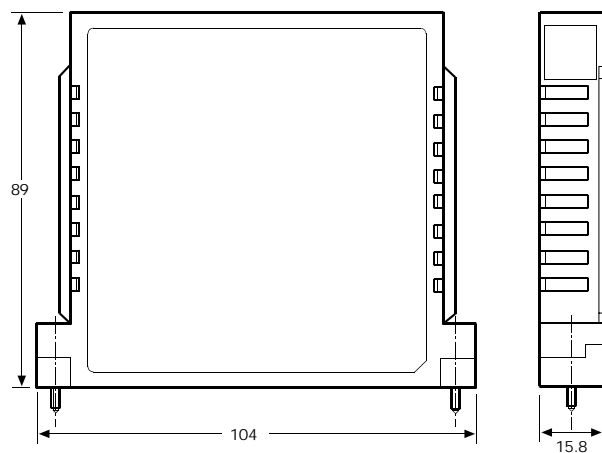
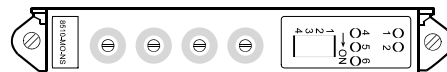
POWER SUPPLIES

Railbus (12V) current30 mA (max.)

MECHANICAL

Weight100 g (nom.)
Mountingcompatible with 8711, 8712 & 8718 carriers

DIMENSIONS (mm)



HART® interface module

8512-IF-HA

- ◆ supports up to 256 HART devices per node
- ◆ supports AMS software
- ◆ simplifies maintenance of HART field devices
- ◆ mountable in Zone 2 or Div 2 hazardous areas
- ◆ only one required per 8000 node

MODULE SPECIFICATION

See also System Specification

HOST INTERFACE

Electrical specificationRS485
 Physical medium2-wire multidrop
 Number of nodes per workstation31 (max.)
 Unit addresses (software configurable)1 – 31
 Baud rate (s/ware configurable)..1.2, 9.6, 19.2 and 38.4 baud
 Instrument management software supported

- ◆ AMS (contact GE Fanuc for further options)

8000 INTERFACE

Connection to BIMvia Configurator port
 HART devices per mode256 (max.)

HAZARDOUS AREA APPROVALS

Location of 8512-IF-HASafe area or
Class I, Div 2, Groups A, B, C, D T4 Hazardous location or
Zone 2, IIC T4 Hazardous location

ISOLATION

Port to port and psu250 V ac rms (to EN 61010-1)
(tested at 2.3 kV ac rms for 1 min.)

LED INDICATORS

LEDs for status indication of HOST and 8000 port

ELECTRICAL

Power supply voltage (Vs)20 – 35 V dc
 Current required

at 20 V135 mA (max.)
 at 24 V115 mA (max.)
 at 35 V75 mA (max.)

Connectionsscrew terminals

Conductor cross-section2.5 mm² (max.)

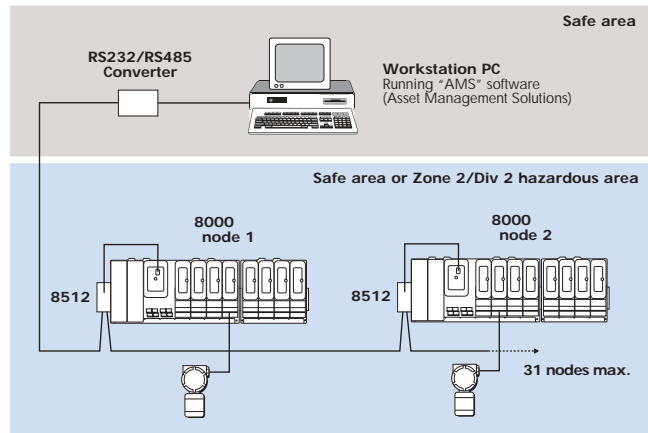
MECHANICAL

Mountingdirectly on to T- or G- section DIN rail

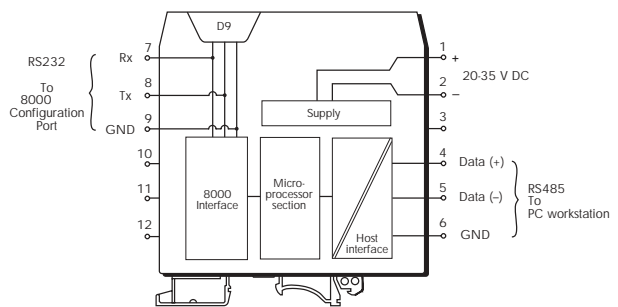
Casingpolyamide

Module width40 mm

Weight (approx.)100 g



Circuit and wiring diagram



Dimensions and mounting (mm)

