SafetyNet IO Modules

SafetyNet IO Modules interface to safety system field wiring via Field Terminals. The IO Modules and the Field Terminals mount on Carriers that provide mechanical support, but also connect the internal communication bus and power supply connections to the Modules. The IO Modules are certified as suitable for use in SIL 2 safety-related applications.

- **Certification**

    The SafetyNet IO Modules are certified for use in safety-related applications up to and including SIL 2. The SafetyNet System achieves this certification with a 1oo1D architecture. The SafetyNet IO Modules have been designed specifically for safety-related applications and are certified on the basis of the excellence of their design. The certification does not depend on "proven in use" data.

- **Diagnostics**

    The IO Modules perform comprehensive internal diagnostic tests as an essential part of ensuring that the IO can carry out the required safety function. If the SafetyNet IO Module's internal diagnostics detect a fault that would prevent the SafetyNet System from carrying out its safety function,

then it will initiate a controlled shutdown. A controlled shutdown has two objectives – firstly, to ensure that the IO Module enters its failsafe mode; and secondly, to record sufficient data to allow the reason for the shutdown to be determined. If a SafetyNet Module enters a controlled shutdown, then all IO channels are deactivated: input channels are not scanned; and output channels are de-energized.

- **Bussed Field Power**

    The Bussed Field Power (BFP) connectors on the rear of IO Module Carriers provide the power connections for field instruments wired to the IO Modules. For the SafetyNet System, BFP must be 24 VDC and supplied by MTL's 8914-PS-AC units. These power supplies may be used in redundant pairs, if required.

- **Live Maintenance**

    SafetyNet IO Modules can be removed and replaced in a Class 1, Division 2 or Zone 2 hazardous area - once the relevant Bussed Field Power (BFP) connection has been isolated using an appropriate hazardous area switch (such as the MTL951). Removing and replacing the Modules does not interrupt the operation of the other parts of the node. If a Module is replaced by another Module of identically the same type, then no intervention is required for the System to begin operating normally once the Bussed Field Power is restored.

- **Line Fault Monitoring**

    In addition to the comprehensive internal diagnostics the SafetyNet IO Modules can monitor field wiring for line faults.

- **Event Logging**

  Data from SafetyNet IO Modules can be time stamped and stored by the SafetyNet Controller before being downloaded to the PAC8000 SOE Data Retrieval Client or a 3rd party historian package. SafetyNet IO Module data is time stamped with a resolution of better than 200ms.

- **Failsafe Mode**

  IO Modules will enter Failsafe Mode from the Running State either due to loss of communications with the Controller or because the module has received an instruction from the Controller to enter the Failsafe State. In this state:

  - The Red Fault LED is lit
  - The IO Module is flagged as unhealthy to the Controller
  - All Railbus Write requests are rejected, except instructions to Reset or to exit the Failsafe State
  - Inputs and HART data are read
  - Outputs are de-energized
  - Background diagnostics continue and if a failure is detected, the module will enter Controlled Shutdown

- **Controlled Shutdown**

  A Controlled Shutdown is carried out if a fault is detected in the Module. In this state it can communicate the reason for shutdown.

- **LEDs**

  A number of LEDs are provided on each IO Module to provide visual indication of the status of the Module, its channels and its power supply.

- **Module 'Fault' LED (red)**

  - On - Failsafe
  - Off - Normal operation Flashing (equal:mark space ratio) – Cold start in process, will flash until communication is established with SafetyNet Controller.
  - Blinking (On for a short period, then On for a longer period – morse code 'a') – Fault state after controlled shutdown

- **Module 'Power' LED (green)**

  - On - Power OK
  - Off - BFP or Railbus Power Failure

- **Module 'Channel' LED's (yellow)**

  - See Individual Module Specifications.

Publication Reference Chart

GFA-1779	PAC8000 2/x Series Modular I/O
GFA-1769	PAC8000 Carriers and Field Terminals

PAC8000 Process I/O

PAC8000 delivers full-specification performance in harsh process environment conditions; extreme temperatures, humidity or corrosives and conditions subject to shock and vibration. In ATEX environments, PAC8000 also excels. All components can be mounted and maintained in Zone 2/Division 2 hazardous areas. The I/O includes types that can be connected directly to Intrinsically Safe (Exi) or Increased Safety (Exe) field wiring. PAC8000 provides comprehensive diagnostic data on Controllers, Bus Interface Modules, I/O Modules, field wiring and field instruments, allowing users to respond to issues quickly and effectively.

PAC8000 I/O can be used in conjunction with intelligent Controllers on architectures which require distributed control (Refer to Section 2 Conventional Control Systems). Alternatively, where remote I/O is required, the node can use a Bus Interface Module (BIM) or a network scanner. A range of BIMs are available for connection to remote hosts using different protocols. PROFINET, Modbus RTU, PROFIBUS DP and Modbus TCP/IP.

Benefits of PAC8000 I/O

• **Bus Interface Modules**

For architectures that require remote or distributed I/O, PAC8000 uses Bus Interface Modules (BIMs) to act as a network interface or scanner. Some BIMs can be used redundantly, mounted on the same BIM carrier to increase availability. BIMs that can only be used in simplex mode can work with the 8510-NS-MO Node Services Module, which stores the relevant parameters, so that insertion of a new replacement triggers automatic configuration of the unit and the node.

• **I/O Modules**

A broad range of PAC8000 I/O modules are available to meet the needs of different applications. All modules provide comprehensive diagnostic information. Analog and discrete output modules are typically 8-channel, with 8-, 16- or 32-channel discrete input modules. The maximum number of I/O Modules that can be mounted on a node depends on the BIM type – either 24 (PROFIBUS DP types), 32 (Modbus RTU type) or 64 (Modbus TCP/IP type) modules can be mounted on each node. Modules that mount in zone 2 and can accept field wiring to zone 2 are known as PAC8000 2/2 modules. Modules which mount in zone 2 and

are compatible with intrinsically safe field wiring are known as PAC8000 2/1 modules.

• **Environmental and Hazardous Area Operation**

PAC8000 can go where other products cannot. They can be field mounted and will operate under the following conditions:

– -40°C to +70°C ambient temperature

– ISA Level G3 corrosive atmospheres

– 30g shock and 5g vibration

– Class I, Division 2 and Zone 2 hazardous areas, with I/O field wiring including intrinsically safe (Exi) and increased safety (Exe) options.

Publication Reference Chart

GFK2839	PAC8000 PNS Manual
INM8100	8000 I/O - 2/2 I/O modules with SafetyNet
INM8200	8000 I/O - 2/x I/O modules
INM8502	8000 I/O - Profibus-DP BIM
INM8505	8000 I/O – Modbus BIM
INM8510	8510 – Node Services Module
INM8512	8512 - HART Interface Module

- **LAN Redundancy**

  Different LAN Redundancy options are available from the different BIMs. PROFINET BIMs support a ring architecture (PROFINET's "Media Redundancy Protocol", or MRP), the Ethernet BIM supports redundant, fault tolerant Ethernet and the Modbus RTU BIM can operate two LANs in a number of different ways based on its configuration. The 8507-BI-DP BIM can provide redundant LANs when redundant BIMs are installed.

- **HART Pass-through**

  All PAC8000 BIMs are designed to work with HART field instruments when combined with appropriate HART-capable Analog I/O Modules. This allows remote asset management packages to communicate directly with HART field instruments. The PROFINET BIM due for initial release will have this feature in 2013, and the 8505-BI-MB Modbus BIM requires the use of the 8512-IF-HA HART Interface Module to enable HART pass-through.

- **HART Acquisition**

  PAC8000 HART I/O Modules can directly address smart instruments and provide HART process and status information directly to the host. This enables the implementation of a number of advanced techniques such as live re-calibration of the 4-20 mA loop by continually comparing it to the original digitized measurement from the transmitter.

- **Upgrading Legacy System Installations**

  The Modbus TCP/IP Ethernet BIM shares the same hardware as the PAC8000 Intelligent Controllers. It can be upgraded from a BIM to a Controller by a simple firmware download. This feature is particularly useful in legacy system upgrades, by following a process such as:

  – The PAC8000 Ethernet BIM and I/O is used to gradually replace failed legacy system I/O, acting as new remote I/O to the legacy host – connected by either Modbus TCP/IP over Ethernet, or Modbus RTU over an RS485 serial link.

  – Many legacy control rooms have little free space, so users can take advantage of the PAC8000's harsh and hazardous environmental performance to mount the new I/O remotely on the plant, close to the field instruments, freeing up space in the control room.

  – Once the entire legacy I/O has been replaced, the legacy host can be removed and the control capability of the Ethernet BIMs enabled to instigate distributed control on a new platform, with no legacy issues.

- **Ease of Use**

  A range of features provide simplified day-to-day operation of a process automation system:

  – Only field wiring is connected to field terminals – field power is connected to the carrier's terminals, simplifying field wiring tasks and I/O module replacement.

  – I/O modules feature LEDs to assist with fault finding in I/O modules and field wiring.

  – Field terminals and I/O modules are keyed to each other. It is impossible to make an unsafe combination of terminals and modules, or inadvertently replace a failed module with an incorrect replacement.

  – When replacing an I/O module, the Controller or Bus Interface Module will automatically bring it online if it recognizes the type as correct.

  – Online download of new application programs is possible with simplex Controllers, and online download of new firmware is often possible with redundant Controllers.

- **Power Supplies**

  12 V System Power must be connected to each node. This can be supplied by the AC Power Supply 8913-PS-AC or the DC Power Supply BQ2320-9R-EX. The Ethernet BIM also requires its own 12 V Controller Power connection. Using 12 V for the internal communication bus allows live module removal from the Carriers, even in zone 2 hazardous areas. Different 2/2 I/O Modules require different Bussed Field Power Supplies. This power supply is connected to the node via connectors on the back of the I/O Carrier, and is routed through the I/O module to the field wiring. It will normally be necessary to isolate this supply before removing the module. As the name suggests, Bussed Field Power can be bussed along the back of the I/O Carrier to simplify connection of the various supply voltages a node may need. All the power for 2/1 modules is supplied through the Carrier, with System Power being provided by the dedicated IS Power Supply 8920-PS-DC.

- **Addressing of I/O modules**

  Modules are addressed in terms of their position, or slot, on the Carrier. As a result, a module can be removed and replaced by another of the same type and the system will resume operation, including the new module, automatically. And since all configuration data is stored in non-volatile memory, the configuration is retained even during a power cycle and without the need for internal batteries.

- **Sequence of Event Recording**

  The 8127-DI-SE module can time stamp input changes for Sequence of Events recording. This function is supported on PAC8000 Controllers and Ethernet BIMs.

- **Integrated Control and Safety**

  The majority of PAC8000 I/O Modules can be mounted on SafetyNet SIL 2 functional safety nodes, together with SafetyNet I/O Modules and Controllers, to implement Integrated Control and Safety Systems. (Modules 8129-IO-DC and 8133-HI-TX are not supported by SafetyNet).
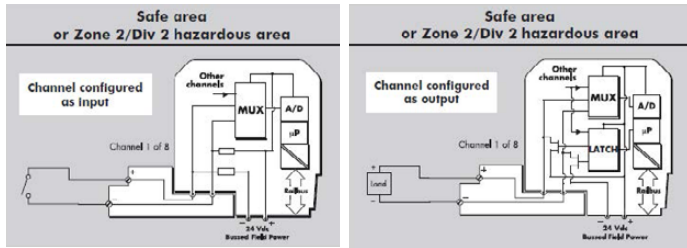
- **Engineering Tools**

  The configuration tool that is required by each of the different BIM types is given in the comparison tables.

SafetyNet Discrete Input/Output Module

SafetyNet Discrete Input/Output Module features:

- 8 inputs - any combination of inputs and outputs
- Certified for use in SIL 2 safety applications
- Non-arcing inputs and outputs
- Output channels rated up to 2A continuous
- Inputs for dry contact switches
- 24Vdc Bussed Field Power required from 8914-PS-AC

	8811-IO-DC
Product Name	24Vdc, Non-isolated Discrete Input/Output Module
Lifecycle Status	Active
Number of Channels (independently configured as inputs or outputs)	8
Inputs	
ON/OFF Threshold Current	0.9mA (typ.)
O/C Voltage	24 VDC (typ.) - depends on BFP Supply
Wetting Current	1.2mA (typ.)
Minimum Pulse Width Detected	5ms
Max Input Frequency in Pulse Counting Mode (no debounce)	30Hz
Isolation (any channel to Railbus)	250 VAC
Outputs	
Maximum Output Current per Channel	2A
Maximum Output Current per Module - Continuous	6A
Maximum Output Current per Module - Non-continuous (<10 seconds)	8A
Input Configurable Parameters	
Filter Time Interval	0 to 8s (in 1ms steps)
Earth Leakage Detection Channel	ON/OFF
Latch Inputs	enable /disable
Latch Polarity	latch on high/latch on low
Pulse Counting	up transition/down transition/disable
Line Fault Detection	none/open circuit/open & short circuit
Output Configurable Parameters	
Output Type	pulse/discrete/pattern
Pulse Width	1ms to 60s
Line Fault Detection[†]	open line & short circuit detect /disable
Resistance Measurement Accuracy	
For Normally De-energized Output Open and Short-circuit Detection.	
With forward biased test current	$\pm(3.4\%+5.3ohm)$ for line resistance δ 220ohm greater of: $\pm7\%$ or $\pm(3.1\%+27\wedge)$ for line resistance $>220\wedge$, <1kohm
With reverse biased test current	greater of: $\pm7\%$ or $\pm(3.1\%+430ohm)$
Response Time	
Input Signal Change to Availability on Railbus	5ms (max.)
Railbus Command to Output Change	1ms (max.)
Hazardous Area Specification	
Protection Technique	EEx nA nL IIC T4
Location (FM and CSA)	Class 1, Div.2, Grps A,B,C,D T4
Power Supplies	
System Power Supply	50mA (typ.), 70mA (max.)
Bussed Field Power Supply	
All Channels Configured as Inputs	50mA (max)
Any Channels Configured as Output Currents	50mA + output load
Module key code	B6
Module Width (mm)	42
Weight (g)	210

SafetyNet Analog Input Module

SafetyNet Analog Input Module features:

- 8 single ended 4-20mA input channels
- Certified for use in SIL 2 safety applications
- Non-incendive field circuits
- 2-, 3- or 4-wire transmitters
- HART pass-through, acquisition and status reporting[†]
- 24 VDC Bussed Field Power required from 8914-PSAC
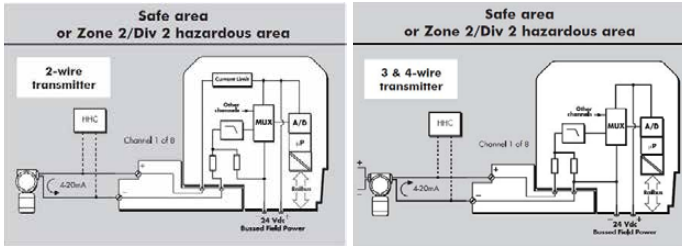
	8810-HI-TX
Product Name	4-20 mA Analog Input Module with HART
Lifecycle Status	Active
Inputs	
Number of Channels	8, single-ended
Nominal Signal Range (span)	4 to 20mA
Full Signal Range	0.25 to 24mA
Line Fault Detection:	
Short Circuit Current	> 23.5mA
Open Circuit Current	< 0.5mA
Output Voltage (@ 20mA)	10.2V (min.)
Output Current	28mA (max.)
Accuracy (at 25°C)	± 0.1% of span
Temperature Coefficient	38 ppm/C
Resolution	16 bits
Repeatability	0.05% of span
Data format	16-bit unsigned (0-25mA = 0-65,535)
HART data format	IEEE754 floating point
Isolation (any channel to Railbus)	250 VAC RMS
Isolation (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 Fault State	disabled /upscale /downscale
HART Variable and Status Reporting	enable /disable
Response Time	
Signal Change to Availability on Railbus:	
4– 20 mA Mode	25ms (max.)
HART Mode	0.75s per channel
Hazardous Area Specification	
Protection Technique	EEx nA [nL] IIC T4
Location (FM and CSA[‡])	ss 1, Div.2, Grps A,B,C,D T4
FM Non-incendive Field Wiring Parameters (each channel)	Voc = 28.7V; Isc = 33mA
Gas Groups A, B	Ca = 0.17µF; La = 11mH
Gas Group C	Ca = 0.51µF; La = 33mH
Gas Group D	Ca = 1.36µF; La = 88mH
Power Supplies	
System Power Supply	50mA (typical), 70mA (max.)
Bussed Field Power Supply	350mA (2-wire TX max.), 110mA (4-wire TX max.)
Module Key Code	A1
Module Width (mm)	42
Weight (g)	200

For recommended and compatible Field Terminals, see Field Terminal - Specification and Selection Guide.

[†]The first release of SafetyNet will not have full HART capability, contact GE for further information.

[‡]CSA with non-incendive field terminal, subject to conditions in CSA certificate.)
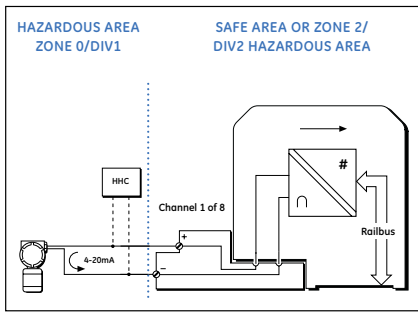
8-channel Analog Input

8-channel Analog Input, 4-20 mA with HART features:

- 8 single-ended input channels
- Intrinsically safe field circuits
- Conventional 4–20 mA
- HART pass-through
- HART variable and status reporting
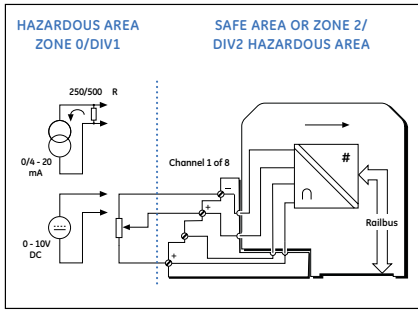- For 2-wire transmitters
- In-built power supply

	8201-HI-IS
Product Name	8-channel Analog Input, 4-20 mA with HART
Lifecycle Status	Active
Inputs	
Number of Channels	8
Nominal Signal Range (span)	4 to 20 mA
Full Signal Range	0.5 to 22 mA
Line Fault Detection	Short circuit current – >21.5 mA; Open circuit current – <0.5 mA
Voltage to Transmitter @ 20mA	15 V (min.)
Accuracy (@25 °C)	± 20 µA
Resolution	16 bits
Temperature Stability	(-40 °C to +70 °C) – ± 0.006% of span per °C
Isolation	Any channel to Railbus – 60 VAC 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	4–20 mA mode – 33 ms (max.) HART mode – 0.75 s per channel
Safety	
Field Wiring Protection	[EEx ia] IIC
Safety Description (each channel)	$U_o = 28$ V, $I_o = 93$ mA, $P_o = 0.65$ W
FM Entity Parameters	$V_{oc} \leq 28$ VDC, $I_{sc} \leq 93$ mA, $C_a \leq 0.14$ µF, $L_a \leq 4.38$ mH
Power Supplies	
IS Railbus (12V) Current (all channels @ 22 mA)	600 mA (typ.)
Power Dissipation Within Module	4.2 W (max.)
Module Key Code	A1
Module width (mm)	42
Weight (g)	260
Field Terminals – Field Wiring Type	
Intrinsically Safe Standard	8621-FT-IS
Intrinsically Safe Loop Disconnect	8622-FT-IS

PAC8000 2/2 4-20 mA Analog Input Modules

2/2 4–20 mA Analog Input modules measure the current in a 4–20 mA field instrument loop and report the value read on each channel. The 4-20 mA analog input modules have eight channels. When the current is measured outside the 4-20 mA range, the module detects this and reports open and short circuit line faults.

Analog input 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 access data on up to 4 dynamic variables and status from each instrument. This provides more process information to the control system from each device. Compensating for A/D and D/A errors and comparing the value reported by the module with the original measurement taken by the field instrument can result in greater accuracy. In addition, HART pass-through may be used for device configuration, calibration and advanced diagnostics by remote asset management packages.

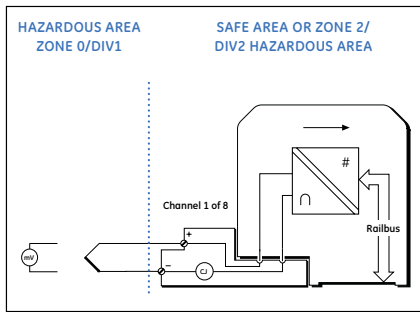|	8101-HI-TX	8103-AI-TX
Product Name	8-channel AI, 4-20 mA with HART	8-channel AI, 4-20 mA
Lifecycle Status	Active	Active
Module Type	Analog Input	Analog Input
Range	4 to 20 mA	4 to 20 mA
Bussed Field Power	24 VDC ±10% 300 mA (2-wire), 60 mA (4-wire)	24 VDC ±10% 300 mA (2-wire), 60 mA (4-wire)
Transmitter Type	2 or 4 wire	2 or 4 wire
Full Signal Range	1-23 mA	1-23 mA
Output Current	32 mA max.	32 mA max.
Failsafe Mode	Low, high or hold last value	Low, high or hold last value
LED Indicators	Power, Fault 8 x Channel Status	Power, Fault 8 x Channel Status
Alarms	Hi Hi, Hi, Lo, Lo Lo	Hi Hi, Hi, Lo, Lo Lo
Alarm Deadband	User-Defined	User-Defined
Line Fault Detection	Open (<0.5 mA) Short (>23.5 mA)	Open (<0.5 mA) Short (>23.5 mA)
Resolution	16-bit unsigned	16-bit unsigned
Accuracy (% of span)	±0.1%	±0.1%
Repeatability	0.05% of span	0.05% of span
Response Time	27 ms max. (mA mode) 0.75 s per channel (Hart mode)	27 ms max.
Channel to Channel Isolation	No	No
Dead Zone	User-Defined; Zero Default	User-Defined; Zero Default
HART Data	IEEE754 floating point	N/A
Filtering	Configurable	Configurable
Field Circuits	Non-incendive	Non-incendive
System Power (12 V)	100 mA typ., 150 mA max.	100 mA typ., 150 mA max.
Module Key Code	A1	A1
Module Width (mm)	42	42
Module Weight (g)	200	200
Compatible Field Terminals		
General Purpose Wiring	8602-FT-ST (2-wire) 8604-FT-FU (2-wire) 8615-FT-FU (4-wire)	8602-FT-ST (2-wire) 8604-FT-FU (2-wire) 8615-FT-FU (4-wire)
Non-incendive Wiring	8601-FT-ST (2-wire) 8603-FT-FU (2-wire) 8615-FT-4W (4-wire)	8601-FT-ST (2-wire) 8603-FT-FU (2-wire) 8615-FT-4W (4-wire)
Common PAC8000 Specifications	See Section xx for System Specifications	See Section xx for System Specifications

8-channel Analog Input

8-channel Analog Input, 0-10V/potentiometer input features:

- 8 single-ended input channels
- Intrinsically safe field circuits
- Conventional 4–20 mA
- HART pass-through
- HART variable and status reporting
- For 2-wire transmitters
- In-built power supply

	8230-AI-IS
Product Name	**8-channel Analog Input, 0-10V/potentiometer input**
Lifecycle Status	Active
Inputs	
Number of Channels	8, single-ended
0 –10V Input Characteristics	Nominal signal range (span) – 0 to 10 V Full signal range – 0 to +11 V Resolution – 16 bits Input impedance – >100 kΩ Under-range indication – -100 mV
Potentiometer Input Characteristics	Nominal signal range (span) – 0 to 100% of travel Potentiometer resistance – 100Ω to 10 kΩ Excitation voltage (nom.) – 10 V (from 2.2 kΩ source) Resolution (≥1kΩ potentiometer) – 14 bits Resolution (100Ω potentiometer) – 11 bits
Accuracy (at 25 °C)	± 0.1% of span
Isolation	Any channel to Railbus – 100 VAC 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 Railbus	33 ms (max.)
Open Circuit Line Fault Detection Time	≤ 5 s
Safety	
Field Wiring Protection	[EExia] IIC
Safety Description (each channel non linear output)	$U_o \leq 15.75$ V, $I_o \leq 20$ mA, $P_o \leq 0.315$ W
FM Entity Parameters	$V_{oc} = 15.75$ V, $I_{sc} = 20$ mA, $C_a = 0.22$ µF, $L_a = 5$ mH
Power Supplies	
IS Railbus (12V) current	Typical – 200 mA Max with voltage/current inputs – 250 mA Max. with 100Ω potentiometer inputs – 350 mA
Power Dissipation Within Module	Max with voltage/current inputs – 3 W Max. with 100Ω potentiometer inputs – 4.2 W
Module Key Code	C4
Module Width (mm)	42
Weight (g)	200
Field Terminals – Field Wiring Type	
Intrinsically Safe, Standard	8623-FT-IS

HAZARDOUS AREA ZONE 0/DIV1 — SAFE AREA OR ZONE 2/ DIV2 HAZARDOUS AREA

Channel 1 of 8

Railbus

8-channel Analog Input

8-channel Analog Input, Thermocouple and mV features:

- 8 input channels
- Intrinsically safe field circuits
- Thermocouple and mV
- Cold junction compensation (internal or remote)
- Built-in thermocouple linearization
- Channels independently configurable
- Open-circuit field wiring detection

	8205-TI-IS
Product Name	**8-channel Analog Input, Thermocouple and mV**
Lifecycle Status	Active
Inputs	
Number of Channels	8
THC Inputs	B,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 rOCT 3044-84 User definable linearization table, Note 1
Temperature Drift	< ± 0.003% of span/°C
Cold Junction Compensation Error†	< ± 1°C (− 40 to + 70°C)
Accuracy (% of Span)	

		mV inputs:	THC inputs:
Ambient Temperature			
25° C		± 0.05%	± 0.05%
+10 to +40° C		± 0.08%	± 0.1%
-40 to +70° C		± 0.18%	± 0.3%
Resolution	16 bits		
Common Mode Rejection	>87 dB @ 50/60 Hz		
Series Mode Rejection	>50 dB @ 50/60 Hz		
Common Mode Voltage Between Channels	± 5 V (max.)		
Absolute Maximum Input Voltage	± 30 V		
Isolation (any channel to Railbus)	60 V peak		
Configurable Parameters			
Sensor Type	User selectable		
Alarms	High and low		
Input Dead Zone	User defined value		
Selectable Input Filtering	Off / 2 reading avgerage / running avgerage		
Drive on Open Circuit Fault	Disabled / upscale / downscale		
Channel Status	Active / Inactive		
Cold Junction Compensation	Enable / disable / channel number		
Response Time			
Analog Signal Change to Availability on Railbus	600 ms (max.)		
Safety			
Field Wiring Protection	[EEx ia] IIC		
Safety Description (each channel)	Channels 1, 2, 3, 4, 7 and 8, wired as separate IS circuits – U_o = 16.4 V, I_o = 79 mA, P_o = 0.33 W Channels 5 and 6, wired as separate IS circuits – U_o = 1 V, I_o = 1.1 mA, P_o = 0.3 mW (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} = 16.4 V, I_{sc} = 63.7 mA, P_o = 131mW Channels 5 and 6, wired as separate IS circuits – U_o = 1 V, I_o = 1 mA, P_o = 0.25 mW		
Power Supplies			
IS Railbus (12V) Current	120 mA (max.)		
Power Dissipation Within Module	1.5 W (max.)		
Module Key Code	C1		
Module Width (mm)	42		
Weight (g)	245		
Field Terminals – Field Wiring Type			
Intrinsically Safe THC	8625-FT-IS		

Notes:

Consult GE for support in BIM/configurator.

†Cold junction compensation located in recommended field terminal.
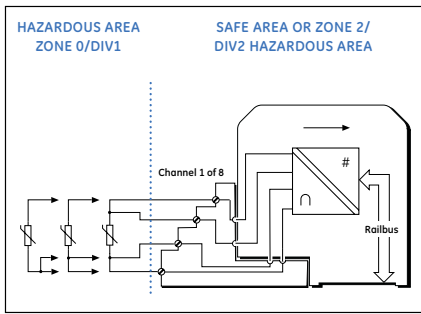
8-channel Analog Input

8-channel Analog Input, RTD and Ω features:

- 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

	8206-TI-IS
Product Name	8-channel Analog Input, RTD and Ω
Lifecycle Status	Active
Inputs	
Number of Channels	8
RTD Inputs	(2-, 3- or 4-wire) Pt100, Pt500 to BS EN60751: 1996 Ni120 to DIN 43 760: 1985 jPt100 to JIS C1604: 1981 User definable linearization table, note 1
Input type	Range
Pt100, Pt500	-200 to +850° C
jPt100	-200 to +650° C
Ni120	-60 to +250° C
Resistance Input	
Excitation current	Range
211 mA	0 to 110 Ω
211 mA	0 to 280 Ω
211 mA	0 to 470 Ω
48 mA	0 to 2000 Ω
Accuracy (% of span), see note 2	
Ambient Temperature	RTD & Ω inputs
25° C	± 0.05%
+10 to +40° C	± 0.1%
-40 to +70° C	± 0.2%
Cable Resistance per Loop	50 W (max)
RTD Excitation Current	211 µA (nom.)
Compliance Voltage of Current Source	6.8 V
Resolution	16 bits
Series Mode Rejection	>50 dB @ 50/60 Hz
Isolation (any channel to Railbus)	60 V peak
Configurable Parameters	
Sensor Type	User selectable
Alarms	High and low
Input Dead Zone	User defined value
Selectable Input Filtering	Off / 2 reading average / running average
Drive on Open Circuit Fault	Disabled / upscale / downscale
Channel Status	Active / Inactive
Offset (2-wire RTD mode)	User defined value
Response Time – Signal Change to Availability on Railbus	600 ms (max.)
Safety	
Field Wiring Protection	[EEx ia] IIC
Safety Description (all channels combined)	U_o = 16.4 V, I_o = 217 mA, P_o = 0.9 W
FM Entity Parameters	V_{oc} = 16.4 VDC , I_{sc} = 350 mA, P_o = 718 mW
Power Supplies	
IS Railbus (12V) Current	120 mA (max.)
Power Dissipation Within Module	1.5 W (max.)
Field Terminals – Field Wiring Type	
Intrinsically Safe Standard	8626-FT-IS
Module Key Code	C3
Module Width (mm)	42
Weight (g)	245

Notes:

Consult GE for support in BIM/configurator.

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.

PAC8000 2/2 Temperature, Voltage and Universal Analog Input Modules

These modules provide digitized data and status information of analog measurements from thermocouples, mV sources, RTDs and resistance sources. The Universal Module can also be configured for 4-20 mA and Voltage input operation.

Cold junction compensation for thermocouple applications is provided by means of a sensor in the dedicated field terminal.

RTD modules provide channels for monitoring input signals from RTD or resistance sources. The RTD can be 2-, 3- or 4-wire type.

Only the recommended field terminals can be used with these modules.
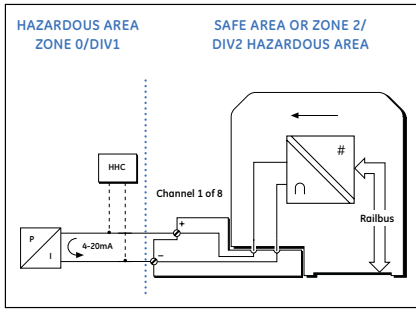
	8105-TI-TC	8106-TI-RT	8119-VI-05	8132-AI-UN
Product Name	4-channel THC/mV Input	4-channel RTD or Resistance Input	8-channel Voltage Input	8-channel Universal AI
Lifecycle Status	Active	Active	Active	Active
Module Type	Analog Input	Analog Input	Voltage Input	Analog Input
Range	Thermocouple / 0 to +120 mV	RTD (0-500 ohm)	0.19 to 5.64 VDC	4 to 20 mA/THC/RTD/Voltage
Bussed Field Power	N/A	N/A	24 VDC ±10%, 60 mA	24 VDC ±10%, 300 mA (4-20 mA with excitation), 125 mA (All other configurations)
Transmitter Type	N/A	2, 3 or 4 wire	N/A	2 or 4 wire
Sensor Type	B, E, J, K, N, R, S, T, W3, W5 Russian K, L mV (0 to +120 mV)	Pt100 to BS1904/DIN43760/ IEC 75Ni120; jPt100 to JIS C1604: 1989	1-5 VDC	THC: B, E, J, K, N, R, S, T, W3, W5, Russian K, Russian L, RTD (2 or 3 wire): Pt100, jPt100, Pt200, Pt500, Ni120, Cu10, Volt: ±120 mV, 0-1 V, 0-5 V, 1-5 V, 0-10 V, ±10 V
Output Current	N/A	RTD Excitation Current: 200 µA (nom.)	User-Defined Active/Inactive	25 mA max.
LED Indicators	Power, Fault, 4 x Channel Status	Power, Fault, 4 x Channel Status	Power, Fault, 8 x Channel Status	Power, Fault, 8 x Channel Status
Alarms	High/Low	High/Low	High, High-High, Low, Low-Low	High-High, High, Low, Low-Low
Alarm Deadband	Fixed at 1%	Fixed at 1%		User-Defined
Action on Line Fault Detection	Off, Drive Upscale or Drive Downscale	Off or Drive Upscale	Off, Drive Upscale or Drive Downscale	O/C Detection <1 sec
Resolution	15-bit plus sign	15-bit plus sign	16-bits	15-bit (mA) 14-bit (THC, RTD, Volt and Resistance)
Accuracy (% of span)	25°C ±0.05%, +10 to 40°C ±0.1% -40 to 70°C ±0.3%	25°C ±0.05%, +10 to 40°C ±0.1% -40 to 70°C ±0.2%	±0.1% of span ±0.05% of span repeatability	10°C to 40°C – ±0.1% to 0.3% (depends on input type) -40°C to 70°C – ± 0.2% to 0.5% (depends on input type)
Repeatability			0.05% of span	0.05% of span
Response Time*	120 ms min. 420 ms max.	180 ms min. 840 ms max.	27 ms	11 ms min. (reduced resolution) 505 ms max.
Channel to Channel Isolation	None	None	None	250 VAC rms
Input Dead Zone	User-Defined; Zero Default	User-Defined; Zero Default	User-Defined; Zero Default	User-Defined; Zero Default
HART Data	N/A	N/A	N/A	N/A
Filtering	Off, 2-Reading Avg. Running Avg.	Off, 2-Reading Avg. Running Avg.	User Selectable Filter and Sample Rates	User Selectable Filter and Sample Rates
Field Circuits	Non-incendive	Non-incendive	Non-incendive	Non-incendive
System Power (12 V)	150 mA typ., 200 mA max.	150 mA typ., 200 mA max.	100 mA typ., 150 mA max.	60 mA typ., 100 mA max.
Module Key Code	C1	C3	A1	A1
Module Width (mm)	42	42	42	42
Module Weight (g)	200	200	200	230
Compatible Field Terminals **General Purpose Wiring** **Non-incendive Wiring**	8605-FT-TC 8605-FT-TC	8606-FT-RT 8606-FT-RT	8615-FT-4W 8615-FT-4W	
Common PAC8000 Specifications	See Section xx for System Specifications	See Section xx for System Specifications	See Section xx for System Specifications	See Section xx for System Specifications

*Depends on filter and sample time configuration.

PAC8000 2/2 4-20 mA Analog Output Modules

PAC8000 4-20 mA Analog Output modules feature eight channels, with or without HART capability. The HART module 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 can be used to gather up to four dynamic HART process variables together with status information.

	8102-HO-IP	8104-AO-IP
Product Name	8-channel AO, 4-20 mA with HART	8-channel AO, 4-20 mA
Lifecycle Status	Active	Active
Module Type	Analog Output	Analog Output
Range	4 to 20 mA	4 to 20 mA
Bussed Field Power	24 VDC ±10% 300 mA max.	24 VDC ±10% 300 mA max.
Sample Rate	20 ms	20 ms
Full Signal Range	1 to 23 mA	1 to 23 mA
Channel State	User-Defined Active/Inactive	User-Defined Active/Inactive
LED Indicators	Power, Fault 8 x Channel Status	Power, Fault 8 x Channel Status
Open Loop Detection	0.7 ±0.25 mA for 1 sec	0.7 ±0.25 mA for 1 sec
HART Data	Pass through and acquisition	N/A
Resolution	12 bits stored as 16-bit unsigned	12 bits stored as 16-bit unsigned
Accuracy (Over Temp. Range)	±0.25% of span	±0.25% of span
Response Time	25 ms max. (mA mode) 0.75 s per channel (Hart mode)	25 ms max.
Channel to Channel Isolation	No	No
Channel to Railbus Isolation	100 VAC	100 VAC
Field Circuits	Non-incendive	Non-incendive
System Power (12 V)	100 mA typ. 150 mA max.	100 mA typ. 150 mA max.
Module Key Code	A4	A4
Module Width (mm)	42	42
Module Weight (g)	200	200
Compatible Field Terminals General Purpose Wiring	8602-FT-ST 8604-FT-FU	8602-FT-ST 8604-FT-FU
Non-incendive Wiring	8601-FT-ST 8603-FT-FU	8601-FT-ST 8603-FT-FU
Common PAC8000 Specifications	See Section xx for System Specifications	See Section xx for System Specifications

HAZARDOUS AREA ZONE 0/DIV1 — SAFE AREA OR ZONE 2/ DIV2 HAZARDOUS AREA

8-channel Analog Output

8–channel Analog Ouput, 4–20 mA with HART features:

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

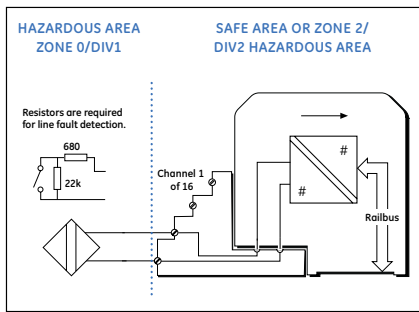|	8202-HO-IS
Product Name	8-channel Analog Output, 4–20 mA with HART
Lifecycle Status	Active
Outputs	
Number of Channels	8
Nominal Signal Range (span)	4 to 20 mA
Full Signal Range	1 to 22 mA
Voltage to Load	13 V min. @ 20 mA
Load Resistance	0 to 650 Ω max.
Accuracy (@ 25°C)	± 20 µA
Temperature Stability	(-40°C to + 70 °C) – ± 0.006% of span per °C
Resolution	12 bits
Open Circuit Detection Threshold	> 685 Ω (typ.) (also detects loads greater than driveable range)
Isolation	Any channel to Railbus – 60 VAC Between channels – None
Configurable Parameters	
Output Initialization State	Predefined value
Drive on "Fail-safe"	Upscale / downscale / last value
Channel Status	Active / Inactive
HART Variable and Status Reporting	Enable / Disable
Response Time	
Railbus Command to Output Change	4-20 mA mode – 20 ms (typ.) – 80 ms* (max.) HART mode – 1 s per channel
Safety – Location of Module	
Field Wiring Protection	[EEx ia] IIC
Safety Description (each channel)	V_o = 24.6 V, I_o = 93 mA, P_o = 0.57 W
FM Entity Parameters	$V_{oc} \leq$ 24.6 VDC, $I_{sc} \leq$ 93 mA $C_a \leq$ 0.42 µF, $L_a \leq$ 4.2 mH
Power Supplies	
IS Railbus (12V) Current	All channels @ 22 mA into 650 Ω load – 630 mA
Power Dissipation Within Module	4.1 W (max.)
Module Key Code	A4
Module Width (mm)	42
Weight (g)	265
Field Terminals – Field Wiring Type	
Intrinsically Safe Standard	8621-FT-IS
Intrinsically Safe Loop Disconnect	8622-FT-IS
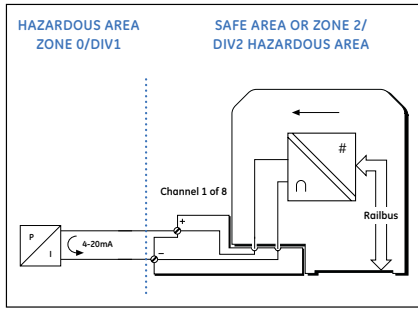
8-channel Analog Output

8-channel Analog Output, 4–20 mA features:

- 8 single-ended output channels
- Intrinsically safe
- Conventional 4–20 mA
- Open-circuit field wiring detection

	8204-HO-IS
Product Name	**8-channel Analog Output, 4–20 mA**
Lifecycle Status	Active
Outputs	
Number of channels	8
Nominal Signal Range (span)	-4 to 20 mA
Full Signal Range	1 to 22 mA
Voltage to Load	13 V min. @ 20 mA
Load Resistance	450 Ω max.
Accuracy (@ 25°C)	± 20 µA
Temperature Stability	(-40°C to +70 °C) – ± 0.006% of span per °C
Resolution	12 bits
Open Circuit Detection Threshold	0.7 mA ± 0.2 mA
Isolation	Any channel to Railbus – 60 VAC Between channels – None
Configurable Parameters	
Output Initialization State	Predefined value
Drive on "Fail-safe"	Upscale / downscale / last value
Channel Status	Active / Inactive
Safety	
Field Wiring Protection	[EEx ia] IIC
Safety Description	$V_o = 24.6$ V, $I_o = 93$ mA, $P_o = 0.57$ W
Power Supplies	
IS Railbus (12V) Current	All channels @ 22 mA into 530 Ω load – 630 mA
Power Dissipation Within Module	3.8 W (max.)
Module Key Code	A4
Module Width (mm)	42
Weight (g)	245
Field Terminals – Field Wiring Type	
Intrinsically Safe Standard	8621-FT-IS
Intrinsically Safe Loop Disconnect	8622-FT-IS

HAZARDOUS AREA ZONE 0/DIV1 — SAFE AREA OR ZONE 2/DIV2 HAZARDOUS AREA

16-channel Discrete Input

16-channel Discrete Input, Switch/proximity detector features:

- 16 single-ended input channels
- Intrinsically safe field circuits
- Simple apparatus, dry contacts or IS proximity detectors
- Open and short-circuit field wiring detection

	8220-DI-IS
Product Name	16-channel Discrete Input, Switch/proximity detector
Lifecycle Status	Active
Inputs	
Number of Channels	16
OFF Current	<1.2 mA
ON Current	>2.1 mA
Switching Hysteresis	200 µA (nom.)
Applicable Specifications	NAMUR, DIN19234
Voltage Applied to Sensor	7.0 to 9.0 V from 1 kΩ ±10%
Output (wetting) Current	@ 100Ω line impedance >6 mA
Line Fault Detection	Short circuit <100 Ω Open circuit >90 kΩ
Maximum Input Frequency in Pulse Counting Mode	20 Hz
Minimum Pulse Width Detected	45 ms
Configurable Parameters	
Selectable Input Filter	Fast, slow or user defined (User defined permits 0 to 512 ms 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	
Field Event to Availability on Railbus	6 ms (max.)
Safety	
Field Wiring Protection	[EEx ia] IIC
Safety Description (each channel)	U_o = 10.5 V, I_o = 14 mA, P_o = 0.04 W
FM Entity Parameters	$V_{oc} \leq 10.5$ VDC, $I_{sc} \leq 14$ mA $C_a \leq 2.67$ µF, $L_a \leq 176$ mH
Isolation	Any channel to Railbus – 60 VAC (channels arranged in two groups of eight, with returns commoned within each group)
Power Supplies	
IS Railbus (12V) Current	(16-channel mode) – 350 mA (max.) (8-channel mode) – 285 mA (max.)
Module Key Code	B1
Module Width (mm)	42
Weight (g)	170
Field Terminals – Field Wiring Type	
Intrinsically Safe, 16-channel	8623-FT-IS
Intrinsically Safe, 8-channel Loop Disconnect	8624-FT-IS

PAC8000 2/2 DC Discrete Input Modules

PAC8000 2/2 DC Discrete Input Modules can accept up to 8, 16 or 32 discrete inputs, depending on module type. Inputs can be from dry contacts, NAMUR standard proximity detectors or switched voltages. The source voltage for the field wiring can be provided through the module (sourcing) or from an independent field supply (sinking). In operation, the input voltage is compared against a threshold voltage to create a 'true' or 'false' condition. A pulse counter is also included, which can count the number of input pulses for each of the channels.

The 8127-DI-SE module is capable of carrying out time stamping of input changes for sequence of events recording.

	8109-DI-DC	8110-DI-DC	8121-DI-DC
Product Name	8-channel DI, 24 VDC, isolated, sinking	8-channel DI, 24 VDC, non-isolated, sourcing	16-channel DI, 24 VDC, non-isolated, sourcing
Lifecycle Status	Active	Active	Active
Module Type	Discrete Input	Discrete Input	Discrete Input
Maximum Voltage	-25 V to +30 VDC	As per Bussed Field Power	As per Bussed Field Power
Latch	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low
Pulse Counting	Enable/Disable	Enable/Disable	Enable/Disable
LED Indicators	Power Fault 8 x Channel Status	Power Fault 8 x Channel Status	Power Fault 16 x Channel Status
Line Fault Detection	No	No	No
Filtering	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps
Input OFF	<3.2 VDC	<0.69 mA	<0.3 mA
Input ON	>11 VDC	>2.24 mA	>1.2 mA
Wetting Current	6.3 mA typ.	5 mA typ.	2.8 mA typ.
Minimum Pulse Width	3 ms	3 ms	5 ms
Maximum Switching Frequency	200 Hz	200 Hz	100 Hz
Response Time (max.)			
Channel to Channel Isolation		None	None
Channel to Railbus Isolation	250 VAC	250 VAC	250 VAC
Bussed Field Power Required	N/A	40 mA, 18-30 VDC	60 mA, 18-30 VDC
Field Circuits	Non-incendive	Non-incendive	Non-incendive
System Power (12 V)	35 mA typ., 55 mA max.	35 mA typ., 55 mA max.	90 mA typ., 135 mA max.
Module Key Code	B2	B1	E1
Module Width (mm)	42	42	42
Module Weight (g)	170	170	210
Compatible Field Terminals			
General Purpose Wiring	8602-FT-ST 8604-FT-FU	8602-FT-ST 8604-FT-FU	8617-FT-NI
Non-incendive Wiring	8610-FT-NA 8611-FT-FU	8601-FT-ST 8603-FT-FU	8617-FT-NI
Common PAC8000 Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications

PAC8000 2/1 Discrete Input Module

The PAC8000 Intrinsically Safe Discrete Input Module can interface to 16 channels of switch or proximity detector inputs. Open and short circuit line fault detection are provided for all input types. The inputs can be configured to latch or to be pulse counting – up to a frequency of 20 Hz with a minimum pulse width of 45 ms.

	8121-DI-DC
Product Name	16-channel Intrinsically Safe DI Switch/ proximity Detector Discrete Input
Lifecycle Status	Active
Module Type	Discrete Input
Latch	User-Defined: Enable/Disable High/Low
Pulse Counting	Enable/Disable
LED Indicators	Power, Fault 16 x Channel Status
Line Fault Detection	Short circuit <100 Ω Open circuit >90 kΩ
Input OFF	<1.2 mA
Input ON	>2.1 mA
Wetting Current	>6 mA
Minimum Pulse Width	6 ms
Maximum Pulse Frequency	20 Hz
Response Time (max.)	
Channel to Channel Isolation	None
Channel to Railbus Isolation	60 VAC (channels arranged in two groups of 8, with returns commoned within each group)
Field Circuits	[EEx ia] IIC
System Power (12 V)	350 mA max. (16-ch mode) 285 mA max. (8-ch mode)
Module Key Code	B1
Module Width (mm)	42
Module Weight (g)	170
Compatible Field Terminals	8623-FT-IS 8624-FT-IS
Common PAC8000 Specifications	See Section 14 for System Specifications

PAC8000 2/2 DC Discrete Input Modules

PAC8000 2/2 DC Discrete Input Modules can accept up to 8, 16 or 32 discrete inputs, depending on module type. Inputs can be from dry contacts, NAMUR standard proximity detectors or switched voltages. The source voltage for the field wiring can be provided through the module (sourcing) or from an independent field supply (sinking). In operation, the input voltage is compared against a threshold voltage to create a 'true' or 'false' condition. A pulse counter is also included, which can count the number of input pulses for each of the channels.

The 8127-DI-SE module is capable of carrying out time stamping of input changes for sequence of events recording.

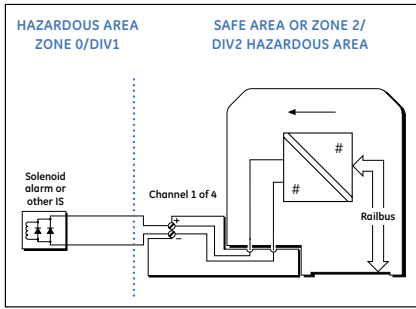|	8122-DI-DC	8125-DI-DC	8127-DI-SE
Product Name	16-channel 24 VDC, isolated, sinking	32-channel DI, 24 VDC non-isolated, sourcing	32-channel SOE DI 24 VDC non-isolated, sourcing
Lifecycle Status	Active	Active	Active
Module Type	Discrete Input	Discrete Input	SOE Input
Maximum Voltage	-25 V to +30 VDC	As per Bussed Field Power	0 to 12 VDC
Latch	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low
Pulse Counting	Enable/Disable	Enable/Disable	Enable/Disable
LED Indicators	Power Fault 16 x Channel Status	Power Fault 32 x Channel Status	Power Fault 32 x Channel Status
Line Fault Detection	No	Short circuit <100 Ω, Open circuit <50 µA	Short circuit <100 Ω, Open circuit <50 µA
Filtering	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps
Input OFF	<3.4 VDC	<1.2 mA	<1.2 mA
Input ON	>11 VDC	>2.1 mA	>2.1 mA
Wetting Current	2.8 mA typ.	8.6 mA typ.	8.6 mA typ.
Minimum Pulse Width	5 ms	250 µs	250 µs
Maximum Switching Frequency	100 Hz	500 Hz	500 Hz
Response Time (max.)			
Channel to Channel Isolation	150 V peak	None	None
Channel to Railbus Isolation	250 VAC	250 VAC	250 VAC
Bussed Field Power Required	N/A	190 mA, 18-30 VDC	190 mA, 18-30 VDC
Field Circuits	Non-incendive	Non-arcing	Non-incendive
System Power (12 V)	90 mA typ., 135 mA max.	<50 mA	<50 mA
Module Key Code	E2	B3	B3
Module Width (mm)	42	42	42
Module Weight (g)	210	185	185
Compatible Field Terminals General Purpose Wiring	8617-FT-NI	8617-FT-NI 8619-FT-MT*	8617-FT-NI 8619-FT-MT*
Non-incendive Wiring	8617-FT-NI	8617-FT-NI 8619-FT-MT*	8617-FT-NI 8619-FT-MT*
Common PAC8000 Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications

* When using 8619-FT-MT mass termination assembly, channel current should be externally limited to 250 mA. Ensure both ribbon cables are in place.

When used with a PAC8000 Controller or the Ethernet BIM, the 8127-DI-SE can perform time stamping on input data to within 0.25 ms (max.) between two channels within the same module, 0.5 ms (max.) for channels on different modules on the same node and 5 ms (typ.) for channels on different nodes (the latter depending mainly on the accuracy of the Network Time Reference employed). The module can store up to 480 events. The execution cycle of the node must be such that the event store does not overflow between consecutive reads of the module by the Controller. The maximum recording rate for the SOE module is 64k events / second. SOE functions are not supported on serial BIMs (8502-BI-DP, 8505-BI-MB, 8507-BI-DP) or the PROFINET BIMs (8515-BI-PN, 8516-BI-PN).

PAC8000 2/2 AC Discrete Input Modules

AC Discrete Input modules can accept up to 8 or 16 inputs, depending on module type. The source voltage for field switching can be provided through the module (sourcing modules) or from an independent field supply (sinking modules). In operation, the input voltage is compared against a threshold voltage to create a 'true' or 'false' condition. A pulse counter is also included which can count the number of input pulses for each of the channels.

	8111-DI-AC	8112-DI-AC	8113-DI-AC	8114-DI-AC	8140-DI-AC
Product Name	8-channel DI, 115 VAC, isolated, sinking	8-channel DI, 115 VAC, non-isolated, sourcing	8-channel 230 VAC, isolated, sinking	8-channel DI, 230 VAC, non-isolated, sourcing	16-channel DI, 115 VAC, isolated, sinking
Lifecycle Status	Active	Active	Active	Active	Active
Module Type	Discrete Input	Discrete Input	Discrete Input	Discrete Input	Discrete Input
Latch	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low	User-Defined: Enable/Disable High/Low
Pulse Counting	Enable/Disable	Enable/Disable	Enable/Disable	Enable/Disable	Enable/Disable
Pulse Counting Maximum Frequency					
Pulse Counting Minimum Pulse Width					
LED Indicators	Power Fault 8 x Channel Status	Power Fault 8 x Channel Status	Power Fault 8 x Channel Status	Power Fault 8 x Channel Status	Power Fault 16 x Channel Status
Line Fault Detection	No	No	No	No	No
Filtering	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps	Fast (22 ms), Slow (258 ms) or User Defined: 2 to 512 ms in 2 ms steps
Input OFF	<34 VAC	<0.56 mA	<68 VAC	<0.28 mA	<34 VAC
Input ON	>84 VAC	>1.4 mA	>168 VAC	>0.71 mA	>84 VAC
Wetting Current	2 mA nominal	2 mA nominal	1 mA nominal	1 mA nominal	1.9 mA nominal
Maximum Input Voltage	130 VAC	As Bussed Field Power	265 VAC	As Bussed Field Power	
Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Response Time (max.)	33 ms	33 ms	33 ms	33 ms	33 ms
Channel to Channel Isolation		No		No	275 VAC max. between 4-ch blocks
Channel to Railbus Isolation					275 VAC max.
Bussed Field Power Required	No		No		No
Field Circuits	Non-arcing	Non-arcing	Non-arcing	Non-arcing	Non-arcing
Railbus Current (12 V)	40 mA typ., 60 mA max.	40 mA typ., 60 mA max.	40 mA typ., 60 mA max.	40 mA typ., 60 mA max.	110 mA typ.
Module Key Code	E4	E1	E5	E2	E3
Module Width (mm)	42	42	42	42	42
Module Weight (g)	170	170	170	170	170
Compatible Field Terminals General Purpose Wiring	8602-FT-ST 8604-FT-FU	8604-FT-FU 8602-FT-ST	8602-FT-ST 8604-FT-FU	8604-FT-FU 8602-FT-ST	8612-FT-NA
Non-incendive Wiring	8610-FT-NA 8611-FT-FU	8611-FT-FU 8610-FT-NA	8610-FT-NA 8611-FT-FU	8611-FT-FU 8610-FT-NA	8612-FT-NA
Common PAC8000 Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications

HAZARDOUS AREA ZONE 0/DIV1   SAFE AREA OR ZONE 2/ DIV2 HAZARDOUS AREA

Solenoid alarm or other IS

Channel 1 of 4

Railbus

4-channel Discrete Output

4-channel Discrete Output, 4 Solenoid driver, IIC gas groups features:

- 4 single-ended output channels
- Intrinsically safe field circuits
- Solenoid valves and alarms or LED indicators
- Line-fault detection

	8215-DO-IS
Product Name	4-channel Discrete Output, 4 Solenoid driver, IIC gas groups
Lifecycle Status	Active
Outputs	
Number of Channels	4
Minimum Output Voltage	Open circuit – 22 V 45 mA load – 11 V
Maximum Output Voltage	25 V
Current Limit per Channel	45 mA (min.)
Output Supply Ripple	<0.5% of output (pk. to pk.)
Line Fault Detection	Short circuit – <15 Ω Open circuit – >13 kΩ
Isolation	Any channel to Railbus – 60 VAC Between channels – None
Configurable Parameters	
Output Initialization State	High / low
Output State on "Fail-safe"	High / low / last value
Channel Status	Active / Inactive
Operation Mode	Static / dynamic
Output	Discrete / momentary pulse / continuous pulse
Pulse Width	2 ms to 130 s
Duty Cycle	2 ms to 130 s (0.01% to 99.99%)
Line Fault Detection	Enable / Disable
Response Time	
Railbus Command to Output Change	10 ms (typ.)
Safety	
Field Wiring Protection	[EEx ia] IIC
Safety Description (each channel)	V_o = 25 V, I_o = 110 mA, P_o = 0.69 W
FM Entity Parameters	$V_{oc} \leq$ 25 VDC, $I_{sc} \leq$ 110 mA $C_a \leq$ 0.19 µF, $L_a \leq$ 3.15 mH
Power Supplies	
IS Railbus (12V) Current	560 mA (max.)
Power Dissipation Within Module	3.7 W (max.)
Module Key Code	B5
Module Width (mm)	42
Weight (g)	220
Field Terminals – Field Wiring Type	
Intrinsically Safe Standard	8621-FT-IS
Intrinsically Safe Loop Disconnect	8622-FT-IS

PAC8000 2/2 DC Discrete Output Modules

DC discrete output modules can provide 8 or 16 discrete channels, depending upon module type. The output voltage for the sourcing types is determined by the Bussed Field Power connected to the I/O Carrier. (Note – each BFP connection provides the field power to two adjacent I/O modules). All modules feature solid state relay outputs for reliability – with 8-channel modules switching 1 A per channel continuous and 16-channel modules switching 0.5 A continuous. Higher currents can be switched for short periods of time, with the limit of 16 A per module. 8-channel modules can be used with the field terminals that include fused disconnects to simplify panel design.

|	8115-DO-DC	8117-DO-DC	8142-DO-DC
Product Name	8-channel DO, 2-60 VDC, non-isolated, sourcing	8-channel DO, 2-60 VDC, isolated, sinking	8-channel DO, 24 VDC, non-isolated, sourcing
Lifecycle Status	Active	Active	Active
Module Type	Discrete Output	Discrete Output	Discrete Output
Output Voltage	2 to 60 VDC	2 to 60 VDC	12 to 42 VDC
Output Modes	Discrete / Momentary or Continuous Pulsed	Discrete / Momentary or Continuous Pulsed	Discrete / Momentary or Continuous Pulsed
LED Indicators	Power, Fault 8 x Channel Status	Power, Fault 8 x Channel Status	Power, Fault 8 x Channel Status
Line Fault Detection	No	No	No
Pulse Width	2 ms to 130 s	2 ms to 130 s	500 ms to 60 s
ON Voltage Drop	0.25 V max.	0.25 V max.	<0.25 V @ 0.5 A/channel <0.75 V @ 6 A module total
OFF Leakage Current	1 mA max.	1 mA max.	1 mA max.
Switched Current (per channel)	1 A Continuous$^\Delta$ 4 A for <100 ms 6 A for <20 ms	1 A Continuous 4 A for <100 ms 6 A for <20 ms	0.5 A max. per channel 6 A max. per module
Min. Load Current per Channel	N/A	N/A	N/A
Response	1 ms	3 ms	2 ms
Bussed Field Power Required	2 to 60 VDC	No	12 to 42 VDC, 6 A max.
Field Circuits	Non-arcing	Non-arcing	Non-arcing
System Power (12 V)	75 mA typ., 125 mA max.	45 mA typ., 70 mA max.	80 mA typ., 125 mA max.
Module Key Code	B6	B5	B4
Module Width (mm)	42	42	42
Module Weight (g)	200	200	220
Compatible Field Terminals General Purpose Wiring Non-incentive Wiring	8604-FT-FU 8602-FT-ST 8611-FT-FT 8610-FT-NA	8604-FT-FU 8602-FT-ST 8611-FT-FT 8610-FT-NA	8612-FT-NA 8619-FT-MT* 8612-FT-NA
Common PAC8000 Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications

$^\Delta$ Note the 8129-IO-DC module can supply 2 A continuous at 24 VDC, if higher current capacity is required than can be supplied by the 8115-DO-DC.

* When using 8619-FT-MT mass termination assembly, channel current should be externally limited to 250 mA. Ensure both ribbon cables are in place.

PAC8000 2/2 AC Discrete Output Modules

AC Discrete Output modules can provide up to 8 outputs, sourcing or sinking, depending upon module type. The output voltage for the sourcing type is determined by the Bussed Field Power connected to the I/O Carrier. (Note – each BFP connection provides the field power to two adjacent I/O modules). Both modules feature solid state relay outputs for reliability – switching 1 A per channel continuous, (3 A maximum continuous for each module). Higher currents can be switched for short periods of time. Fused field terminals can be used to simplify panel design.

	8116-DO-AC	8118-DO-AC
Product Name	8-channel DO, 20-265 VAC, non-isolated, sourcing	8-channel DO, 20-265 VAC, isolated, sinking
Lifecycle Status	Active	Active
Module Type	Discrete Output	Discrete Output
Output Voltage	20 to 265 VAC 50/60 Hz	20 to 265 VAC 50/60 Hz
LED Indicators	Power, Fault 8 x Channel Status	Power, Fault 8 x Channel Status
Pulse Width	2 ms to 130 s	2 ms to 130 s
ON Voltage Drop	<1.2 V	<1.2 V
OFF Leakage Current	<4 mA	<4 mA
Switched Current (per channel)	1 A Continuous 5 A for <100 ms 20 A for <20 ms	1 A Continuous 5 A for <100 ms 20 A for <20 ms
Min. Load Current per Channel	11 mA @ 115 VAC 5 mA @ 230 VAC	11 mA @ 115 VAC 5 mA @ 230 VAC
Response Time	2 ms + 11/42 cycle of mains frequency	2 ms + 11/42 cycle of mains frequency
Bussed Field Power Required	20 to 265 VAC	No
Field Circuits	Non-arcing	Non-arcing
Railbus Current (12 V)	75 mA typ., 125 mA max.	75 mA typ., 125 mA max.
Module Key Code	F1	F4
Module Width (mm)	42	42
Module Weight (g)	220	220
Compatible Field Terminals		
General Purpose Wiring	8604-FT-FU 8602-FT-ST	8604-FT-FU 8602-FT-ST
Non-incendive Wiring	8611-FT-ST 8610-FT-NA	8611-FT-ST 8610-FT-NA
Common PAC8000 Specifications	See Section 14 for System Specifications	See Section 14 for System Specifications
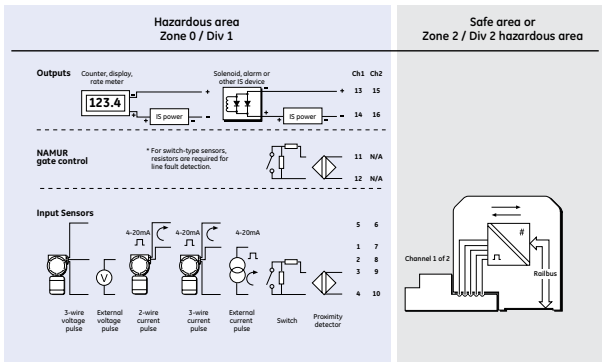
Pulse Input Module

Pulse Input Module, 2-channel pulse input features:

- 2 input channels with power supplies or single quadrature input
- 1 Hz to 50 kHz signal capability
- Frequency and 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

	8223-PI-IS
Product Name	Pulse Input Module, 2-channel pulse input
Lifecycle Status	Active
Pulse/Frequency	
Number of Channels	2
Frequency Range	50 kHz In quadrature mode – 12.5 kHz
Accuracy (25°C)	± 0.05% of span
Temperature Stability	0.005% / °C
Control Gate (for gating Channel 1 only)	
Switching Thresholds	1.2 mA / 2.1 mA
Input Impedance	1 kΩ
Supply Voltage	8.1 V (nom.) at 8 mA
Sensor Input Characteristics	
Namur 1	
Switching Thresholds	1.2 mA / 2.1 mA
Input Impedance	1 kΩ
Supply Voltage	8.1 V (nom.) at 8 mA
Current	
Input Signal	20 mA (max.)
Threshold	Configurable in 8 levels
Input Impedance	25 Ω
Open Circuit Current	<0.5 mA
Short Circuit Current	>21.5 mA
Voltage	
Input Signal	0 - 24 VDC (50 V max.)
Threshold	Configurable in 8 levels
Input Impedance	>10 kΩ
Switching Hysteresis	100 mV
Switch	
Input Voltage Range	0 – 10 VDC
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	30 V (max)
OFF State Leakage Current	10µA (max)
ON State Voltage Drop	<1.0V @ 50 mA
ON State Current	100 mA
Retransmission Bandwidth	1 2000 Hz
Configurable Parameters	
Inputs	
Channel	Enable / Disable
Sensor type	NAMUR prox. type (select low / high speed) Current pulse input Voltage pulse input Switch input

table continued on next page

Frequency Ranges	0.1, 0.3, 0.5, 1, 3, 5, 10, 30, 50, 100[†] kHz
Sample Period	20 ms to 200 s
Quadrature	Enable / Disable
Threshold Level	User defined values
Triggering	Rising edge / falling edge
Filtering	Off, 1, 5, 20, 100 kHz
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
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 – 25
Control Gate 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	60 VAC
Between Input Channels	None (common 0V connection)
Between Output Channels	30 VAC
Response Times	
Signal Change to Availability on Railbus	25 ms (max.)
Power Supplies	
Railbus Current (both channels @22 mA)	300 mA (max.)
Power Dissipation (both channels @22 mA)	2.8 W (max.) No load – 2.0 W (max.)
Module Key Code	F2
Module Width (mm)	42
Weight (g)	260
Safety	
Field Wiring Protection	[EEx ia] IIC ([EEx ia] IIB with BEI Optical Encoder)
The following figures are for Gas Groups A/B (IIC) unless otherwise stated.	
24V TX Supplies (Ch1 & Ch2)	U_o = 27.4 V, I_o = 93.2 mA, P_o = 639 m C_o = 0.087 µF, L_o = 4.2 mH
Current Inputs (Ch1 & Ch2)	U_o = ± 1.1 V, I_o = 53 mA, P_o = 15 mW U_i = 1.1 V, I_i = 50 mA C_o = 1000 µF, L_o = 13.1 mH
Voltage Inputs (Ch1 & Ch2)	
NAMUR Inputs (Ch1 & Ch2)	

Notes:

[†]While measurements can be made in the upper half of this range, the stated accuracy applies only to frequencies up to 50kHz.

NAMUR Gate Input (Ch1)	U_o = 9.6 V, I_o = 25 mA, P_o = 57 mW Ui = 18.2 V, Pi = 333 mW C_o = 3.6 µF, L_o = 56.6 mH
Discrete Outputs (Ch1 & Ch2)	Ui = 30 V, Pi = 333 mW
All Circuits Combined Within One Channel	U_o = 28.5 V, I_o = 93.2 mA (or 169mA at 13.4V), P_o = 639 mW, C_o = 0.078 µF, L_o = 1.28 mH
FM Entity Parameters	
24V TX Supplies (Ch1 & Ch2)	U_o = 27.4 V, I_o = 93.2 mA, P_o = 639 mW C_a = 0.08 µF, L_a = 4.1 mH
24V TX Supplies (Ch1 & Ch2 connected together)	Gas Groups C,E (IIB): U_o = 27.4 V, I_o = 186.4 mA, P_o = 1.28 W C_a = 0.67 µF, L_a = 4.3 mH
Current Inputs (Ch1 & Ch2)	U_o = 1.2 V, I_o = 57.4 mA, P_o = 17.2 mW C_a = 1000 µF, L_a = 10.6 mH
3-wire Current Inputs (Ch1 & Ch2)	Gas Groups C,E (IIB): U_o = 27.4 V, I_o = 150.6 mA, P_o = 656 mW C_a = 0.67 µF, L_a = 6.4 mH
Voltage Inputs (Ch1 & Ch2)	U_o = 9.56 V, I_o = 1.0 mA, P_o = 2.39 mW C_a = 3.7 µF, L_a = 1000 mH
3-wire Voltage Inputs (Ch1 & Ch2)	U_o = 27.4 V, I_o = 93.2 mA, P_o = 642 mW C_a = 0.08 µF, L_a = 4.0 mH
NAMUR Inputs (Ch1 & Ch2)	
NAMUR Gate Input (Ch1)	Uo = 9.56 V, Io = 11.1 mA, Po = 26.4 mW Ca = 3.7 µF, La = 263 mH
Discrete Outputs (Ch1 & Ch2)	Ui = 30 V, Ii = 100 mA Ci = 0 µF, Li = 0 mH
Field Terminals – Field Wiring	
Intrinsically Safe, Standard	8621-FT-IS

Terminal Assignments

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

PAC8000 2/2 Pulse/Quadrature Input Module

The PAC8000 Pulse/Quadrature Input Module is a 2-channel device, when used for simple pulse inputs, and a single channel device when used for quadrature pulse measurement with suitable encoders. In pulse mode the module can count pulses at up to 50kHz, in quadrature mode up to 12.5kHz. The unit can measure pulse counts, pulse frequency or rate of acceleration.

Pulse input channels can be configured independently to interface to 2- or 3-wire 4-20 mA transmitters, voltage or current sources and switches or proximity detectors. Thresholds for pulse counting can be configured by the user, depending on the field instrument type. When using dry contacts, if suitable resistors are incorporated in to the field wiring loop, the unit can detect open and short circuit line faults. Additional terminals are provided for re-transmission of the detected inputs (up to 2kHz) and to allow an input to "gate" (start/stop) the Channel 1 pulse counter.

	8123-PI-QU
Product Name	Pulse/Quadrature Input
Lifecycle Status	Active
Module Type	Pulse Input
Number of Channels	2 pulse counting inputs, 1 gate input, 2 re-transmission outputs
Max. Pulse Frequency	50kHz, 12.5kHz quadrature
Sensor Type	NAMUR Proximity Current Pulse, Voltage Pulse, Switch
LED Indicators	Power, Fault, 2 x Pulse Input Status 2 x Output Channel Status
Alarms	User-Defined: Preset Counter Value, Low/High Frequency Low/High Acceleration, Missing Pulse, Line Fault
Counter Type	Up/Down
Counter Resolution	32 bit
Counter Control Data	Start/stop/set/reset/preset
NAMUR Input Data	Thresholds 1.2 mA/2.1 mA Input impedance 1 kΩ, Supply voltage 8.1 V
Current Source Input Data	Input current 4-20 mA Thresholds 8 configurable levels, Input impedance 250 Ω
Voltage Source Input Data	Input voltage 0–24 VDC Thresholds 8 configurable levels, Input impedance >10 kΩ
Gate Input Data	Thresholds 1.2 mA/2.1 mA Input impedance 1 kΩ, Supply voltage 8.1 V
Output Channel Data	Sinking output, On state current 100 mA Off state leakage 10 µA max. On state voltage drop <1 V at 50 mA
Response Time	25 ms max.
Bussed Field Power Required	24 VDC ±10%
Field Circuits	Non-incendive
System Power (12 V)	50 mA typ., 70 mA max.
Module Key Code	F2
Module Width (mm)	42
Module Weight (g)	260
Compatible Field Terminals **General Purpose Wiring** **Non-incendive Wiring**	8602-FT-ST 8601-FT-ST
Common PAC8000 Specifications	See Section 14 for System Specifications

PAC8000 2/1 Pulse/Quadrature Input Module

The PAC8000 Intrinsically Safe Pulse/Quadrature Input Module is a 2-channel device when used for simple pulse inputs, and a single channel device when used for quadrature pulse measurement with suitable encoders. In pulse mode the module can count pulses at up to 50kHz, in quadrature mode up to 12.5kHz. The unit can measure pulse counts, pulse frequency or rate of acceleration.

Pulse input channels can be configured independently to interface to 2- or 3-wire 4-20 mA transmitters, voltage or current sources and switches or proximity detectors. Thresholds for pulse counting can be configured by the user, depending on the field instrument type. When using dry contacts, if suitable resistors are incorporated in to the field wiring loop, the unit can detect open and short circuit line faults. Additional terminals are provided for re-transmission of the detected inputs (up to 2kHz) and to allow an input to "gate" (start/stop) the Channel 1 pulse counter.

	8123-PI-QU
Product Name	Pulse/Quadrature Input
Lifecycle Status	Active
Module Type	Pulse Input
Number of Channels	2 pulse counting inputs, 1 gate input, 2 re-transmission outputs
Max. Pulse Frequency	50 kHz, 12.5 kHz quadrature
Sensor Type	NAMUR Proximity, Current Pulse, Voltage Pulse, Switch
LED Indicators	Power, Fault, 2 x Pulse Input Status 2 x Output Channel Status
Alarms	User-Defined: Preset Counter Value, Low/High Frequency, Low/High Acceleration, Missing Pulse, Line Fault
Counter Type	Up/Down
Counter Resolution	32 bit
Counter Control Data	Start/stop/set/reset/preset
NAMUR Input Data	Thresholds 1.2 mA/2.1 mA Input impedance 1 kΩ Supply voltage 8.1 V
Current Source Input Data	Input current 4-20 mA Thresholds 8 configurable levels Input impedance >250 Ω
Voltage Source Input Data	Input voltage 0–24 VDC Thresholds 8 configurable levels Input impedance >10 kΩ
Gate Input Data	Thresholds 1.2 mA/2.1 mA Input impedance 1 kΩ, Supply voltage 8.1 V
Output Channel Data	Sinking output On state current 100 mA Off state leakage 10 µA max. On state voltage drop <1 V at 50 mA
Response Time	25 ms max.
Field Circuits	[EEx ia] IIC
System Power (12 V)	300 mA max. (both channels @ 22 mA)
Module Key Code	F2
Module Width (mm)	42
Module Weight (g)	260
Compatible Field Terminals	8621-FT-IS
Common PAC8000 Specifications	See Section 14 for System Specifications

PAC8000 2/2 DC Discrete HDC I/O Module

The PAC8000 Discrete HDC module is derived from the equivalent SafetyNet SIL 2 module – and features the same high level of internal and automatic Diagnostic Coverage (hence, HDC). The ability of the unit to detect and report its own internal faults ensures that, when used in redundant I/O applications, the Controller or host is provided with the data necessary to determine when operation should be switched to the standby module. The diagnostics also allow the host to be confident that the standby module has not developed a fault prior to being switched in as the new master.

The 8129-IO-DC has 8-channels which can be individually configured to be inputs or outputs. Outputs can switch up to 2 A per channel continuously and can also be configured to be pulse output.

	8129-IO-DC
Product Name	8-channel DI/DO, 24 VDC non-isolated, sourcing with High Diagnostic Coverage
Lifecycle Status	Active
Module Type	Discrete Input/Output Pulse Output
Input On / Off Threshold	0.9 mA typ.
Input Wetting Current	1.2 mA typ.
Input Minimum Pulse Width Detected	5 ms
Input Maximum Frequency in Pulse Counting Mode	30 Hz
Input Latching	User-Defined: Enable/Disable, Latch on High/Low
Pulse Counting	Up transition / Down transition / Disable
LED Indicators	Power, Fault 8 x Channel Status
Line Fault Detection	None, Open Circuit, Open and Short Circuit*
Input Filtering	0 to 8 s in 1 ms steps
Output Current	2 A per channel, 6 A per module (cont.) 8 A per module (<10s)
Output Minimum Pulse Width	1 ms to 60 s (pulse out)
Output Pulse Types	Pulse / Discrete / User selectable patterns
Frequency	30 Hz
Response Time	5 ms max. (inputs), 1 ms max. (outputs)
Channel to Channel Isolation	No
Channel to Railbus Isolation	250 VAC
Bussed Field Power Required	18-30 VDC, 50 mA (all inputs) 50 mA + output load (any outputs)
Field Circuits	Non-arcing
System Power (12 V)	50 mA typ., 70 mA max.
Bussed Field Power Input	24 VDC ±10%
Module Key Code	B6
Module Width (mm)	42
Module Weight (g)	210
Common PAC8000 Specifications	See Section 14 for System Specifications

* Only for inputs and normally de-energized outputs, not for normally energized outputs

PAC8000 2/2 4-20 mA Analog Input HDC Module

The PAC8000 4-20 mA Analog Input HDC module is derived from the equivalent SafetyNet SIL 2 module and features the same high level of internal and automatic Diagnostic Coverage (hence, HDC). The ability of the unit to detect and report its own internal faults ensures that, when used in redundant I/O applications, the Controller or host is provided with the data necessary to determine when operation should be switched to the standby module. The diagnostics also allow the host to be confident that the standby module has not developed a fault prior to being switched in as the new master.

Standard PAC8000 I/O Modules (such as the 4-20 mA Analog Output type) can be used with the Redundant Switching Module, but they do not carry the same level of internal diagnostic coverage as the HDC modules. The host would only switch to the standby module when line faults are detected or if the module enters failsafe as a result of a major internal fault.

The 8133-HI-TX has 8-channels for interfacing to conventional 4-20 mA circuits and supports both HART pass-through and acquisition.

	8133-HI-TX
Product Name	8-channel, 4-20 mA AI with HART and High Diagnostic Coverage
Lifecycle Status	Active
Module Type	Analog Input
Range	4 to 20 mA
Bussed Field Power Input	24 VDC ±10%, 300 mA (2-wire), 110 mA (4-wire)
Transmitter Type	2 or 4 wire
Sample Rate per Channel	27 ms
Full Signal Range	0.25-24 mA
Output Current	28 mA max.
Failsafe Mode	Low, high or hold last value
LED Indicators	Power, Fault, 8 x Channel Status
Alarms	Hi Hi, Hi, Lo, Lo Lo
Line Fault Detection	Open circuit <0.5 mA, Short circuit >23.5 mA
Resolution	16-bit unsigned
Accuracy (% of span)	±0.1%
Repeatability	0.05% of span
Response Time	25 ms max. (mA mode), 0.75 s per channel (Hart mode)
Channel to Channel Isolation	No
Dead Zone	User-Defined; Zero Default
HART Data	IEEE754 floating point
Filtering	Configurable
System Power (12 V)	50 mA typ., 70 mA max.
Module Key Code	A1
Module Width (mm)	42
Module Weight (g)	200
Compatible Field Terminals	
General Purpose Wiring	
Non-incendive Wiring	
Common PAC8000 Specifications	See Section 14 for System Specifications

PAC8000 2/2 Addressable Smoke and Heat Detector I/O Module

The PAC8000 Addressable Smoke and Heat Detector Module interfaces to devices that communicate Apollo Discovery protocol. Each module can manage a ring of devices – with both ends of the ring connected to a single module.

Up to 126 Apollo XP and Discovery devices (detectors, sounders, beacons and actuators) can interface to a single 8139-SH-DC module and each PAC8000 Node can support up to 10 8139-SH-DC modules. Intrinsically safe Apollo instruments are supported via Apollo protocol converters and isolators.

If required, like other standard modules, the 8139-SH-DC module can be mounted on SafetyNet Controller nodes to work alongside SIL 2 rated 4-20 mA point-to-point fire and gas detectors.

	8139-SH-DC
Product Name	**Addressable Smoke and Heat Detector Module**
Lifecycle Status	Active
Protocol Supported	Apollo Discovery for XP and Discovery detectors
Number of Devices	126
LED Indicators	Power, Fault Request, Status Poll IN, Poll OUT
Poll Time Per Device	Device not in alarm 45 ms typ. Device in alarm 135 ms typ.
Minimum Poll Time	600 ms
Channel to Railbus Isolation	250 VAC
Bussed Field Power Required	750 mA, 30 VDC max.
Field Circuits	Non-arcing
Railbus Current (12 V)	<100 mA
Module Key Code	C2
Module Width (mm)	42
Module Weight (g)	185
Compatible Field Terminals General Purpose Wiring	8610-FT-NA 8611-FT-FU
Non-incendive Wiring	8610-FT-NA 8611-FT-FU
Common PAC8000 Specifications	See Section 14 for System Specifications