



2/2 modules

Analog input modules

8-channel, 4–20mA with HART®	8101–HI–TX
8-channel, 4–20mA	8103–AI–TX
8-channel, 1–5V	8119–VI–05

THC and RTD modules

4-channel, THC and mV	8105–TI–TC
4-channel, RTD and W	8106–TI–RT

Analog output modules

8-channel, 4–20mA with HART®	8102–HO–IP
8-channel, 4–20mA	8104–AO–IP

Discrete input modules

8-channel, 24V dc, isolated, sinking	8109–DI–DC
16-channel, 24V dc, isolated, sinking	8122–DI–DC
8-channel, 24V dc, non-isolated, module powered	8110–DI–DC
16-channel, 24V dc, non-isolated, module powered	8121–DI–DC
32-channel, 24V dc, non-isolated, module powered	8125–DI–DC
32-channel, 24V dc, non-isolated, module powered, Sequence of Events	8127–DI–SE
8-channel, 115V ac, isolated, sinking	8111–DI–AC
8-channel, 115V ac, non-isolated, module powered	8112–DI–AC
8-channel, 230V ac, isolated, sinking	8113–DI–AC
8-channel, 230V ac, non-isolated, module powered	8114–DI–AC

Discrete output modules

8-channel, 2–60V dc, non-isolated, module powered	8115–DO–DC
8-channel, 20–265V ac, non-isolated, module powered	8116–DO–AC
8-channel, 2–60V dc, isolated, unpowered	8117–DO–DC
8-channel, 20–265V ac, isolated, unpowered	8118–DO–AC

Pulse input modules

2-channel, pulse/quadrature input	8123–PI–QU
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2/1 modules

Analog input modules

8-channel, 4–20mA with HART®	8201–HI–IS
8-channel, 0–10V/potentiometer	8230–AI–IS

THC and RTD modules

8-channel, THC and mV	8205–TI–IS
8-channel, RTD and W	8206–TI–IS

Analog output modules

8-channel, 4–20mA with HART®	8202–HO–IS
8-channel, 4–20mA	8204–AO–IS

Discrete input modules

16 (8)* -channel, switch/proximity detector	8220–DI–IS
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Discrete output modules

4-channel, solenoid driver, IIC gas groups	8215–DO–IS
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Pulse input modules

2-channel, pulse/quadrature input	8223–PI–IS
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*8-channel when used with 8624-FI-IS field terminal





General

All I/O modules are connected to a high speed Bus Interface Module (BIM) via a proprietary bus system called 'Railbus' and one BIM can control up to 32 modules.

The module carrier provides the transmission medium for the Railbus and, by plugging a module onto a carrier, connections are made between the module and the bus. The connectors on the carrier also provide the power supply links to the module and, when required, power for the field wiring.

Addressing of I/O modules

Modules are addressed by the BIM in terms of their position, or slot, in the total chain of 32 modules not by individual module types. As a result, a module can be removed and replaced by another of its own type without the need to 'tell' the BIM of the change. During configuration, the BIM is told the characteristics of each necessary module position whether or not the module is present at the time. Consequently, if a module is removed for service replacement, the properties of the 'slot' are still retained by the BIM.

Important modes

Output failsafe mode

Output modules have the ability to assume a failsafe state. This can happen for two reasons.

- 1) The BIM can force a module into a failsafe state by issuing a specific command to it.
- 2) Modules have a configurable "timeout" parameter. This defines the maximum time period of communication inactivity with the BIM. If this period is exceeded the module adopts a failsafe state.

The different module types have their own response to a failsafe command, and those responses are described in the individual sections that follow.

Input fail values

In the event of failure of an input module, the BIM forces the reported value to a predefined state – low, high or hold last value.

This ensures that the host adopts a state consistent with safe operation of the plant.

Power-up/initialisation state

When powering-up a node it is essential for plant safety that the state of each of the outputs is known. While the BIM is initialising, the I/O modules are held in the power-up state (see following pages). After BIM initialisation and before establishing communication with the host, the outputs are set to predefined "initialisation" states. This "safe-state" can be defined by the user for each output channel.

Non-volatile configuration memory

The configuration information for all I/O modules in a node is stored in the BIM in non-volatile memory (NVM). When a module is replaced, when the node is powered up or following a reset, the BIM will download the stored configuration information to the relevant I/O modules.

Visual indicators

LEDs are provided on each module to indicate Power, Fault and channel Status information. These are based on the NAMUR NE44 specification for LED indicators.

The Power and Fault indicators are common to all I/O modules and their states are shown in the following tables.

Module 'Fault' LED (red)

On	<ul style="list-style-type: none"> ◆ Failsafe ◆ A/D error on AI ◆ BFP failure on 2/2 AI
Off	Normal
Flashing	Initialisation error

BFP = Bussed Field Power of 2/2 modules

Module 'Power' LED (green)

On	Power OK
Off	Power failure

Module 'Status' LED (yellow)

The channel "Status" indicators have different meanings according to the module type and are described in the individual module sections.

Field Terminals

An I/O module requires a field terminal to provide a connection to the field wiring.

A field terminal should be chosen to suit the type of module and its field wiring, so the user is advised to consult the module data sheet, which has recommendations for the module and certain types of application.

In addition to the screw-clamp field terminal type, there is also one that uses multi-pin IDC connectors. This type is referred to as a "mass termination assembly" and gives the user a wide choice of options when choosing a method for terminating their field wiring.

See the *Field Terminal* data sheets for further details.

Important note

If, when using the 8502 Profibus BIM, the node is configured via Profibus, a reduced set of configuration parameters is available. Alternatively, if the 8455 Configurator Software is used to configure a Profibus node, a fully detailed range of module configuration parameters is available.

In both cases, the module specifications should be read in conjunction with the Profibus BIM instruction manual INM8502 which explains all the configuration options.

GSD files are available for either of the above options.



General

The 4-20mA AI modules provide digitised data and status information from 4-20 mA current loop sensors.

HART® capability

AI modules "with HART" can obtain information from HART instruments of protocol revision 5.0 or later. Each channel can communicate with a single HART instrument. HART universal command 3 is used to gather up to 4 dynamic variables and status from each HART instrument. This provides more process information to the control system from each device. Greater accuracy can also be achieved by eliminating A/D and D/A errors.

In addition, HART pass-through may be used for device configuration, calibration and advanced diagnostics.

Input sampling

The AI modules have eight user-channels that are sampled every 27ms (2/2) or 33ms (2/1).

Data format

The input signal is stored as a 16-bit unsigned value. In this range 0 is equivalent to 0mA and 65,535 is equivalent to 25mA. Any digital HART data is stored in its original IEEE754 floating point format.

Filtering

The Analog Input modules use a first-order software filter that provides 12dB attenuation at the Nyquist frequency of the algorithm. The filter supports a set of options that can be matched with control algorithm execution rates.

Input alarms

Four configurable alarm levels are provided for each channel—two high and two low (see figure below). When an input value exceeds an alarm limit a flag is set and the BIM gets a new alarm status.

Alarm deadband

The Alarm Deadband prevents the alarm from tripping on and off because of system noise. It can be configured for each channel and is always set on the 'inner' side of the alarm limit to be, typically, greater than the system noise in the plant. If an alarm is activated, it will remain until the input moves the full extent of the deadband towards a "safer" value.

The Hi-Hi and Lo-Lo alarms support the NAMUR recommendations, i.e. if the alarm limit is set less than 3.6mA (Lo-Lo), or greater than 21.0mA (Hi-Hi), the alarms must be active for 4 seconds before the alarm is set. The Deadband does not apply to NAMUR alarms. If the alarm limits are set at values between the NAMUR limits, the alarms function normally.

Dead zone

Each channel has a definable "dead zone". This is to reduce the need for the module to report to the BIM every minor change in input value. If the input value differs by the amount defined by the Dead Zone, or more, then the new value is reported, otherwise it is not. This reduces traffic on the internal bus which improves the system response time. If the Dead Zone value is set to zero (the default), then every input value read will set a 'New Data' flag, and be reported.

Module operating states

Normal/Failsafe mode

The AI modules support failsafe mode as defined in the earlier I/O module introductory section. When not in failsafe the module adopts Normal mode.

Channel Active/Inactive

A channel can be made active or inactive individually. When a channel is made inactive inputs will not be processed.

Default/Power-up conditions

These modules use the following values when they power up.

Module mode

Normal (not "failsafe")

Active/inactive

All channels power up in the active state.

Alarms

All alarms are made inactive by having their values set to high or low extremes, as appropriate.

Dead Zone

0 (i.e. all changes of A/D data are reported for an active channel)

Software Filtering

Disabled.

Passthrough

Passthrough messages to HART instruments are always allowed.

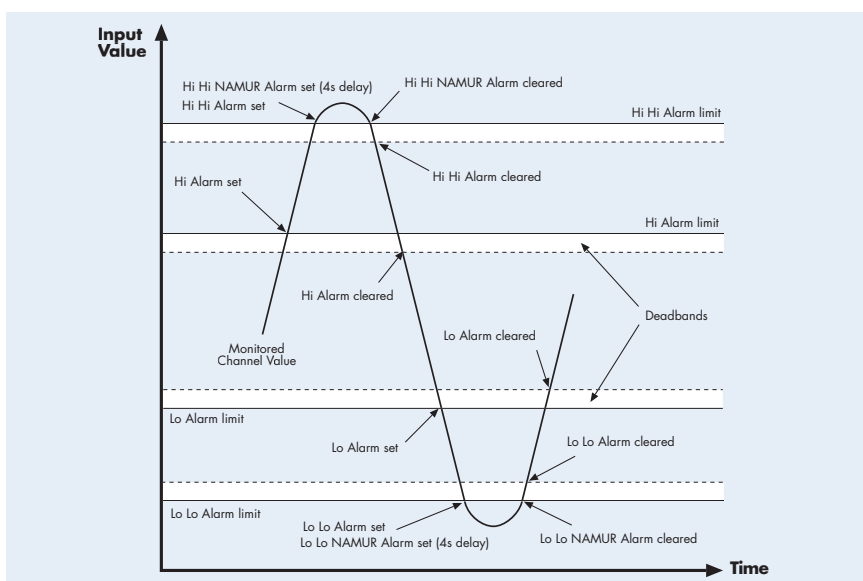
Visual indicators

Channel "Status" LED (yellow)

On	Sensor loop OK
Off	Open circuit sensor <u>and</u> channel inactive
Flashing	Open circuit sensor <u>and</u> channel active OR Error condition

An error – i.e. a flashing LED – could be as a result of any of the following conditions:

- a loss of HART signal,
- an error in the A/D converter,
- a NAMUR alarm or
- a Hi (-Hi) or Low (-Low) alarm.



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EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mti-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mti-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

General

These modules provide digitised data and status information of analog measurements from thermocouples, mV sources, RTDs and resistance sources.

Thermocouple modules provide four or eight channels for monitoring input signals from thermocouples or mV sources. The function of the module is set up during configuration. Cold junction compensation for thermocouple applications is provided by means of a sensor in the field terminal. Only the recommended field terminals can be used with these modules.

RTD modules provide four or eight channels for monitoring input signals from RTD or resistance sources. The function of the module is set up during configuration. The RTD can be 2-, 3- or 4-wire type. Only the recommended field terminals can be used with these modules.

Input sampling

Thermocouple modules sample at intervals of 60ms per channel. In addition, the module has cold junction temperature compensation that is refreshed every 1.8 seconds for 4-channel modules and every 2.4 seconds for 8-channel modules. The sampling technique for the RTD module is similar where samples of the voltage across, and the current through, the RTD are measured at intervals of 60ms per channel. Compensation methods reject the effect of resistance in the cable conductors for 3-wire and 4-wire RTD/Resistance.

Data format

The 8105/6 4-channel modules store data as 15-bit plus sign integers (-32768 to +32768). The 8205/6 8-channel modules store data as 16-bit unsigned integers (0 to 65535).

Filtering

An Infinite Impulse Response (IIR) filter is used on the input data before it reaches the A/D converter. Depending upon the coefficients selected, the output from the filter will be:

- the input value (filter OFF)
- an average of the last two readings (filter ON - setting 1)
- a running average of readings (filter ON - setting 2)

The coefficients can be selected individually for each channel.

Input alarms

The modules provide two configurable alarm levels for each channel—a high limit and a low one. See figure.

When an input value exceeds an alarm limit the appropriate alarm bit (high or low) is set in the channel status byte. In addition, the "new data" signal is set to allow the controller to collect the new alarm status information and the affected channel LED will flash.

Alarm deadband

The alarm deadband (not shown on the diagram) is fixed at 1%.

Dead zone

Each channel has a definable "dead zone". This is to reduce the need for the module to report to the BIM every minor change in input value. If the input value differs by the amount defined by the Dead Zone, or more, then the new value is reported, otherwise it is not. This reduces traffic on the internal bus which improves the system response time. If the Dead Zone value is set to zero (the default), then every input value read will set a 'New Data' flag, and be reported.

Open sensor detection

When configured to do so, the modules will detect an open circuit sensor and report it within 10 seconds. When this occurs a status bit is set in the module and the affected channel LED flashes. The detection options for the two module types are configurable as follows:

THC and mV

Off, drive upscale or drive downscale

RTD and resistance

Off or drive upscale

These choices can be made for each channel.

Module operating states

Normal/Failsafe mode

The THC and RTD modules support failsafe mode as defined in the earlier I/O module introductory section. When not in failsafe the module adopts Normal mode.

Channel Active/Inactive

A channel can be made active or inactive individually. When a channel is made inactive inputs will not be processed.

Power-up conditions

The module uses the following values when it powers up.

Module mode

Normal (not "failsafe")

Active/inactive

All channels power up in the active state.

Alarms

All alarms are made inactive by having their values set to high or low extremes, as appropriate.

Dead zone

0 (i.e. all changes of A/D data are reported for an active channel)

Software filtering

Disabled

Channel type

Type K thermocouple or
3-wire RTD - Pt100

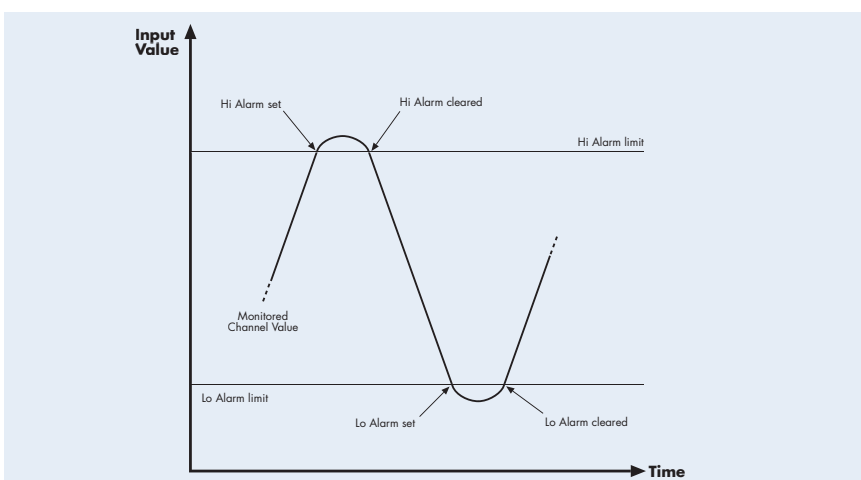
O/C sensor

Off

Visual indicators

Channel "status" LED (yellow)

On	Sensor loop OK
Off	Open circuit sensor <u>and</u> channel inactive
Flashing	Open circuit sensor <u>and</u> channel active OR Error condition



General

The 4–20 mA AO modules use a single D/A converter in a sample and hold configuration to drive each of the output channels. The processor sets the current value for each of the active channels once every 20ms. Any requested output values below 1mA are clamped to 1mA to ensure that the open-loop detection mechanism is always operable.

To verify that active output channels have current flowing to the field, the processor reads a hardware signal every time an output is written to the D/A converter. If the signal indicates “no current flowing”, i.e. < 1mA, for 50 consecutive scans (i.e. one second), an Open-Loop Detection failure is set for that channel.

HART® capability

AO modules “with HART” are compatible with all HART devices of protocol revision 5.0 or later. Each channel can communicate with a single HART instrument and supports HART communication with the wide range of HART valve positioners now available. HART universal command 3 can be used to gather up to 4 dynamic HART variables such as valve position, air pressure, etc., together with HART status variables. These are scanned by the BIM and may be communicated over the LAN for easy integration into the control system.

In addition, HART pass-through may be used for device configuration, calibration and advanced diagnostics.

Data format

The output data has a resolution of 12 bits but is stored as a 16-bit unsigned value. In this range 0 is equivalent to 0mA and 65,535 is equivalent to 25mA.

Module operating states

Failsafe mode

The module supports failsafe mode as defined in the earlier I/O module introductory section. When put in failsafe mode the output can be made to adopt one of the following options.

1) Use configured failsafe values

In this (default) mode, the module forces the output to a predefined percentage value. The default value is 0%.

2) Hold last value

In this mode the channel holds the last value it output.

When not in failsafe the module adopts Normal mode.

Channel Active/Inactive

Each channel can be made active or inactive individually. When a channel is made inactive the output is disabled, i.e. de-energised.

When a channel is made Active again the output is driven based upon the current configuration.

Default/Power-up conditions

The module uses predefined values when it powers up. The following parameters summarise the state of the module when it powers up.

Module mode:

Normal (not “failsafe”)

Active/inactive:

All channels power up in the Inactive state.

Visual indicator

Channel “Status” LED (yellow)

On the AO modules the yellow “Status” LED reacts in the following way to module conditions.

On	Field circuit OK
Off	Open circuit field loop and channel inactive
Flashing	Open circuit field loop and channel active OR Error condition

An error condition – i.e. a flashing LED – could be as the result of the loss of the HART communications signal.

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General

DI modules can accept up to 8, 16 or 32 discrete inputs, from dry contacts, NAMUR standard proximity detectors, or switched voltages, depending upon module type. The source voltage for field switching can be provided through the module or from an independent supply out in the field.

In operation, the input voltage is compared against a threshold voltage to create a 'true' or 'false' condition. If the inputs are from Zone 2/ Zone 1 or Zone 0 hazardous areas, the appropriate (2/1) module provides certified isolation for these signals. A pulse counter is also included which can count the number of input pulses for each of the channels.

Input filter

An input filter can be set individually for each channel to introduce a delay period that allows the input to settle to a stable value.

When switched off, the bandwidth of the DI input is 250Hz (100Hz for 2/1 modules). The timeout filter can introduce a timeout delay of between 2 and 512ms in 2ms steps for 2/2 modules and between 3 and 512ms in 3ms steps for 2/1 modules. Alternatively, preset values of "Fast" (22ms) or "Slow" (258ms) may be used.

Latch

Any channel input can be configured to be "real time" or latched. If the latch feature is enabled, the polarity can also be set so that an input signal that goes:

- ◆ high will be held high
- ◆ low will be held low

until the latch is released by a command from the controller. All channels are latched independently and can be cleared

simultaneously, or independently, by a Write instruction to the module's latch reset register. If controlled by a BIM this will occur automatically in 2 to 3 seconds.

Line fault detection (2/1 only)

When enabled, this will cause a flag to be set to indicate a short or open circuit fault.

Low-frequency pulse counter

The DI modules contain a continuously running 16-bit pulse counter that counts each low-frequency pulse received on the input. The maximum pulse rate, with the timeout filter switched off, depends upon the module selected; consult the individual data sheets for details. With the filter active, the maximum pulse rate will be determined by the timeout period used. In order to start a particular count the counter must be reset to zero by a host instruction. When the counter overflows (i.e. > 65,536 counts) it will restart from zero.

Module operating states

"Failsafe" mode

The module supports failsafe mode as defined in the earlier I/O module introductory section.

Channel Active/Inactive

Each channel can be made active or inactive individually. When a channel is made inactive:

- ◆ inputs are not processed—i.e. the last input value is held and not refreshed
- ◆ channel events are not generated
- ◆ the counter is not incremented

Power-up conditions

On power-up, or if a reset is executed, the configuration will automatically adopt predefined states:

Module mode:

Normal (not "failsafe")

Channel types:

All latches and filters are off

Active/Inactive:

All channels power-up in the Active state

Visual indicators

Channel "Status" LED (yellow)

On the DI modules the yellow "Status" LED reacts in the following way to module conditions.

On	Channel input "high" or latched
Off	Channel input "low"
Flashing	Line fault detect (2/1 only)

Note: the LED may appear to flash when the input goes high and low repeatedly.





General

DO modules can provide up to 4 or 8 discrete outputs, depending upon module type. Continuous switched loads of up to 1A are directly achievable with these modules. Relays rated at 3, 6 and 10A are also available for switching larger load currents. Line fault detection is provided on the 2/1 modules for both open and short-circuit conditions.

Output Mode

The DO module outputs may be configured for one of three different types of output:

- ◆ Discrete
- ◆ Single pulse
- ◆ Continuous pulse

Discrete

The Bus Interface Module (BIM) signals an ON or OFF condition on demand.

Single Pulse

(See Notes 1 & 2)

This is an individual "single-shot" action, creating a single ON pulse of specified duration that occurs at a definable time. The pulse on-time can be varied between 2ms and 130s in increments of 2ms. If a new ON command (i.e. trigger) is given during the ON period the pulse will restart. If a new pulse width is supplied during the ON period, it will not take effect until the next ON period. A pulse can experience a small amount of time dither that depends upon the amount of Railbus activity. This can be $\pm 1\%$ of the pulse width or $\pm 3.5\text{ms}$, whichever is the longer.

Continuous Pulse

(see Notes 2, 3 & 4)

This type of output provides a continuous pulse train that is defined by the pulse on-time, and the pulse period (the time between the start of each ON time). The pulse period is configurable to any value between 4 ms and 130,000ms in 2ms steps. The pulse on-time is the same as for the momentary action described above. The on-time must not exceed the setting for the pulse period. (See also the above note regarding AC modules.) Pulses can experience a small amount of time dither that depends upon the amount of Railbus activity. This can be $\pm 1\%$ of the pulse period, or $\pm 3.5\text{ms}$, whichever is the longer.

Continuous pulse operation has two distinct modes—static and dynamic. When in static mode, the pulse parameters are cleared from memory when the channel is made inactive; in dynamic mode the values are retained for use when the channel is made active once again.

Line Fault detection (2/1 only)

When enabled, this will cause a flag to be set to indicate a short or open circuit fault even when channel output is in OFF state.

Module operating states

Failsafe mode

The module supports failsafe mode as defined in the earlier I/O module introductory section, with the following two additions:

1) Channel using "Configured failsafe values"

In this mode, the module will force the outputs to predefined levels—defined on a per channel basis.

On entering "failsafe":

- a) If channel is in **Static** mode of operation:

Pulse mode is disabled and the channel is configured as a latched output and is driven to its failsafe value.

- b) If channel is in **Dynamic** mode of operation:

If in single pulse (momentary) mode, the configuration is not cleared, but the output is driven to its failsafe value.

On leaving failsafe:

Channel will adopt the mode defined below for a channel going from inactive to active state

2) Channel using "Hold last value"

If the module goes into failsafe during a single pulse, it is allowed to complete the pulse before adopting the failsafe state. A latched (discrete) output will remain at its current value.

Channel Active/ Inactive

Each channel can be made active or inactive individually.

When a channel is made inactive the output is turned OFF (i.e. de-energised).

When a channel changes from inactive to active the following situations apply:

- a) If channel is in **Static** mode of operation:

It becomes a latched output and will remain so until reconfigured by the BIM.

- b) If channel is in **Dynamic** mode of operation:

The channel will resume operation with its previous configuration and output.

Power-up conditions

On power-up, or if a reset is executed, the configuration will automatically adopt predefined states:

Module mode:

Normal (not failsafe)

Channel types

All channels are configured as Discrete outputs

Active/Inactive

All channels power-up in the Inactive state

Line fault detection (2/1 only)

Disabled on all channels

Visual indicators

Channel "Status" LED (yellow)

On the DO modules the yellow "Status" LED reacts in the following way to module conditions.

On	Field circuit OK
Off	Open circuit field loop <u>and</u> channel inactive
Flashing	Open circuit field loop <u>and</u> channel active OR Error condition

Note: the LED may appear to be flashing when input goes high and low repeatedly.

Notes:

1. This action is only available in Static mode.
2. AC modules will react differently to the on-time length and trigger time. The module can only be triggered ON during a zero crossing of the AC waveform; similarly, the module can only switch OFF at a zero crossing point. The minimum on-time is therefore restricted to half the total period of a regular waveform.
3. Continuous pulse operation is supported only by Version 2 models of BIMs 8502 and 8505.
4. On 2/2 modules, this action is only available in Static mode.



General

These modules are designed to meet the requirements of a very wide range of mechanical positioning and flow applications. When used separately, the two input channels will accept pulse inputs to measure:

- ◆ frequency
- ◆ acceleration / rate
- ◆ number of pulses (i.e. counter)

When combined, they provide:

- ◆ rotational position and direction data from quadrature encoding devices

In addition, the module has two digital outputs and one digital input to gate (start/stop) the channel 1 internal counter.

Pulse inputs

Pulse inputs can come from a range of sensors having different amplitudes, trigger levels and input impedance requirements. Inputs types accepted are:

- ◆ Proximity detectors (NAMUR/DIN19234)
- ◆ Current inputs
- ◆ Voltage inputs
- ◆ Switch / electro-mechanical inputs

Threshold levels for the current and voltage input can be set to suit the application.

Dynamic data

Several values are calculated, for each channel, from the signal pulses received.

Frequency

This is calculated by measuring the time interval between pulses. An average is calculated over a period (20ms to 200s) defined by the user. The time interval is measured from the edge of one pulse to the same edge of the next pulse. The polarity (rising or falling edge) can be configured. The default is the rising edge.

There are ten frequency measurement ranges. They start at 0 – 100Hz and rise in ratios of 3, 5 and 10. However, the maximum frequency of the module is 50kHz, so any values in the 100kHz range that exceed this should be considered as “out-of-range”.

Acceleration

This is calculated from the difference in frequency from the start to the end of the sample period. A positive value indicates an increase in the rate of frequency and a negative value is a decrease in the rate.

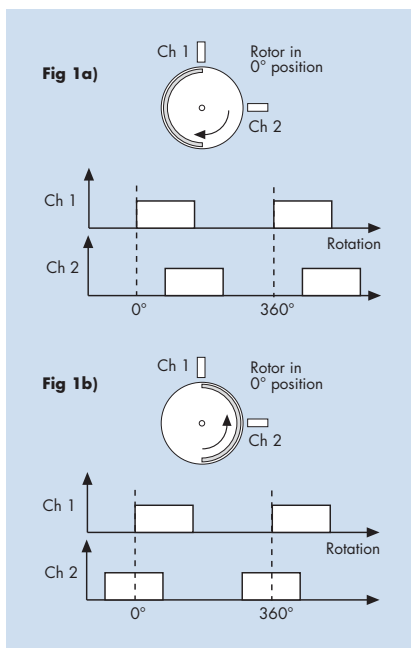
Counting

Each channel has a 32-bit counter that indicates the total number of input pulses since the counter was reset. The counter on Channel 1 can be started and stopped by the control gate input and both channel counters can be started, stopped and reset by BIM commands.

Counters can be configured to count up (the default) or down. If the quadrature calculation is enabled (see below) then the configured counter direction is ignored; instead counter direction is determined by the quadrature value (up for forward, down for reverse).

A counter preset value can be configured by a BIM command which also resets the counter. On reaching the preset count value an event is triggered which can also be passed to the channel's digital output. This state is cleared by resetting the counter or assigning a new preset value.

Quadrature (rotation direction)



The second channel can be used to determine direction of rotation by comparing the phase of its input pulse with that of the first channel.

If the Ch 2 input is in a low state on the rising edge of the Ch 1 pulse then the rotation is forward (Fig 1a). If the Ch 2 input is high on the rising edge of the Ch 1 pulse then the rotation is backward (Fig 1b).

Filtering

The module has a hardware filter which can be used to minimise the effects of contact bounce. The available settings are 1, 5, 20 kHz and Off.

Alarms

High / Low alarms

High and low alarms can be configured for each channel. When the input value goes beyond an alarm limit, channel and module flags are set, the channel LED flashes and, if configured, the channel's digital output state will change.

Acceleration alarms

An acceleration alarm limit can also be set. If the limit is exceeded the actions taken are identical to those for the high/low alarms.

Alarm deadband

A deadband can be specified for the high, low and acceleration alarms. This provides hysteresis to avoid repetitive alarms in noisy signal environments.

Missing pulse alarm

Both channels can be configured to detect a “missing pulse”. If no input pulse is detected for a defined time period an alarm is signalled in the same way as the high/low alarms.

The alarm is cleared on receipt of a pulse or on reconfiguration of the alarm. The time period is restarted after each sample period in which at least one pulse occurs.

Line Fault Detect

Each channel can be configured to sense an open or a short circuit condition on inputs. On detection, the actions are those for the high/low alarms.

On fault, the BIM can: report the frequency value as being at the top or the bottom of the range, freeze the counter, set the acceleration to zero; depending on how the BIM is configured.

Control data

The host can write data to control each channel counter. The available parameters are: start, stop, set, reset and preset value.

Digital outputs

Both digital output channels can reflect the status of the inputs by indicating:

- ◆ frequency or acceleration alarm
- ◆ counter preset value reached while the main channel can also output:
- ◆ quadrature forward or reverse signal
- ◆ scaled retransmission (a “divided by N” version of the input)

General

Sequence of Events (SOE) recording is used to capture each of the events that occur during a shut-down or trip sequence. Such information is invaluable in determining the cause of such an event.

In the course of such a sequence, events often take place very rapidly throughout the process area. The SOE module and its companion *Event Logger* software provide a means for recording these events and, because highly accurate time stamps are used, the precise order in which they occurred can be determined.

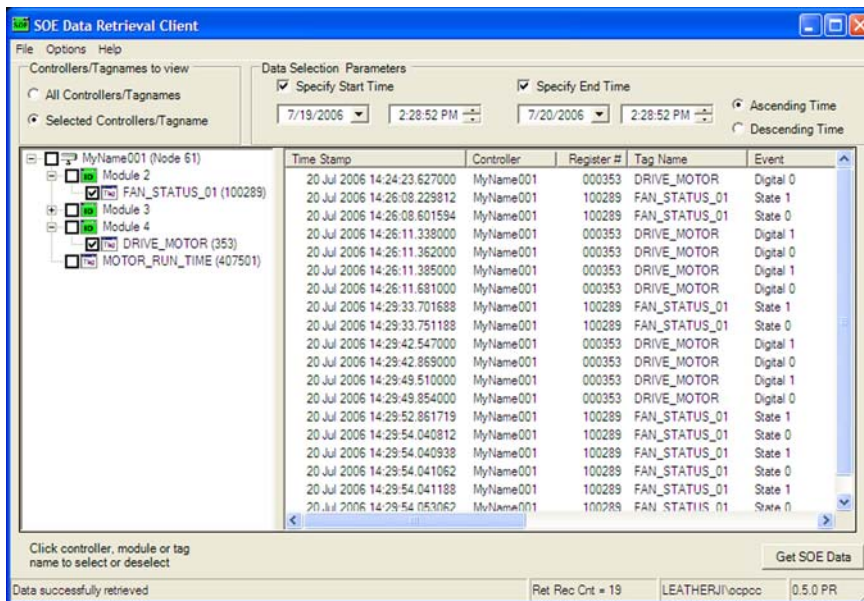
8127-DI-SE is a 32-channel SOE module designed to monitor the status of digital inputs and to record any state changes to an internal buffer. Each state change is time-stamped to the nearest 1/4 millisecond.

The contents of the buffer are periodically transferred to the controller. Each module has a buffer capacity of 512 events, which it can transfer to the controller in about 500ms, consequently, approximately 1000 events per second can be captured.

SOE Event Logger software

The *Event Logger* software is provided with all MOST Workbench products. This software collects time-stamped data from the controller and merges information from multiple controllers into a chronological journal before exporting the data to standard event viewers, such as Wonderware's *InTouch*. Other data export options include OPC Event format or a basic text file.

The event logging software can also be used to record events other than SOE activity. For example, it can be used to record changes of state in the controller, such as when control is switched between master and slave controllers. It could be used to record when an analogue limit has been exceeded or when a digital module changes state. This powerful capability enables all critical events in the process to be recorded, providing a complete picture for further analysis.



Time Stamp	Controller	Register #	Tag Name	Event
20 Jul 2006 14:24:23.627000	MyName001	000353	DRIVE_MOTOR	Digital 0
20 Jul 2006 14:26:08.229812	MyName001	100289	FAN_STATUS_01	State 1
20 Jul 2006 14:26:08.601594	MyName001	100289	FAN_STATUS_01	State 0
20 Jul 2006 14:26:11.338000	MyName001	000353	DRIVE_MOTOR	Digital 1
20 Jul 2006 14:26:11.362000	MyName001	000353	DRIVE_MOTOR	Digital 0
20 Jul 2006 14:26:11.385000	MyName001	000353	DRIVE_MOTOR	Digital 1
20 Jul 2006 14:26:11.681000	MyName001	000353	DRIVE_MOTOR	Digital 0
20 Jul 2006 14:29:33.751188	MyName001	100289	FAN_STATUS_01	State 1
20 Jul 2006 14:29:33.751188	MyName001	100289	FAN_STATUS_01	State 0
20 Jul 2006 14:29:42.547000	MyName001	000353	DRIVE_MOTOR	Digital 1
20 Jul 2006 14:29:42.889000	MyName001	000353	DRIVE_MOTOR	Digital 0
20 Jul 2006 14:29:49.510000	MyName001	000353	DRIVE_MOTOR	Digital 1
20 Jul 2006 14:29:49.854000	MyName001	000353	DRIVE_MOTOR	Digital 0
20 Jul 2006 14:29:52.861719	MyName001	100289	FAN_STATUS_01	State 1
20 Jul 2006 14:29:54.040812	MyName001	100289	FAN_STATUS_01	State 0
20 Jul 2006 14:29:54.040938	MyName001	100289	FAN_STATUS_01	State 1
20 Jul 2006 14:29:54.041062	MyName001	100289	FAN_STATUS_01	State 0
20 Jul 2006 14:29:54.041188	MyName001	100289	FAN_STATUS_01	State 1
20 Jul 2006 14:29:54.053062	MyName001	100289	FAN_STATUS_01	State 0

Benefits

◆ More accurate event sequencing

All logged events are time stamped using 1/8ms resolution for 1/4ms accuracy. The controller uses Network Time Protocol (NTP) to assure time stamp accuracy between modules across the network. When using NTP, all controllers are synchronized across the network to ± 3 ms, resulting in very accurate event sequencing.

◆ Identify problems quickly

Each SOE input has a unique line-fault detection feature to identify a short circuit or open circuit on each input. Problems are identified immediately for correction, saving considerable maintenance time.

◆ Simplifies field wiring

Field circuits are module-powered, eliminating the need to "daisy chain" power supply wiring at field terminals. Field circuits are powered with a minimum of wiring and termination effort.

◆ Locate SOE modules in the process

Like the rest of the control platform, SOE modules can be located in your process, next to your field devices in order to record events locally on a more reliable & timely basis.

◆ Easy integration with other applications

Events from multiple modules and controllers can be stored in a single SOE Event Logger providing an easy interface to other applications.

32 Discrete Channels

The 8127-DI-SE has 32 discrete input channels and each channel can be configured as either an SOE input or a standard discrete input.

SOE input signals can also be used as standard discrete inputs as part of any control strategy. Each module can buffer up to 512 events.

Events are communicated to the controller, which uses Network Time Protocol (NTP) to accurately convert the module's time stamp data to real time. The SOE Event Logger, which constantly polls the controller for new events (typically every 2 seconds), collects each time-stamped event. After recording the events, the Event Logger sends an acknowledgement to the controller, which then clears the event from its memory.

The controller retains all events until all active Event Loggers acknowledge them. Multiple Event Loggers can be used for redundant event recording and will always have consistent time stamps since all events are time stamped by the controller.

Events are displayed by the SOE Data Retrieval Client. Following data retrieval, the user can choose to email the SOE data, Print it or Save it to a CSV file. The user can create a custom report easily by selecting the columns to be viewed and printed.

8-channel Analog Input



4–20mA with HART®

- ◆ 8 single-ended 4-20mA input channels
- ◆ non-incendive field circuits
- ◆ HART pass-through
- ◆ HART variable and status reporting
- ◆ 2- or 4-wire transmitters
- ◆ open and short circuit detection
- ◆ 24V dc bussed field power required

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels8, single-ended
Nominal signal range (span)4 to 20mA
Full signal range1 to 23mA
Line fault detection
Short circuit current.....> 23.5mA
Open circuit current.....< 0.5mA
Output voltage (@ 20mA)13.5V (min.)
Output current32mA (max.)
Accuracy (over temp range)± 0.1% of span
Resolution16 bits
Repeatability0.05% of span
Isolation
(any channel to Railbus)100V ac
(between channels).....none

CONFIGURABLE PARAMETERS

Alarmshigh, high-high, low and low-low
Alarm deadband (hysteresis)user defined value
Input filter time constantuser defined value
Input dead zoneuser defined value
Drive on failsafedisabled /upscale /downscale
Channel statusactive /inactive
HART variable and status reportingenable /disable

RESPONSE TIME

Signal change to availability on Railbus

4–20mA mode.....27ms (max.)
HART mode.....0.75s per channel

SAFETY

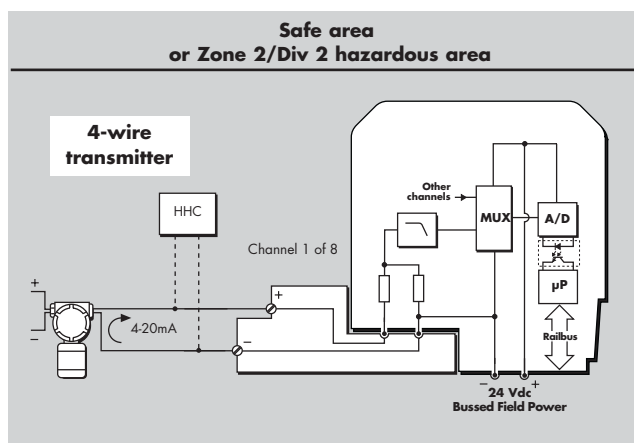
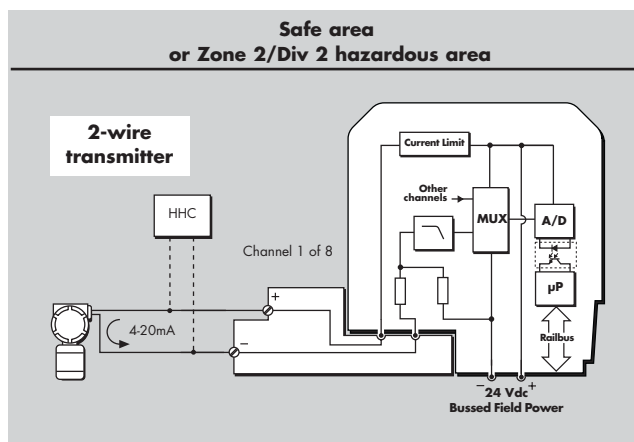
FM non-incendive field wiring parameters (each channel) .
..... $V_{oc} = 28.7V$; $I_{sc} = 33mA$; $C_a = 0.17\mu F$; $L_a = 11.0mH$

POWER SUPPLIES

Railbus (12V) current.....100mA (typ.)
.....150mA (max.)
Bussed Field Power 2-wire Tx300mA (max.)
(@ 24V dc ±10%) 4-wire Tx60mA (max.)

HART® is a registered trademark of the HART Communication Foundation.

8101-HI-TX



MECHANICAL

Module Key CodeA1
Module width42mm
Weight200g

FIELD TERMINALS (2-WIRE TX)

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General Purpose	8602-FT-ST Standard	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous area	8601-FT-NI Non-incendive	8603-FT-FU Non-incendive Fused

FIELD TERMINALS (4-WIRE TX)

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General Purpose	8615-FT-4W	-
Class 1, Div 2 or Zone 2 hazardous area	8615-FT-4W	-

See also the 8618-FT-MT field terminal for custom termination options.



EUROPE (EMEA) Tel: +44 (0)1582 723633 Fax: +44 (0)1582 422283
AMERICAS Tel: +1 603 926 0090 Fax: +1 603 926 1899
ASIA PACIFIC Tel: +65 487 7887 Fax: +65 487 7997
E-mail: enquiry@mti-inst.com Web site: www.mti-inst.com

Oct 2006

8-channel Analog Input

4-20mA

- ◆ 8 single-ended 4-20mA input channels
- ◆ non-incendive field circuits
- ◆ 4-20mA
- ◆ 2- or 4-wire transmitters
- ◆ open and short circuit detection
- ◆ 24V dc bussed field power required

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels8, single-ended
Nominal signal range (span)4 to 20mA
Full signal range1 to 23mA
Out of range alarm
 Lower threshold> 23.5mA
 Upper threshold< 0.5mA
Output voltage (@ 20mA)13.5V (min.)
Output current32mA (max.)
Accuracy (over temp range)± 0.1% of span
Resolution16 bits
Repeatability0.05% of span
Isolation
 (any channel to Railbus)100V ac
 (between channels)none

CONFIGURABLE PARAMETERS

Alarmshigh, high-high, low and low-low
Alarm deadband (hysteresis)user defined value
Input filter time constantuser defined value
Input dead zoneuser defined value
Drive on failsafedisabled /upscale /downscale
Channel statusactive /inactive

RESPONSE TIME

Signal change to availability on Railbus27ms (max.)

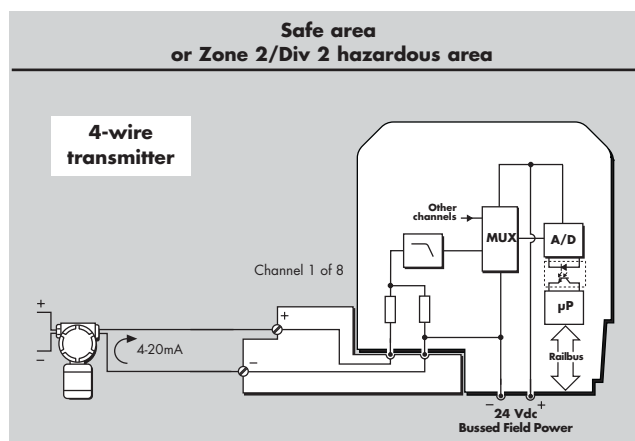
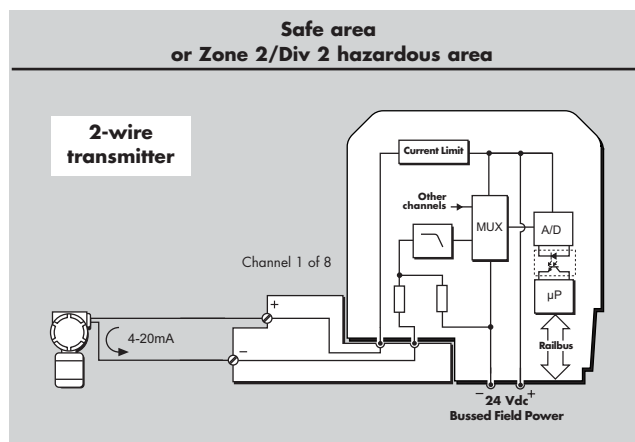
SAFETY

FM non-incendive field wiring parameters (each channel) .
 $V_{oc} = 28.7V$; $I_{sc} = 33mA$; $C_a = 0.17\mu F$; $L_a = 11.0mH$

POWER SUPPLIES

Railbus (12V) current100mA (typ.)
150mA (max.)
Bussed Field Power2-wire Tx 300mA (max.)
 (@ 24V dc ± 10%)4-wire Tx 60mA (max.)

8103-AI-TX



MECHANICAL

Module Key CodeA1
Module width42mm
Weight200g

FIELD TERMINALS (2-WIRE TX)

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General Purpose	8602-FT-ST Standard	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous area	8601-FT-NI Non-incendive	8603-FT-FU Non-incendive Fused

See also the 8618-FT-MT field terminal for custom termination options.



EUROPE (EMEA)
 AMERICAS
 ASIA PACIFIC
 E-mail: enquiry@mti-inst.com

Tel: +44 (0)1582 723633
 Tel: +1 603 926 0090
 Tel: +65 487 7887

Fax: +44 (0)1582 422283
 Fax: +1 603 926 1899
 Fax: +65 487 7997

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8-channel Analog Input

1-5V

8119-VI-05

- ◆ 8 single-ended input channels
- ◆ non-incendive field circuits
- ◆ 1-5V inputs
- ◆ open circuit and short circuit detection
- ◆ 24V dc bussed field power required

MODULE SPECIFICATION

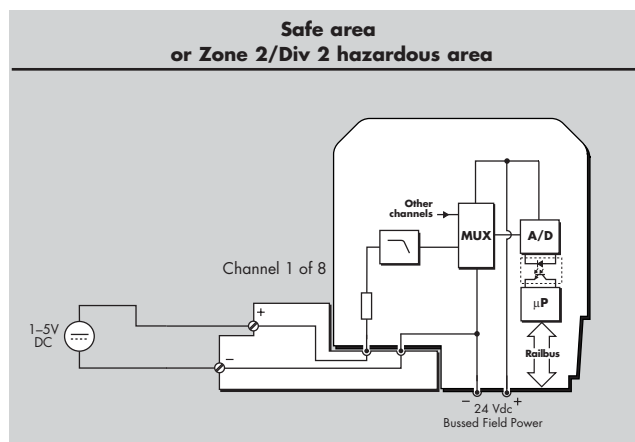
See also System Specification

INPUTS

Number of channels	8, single-ended
Nominal signal range (span)	1 to 5V
Full signal range	0.19 to 5.64V
Input impedance	2M Ω
Out of range alarm	
Lower threshold	< 0.19V
Upper threshold	> 5.64V
Accuracy (over temp range)	$\pm 0.1\%$ of span
Resolution	16 bits
Repeatability	0.05% of span
Isolation (any channel to Railbus)	100V ac
(between channels)	none

CONFIGURABLE PARAMETERS

Alarms	high, high-high, low and low-low
Alarm deadband (hysteresis)	user defined value
Input filter time constant	user defined value
Input dead zone	user defined value
Drive on failsafe	disabled /upscale /downscale
Channel status	active /inactive



RESPONSE TIME

Signal change to availability on Railbus	27ms (max.)
--	-------------

SAFETY

FM non-incendive field wiring parameters (each channel)	
$V_{oc} = 28.7V$; $I_{sc} = 33mA$; $C_a = 0.17\mu F$; $L_a = 11.0mH$	

POWER SUPPLIES

Railbus (12V) current	100mA (typ.)
	150mA (max.)
Bussed Field Power	60mA (max.) at 24V dc $\pm 10\%$

MECHANICAL

Module Key Code	A1
Module width	42mm
Weight	200g

FIELD TERMINALS

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General Purpose	8615-FT-4W 4-wire transmitter	—
Class 1, Div 2 or Zone 2 hazardous area	8615-FT-4W 4-wire transmitter	—

See also the 8618-FT-MT field terminal for custom termination options.



4-channel Analog Input



Thermocouple and mV

8105-TI-TC

- ◆ four thermocouple or mV* input channels
- ◆ cold junction compensation

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels4

THCs types

.....B,E,J,K,N,R,S, or T to EN 60584-2, IEC584-2, BS4937;
.....W3 and W5.

Input type	Range	Overall accuracy
mV	0 to + 120mV	$\pm 0.1\%$ of span (+10 to +40°C) $\pm 0.2\%$ of span (-40 to +70°C)
THC: B	0 to + 1820°C	< 600°C 1.5°C + BTA $\geq 600^\circ\text{C}$ 0.45°C + BTA
E	- 270 to + 1000°C	0.3°C + BTA
J	- 210 to + 1200°C	0.3°C + BTA
K	- 270 to + 1372°C	0.3°C + BTA
N	- 270 to + 1300°C	0.3°C + BTA
R	- 50 to + 1767°C	0.6°C + BTA
S	- 50 to + 1767°C	0.4°C + BTA
T	- 270 to + 400°C	0.3°C + BTA
W3	0 to + 2320°C	0.6°C + BTA
W5	0 to + 2320°C	0.4°C + BTA

Basic THC accuracy (BTA)25°C $\pm 0.05\%$ of THC span
.....+10°C to +40°C $\pm 0.1\%$ of THC span
.....-40°C to +70°C $\pm 0.3\%$ of THC span

Cold junction compensation error† $< \pm 1^\circ\text{C}$ (-40 to +70°C)

Resolution15 bits plus sign bit

Common mode rejection> 80dB @ 50/60Hz

Series mode rejection> 40dB @ 50/60Hz

Maximum input voltage $\pm 4.0\text{V}$

Common mode voltage between channels $\pm 4.5\text{V}$ (max.)

Isolation (any channel to Railbus)250V ac rms

Open circuit bleed current $\pm 0.5\mu\text{A}$ (nom.)

CONFIGURABLE PARAMETERS

Sensor typeuser selectable

Input dead zone (hysteresis)user defined value

Selectable input filtering ...off /2 reading avge./running avge.

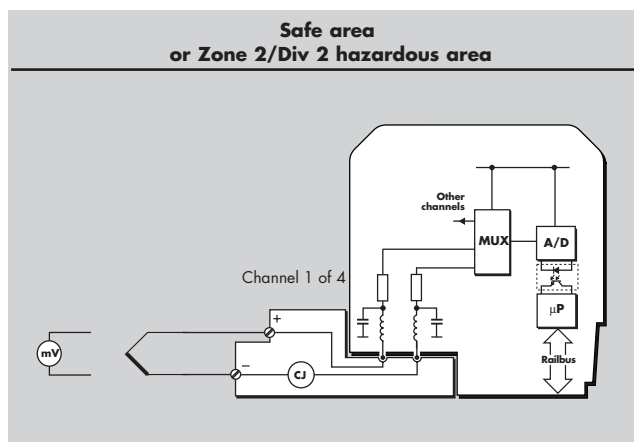
Drive on open circuit fault disabled /upscale /downscale

Alarmshigh and low

Channel statusactive/ inactive

* Consult MTL for availability

† C J compensation located in recommended field terminal



RESPONSE TIMES

Signal change to availability on Railbus

.....120ms (min.)

.....420ms (max.)

O/C sensor detection $\leq 10\text{s}$

SAFETY

FM non-incendive field wiring parameters (each channel) .

..... $V_{oc} = 10.5\text{V}$; $I_{sc} = 3.6\text{mA}$; $C_a = 14.9\mu\text{F}$; $L_a = 1000\text{mH}$

POWER SUPPLIES

Railbus (12V) current150mA (typ.)

.....200mA (max.)

Bussed Field Powernot required

MECHANICAL

Module Key CodeC1

Module width42mm

Weight200g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8605-FT-TC THC	-
Class 1, Div 2 or Z one 2 hazardous area	8605-FT-TC THC	-



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mtl-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mtl-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

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4-channel Analog Input



RTD and Ω

8106-TI-RT

- ◆ 4 RTD or resistance* source inputs
- ◆ function defined by configuration
- ◆ 2-, 3- or 4-wire RTD types accommodated

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels4

RTD input (2, 3, or 4 wire)

.....Pt100 to BS1904/DIN43760/IEC 75

.....Ni120; jPt100 to JIS C1604: 1989

Input range

Input type	Range
Resistance	Consult MTL for availability
RTDs: Pt100	- 200 to + 850 °C
jPt100	- 200 to + 510 °C
Ni120	- 80 to + 320 °C

Input resistance range (span)0 to 500 Ω

Accuracy (% of span)

T _{amb}	(RTD & Ω inputs)
25°C	± 0.05%
+10 to + 40°C	± 0.1%
- 40 to + 70°C	± 0.2%

RTD excitation current200 μ A (nom.)

Resolution15 bits plus sign bit

Common mode rejection> 80dB @ 50/60 Hz

Series mode rejection> 40dB @ 50/60 Hz

Isolation (any channel to Railbus)250V ac rms

Open circuit bleed current0.5 μ A (nom.)

CONFIGURABLE PARAMETERS

Sensor typeuser selection

Input deadzoneuser defined value

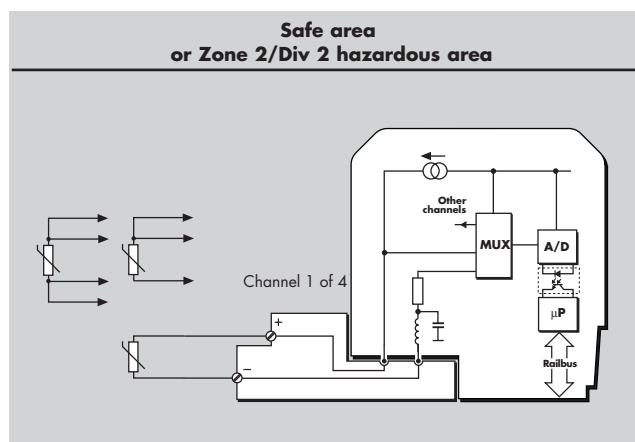
Selectable input filteringoff /2-reading avge./running avge.

Drive on open circuit fault disabled /upscale

Alarmshigh and low

Channel statusactive/ inactive

Offset (2-wire RTD mode)user defined value



RESPONSE TIMES

Signal change to availability on Railbus

.....180ms (min.)

.....840ms (max.)

O/C sensor detection≤ 10s

SAFETY

FM non-incendive field wiring parameters (each channel) .

.....V_{oc} = 10.5V; I_{sc} = 3.6mA; C_a = 14.9 μ F; L_a = 1000mH

POWER SUPPLIES

Railbus (12V) current150mA (typ.)

.....200mA (max.)

Bussed Field Powernot required

MECHANICAL

Module Key CodeC3

Module width42mm

Weight200g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8606-FT-RT RTD	-
Class 1, Div 2 or Zone 2 hazardous areas	8606-FT-RT RTD	-

* Consult MTL for availability



8-channel Analog Output

4–20mA with HART®

8102-HO-IP

- ◆ 8 single-ended 4–20mA output channels
- ◆ non-incendive field circuits
- ◆ HART pass-through
- ◆ HART variable and status reporting
- ◆ valve positioners and remote indicators, etc.
- ◆ open circuit detection on each channel
- ◆ 24V dc bussed field power required

MODULE SPECIFICATION

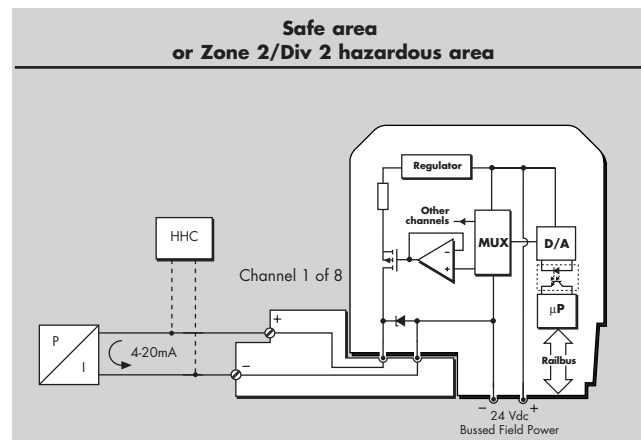
See also System Specification

INPUTS

Number of channels8, single-ended
Nominal signal range (span)4 to 20mA
Full signal range1 to 23mA
Open loop detection threshold 0.7 ± 0.25 mA
Output compliance20mA at 21.6V dc supply
(into 700Ω load)
Accuracy (over temp range) $\pm 0.25\%$ of span
Resolution12 bits
Isolation
 (any channel to Railbus)100V ac
 (between channels)none

CONFIGURABLE PARAMETERS

Initialisation statepredefined value
Drive on fail-safepredefined value/last value
Channel statusactive /inactive
HART variable and status reportingenable /disable



RESPONSE TIME

Signal change to availability on Railbus

4–20mA mode25ms (max.)
 HART mode0.75s per channel

SAFETY

FM non-incendive field wiring parameters (each channel) .
 $V_{oc} = 28.7V$; $I_{sc} = 33mA$; $C_a = 0.17\mu F$; $L_a = 11.0mH$

POWER SUPPLIES

Railbus (12V) current100mA (typ.)
150mA (max.)
Bussed Field Power300mA (max.) at 24V dc $\pm 10\%$

MECHANICAL

Module Key CodeA4
Module width42mm
Weight200g

FIELD TERMINALS

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General Purpose	8602-FT-ST Standard	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous area	8601-FT-NI Non-incendive	8603-FT-FU Non-incendive Fused

See also the 8618-FT-MT field terminal for custom termination options.

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AMERICAS Tel: +1 603 926 0090 Fax: +1 603 926 1899
ASIA PACIFIC Tel: +65 487 7887 Fax: +65 487 7997
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8-channel Analog Output

4–20mA

8104-AO-IP

- ◆ 8 single-ended outputs
- ◆ 4–20mA
- ◆ for I/P converters and remote indicators, etc
- ◆ open circuit detection is provided on each channel
- ◆ 24V dc bussed field power required

MODULE SPECIFICATION

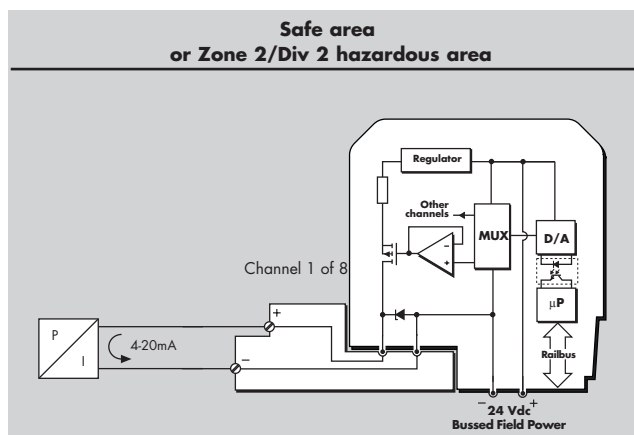
See also System Specification

OUTPUTS

Number of channels8, single-ended
Nominal signal range (span)4 to 20mA
Full signal output range1 to 23mA
Open loop detection threshold 0.7 ± 0.25 mA
Output compliance
.....20mA at 21.6V dc supply (into 700 Ω load)
Accuracy (over temp range) $\pm 0.25\%$ of span
Output ripple< 0.02% of span
Resolution12 bits
Isolation
any channel to Railbus100V ac

CONFIGURABLE PARAMETERS

Initialisation statepredefined value
Drive on fail-safepredefined value / last value
Channel statusactive / inactive



RESPONSE TIME

Response time

From Railbus command to output change25ms (max.)

SAFETY

FM non-incendive field wiring parameters (each channel) .
..... $V_{oc} = 28.7V$; $I_{sc} = 33mA$; $C_a = 0.17\mu F$; $L_a = 11.0mH$

POWER SUPPLIES

Railbus (12V) current100mA (typ.)
.....150mA (max.)
Bussed Field Power300mA (max.) @ 24V dc $\pm 10\%$
Quiescent current60mA

MECHANICAL

Module Key CodeA4
Module width42mm
Weight200g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8602-FT-ST Standard	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous areas	8601-FT-NI Non-incendive	8603-FT-FU Non-incendive, fused

See also the 8618-FT-MT field terminal for custom termination options.



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

E-mail: enquiry@mti-inst.com Web site: www.mti-inst.com

Oct 2006

8-channel Discrete Input

24V dc, isolated, sinking

8109-DI-DC

- ◆ 8 discrete isolated inputs
- ◆ 24V dc field voltage sources
- ◆ user definable input threshold
- ◆ pulse counting option

MODULE SPECIFICATION

See also System Specification

INPUTS

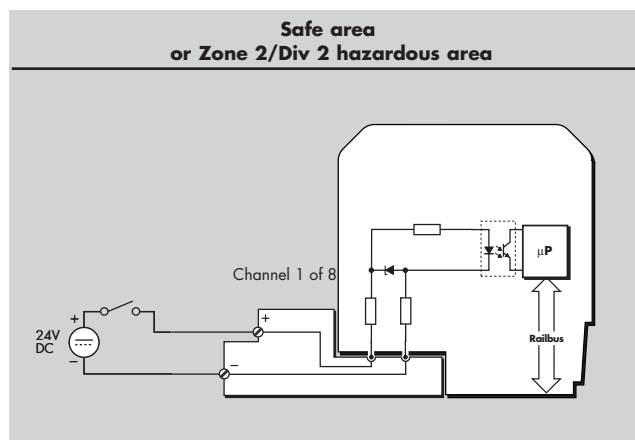
Number of channels	8
OFF voltage	< 3.2V dc
ON voltage	> 11V dc
Wetting current	6.3mA (nom.) @ 24V dc
Minimum pulse width detected	3ms
Maximum switching frequency (no-filtering)	200Hz
Maximum voltage	
Input	30V dc
Reverse input	- 25V dc

CONFIGURABLE PARAMETERS

Selectable input filter	fast, slow or user defined (User defined permits 0 to 512ms values in 2ms steps)
Latch inputs	enable /disable
Latch polarity	latch on high / latch on low
Pulse counting	enable /disable

RESPONSE TIME

I/O response time	
Field event to new data available on Railbus	3ms (max.)



SAFETY

FM non-incendive field wiring parameters (each channel)
 $V_{max} = 30V$; $I_{max} = 100mA$; $C_i = 0\mu F$; $L_i = 0mH$

POWER SUPPLIES

Railbus (12V) current	35mA (typ.)
	55mA (max.)
Bussed Field Power	not required

MECHANICAL

Module Key Code	B2
Module width	42mm
Weight	170g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8602-FT-ST Standard †	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous areas	8610-FT-NA Non-arcing †	8611-FT-FU Non-arcing Fused

See also the 8618-FT-MT field terminal for custom termination options.

† External fusing of the Field Power supply is recommended in order to protect the field wiring.



16-channel Discrete Input

24V dc, isolated, sinking

8122-DI-DC

- ◆ 16 input channels
- ◆ 24V dc field voltage sources
- ◆ individually isolated channels
- ◆ user definable input threshold
- ◆ pulse counting option

MODULE SPECIFICATION

See also System Specification

INPUTS

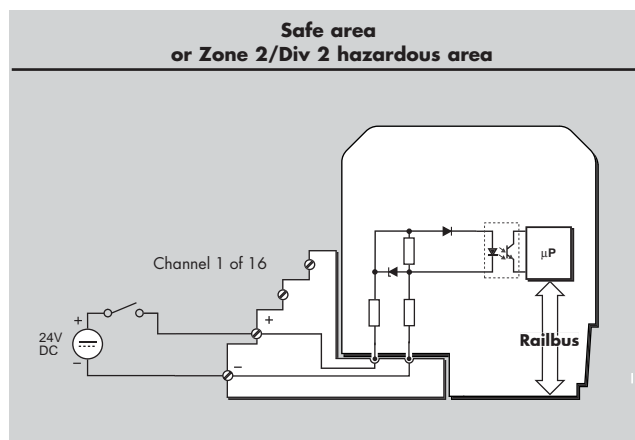
Number of channels	16
OFF voltage	< 3.4V dc
ON voltage	> 11V dc
Wetting current	2.8mA (nom.) @ 24V dc
Minimum pulse width detected	5ms
Max input freq in pulse counting mode (no-debounce)	100Hz
Maximum voltage	
Input	30V dc
Reverse input	25V dc
Isolation (Any Channel to railbus)	250V ac
Isolation (channel to channel)	150V peak

CONFIGURABLE PARAMETERS

Selectable input filter	fast, slow or user defined (User defined permits 0 to 512ms values in 2ms steps)
Latch inputs	enable /disable
Latch polarity	latch on high / latch on low
Pulse counting	enable /disable

RESPONSE TIME

I/O response time	5ms (max.)
(Field event to new data available on Railbus)	



SAFETY

FM non-incendive field wiring parameters (each channel)
 $V_{max} = 30V$; $I_{max} = 100mA$; $C_i = 0\mu F$; $L_i = 0mH$

POWER SUPPLIES

Railbus (12V) current	90mA (typ.)
	135mA (max.)
Bussed Field Power	not required

MECHANICAL

Module Key Code	E2
Module width	42mm
Weight	210g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8617-FT-NI † 16/30 channel DI	8619-FT-MT † 44-pin MTA
Class 1, Div 2 or Zone 2 hazardous areas	8617-FT-NI † 16/30 channel DI	8619-FT-MT † 44-pin MTA

† External fusing of the Field Power supply is recommended in order to protect the field wiring.



8-channel Discrete Input

24V dc, non-isolated, module powered

8110-DI-DC

- ◆ 8 discrete inputs
- ◆ for dry contact switches
- ◆ pulse counting option
- ◆ 24V dc busfed field power required

MODULE SPECIFICATION

See also System Specification

INPUTS

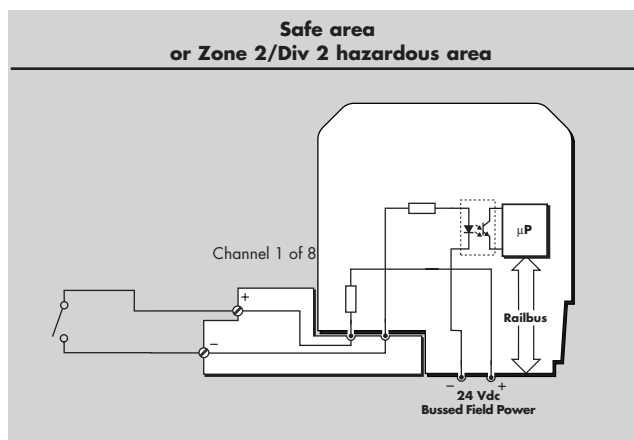
Number of channels8
 OFF current< 0.69mA
 ON current> 2.24mA
 Wetting current.....5mA (typ.)
 Minimum pulse width detected3ms
 Maximum switching frequency (no-filtering)200Hz
 Isolation (any channel to Railbus)250V ac

CONFIGURABLE PARAMETERS

Selectable input filterfast, slow or user defined
 (User defined permits 0 to 512ms values in 2ms steps)
 Latch inputsenable /disable
 Latch polarity.....latch on high / latch on low
 Pulse countingenable /disable

RESPONSE TIME

I/O response time3ms (max.)
 (Field event to new data available on Railbus)



SAFETY

FM non-incendive field wiring parameters (each channel)
 $V_{oc} = 30V$; $I_{sc} = 15.2mA$; $C_a = 0.12\mu F$; $L_a = 151mH$

POWER SUPPLIES

Railbus (12V) current.....35mA (typ.)
55mA (max.)
 Busfed Field Power40mA, @ 18–30V dc

MECHANICAL

Module Key CodeB1
 Module width42mm
 Weight170g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8602-FT-ST Standard †	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous areas	8601-FT-NI Non-incendive †	8603-FT-FU Non-incendive, fused

See also the 8618-FT-MT field terminal for custom termination options.

† External fusing of the field power supply is recommended in order to protect the field wiring.



16-channel Discrete Input

24V dc, non-isolated, module-powered

8121-DI-DC

- ◆ 16 input channels
- ◆ for dry contact switches
- ◆ pulse counting option
- ◆ 24V dc bussed field power required

MODULE SPECIFICATION

See also System Specification

INPUTS

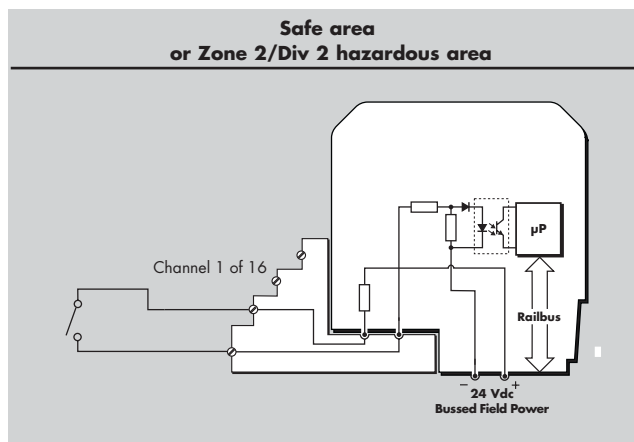
Number of channels 16
 OFF current < 0.3mA
 ON current > 1.2mA
 Wetting current 2.8mA (typ.)
 Minimum pulse width detected 5ms
 Max input freq in pulse counting mode (no-debounce) 100Hz
 Isolation (any channel to Railbus) 250V ac

CONFIGURABLE PARAMETERS

Selectable input filter fast, slow or user defined
 (User defined permits 0 to 512ms values in 2ms steps)
 Latch inputs enable /disable
 Latch polarity latch on high / latch on low
 Pulse counting enable /disable

RESPONSE TIME

I/O response time 5ms (max.)
 (Field event to new data available on Railbus)



SAFETY

FM non-incendive field wiring parameters (each channel)
 $V_{oc} = 30V$; $I_{sc} = 3.5mA$; $C_a = 0.12\mu F$; $L_a = 1000mH$

POWER SUPPLIES

Railbus (12V) current 90mA (typ.)
 135mA (max.)
 Bussed Field Power 60mA, @ 18–30V dc

MECHANICAL

Module Key Code E1
 Module width 42mm
 Weight 210g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8617-FT-NI 16/30 channel DI	8619-FT-MT 44-pin MTA
Class 1, Div 2 or Zone 2 hazardous areas	8617-FT-NI 16/30 channel DI	8619-FT-MT 44-pin MTA

32-channel Discrete Input

24V dc, non-isolated, module-powered

8125-DI-DC

- ◆ up to 32 input channels
- ◆ for dry contact switches or proximity detectors
- ◆ pulse counting and latching option
- ◆ 24V dc bussed field power required
- ◆ line fault detection on all inputs

MODULE SPECIFICATION

See also System Specification

INPUT

Number of channels	32
OFF current	< 1.2mA
ON current	> 2.1mA
Short circuit current	8.6mA (typ.)
Output resistance	950Ω (typ.)
Open circuit output voltage	8.2V dc (typ.)
Line fault detection	
Short Circuit	< 100Ω
Open Circuit	< 50μA
Input voltage range without damage	0 to +12V dc
Isolation (channel to Railbus)	250V ac
Input sampling rate (all 32)	8kHz
Input pulse width	250μs (min.)
DI counting frequency without loss	500Hz (max.)
Applicable specification	NAMUR, DIN 19234

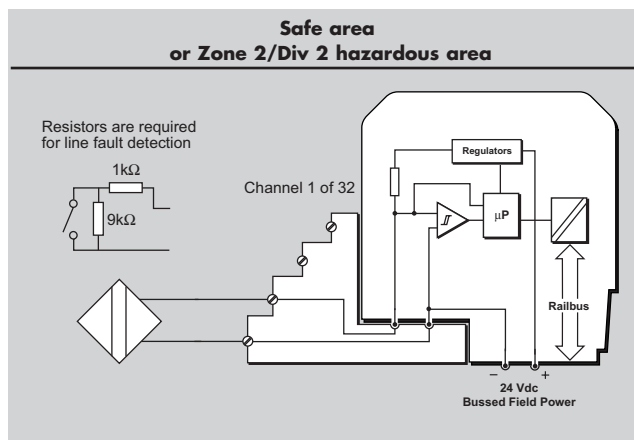
CONFIGURABLE PARAMETERS

Input filter	0 to 8.192secs in 250μs steps
Pulse counting	on/off
Latching	on/off

RESPONSE TIME

Input module scan time	< 1ms
------------------------	-------

(Inputs sampled at 8kHz and processed every 1ms)



SAFETY

FM non-incendive field wiring parameters (each channel)
 $V_{oc} = 8.64V$; $I_{sc} = 18.5mA$; $C_a = 28\mu F$; $L_a = 23.6mH$

POWER SUPPLIES

Railbus (12V) current	< 50mA
Bussed field power	190mA (max.) at 24V dc

MECHANICAL

Module Key Code	B3
Module width	42mm
Weight	185g

FIELD TERMINAL

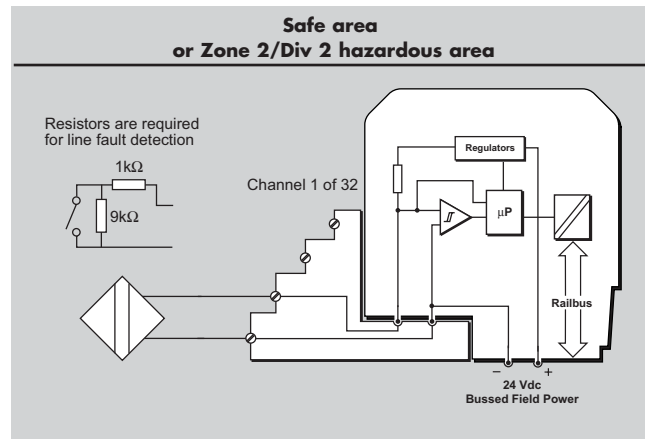
Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8617-FT-NI 16/30 channel DI	8619-FT-MT 44-pin MTA
Class 1, Div 2 or Zone 2 hazardous areas	8617-FT-NI 16/30 channel DI	8619-FT-MT 44-pin MTA

32-channel Sequence of Events

24V dc, non-isolated, module-powered

8127-DI-SE

- ◆ switch or proximity detector inputs
- ◆ captures events with 1/4 ms resolution
- ◆ distributed architecture for accurate event recording
- ◆ line fault detection on all inputs
- ◆ power to all field inputs - simplifies field wiring
- ◆ hi-res time stamp for accurate event sequencing
- ◆ log event data, e.g. controller status & module alarms
- ◆ export data to PC for reporting or analysis
- ◆ 24V dc bussed field power required



MODULE SPECIFICATION

See also System Specification

INPUT

Number of channels	32
OFF current	< 1.2mA
ON current	> 2.1mA
Short circuit current	8.6mA (typ)
Output resistance	950Ω (typ)
Open circuit output voltage	8.2Vdc (typ)
Line fault detection	
Short Circuit	< 100Ω
Open Circuit	< 50µA
Input voltage range without damage	0 to +12V dc
Isolation (channel to Railbus)	250V ac
Input sampling rate (all 32 inputs)	8kHz
Input pulse width	250µs (min)
DI counting frequency without loss	500Hz (max)
Applicable specification	NAMUR, DIN 19234

SOE SPECIFICATION

Module event buffer	480 events + 32 overflow
Event recording peak rate (module)	64,000 events/sec
Duration of peak rate	7.5 ms (max.)
(for 32 SOE channels enabled)	
Event recording continuous rate	
Module	220 events/sec (min.)
Each of 32 inputs	6.8 events/sec (min.)
Excessive event threshold (for 32 inputs)	150 events/sec/ch.
(for each channel)	
SOE module time stamping resolution	125 µs
System time stamping resolution	250 µs
Simultaneous inputs, time stamping error	
Within one module	0.25 ms (max.)
Within one 8000 node	1.0 ms (max.)
Between 8000 nodes	5.0 ms (typ.)
(Absolute accuracy will depend on network time reference in use)	

CONFIGURABLE PARAMETERS

SOE Logging	configurable per channel
Input filter	0 to 8.192secs in 250µs steps
Pulse counting	on/off
Latching	on/off

RESPONSE TIME

Input module scan time	< 1 ms
(Inputs sampled at 8kHz and processed every 1 ms)	

SAFETY

FM non-incendive field wiring parameters (each channel)	
..... $V_{oc} = 8.64V$; $I_{sc} = 18.5mA$; $C_a = 28\mu F$; $L_a = 23.6mH$	

POWER SUPPLIES

Railbus (12V) current	< 50mA
Bussed field power	190mA (max) at 24V dc

MECHANICAL

Module Key Code	B4
Module width	42mm
Weight	185g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8617-Ft-NI 16/30 channel DI	8619-Ft-MT 44-pin MTA
Class 1, Div 2 or Zone 2 hazardous areas	8617-Ft-NI 16/30 channel DI	8619-Ft-MT 44-pin MTA



8-channel Discrete Input

115V ac, isolated, sinking

8111-DI-AC

- ◆ 8 discrete inputs
- ◆ 115V ac field voltage sources
- ◆ user definable input threshold
- ◆ pulse counting option

MODULE SPECIFICATION

See also System Specification

INPUTS

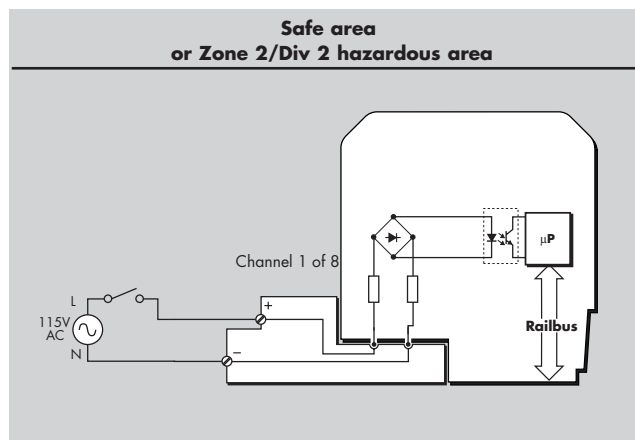
Number of channels	8
OFF voltage	< 34V ac
ON voltage	> 84V ac
Wetting current	2mA (nom.) @ 115V ac
Max. input voltage	130V ac
Frequency	50 / 60Hz

CONFIGURABLE PARAMETERS

Selectable input filter	fast, slow or user defined (User defined permits 0 to 512ms values in 2ms steps)
Latch inputs	enable /disable
Latch polarity	latch on high / latch on low
Pulse counting	enable /disable

RESPONSE TIME

I/O response time	33ms (max.)
(Field event to new data available on Railbus)	



POWER SUPPLIES

Railbus (12V) current	40mA (typ.)
	60mA (max.)
Bussed Field Power	not required

MECHANICAL

Module Key Code	E4
Module width	42mm
Weight	170g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8602-FT-ST Standard †	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous areas	8610-FT-NA Non-arching †	8611-FT-FU Non-arching, fused

† External fusing of the Field Power supply is recommended in order to protect the field wiring.



8-channel Discrete Input

115V ac, non-isolated, module powered

8 112-DI-AC

- ◆ 8 discrete inputs
- ◆ for dry contact switches.
- ◆ 115V ac provided on input high side
- ◆ returns commoned internally
- ◆ pulse counting option
- ◆ 115V ac Bussed Field Power required

MODULE SPECIFICATION

See also System Specification

INPUTS

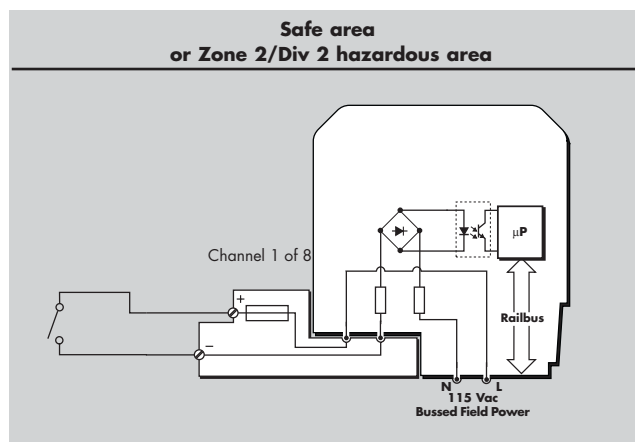
Number of channels8
OFF current< 0.56mA
ON current> 1.4mA
Wetting current2mA (nom.) @ 115V ac

CONFIGURABLE PARAMETERS

Selectable input filterfast, slow or user defined
 (User defined permits 0 to 512ms values in 2ms steps)
Latch inputsenable /disable
Latch polaritylatch on high / latch on low
Pulse countingenable /disable

RESPONSE TIME

I/O response time33ms (max.)
 (Field event to new data available on Railbus)



POWER SUPPLIES

Railbus (12V) current40mA (typ.)
60mA (max.)
Bussed Field Power115V ac $\pm 10\%$
Frequency50 / 60Hz

MECHANICAL

Module Key CodeE1
Module width42mm
Weight170g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8604-FT-FU Fused	8602-FT-ST Standard †
Class 1, Div 2 or Zone 2 hazardous areas	8611-FT-FU Non-arcing, Fused	8610-FT-NA Non-arcing †

† Alternative fusing in the field wiring is recommended if it is not provided in the field terminal.



8-channel Discrete Input

230V ac, isolated, sinking

8113-DI-AC

- ◆ 8 discrete isolated inputs
- ◆ 230V ac field voltage sources
- ◆ user definable input threshold
- ◆ pulse counting option

MODULE SPECIFICATION

See also System Specification

INPUTS

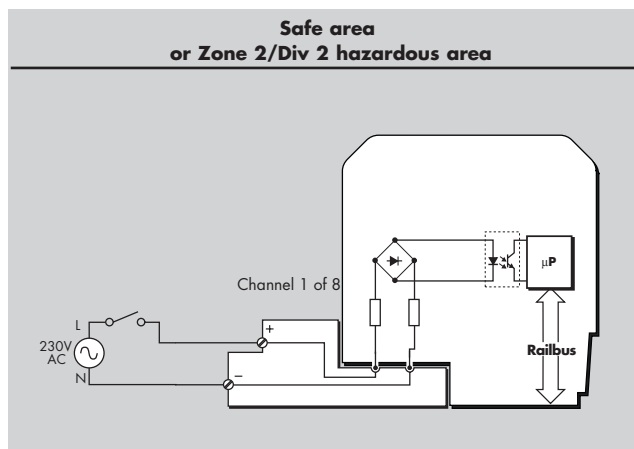
Number of channels8
OFF voltage< 68V ac
ON voltage> 168V ac
Wetting current1mA (nom.) @ 230V ac
Max. input voltage265V ac
Frequency50 / 60Hz

CONFIGURABLE PARAMETERS

Selectable input filterfast, slow or user defined
 (User defined permits 0 to 512ms values in 2ms steps)
Latch inputsenable /disable
Latch polaritylatch on high / latch on low
Pulse countingenable /disable

RESPONSE TIME

I/O response time33ms (max.)
 (Field event to new data available on Railbus)



POWER SUPPLIES

Railbus (12V) current40mA (typ.)
60mA (max.)
Bussed Field Powernot required

MECHANICAL

Module Key CodeE5
Module width42mm
Weight170g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8602-FT-ST Standard †	8604-FT-FU Fused
Class 1, Div 2 or Zone 2 hazardous areas	8610-FT-NA Non-arcing †	8611-FT-FU Non-arcing, fused

† External fusing of the Field Power supply is recommended in order to protect the field wiring.



8-channel Discrete Input

230V ac, non-isolated, module powered

8114-DI-AC

- ◆ 8 discrete inputs
- ◆ for dry contact switches.
- ◆ 230V ac provided on input high side
- ◆ returns commoned internally
- ◆ pulse counting option
- ◆ 230V ac Bussed Field Power required

MODULE SPECIFICATION

See also System Specification

INPUTS

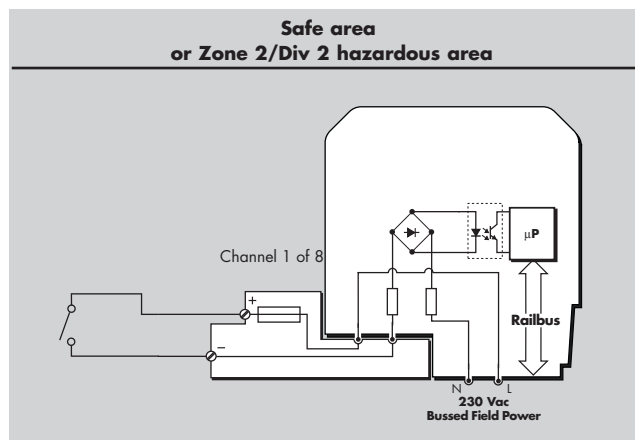
Number of channels8
 OFF current< 0.28mA
 ON current> 0.71mA
 Wetting current1mA (nom.) @ 230V ac

CONFIGURABLE PARAMETERS

Selectable input filterfast, slow or user defined
 (User defined permits 0 to 512ms values in 2ms steps)
 Latch inputsenable /disable
 Latch polaritylatch on high / latch on low
 Pulse countingenable /disable

RESPONSE TIME

I/O response time33ms (max.)
 (Field event to new data available on Railbus)



POWER SUPPLIES

Railbus (12V) current40mA (typ.)
60mA (max.)
 Bussed Field Power207 to 265V ac
 Frequency50 / 60Hz

MECHANICAL

Module Key CodeE2
 Module width42mm
 Weight170g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8604-FT-FU Fused	8602-FT-ST Standard †
Class 1, Div 2 or Zone 2 hazardous areas	8611-FT-FU Non-arcing, Fused	8610-FT-NA Non-arcing †

† Alternative fusing in the field wiring is recommended if it is not provided in the field terminal.



8-channel Discrete Output



2–60V dc, non-isolated, module powered

8115-DO-DC

- ◆ 8 powered outputs
- ◆ controls solenoids and relays
- ◆ common load supply of up to 60V dc
- ◆ discrete or pulsed outputs
- ◆ 1A per channel switched current
- ◆ 2–60V dc bussed field power required

MODULE SPECIFICATION

See also *System Specification*

OUTPUTS

Number of channels	8
Output voltage range	2–60V dc
ON voltage drop	0.25V (max.)
OFF leakage current	1.0mA (max.)
Switched current per channel †	
Continuous*	1A
For < 100 ms	4A
For < 20 ms	6A

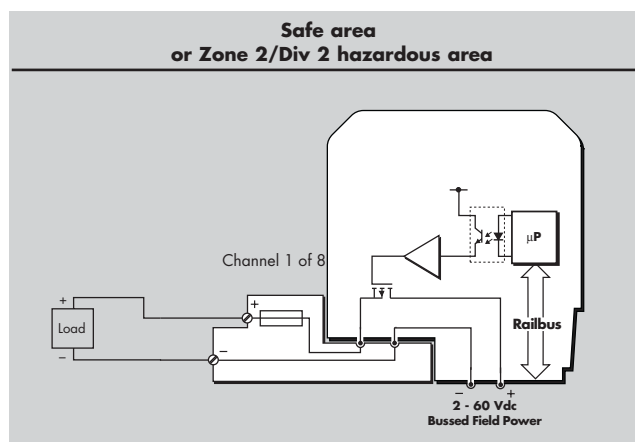
CONFIGURABLE PARAMETERS

Output initialisation state	predefined value
Fail-safe	predefined value/last value
Output	discrete, momentary or continuous pulse ‡
Pulse width	2ms to 130s

† The total instantaneous switched current for the module should not exceed the following:
10A for < 100ms
18A for < 20ms
For a way to increase these limits using high-current relays see *Technical Support Note TSN110* on the MTL web site.

* Limited to 6A per module unless using high current relay option

‡ Consult MTL for availability



RESPONSE TIME

Response time 1 ms (max.)
(From Railbus command to output change)

POWER SUPPLIES

Railbus (12V) current	45mA (typ.)
.....	70mA (max.)
Bussed Field Power	2 to 60V dc

MECHANICAL

Module Key Code	B6
Module width	42mm
Weight	200g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8604-FT-FU Fused	8602-FT-ST Standard †
Class 1, Div 2 or Zone 2 hazardous areas	8611-FT-FU Non-arcing, Fused	8610-FT-NA Non-arcing †

See also the 8618-FT-MT field terminal for custom termination options.

† Alternative fusing in the field wiring is recommended if it is not provided in the field terminal.



8-channel Discrete Output



20–265V ac, non-isolated, module powered

8116-DO-AC

- ◆ 8 powered outputs
- ◆ controls solenoids and relays
- ◆ common load supply of up to 265V ac
- ◆ discrete or pulsed outputs
- ◆ 1A per channel maximum
- ◆ 20–265V ac bussed field power required

MODULE SPECIFICATION

See also System Specification

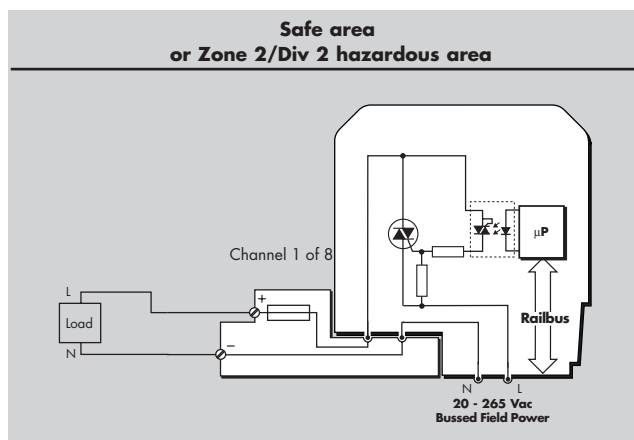
OUTPUTS

Number of channels	8
Output voltage range	20–265V ac
Frequency	50 / 60Hz
ON voltage drop	< 1.2V
OFF leakage current	< 4mA
Switched current per channel †	
Continuous	1A*
For < 100ms	5A
For < 20ms	20A
Minimum load current, per channel	
@ 115V ac	11mA
@ 230V ac	5mA

† Stated figures are for operation with unfused field terminal.
When operating with 2A fused field terminal (part no. 8604-FT-FU)
maximum switched current is 5A inrush for < 10ms pulse width at 0.1%
duty cycle and < 10⁸ operations.

* Limited to 3A per module.

‡ Consult MTL for availability



CONFIGURABLE PARAMETERS

Output initialisation state	predefined value
Fail-safe	predefined value/last value
Output	discrete, momentary or continuous pulse‡
Pulse width	2ms to 130s

RESPONSE TIME

Response time (max.).....2 ms + ½ cycle of mains frequency
(From Railbus command to output change)

POWER SUPPLIES

Railbus (12V) current	75mA (typ.)
	125mA (max.)
Bussed Field Power (voltage)	20 to 265V ac

MECHANICAL

Module Key Code	F1
Module width	42mm
Weight	220g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8604-FT-FU Fused	8602-FT-ST Standard †
Class 1, Div 2 or Zone 2 hazardous areas	8611-FT-FU Non-arcing, Fused	8610-FT-NA Non-arcing †

† Alternative fusing in the field wiring is recommended if it is not provided in the field terminal.



8-channel Discrete Output

2–60V dc, isolated, unpowered

8117-DO-DC

- ◆ 8 fully isolated semiconductor switched outputs
- ◆ controls solenoids and relays
- ◆ for load supplies of up to 60V dc
- ◆ discrete or pulsed outputs
- ◆ 1A per channel switched

MODULE SPECIFICATION

See also *System Specification*

OUTPUTS

Number of channels	8
Output voltage range	2–60V dc
ON voltage drop	0.25V (max.)
OFF leakage current	1.0mA (max.)
Switched current per channel	
Continuous	1A
For < 100ms	4A
For < 20ms	6A

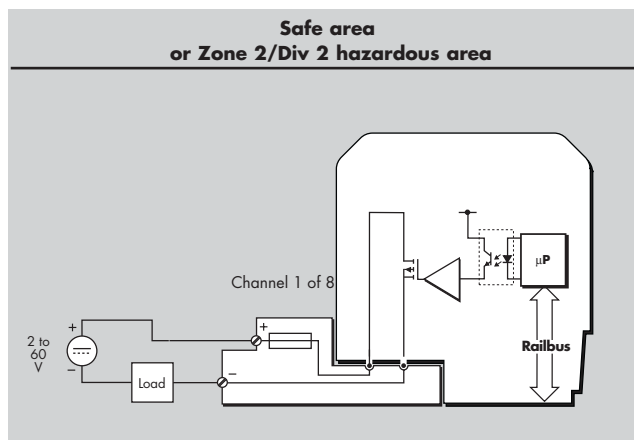
CONFIGURABLE PARAMETERS

Output initialisation state	predefined value
Fail-safe	predefined value/last value
Output	discrete, momentary or continuous pulse‡
Pulse width	2ms to 130s

RESPONSE TIME

Response time	3ms (max.)
(From Railbus command to output change)	

‡ Consult MTL for availability



POWER SUPPLIES

Railbus (12V) current	45mA (typ.)
	70mA (max.)
Bussed Field Power	not required

MECHANICAL

Module Key Code	B5
Module width	42mm
Weight	200g

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8604-FT-FU Fused	8602-FT-ST Standard
Class 1, Div 2 or Zone 2 hazardous areas	8611-FT-FU Non-arcing, Fused	8610-FT-NA Non-arcing

Note: External fusing to protect field wiring is recommended.

See also the 8618-FT-MT field terminal for custom termination options.



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mtl-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

Web site: www.mtl-inst.com

Oct 2006

8-channel Discrete Output

20–265V ac, isolated, unpowered

8118-DO-AC

- ◆ 8 fully isolated semiconductor switched outputs
- ◆ controls solenoids and relays
- ◆ for load supplies of up to 250V ac
- ◆ discrete or pulsed outputs
- ◆ 1A per channel maximum

MODULE SPECIFICATION

See also System Specification

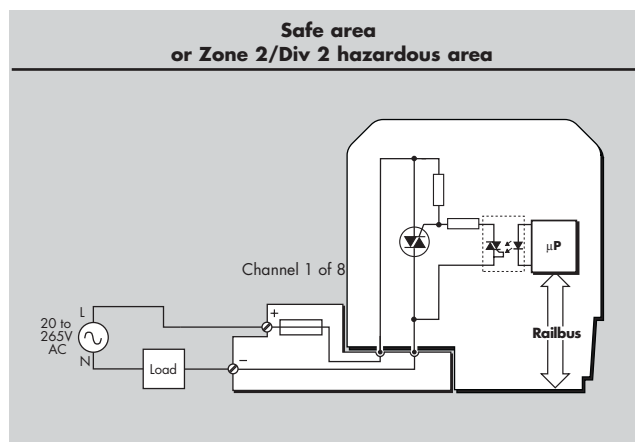
OUTPUTS

Number of channels	8
Output voltage range	20–265V ac
Frequency	50 / 60Hz
ON voltage drop	< 1.2V
OFF leakage current	< 4mA
Switched current per channel †	
Continuous	1A*
For < 100ms	5A
For < 20ms	20A
Minimum load current, per channel	
@ 115V ac	11mA
@ 230V ac	5mA

† Stated figures are for operation with unfused field terminal. When operating with 2A fused field terminal part no. 8604-FT-FU, maximum switched current is 5A inrush for < 10ms pulse width at 0.1% duty cycle and < 10⁸ operations.

* Limited to 3A per module.

‡ Consult MTL for availability



CONFIGURABLE PARAMETERS

Output initialisation state	predefined value
Fail-safe	predefined value/last value
Output	discrete, momentary or continuous pulse‡
Pulse width	2ms to 130s

RESPONSE TIME

Response time (max.) 2ms + ½ cycle of mains frequency
(From Railbus command to output change)

POWER SUPPLIES

Railbus (12V) current	75mA (typ.)
.....	125mA (max.)
Bussed Field Power	not required

MECHANICAL

Module Key Code	F4
Module width	42mm
Weight	220g

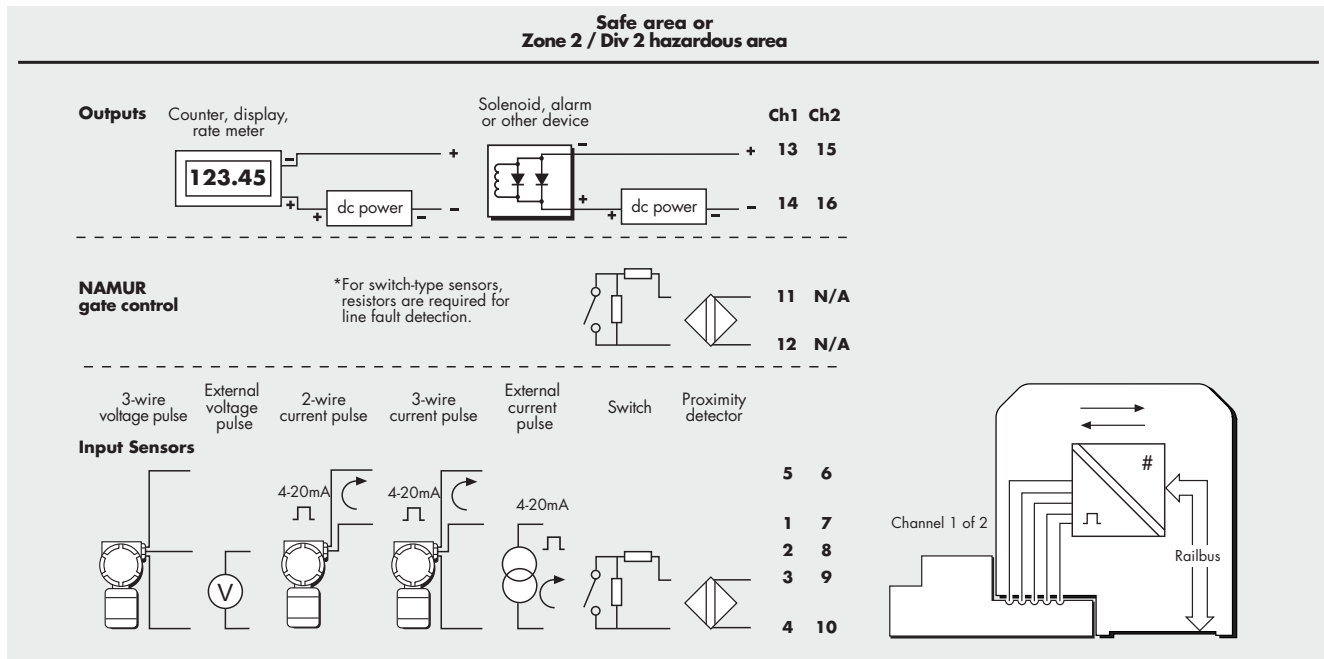
FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8604-FT-FU Fused	8602-FT-ST Standard
Class 1, Div 2 or Zone 2 hazardous areas	8611-FT-FU Non-arcing, Fused	8610-FT-NA Non-arcing

Note: External fusing to protect field wiring is recommended.

2-channel pulse/quadrature input

8123-PI-QU



- ◆ 2 input channels with power supplies or single quadrature input
- ◆ 1Hz to 50kHz signal capability
- ◆ frequency & acceleration measurement
- ◆ 2-alarm/repeater retransmitted output channels
- ◆ 2- and 3-wire pulse transmitter format
- ◆ pulse counting (with gate control)
- ◆ channels independently configurable
- ◆ open circuit, short circuit and missing pulse detection

MODULE SPECIFICATION

See also System and Common Module Spec.

INPUTS

PULSE/FREQUENCY

Number of channels	2
Maximum frequency	50kHz
(in quadrature mode)	12.5kHz
Accuracy (25°C)	± 0.05% of span
Temperature Stability	0.005% / °C

CONTROL GATE (for gating Channel 1 only)

Switching thresholds	1.2mA / 2.1mA
Input impedance	1kΩ
Supply voltage	8.1V (nom.) at 8mA

INPUT CHARACTERISTICS

NAMUR 1

Switching thresholds	1.2mA / 2.1mA
Input impedance	1kΩ
Supply voltage	8.1V (nom.) at 8mA

CURRENT

Input signal	20mA (max.)
Threshold	configurable in 8 levels
Input impedance	25Ω
Open circuit current	< 0.5mA
Short circuit current	> 21.5mA

VOLTAGE

Input signal	0 - 24V dc (50V max.)
Threshold	configurable in 8 levels
Input impedance	> 10kΩ
Switching hysteresis	100mV

SWITCH

Input voltage range	0 - 10V dc
---------------------	------------

OUTPUTS (TX SUPPLY)

The outputs are **open-collector type** for separately powered devices such as LED clusters, annunciators or solenoids

Number of channels	2
OFF state voltage	30V (max)
OFF state leakage current	10μA (max)
ON state voltage drop	< 1.0V @ 50mA
ON state current	100mA
Retransmission bandwidth	1 - 2000Hz

2-channel pulse/quadrature input

8123-PI-QU

CONFIGURABLE PARAMETERS

INPUTS

Channel enable / disable
Sensor type NAMUR prox. type (select low / high speed)
 current pulse input
 voltage pulse input
 switch input
Frequency ranges 0.1, 0.3, 0.5, 1, 3, 5, 10, 30, 50, 100*kHz
Sample period 50ms to 200s
Quadrature enable / disable
Threshold level user defined values
Triggering rising edge / falling edge
Filtering off, 1, 5, 20, 100kHz
Alarms frequency / acceleration
Alarm limits high / low
Alarm deadband (hysteresis) user defined value
Line fault detect enable / disable
Channel status active / inactive
Counter enable / disable
Counting direction count up / count down

* While measurements can be made in the upper half of this range, the stated accuracy applies only to frequencies up to 50kHz.
 In quadrature mode, the upper limit is 12.5kHz.

DISCRETE OUTPUT

Function selection disabled
 high / low alarm
 acceleration alarm
 counter preset value reached
 quadrature output (channel 1 only)
 scaled retransmission (channel 1 only)
Retransmission scaling (K factor – channel 1 only) 1 – 256

AUXILIARY DISCRETE INPUT

Counter (channel 1) start (count)/pause

DYNAMIC DATA (READ ONLY)

PROCESS VALUES

Frequency 16 bit unsigned
Count 32 bit signed
Acceleration 16 bit signed

STATUS VALUES

Frequency / acceleration alarms High / low
 missing pulse detect
Line fault detect open/short circuit
Quadrature direction 1 =clockwise, 2 =anti-clockwise
Counter alarms preset value reached

CONTROL DATA (WRITE ONLY)

Counter preset value 32 bit signed
 load preset value = 0 to disable
Counter commands start / stop / reset
 Note: Channel 1 counter can also be controlled by control gate input: 1= start (count), 0 = pause

ISOLATION

Any channel to Railbus 100V ac
Between input channels none (common 0V connection)
Between output channels 30V ac

RESPONSE TIME

Response time 25ms (max.)
 (Signal change to availability on Railbus)

POWER SUPPLIES

Railbus current (both channels @22mA) 300mA (max.)
Bussed field power 20mA @ 24 ± 10% V dc
Power dissipation (both channels @22mA) 2.8W (max.)
 (no load) 2.0W (max.)

MECHANICAL

Module Key Code F2
Module width 42mm
Weight 260g

Terminal	Description	
1	Current input	Channel #1
2	Voltage input	
3	NAMUR input	
4	Common	
5	Power supply +ve	Channel #2
6	Power supply +ve	
7	Current input	
8	Voltage input	
9	NAMUR input	Channel #1
10	Common	
11	NAMUR gate/control input	
12	Common	
13	Output +ve	Channel #2
14	Output -ve	
15	Output +ve	
16	Output -ve	

FIELD TERMINAL

Field wiring	Recommended Field Terminal	Compatible Field Terminal
General purpose	8602-FT-ST Standard	8618-FT-MT 16-pin MTA
Class 1, Div 2 or Zone 2 hazardous areas	8601-FT-NI Non-incendive	8618-FT-MT 16-pin MTA

2-channel pulse/quadrature input

8123-PI-QU

TERMINAL ASSIGNMENTS

SAFETY

Field wiring protectionnon-incendive

FM and ATEX Cat 3 NON-INCENDIVE FIELD WIRING PARAMETERS

The following figures are for Gas Groups A/B (IIC) unless otherwise stated.

Current inputs (Ch1 & Ch2)

..... $U_o \leq 0.6V$, $I_o \leq 0.5mA$, $P_o \leq 75\mu W$

..... $C_a = 1000\mu F$, $L_a = 1000mH$

3-wire current inputs (Ch1 & Ch2)

..... $U_o \leq 30V$, $I_o \leq 102.5mA$, $P_o \leq 765.7mW$

..... $C_a = 0.165\mu F$, $L_a = 6mH$, $L_a/R_a = 82\mu H/\Omega$

Voltage inputs (Ch1 & Ch2)

..... $U_o \leq 5.5V$, $I_o \leq 0.58mA$, $P_o \leq 0.8mW$

..... $C_a = 535\mu F$, $L_a = 1000mH$

3-wire voltage inputs (Ch1 & Ch2)

..... $U_o \leq 30V$, $I_o \leq 102.6mA$, $P_o \leq 765.8mW$

..... $C_a = 0.165\mu F$, $L_a = 6mH$, $L_a/R_a = 82.1\mu H/\Omega$

NAMUR inputs (Ch1 & Ch2)

..... $U_o \leq 9.1V$, $I_o \leq 10.6mA$, $P_o \leq 24mW$

..... $C_a = 20\mu F$, $L_a = 490mH$

NAMUR gate input (Ch1)

..... $U_o \leq 9.1V$, $I_o \leq 10.6mA$, $P_o \leq 24mW$

..... $C_a = 20\mu F$, $L_a = 490mH$

Discrete outputs (Ch1 & Ch2)

Each pair of field terminals may be considered as non-incendive when connected into a field circuit with the following parameters

..... $V_{max}=30V$ dc, $I_{max}=100mA$, $C_i=0\mu F$, $L_i=0mH$

LED INDICATORS

POWER – Green LED

OFF	ON	FLASHING
Power failure	Power OK	Not applicable

FAULT – Red LED

OFF	ON	FLASHING
In running state	Fault	Awaiting module training

PULSE INPUT CHANNEL – Yellow LED

OFF	ON	FLASHING
Channel inactive	Channel active and operating normally	Channel active but in alarm condition

DIGITAL OUTPUT CHANNEL – Yellow LED

OFF	ON	FLASHING
Channel inactive	Channel active and operating normally	Not applicable

8-channel Analog Input

4–20mA with HART®

8201-HI-IS

- ◆ 8 single-ended input channels
- ◆ intrinsically safe field circuits
- ◆ conventional 4–20mA
- ◆ HART pass-through
- ◆ HART variable and status reporting
- ◆ for 2-wire transmitters
- ◆ in-built power supply

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels	8
Nominal signal range (span)	4 to 20mA
Full signal range	0.5 to 22mA
Line fault detection	
Short circuit current	> 21.5mA
Open circuit current	< 0.5mA
Voltage to transmitter @ 20mA	15V (min.)
Accuracy (@25°C)	± 2µA
Resolution	16 bits
Temperature Stability	
(–40°C to +70°C)	± 0.006% of span per °C
Isolation	
(any channel to Railbus)	60V ac
(between channels in same module)	none

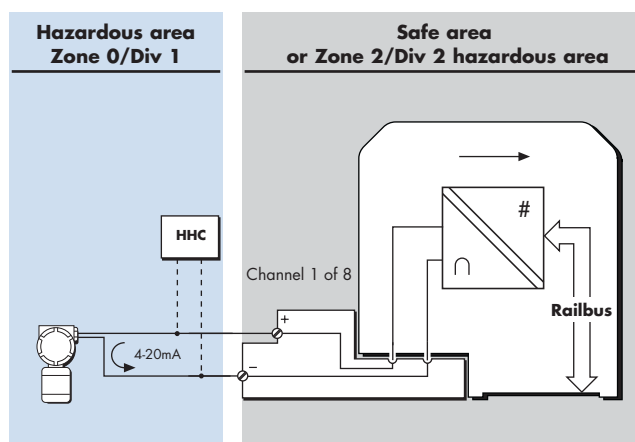
CONFIGURABLE PARAMETERS

Alarms	high, high-high, low, low-low
Alarm deadband (hysteresis)	user defined value
Input filter time constant	user defined value
Input dead zone	user defined value
Drive on failsafe	user defined value
Channel status	active /inactive
HART comms	enable /disable

RESPONSE TIME

Analog signal change to availability on Railbus

4–20mA mode	33ms (max.)
HART mode	0.75s per channel



SAFETY

Field wiring protection.....[EEx ia] IIC
Safety description (each channel)

..... $U_o = 28V$, $I_o = 93mA$, $P_o = 0.65W$
FM entity parameters $V_{oc} \leq 28V$ dc, $I_{sc} \leq 93mA$
..... $C_a \leq 0.14\mu F$, $L_a \leq 4.38mH$

POWER SUPPLIES

IS Railbus (12V) current (all channels @ 22mA)

.....	600mA (typ.)
Power dissipation within module	4.2W (max.)

MECHANICAL

Module Key Code	A1
Module width	42mm
Weight	260g

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe standard	8621-FT-IS
Intrinsically safe loop disconnect	8622-FT-IS

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EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mti-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mti-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

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8-channel Analog Input



0-10V/potentiometer input

8230-AI-IS

- ◆ 8 single-ended input channels
- ◆ intrinsically safe field circuits
- ◆ 0-10V/100Ω-10kΩ potentiometer
- ◆ 0/4 - 20mA current input with additional burden resistor
- ◆ true zero on voltage input
- ◆ open circuit field wiring detection

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels8, single-ended

0-10V input characteristics

Nominal signal range (span)0 to 10V

Full signal range.....0 to +11V

Resolution.....16 bits

Input impedance> 100kΩ

Under-range indication-100mV

Potentiometer input characteristics

Nominal signal range (span)0 to 100 % of travel

Potentiometer resistance.....100Ω to 10kΩ

Excitation voltage (nom.)10V (from 2.2kΩ source)

Resolution (≥1kΩ potentiometer)14 bits

Resolution (100Ω potentiometer)11 bits

Accuracy (at 25°C)± 0.1% of span

Isolation

(any channel to Railbus)100V ac

(between channels).....none

CONFIGURABLE PARAMETERS

Input type (per channel).....voltage/potentiometer

Alarms.....high and low

Alarm deadband (hysteresis).....user defined value

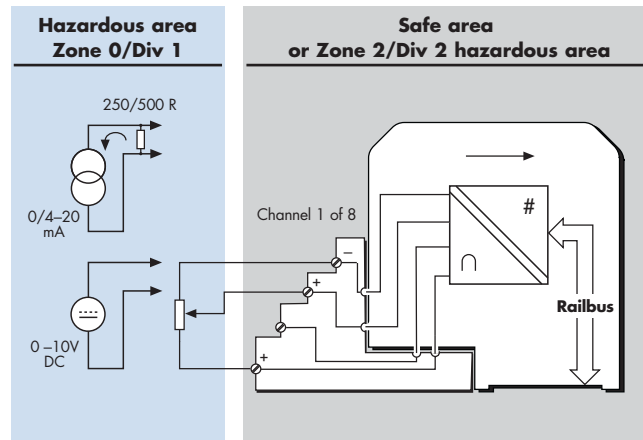
Input filter time constant.....user defined value

Input dead zone.....user defined value

Drive on open circuit..... disabled /upscale /downscale

Channel status..... active/inactive

Lead compensation.....user defined value



RESPONSE TIME

Signal change to availability on Railbus33ms (max.)

Open circuit line fault detection time≤ 5s

SAFETY

Field wiring protection.....[EEExia] IIC

Safety description (each channel - non linear output)

..... $U_o \leq 15.75V$, $I_o \leq 20mA$, $P_o \leq 0.315W$

FM entity parameters..... $V_{oc} = 15.75V$, $I_{sc} = 20mA$

..... $C_a = 0.22\mu F$, $L_a = 5mH$

POWER SUPPLIES

IS Railbus (12V) current

Typical200mA

Max with voltage/current inputs.....250mA

Max. with 100Ω potentiometer inputs.....350mA

Power dissipation within module

Max with voltage/current inputs.....3W

Max. with 100Ω potentiometer inputs.....4.2W

MECHANICAL

Module Key CodeC4

Module width42mm

Weight200g

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe, standard	8623-FT-IS



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mti-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mti-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

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8-channel Analog Input

2-1

Thermocouple and mV

8205-TI-IS

- ◆ 8 input channels
- ◆ intrinsically safe field circuits
- ◆ thermocouple and mV
- ◆ cold junction compensation (internal or remote)
- ◆ built-in thermocouple linearisation
- ◆ channels independently configurable
- ◆ open-circuit field wiring detection

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels8
THC inputsB,E,J,K,N,R,S or T to EN 60584-1: 1995;
.....W3 and W5 to ASTM E 988-96
.....Russian K and Russian L to GOST 3044-84
.....user definable linearisation table, note 1

Input type	Range
Thermocouples: B	0 to + 1820°C
E	- 270 to + 1000°C
J	- 210 to + 1200°C
K	- 270 to + 1372°C
N	-270 to + 1300°C
R & S	- 50 to + 1768.1°C
T	- 270 to + 400°C
W3 & W5	0 to + 2315°C
Russian K	-200 to + 1300°C
Russian L	-200 to + 800°C
mV	- 8 to + 24 mV
	- 20 to + 60 mV
	- 33.333 to + 100 mV
	- 100 to + 100 mV

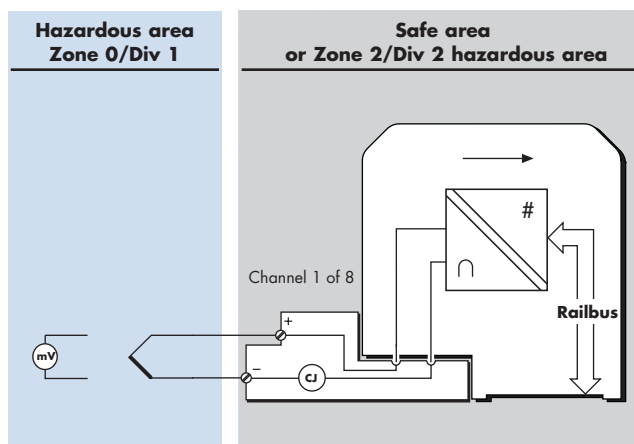
In addition, see error table in System specification section

Accuracy (% of span)

T _{amb}	mV inputs	THC inputs
25°C	± 0.05%	± 0.05%
+10 to + 40°C	± 0.08%	± 0.1%
- 40 to + 70°C	± 0.18%	± 0.3%

Temperature drift< ± 0.003% of span/°C
Cold junction compensation error* ..< ± 1°C (-40 to +70°C)
Resolution16 bits
Common mode rejection> 87dB @ 50/60 Hz
Series mode rejection> 50dB @ 50/60 Hz
Common mode voltage between channels± 5V (max.)
Absolute maximum input voltage.....± 30V
Isolation (any channel to Railbus)60V peak

Note 1: Consult MTL for support in BIM/configurator.



CONFIGURABLE PARAMETERS

Sensor typeuser selectable
Alarmshigh and low
Input dead zoneuser defined value
Selectable input filteringoff /2 reading avg./running avg.
Drive on open circuit fault disabled/upscale/downscale
Channel statusactive/inactive
Cold junction compensationenable/disable/channel no.

RESPONSE TIME

Response time600ms (max.)
(Analog signal change to availability on Railbus)

SAFETY

Field wiring protection[Ex ia] IIC

Safety Description (each channel)

Channels 1, 2, 3, 4, 7 and 8, wired as separate IS circuits
.....U_o = 16.4V, I_o = 79mA, P_o = 0.33W
Channels 5 and 6, wired as separate IS circuits
.....U_o = 1V, I_o = 1.1mA, P_o = 0.3mW
(Input terminals are equivalent to non-energy storing apparatus)

FM entity parameters

Channels 1, 2, 3, 4, 7 and 8, wired as separate IS circuits
.....V_{oc} = 16.4V, I_{sc} = 63.7mA, P_o = 131mW
Channels 5 and 6, wired as separate IS circuits
.....U_o = 1V, I_o = 1mA, P_o = 0.25mW

POWER SUPPLIES

IS Railbus (12V) current120mA (max.)
Power dissipation within module1.5W (max.)

MECHANICAL

Module Key CodeC1
Module width42mm
Weight245g

* Cold junction compensation located in recommended field terminal.

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe THC	8625-FI-IS



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mtl-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mtl-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

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8-channel Analog Input



RTD and Ω

8206-TI-IS

- ◆ 8 input channels
- ◆ intrinsically safe field circuits
- ◆ RTD and Ω
- ◆ 2-, 3- and 4-wire RTD format
- ◆ channels independently configurable
- ◆ channels are o/c failure independent

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels 8
RTD inputs (2-, 3- or 4-wire)
..... Pt100, Pt500 to BS EN60751: 1996
..... Ni120 to DIN 43 760: 1985
..... iPt100 to JIS C1604: 1981
..... user definable linearisation table, note 1
RTD input

Input type	Range
RTDs: Pt100, Pt500	- 200 to + 850°C
iPt100	- 200 to + 650°C
Ni120	- 60 to + 250°C

Resistance input

Excitation current	Range
211 μ A	0 to 110 Ω
211 μ A	0 to 280 Ω
211 μ A	0 to 470 Ω
48 μ A	0 to 2000 Ω

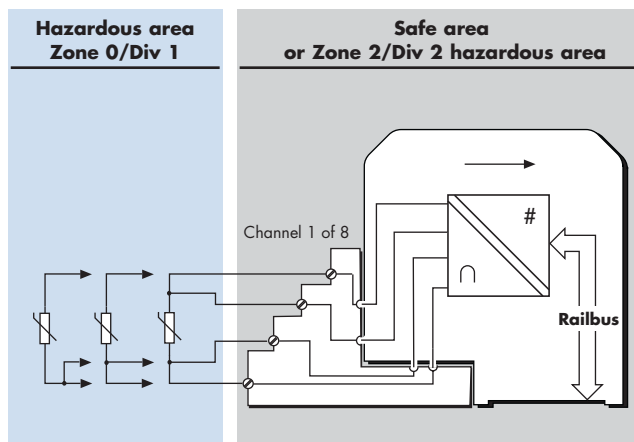
Accuracy (% of span), see note 2

Tamb	(RTD & Ω inputs)
25°C	$\pm 0.05\%$
+10 to + 40°C	$\pm 0.1\%$
- 40 to + 70°C	$\pm 0.2\%$

Cable resistance per loop 50 Ω (max)
RTD excitation current 211 μ A (nom.)
Compliance voltage of current source 6.8V
Resolution 16 bits
Series mode rejection > 50dB @ 50/60Hz
Isolation (any channel to Railbus) 60V peak

Note 1: Consult MTL for support in BIM/configurator.

Note 2: For Pt500 and 0 to 2000 Ω ranges a deviation of 0 to + 0.1% of reading is to be added for channel 1 or any channel preceded by a lower resistance range.



CONFIGURABLE PARAMETERS

Sensor type user selectable
Alarms high and low
Input dead zone user defined value
Selectable input filtering off / 2 reading avg./running avg.
Drive on open circuit fault disabled / upscale / downscale
Channel status active/ inactive
Offset (2-wire RTD mode) user defined value

RESPONSE TIME

Response time 600ms (max.)
(Analog signal change to availability on Railbus)

SAFETY

Field wiring protection [Ex ia] IIC
Safety Description (all channels combined)
..... $U_o = 16.4V$, $I_o = 217mA$, $P_o = 0.9W$
FM entity parameters
..... $V_{oc} = 16.4V$ dc, $I_{sc} = 350mA$, $P_o = 718mW$

POWER SUPPLIES

IS Railbus (12V) current 120mA (max.)
Power dissipation within module 1.5W (max.)

MECHANICAL

Module Key Code C3
Module width 42mm
Weight 245g

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe RTD	8626-FI-IS



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mtl-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mtl-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

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8-channel Analog Output



4–20mA with HART®

- ◆ 8 single ended output channels
- ◆ intrinsically safe field circuits
- ◆ 4–20mA for I/P converters
- ◆ open-circuit field wiring detection
- ◆ HART pass-through
- ◆ HART variable and status reporting

MODULE SPECIFICATION

See also System Specification

OUTPUTS

Number of channels8
Nominal signal range (span)4 to 20mA
Full signal range1 to 22mA
Voltage to load13V min. @ 20mA
Load resistance0 to 650Ω max.
Accuracy (@ 25°C)± 20µA
Temperature stability
(–40°C to + 70°C)± 0.006% of span per °C
Resolution12 bits
Open circuit detection threshold> 685Ω (typ.)
(also detects loads greater than driveable range)
Isolation
(any channel to Railbus)60V ac
(between channels)none

CONFIGURABLE PARAMETERS

Output initialisation statepredefined value
Drive on “fail-safe” upscale /downscale /last value
Channel status active /inactive
HART variable and status reportingenable/disable

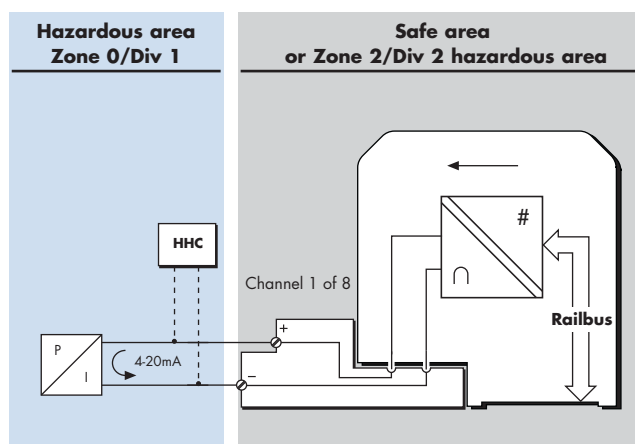
RESPONSE TIME

Railbus command to output change

4–20mA mode20ms (typ.)
.....80ms* (max.)
HART mode1s per channel

*Time to reach 90% level for 4–20mA step into 650Ω load

8202-HO-IS



SAFETY

Location of module

Field wiring protection[EEx ia] IIC

Safety description

(each channel) $V_o = 24.6V$, $I_o = 93mA$, $P_o = 0.57W$

FM entity parameters $V_{oc} \leq 24.6V$ dc, $I_{sc} \leq 93mA$

..... $C_a \leq 0.42\mu F$, $L_a \leq 4.2mH$

POWER SUPPLIES

IS Railbus (12V) current

(all channels @ 22mA into 650Ω load)630mA

Power dissipation within module4.1W (max.)

MECHANICAL

Module Key CodeA4

Module width42mm

Weight265g

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe standard	8621-FT-IS
Intrinsically safe loop disconnect	8622-FT-IS



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mti-inst.com

Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mti-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
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Oct 2006

8-channel Analog Output

4–20mA

8204-AO-IS

- ◆ 8 single ended output channels
- ◆ intrinsically safe
- ◆ conventional 4–20mA
- ◆ for I/P converters
- ◆ open-circuit field wiring detection

MODULE SPECIFICATION

See also System Specification

OUTPUTS

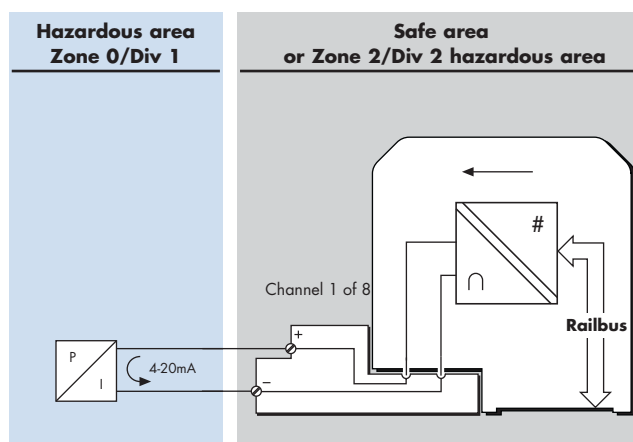
Number of channels	8
Nominal signal range (span)	4 to 20mA
Full signal range	1 to 22mA
Voltage to load	13V min. @ 20mA
Load resistance	450Ω max.
Accuracy (@ 25°C)	± 20µA
Temperature stability	
(–40°C to + 70°C)	± 0.006% of span per °C
Resolution	12 bits
Open circuit detection threshold	0.7 ± 0.2mA
Isolation	
(any channel to Railbus)	60V ac
(between channels)	none

CONFIGURABLE PARAMETERS

Output initialisation state	predefined value
Drive on “fail-safe”	upscale /downscale /last value
Channel status	active /inactive

RESPONSE TIME

Railbus command to output change	
	25ms (typ.)
	80ms (max.)



SAFETY

Field wiring protection	[EEx ia] IIC
Safety description	
(each channel)	$V_o = 24.6V$, $I_o = 93mA$, $P_o = 0.57W$

POWER SUPPLIES

IS Railbus (12V) current	
(all channels @ 22mA)	530mA
Power dissipation within module	3.8W (max.)

MECHANICAL

Module Key Code	A4
Module width	42mm
Weight	245g

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe, standard	8621-FT-IS
Intrinsically safe, loop disconnect	8622-FT-IS



16-channel Discrete Input

Switch/proximity detector

8220-DI-IS

- ◆ 16 single-ended input channels
- ◆ intrinsically safe field circuits
- ◆ simple apparatus, dry contacts or IS proximity detectors
- ◆ open and short-circuit field wiring detection

MODULE SPECIFICATION

See also System Specification

INPUTS

Number of channels	16
OFF current	< 1.2mA
ON current	> 2.1mA
Switching hysteresis	200µA (nom.)
Applicable specifications	NAMUR, DIN19234
Voltage applied to sensor	7.0 to 9.0V from 1kΩ ±10%
Output (wetting) current	
@ 100Ω line impedance	> 6mA
Line fault detection	
Short circuit	< 100Ω
Open circuit	> 90kΩ
Maximum input frequency	
in pulse counting mode	20Hz
Minimum pulse width detected	45ms

CONFIGURABLE PARAMETERS

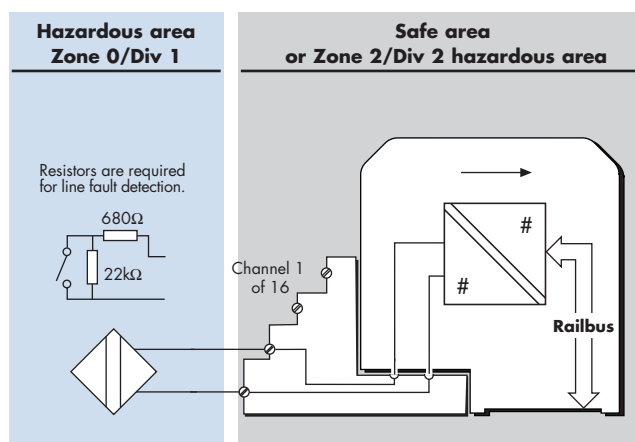
Selectable input filter	fast, slow or user defined
(User defined permits 0 to 512ms values in 3ms steps)	
Latch inputs	enable /disable
Latch polarity	latch on high / latch on low
Pulse counting	enable /disable
Line fault detection	enable /disable

RESPONSE TIME

Response time	6ms (max.)
(Field event to availability on Railbus)	

SAFETY

Field wiring protection	[EEx ia] IIC
Safety Description (each channel)	
(each channel)	$U_o = 10.5V$, $I_o = 14mA$, $P_o = 0.04W$
FM Entity parameters	$V_{OC} \leq 10.5V$ dc, $I_{SC} \leq 14mA$
	$C_d \leq 2.67\mu F$, $L_d \leq 176mH$
Isolation	
(any channel to Railbus)	60V ac
(channels arranged in two groups of eight, with returns commoned within each group)	



POWER SUPPLIES

IS Railbus (12V) current

(16-channel mode)	350mA (max.)
(8-channel mode)	285mA (max.)

MECHANICAL

Module Key Code	B1
Module width	42mm
Weight	170g

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe, 16-channel	8623-FT-IS
Intrinsically safe, 8-channel loop disconnect	8624-FT-IS



4-channel Discrete Output



Solenoid driver, IIC gas groups

8215-DO-IS

- ◆ 4 single-ended output channels
- ◆ intrinsically safe field circuits
- ◆ solenoid valves and alarms or LED indicators
- ◆ line-fault detection

MODULE SPECIFICATION

See also System Specification

OUTPUTS

Number of channels4

Minimum output voltage

Open circuit22V

45mA load11V

Maximum output voltage25V

Current limit per channel45mA (min.)

Output supply ripple<0.5% of output (pk. to pk.)

Line fault detection

Short circuit< 15Ω

Open circuit> 13kΩ

Isolation

(any channel to Railbus)60V ac

(between channels)none

CONFIGURABLE PARAMETERS

Output initialisation statehigh /low

Output state on "fail-safe"high /low /last value

Channel statusactive /inactive

Operation modestatic /dynamic

Outputdiscrete /momentary pulse /continuous pulse

Pulse width2ms to 130s

Duty cycle2 ms to 130 s (0.01% to 99.99%)

Line fault detectionenable /disable

RESPONSE TIME

Response time10ms (typ.)

(Railbus command to output changes)

SAFETY

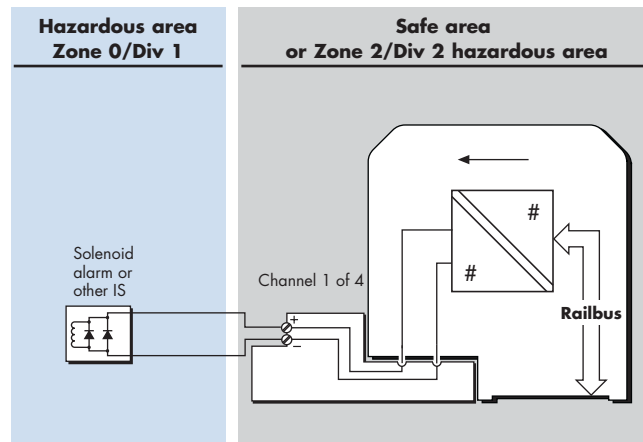
Field wiring protection[EEx ia] IIC

Safety description

(each channel) $V_o = 25V$, $I_o = 110mA$, $P_o = 0.69W$

FM Entity parameters $V_{oc} \leq 25V$ dc, $I_{sc} \leq 110mA$

..... $C_a \leq 0.19\mu F$, $L_a \leq 3.15mH$



POWER SUPPLIES

IS Railbus (12V) current560mA (max.)

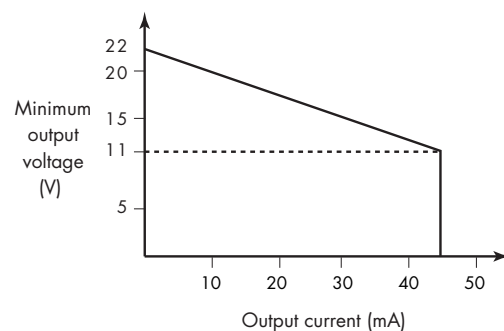
Power dissipation within module3.7W (max.)

MECHANICAL

Module Key CodeB5

Module width42mm

Weight220g



FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe, standard	8621-FT-IS
Intrinsically safe, loop disconnect	8622-FT-IS



EUROPE (EMEA)
AMERICAS
ASIA PACIFIC
E-mail: enquiry@mti-inst.com

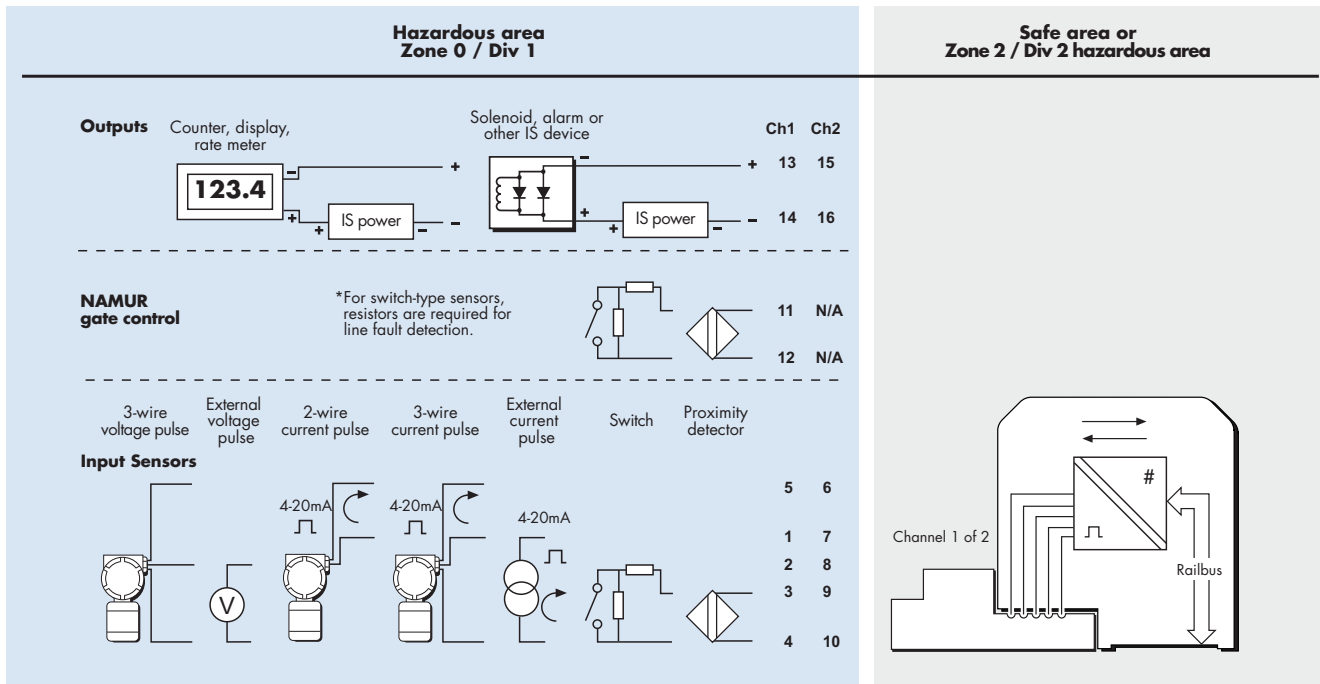
Tel: +44 (0)1582 723633
Tel: +1 603 926 0090
Tel: +65 487 7887
Web site: www.mti-inst.com

Fax: +44 (0)1582 422283
Fax: +1 603 926 1899
Fax: +65 487 7997

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2-channel pulse input

8223-PI-IS



- ◆ 2 input channels with power supplies or single quadrature input
- ◆ 1 Hz to 50kHz signal capability
- ◆ frequency & acceleration measurement
- ◆ 2 alarm/repeater retransmitted output channels
- ◆ 2- and 3-wire pulse transmitter format
- ◆ pulse counting (with gate control)
- ◆ channels independently configurable
- ◆ open circuit, short circuit and missing pulse detection

MODULE SPECIFICATION

See also System and Common Module Spec.

PULSE/FREQUENCY

Number of channels	2
Maximum frequency	50kHz
(in quadrature mode)	12.5kHz
Accuracy (25°C)	± 0.05% of span
Temperature Stability	0.005% / °C

CONTROL GATE (for gating Channel 1 only)

Switching thresholds	1.2mA / 2.1mA
Input impedance	1kΩ
Supply voltage	8.1V (nom.) at 8mA

SENSOR INPUT CHARACTERISTICS

NAMUR 1

Switching thresholds	1.2mA / 2.1mA
Input impedance	1kΩ
Supply voltage	8.1V (nom.) at 8mA

CURRENT

Input signal	20mA (max.)
Threshold	configurable in 8 levels
Input impedance	25Ω
Open circuit current	< 0.5mA
Short circuit current	> 21.5mA

VOLTAGE

Input signal	0 - 24V dc (50V max.)
Threshold	configurable in 8 levels
Input impedance	> 10kΩ
Switching hysteresis	100mV

SWITCH

Input voltage range	0 - 10V dc
---------------------	------------

OUTPUTS

The outputs are open-collector type for separately powered IS devices such as LED clusters, annunciators or solenoids

Number of channels	2
OFF state voltage	30V (max)
OFF state leakage current	10μA (max)
ON state voltage drop	< 1.0V @ 50mA
ON state current	100mA
Retransmission bandwidth	1 - 2000Hz

2-channel pulse input

8223-PI-IS

CONFIGURABLE PARAMETERS

INPUTS

Channelenable / disable
Sensor typeNAMUR prox. type (select low / high speed)
current pulse input
voltage pulse input
switch input
Frequency ranges 0.1, 0.3, 0.5, 1, 3, 5, 10, 30, 50, 100*kHz
Sample period50ms to 200s
Quadratureenable / disable
Threshold leveluser defined values
Triggeringrising edge / falling edge
Filteringoff, 1, 5, 20, 100kHz
Alarmsfrequency / acceleration
Alarm limitshigh / low
Alarm deadband (hysteresis)user defined value
Line fault detectenable / disable
Channel statusactive / inactive
Counterenable / disable
Counting directioncount up / count down

* While measurements can be made in the upper half of this range,
 the stated accuracy applies only to frequencies up to 50kHz.
 In quadrature mode, the upper limit is 12.5kHz.

DISCRETE OUTPUT

Function selectiondisabled
high / low alarm
acceleration alarm
counter preset value reached
quadrature output (channel 1 only)
scaled retransmission (channel 1 only)
Retransmission scaling (K factor – channel 1 only)1 – 256

CONTROL GATE INPUT

Counter (channel 1)start (count)/pause

DYNAMIC DATA (READ ONLY)

PROCESS VALUES

Frequency16 bit unsigned
Count32 bit signed
Acceleration16 bit signed

STATUS VALUES

Frequency / acceleration alarmsHigh / low
missing pulse detect
Line fault detectopen/short circuit
Quadrature direction1 = clockwise, 2 = anti-clockwise
Counter alarmspreset value reached

CONTROL DATA (WRITE ONLY)

Counter preset value32 bit signed
load preset value = 0 to disable
Counter commandsstart / stop / reset

Note: Channel 1 counter can also be controlled by control gate
 input: 1 = start(count), 0 = pause

ISOLATION

Any channel to Railbus60V ac
Between input channelsnone (common 0V connection)
Between output channels30V ac

RESPONSE TIME

Response time25ms (max.)
 (Signal change to availability on Railbus)

POWER SUPPLIES

Railbus current (both channels @22mA)300mA (max.)
Power dissipation (both channels @22mA)2.8W (max.)
 (no load)2.0W (max.)

MECHANICAL

Module Key CodeF2
Module width42mm
Weight260g

TERMINAL ASSIGNMENTS

Terminal	Description	
1	Current input	Channel #1
2	Voltage input	
3	NAMUR input	
4	Common	
5	Power supply +ve	Channel #2
6	Power supply +ve	
7	Current input	
8	Voltage input	
9	NAMUR input	Channel #1
10	Common	
11	NAMUR gate/control input	
12	Common	
13	Output +ve	Channel #2
14	Output -ve	
15	Output +ve	
16	Output -ve	

FIELD TERMINAL

Field wiring type	Recommended Field Terminal
Intrinsically safe, standard	8621-FT-IS

2-channel pulse input

8223-PI-IS

SAFETY

Field wiring protection.....[EEx ia] IIC
The following figures are for Gas Groups A/B (IIC) unless otherwise stated.

24V TX supplies (Ch1 & Ch2)

..... $U_o = 27.4V$, $I_o = 93.2mA$, $P_o = 639mW$
..... $C_o = 0.087\mu F$, $L_o = 4.2mH$

Current inputs (Ch1 & Ch2)

..... $U_o = \pm 1.1V$, $I_o = 53mA$, $P_o = 15mW$
..... $U_i = 1.1V$, $I_i = 50mA$
..... $C_o = 1000\mu F$, $L_o = 13.1mH$

Voltage inputs (Ch1 & Ch2)

NAMUR inputs (Ch1 & Ch2)

NAMUR gate input (Ch1)

..... $U_o = 9.6V$, $I_o = 25mA$, $P_o = 57mW$
..... $U_i = 18.2V$, $P_i = 333mW$
..... $C_o = 3.6\mu F$, $L_o = 56.6mH$

Discrete outputs (Ch1 & Ch2)

..... $U_i = 30V$, $P_i = 333mW$

All circuits combined within one channel

..... $U_o = 28.5V$, $I_o = 93.2mA$ (or $169mA$ at $13.4V$), $P_o = 639mW$
..... $C_o = 0.078\mu F$, $L_o = 1.28mH$

FM ENTITY PARAMETERS

24V TX supplies (Ch1 & Ch2)

..... $U_o = 27.4V$, $I_o = 93.2mA$, $P_o = 639mW$
..... $C_a = 0.08\mu F$, $L_a = 4.1mH$

24V TX supplies (Ch1 & Ch2 connected together)

Gas Groups C,E (IIB)

..... $U_o = 27.4V$, $I_o = 186.4mA$, $P_o = 1.28W$
..... $C_a = 0.67\mu F$, $L_a = 4.3mH$

Current inputs (Ch1 & Ch2)

..... $U_o = 1.2V$, $I_o = 57.4mA$, $P_o = 17.2mW$
..... $C_a = 1000\mu F$, $L_a = 10.6mH$

3-wire current inputs (Ch1 & Ch2)

Gas Groups C,E (IIB)

..... $U_o = 27.4V$, $I_o = 150.6mA$, $P_o = 656mW$
..... $C_a = 0.67\mu F$, $L_a = 6.4mH$

Voltage inputs (Ch1 & Ch2)

..... $U_o = 9.56V$, $I_o = 1.0mA$, $P_o = 2.39mW$
..... $C_a = 3.7\mu F$, $L_a = 1000mH$

3-wire voltage inputs (Ch1 & Ch2)

..... $U_o = 27.4V$, $I_o = 93.2mA$, $P_o = 642mW$
..... $C_a = 0.08\mu F$, $L_a = 4.0mH$

NAMUR inputs (Ch1 & Ch2)

NAMUR gate input (Ch1)

..... $U_o = 9.56V$, $I_o = 11.1mA$, $P_o = 26.4mW$
..... $C_a = 3.7\mu F$, $L_a = 263mH$

Discrete outputs (Ch1 & Ch2)

..... $U_i = 30V$, $I_i = 100mA$
..... $C_i = 0\mu F$, $L_i = 0mH$

LED INDICATORS

POWER – Green LED

OFF	ON	FLASHING
Power failure	Power OK	Not applicable

FAULT – Red LED

OFF	ON	FLASHING
In running state	Fault	Awaiting module training

PULSE INPUT CHANNEL – Yellow LED

OFF	ON	FLASHING
Channel inactive	Channel active and operating normally	Channel active but in alarm condition

DIGITAL OUTPUT CHANNEL – Yellow LED

OFF	ON	FLASHING
Channel inactive	Channel active and operating normally	Not applicable