GM INTERNATIONAL
TECHNOLOGY FOR SAFETY

SHORT FORM

INTRINSICALLY SAFE SIL CERTIFIED INSTRUMENTATION FOR HAZARDOUS AREAS

INDEX





Company Profile

Glisente Landrini is the President and Managing Director of G.M. International and of its worldwide subsidiaries.

In 1970 Mr. Landrini founded Elcon Instruments, which has been acknowledged as an international leader in the design and manufacturing of Intrinsically Safe products and systems.
Mr. Landrini started G.M. International to provide state of the art SIL rated products and services to support Intrinsically Safe applications in Oil & Gas, Petrochemical and Pharmaceutical Industries.

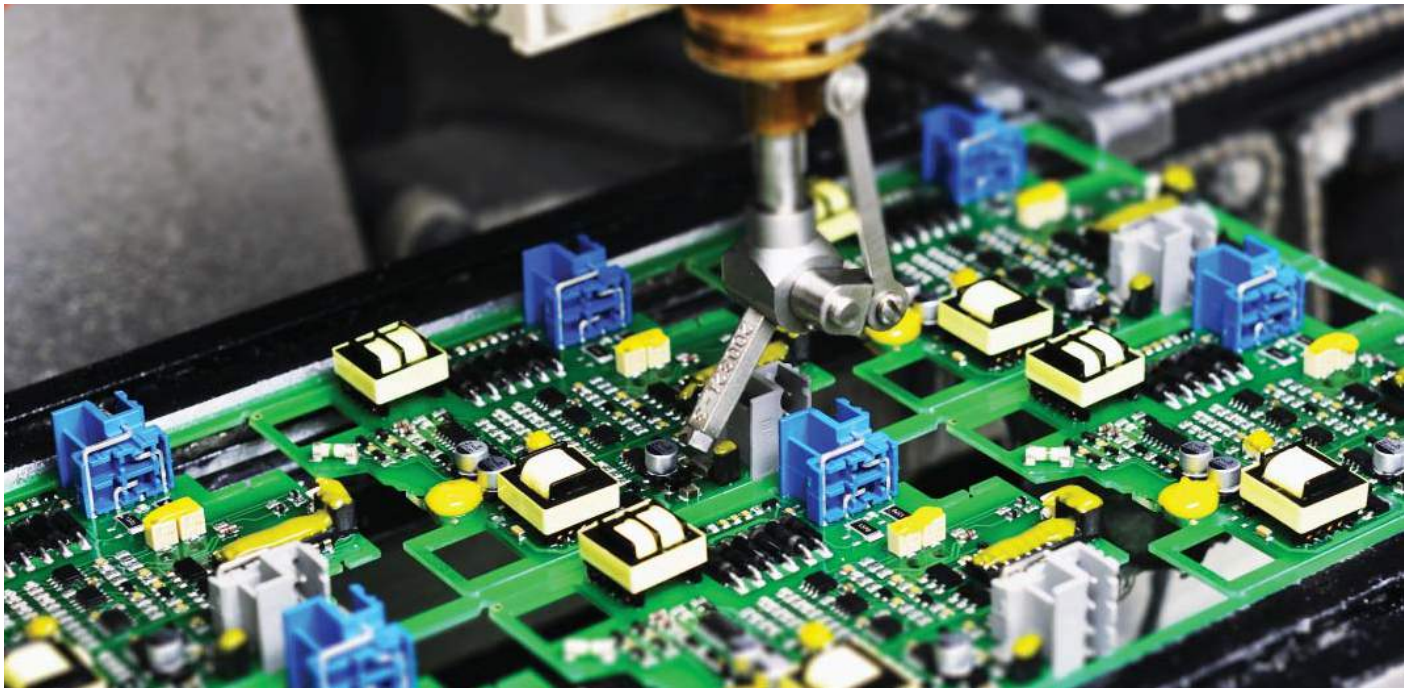
G.M. International was founded in 1993, but the core Management experience remarkably exceeds over 40 years of qualified activity in hazardous locations and industrial electronics.

G.M. International's products have been successfully installed in plants all over the world, including Europe, Russia, North America, Middle and Far East and China.

G.M. International's products are installed on all wiring between safe and hazardous areas and represent a fundamental, yet often under-estimated, layer of the instrumentation package.

Intrinsically Safe interfaces provide energy limitation to protect from risks of explosion. At the same time they must provide the highest grade of availability to guarantee both continuous operation and effectiveness of the safety layer.

G.M. International has obtained SIL 3 FSM approval by TÜV according to IEC 61508:2010 standard, and its products are certified up to SIL3, offering the greatest levels of functional safety for high integrity and critical applications.



MANUFACTURING EXCELLENCE

Laser Marking

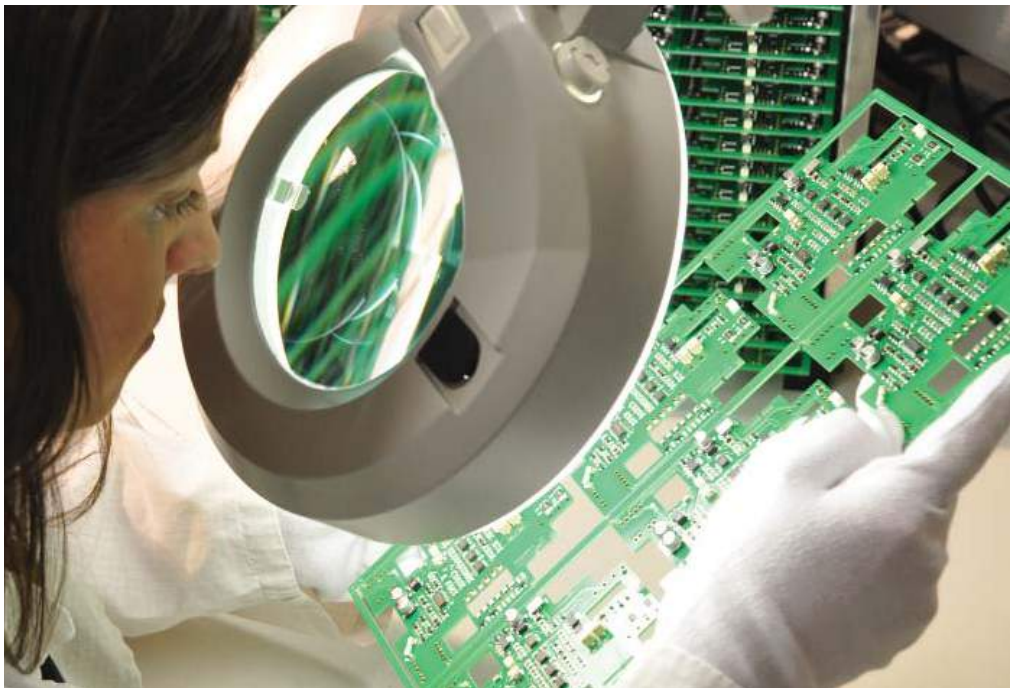
All markings are engraved using a state-of-the-art laser etching machine; permanent in every environmental condition.
Marking includes complete wiring diagrams, terminal block number assignments and certification data.

Product Traceability

All products follow a strict traceability standard. From the batch of components to customer assignment through every manufacturing and testing steps, all data of individual modules are stored.
Starting from the serial number, the complete history of any module can be traced through all production phases.

Protective G3 Coating

All units are treated with a “G3” compliant silicon based coating.
Such tropicalization is applied to improve electrical characteristics, as well as to protect from harsh environmental conditions.



QUALITY EXCELLENCE

Manufacturing Facilities

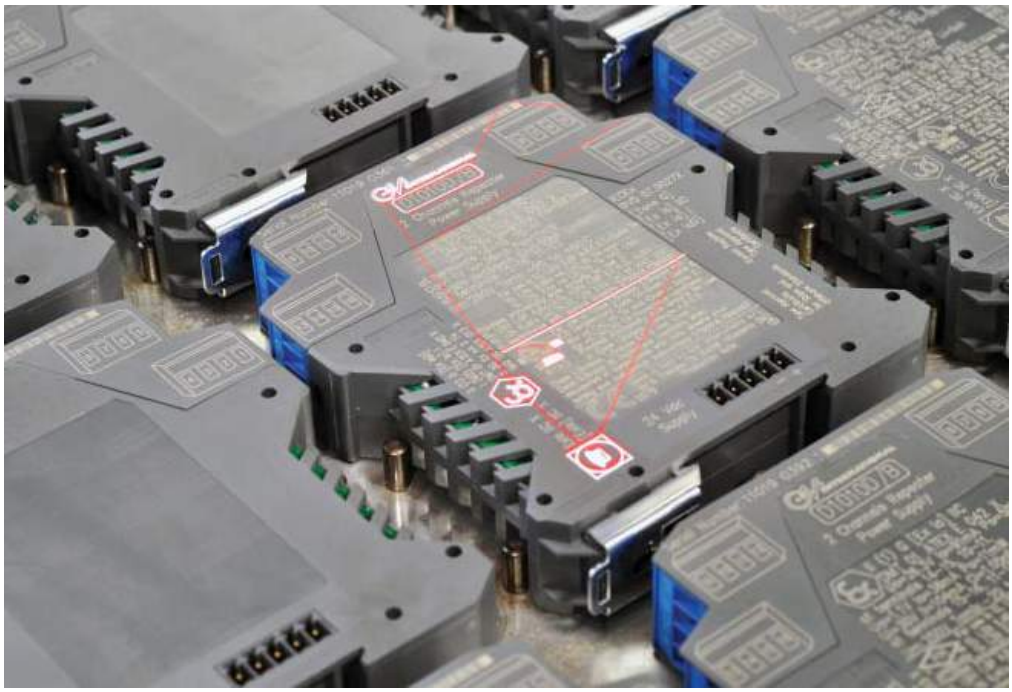
G.M. International's products are entirely manufactured in our facilities in Italy utilizing the latest technologies and machinery.
Having complete control on the manufacturing process ensures the highest level of quality and guarantees the greatest flexibility for all customers' requirements with improved delivery time for large or small orders alike.
Manufacturing equipments are constantly renewed and updated; Automatic Test Equipment, specifically developed by our engineering team, are constantly checked and calibrated against traceable standards to ensure accuracy and repeatability. The entire manufacturing process is SIL 3 certified by TÜV.

Quality

Quality is crucial to achieve customer satisfaction and market success.
G.M. International's products satisfy customers' expectations and meet the specifications of international standards.
Safety, performance, reliability and product documentation are the basic principles of product quality. G. M. International has obtained ISO 9001:2008 in 2006.

HSE

G.M. International also strives to conform to latest HSE standards and to all local Health and Safety regulations and requirements with continuous and extensive personnel formation and hands-on training. Management is committed to the highest achievable HSE level throughout all stages of our activities and, it is our policy to protect our employees, customers, subcontractors and the community. Our objective is to reduce risks to the lowest level in order to reach a HSE goal of zero incidents, confirmed by OHSAS 18001:2007 certification.



Our products are proudly assembled, calibrated and tested in Italy.

Innovative Design

D5000 and D6000 series modules use embedded Planar Transformers to guarantee the greatest reliability, accuracy and stability, as well as low manufacturing costs.
We strive to use the best industry components, qualified as a minimum for operations up to 85°C, and use advanced designed techniques to improve performances and quality. D5000 series does not use electrolytic capacitors and has obtained TÜV certification for 20 years lifetime.

100 % Testing

The entire production goes through rigorous and automated test and calibration procedures. Test bench calibration is verified several times during the day to guarantee correct and repeatable results. Our actual field return rate, verified according to ISO 9000:2008 records, is lower than 0.1%.

Cutting Edge Technology

Automated assembly lines allow us to improve quality and delivery time thus lowering manufacturing defects. Constant investments are made in the production line to keep abreast with the latest technology.

Made in Italy

Our products are proudly assembled, calibrated and tested in our own facilities in Villasanta, near Milan, ITALY.

GOALS AND VALUES

- Designing and manufacturing Intrinsically Safe Instruments certified up to level SIL 3 suitable to operate with Digital Control, Emergency Shutdowns and Fire & Gas Systems.
- Understanding, managing and reducing risks.
- Preventing accidents.
- Achieving 100% customer satisfaction.
- Demonstrating social responsibility and contributing to sustainable development.
- Minimizing impact on environment and climate, and creating a safe and healthy working environment.
- Improving HSE results.
- Identifying opportunities and challenges.
- Being imaginative and stimulate new ideas.
- Being truthful and act with integrity.
- Working together and sharing experience.
- Striving for simplification and clarity, and focusing on value-adding activities.

Continuous Education

Continuous training and improvement of our staff's skills and capacities are key points to enhancing company performances and customer's satisfaction.
G.M. International offers extra courses to raise our employees awareness of the company products and their use, in addition to mandatory training on HSE, Quality and manufacturing/testing practices.

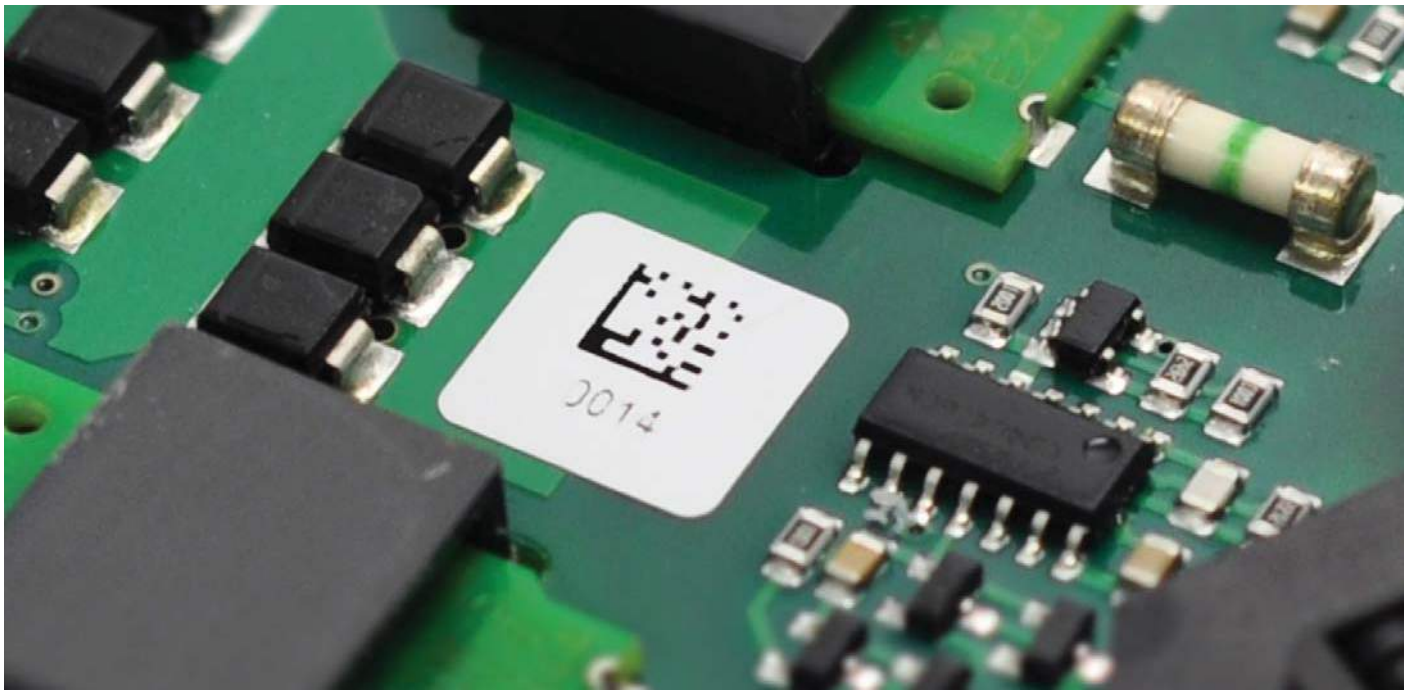
Customer Training

Special courses for engineering companies, end users and system integrators are also given both in-house and at customers sites on topics such as Intrinsic Safety (I.S.) and SIL levels of a Safety Instrumented System (SIS). Specifically, our SIL courses based on our SIL manual, have proven to be highly informative and have gained strong popularity.
G.M. International is a course promoter of the TÜV Rheinland Functional Safety Program for Safety Instrumented Systems (SIS) trainings, see our website for available dates. The main objective is to provide engineers involved in safety instrumented systems with elementary and necessary knowledge of functional safety, based on IEC 61508 and IEC 61511.

Customer Support

G.M. International considers service as an integral part of customer's requirements and satisfaction.
Among the services we offer:

- Cabinet assembly according to customer's specification and worldwide EX standards;
- System Engineering;
- Custom solutions tailored to customer's special requests;
- ISO 9000:2008 certified post sales assistance service.
- Factory Acceptance Tests (FAT) on products and assembled cabinets that can be staged in our facilities in Villasanta (MB) – Italy, at any of our subsidiaries or in the facilities of our worldwide system integrator partners.



Research and Development

G.M. International gives strategic importance to R&D activities and delivers products conforming to the latest standards.
Research, development and manufacturing are strengthened through large investments. Over 20% of the company employees are devoted to research, development and engineering of our products.
R&D personnel works closely with other company teams and keeps tight relationships with customers worldwide; together with our many years of experience in all fields of applications, these are key factors to deliver excellent products that fulfill requirements and anticipate market trends.
R&D department is also covered by a FSM SIL 3 Certification by TÜV.

Assembly Technology

We make use of the latest assembly technology such as SMD mounting of most components including terminal blocks and transformers.
Soldering is performed using reflow technology, industry highest standard. Automatic optical verification of all assembled plates is performed at the end of the assembly process to eliminate all flaws at the earliest stage.

Code of Ethics

All personell is highly qualified, experienced and undergoes continuous training. G.M. employees adhere to a strict code of ethics approved by the Board of Directors.

PRODUCT ADVANTAGES

SIL 3 according to IEC 61508/61511
SIL 3 level in 1oo1 configuration and total compliance with specifications for ESD, F&G, BMS.

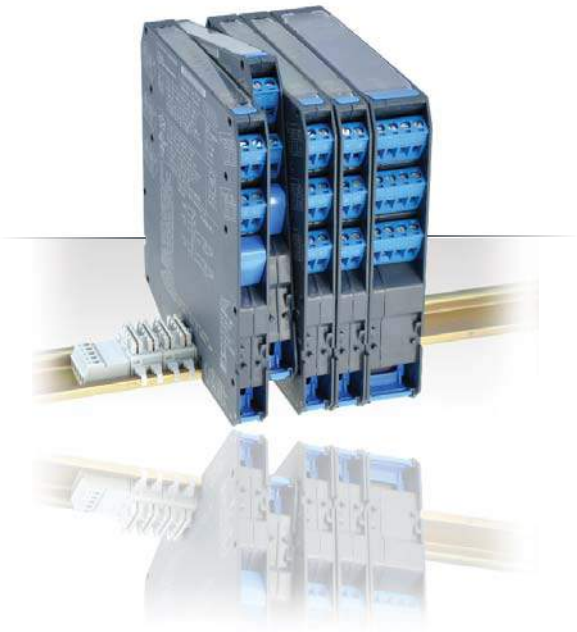
TÜV certification
TÜV guarantees that product specifications, manufacturing facilities and final products conform to the obtained certificate through unannounced inspections and rigorous design and manufacturing procedures.

5-10-20 years T-proof test time intervals
Lower testing requirements after installation result in vast cost savings.

SIL Level claimed using 10% of available PFD
With a 10% limit on the claimed PFD, more room is made available for other SIF components. This is of great help when components more prone to failure must be used in any given SIF.

Input from Zone 0, Division 1 for all products
Installations are possible with all Ex 'i' devices (Ex 'ia', Ex 'ib', Ex 'ic').

Zone 2/ Division 2 installation
Most modules are certified Ex 'n' for installation in classified areas (Zone/Division 2).



Marine Type Approval for offshore and ship applications
Better reliability under all working conditions, including harsh applications.

BUS option installation on standard DIN-Rail
Use of same "low profile" rail for Bus and non-Bus applications simplifies installation design.
For detailed advantages see page 20.

Universal installation options
DIN-Rail, Bus and Board Mountings are available as standard on all D5000 models.

Plug-in, hot swappable modules
Bus or Board mounted units can be replaced without disrupting power to contiguous modules.

20 Years Life Time Certification
Approved and tested for 20 years of continuous operation.

Line Monitoring capabilities
Available in AI, AO, DI and DO modules, both for open and short circuit conditions, signalled via: dry contact, impedance change and/or communication line.

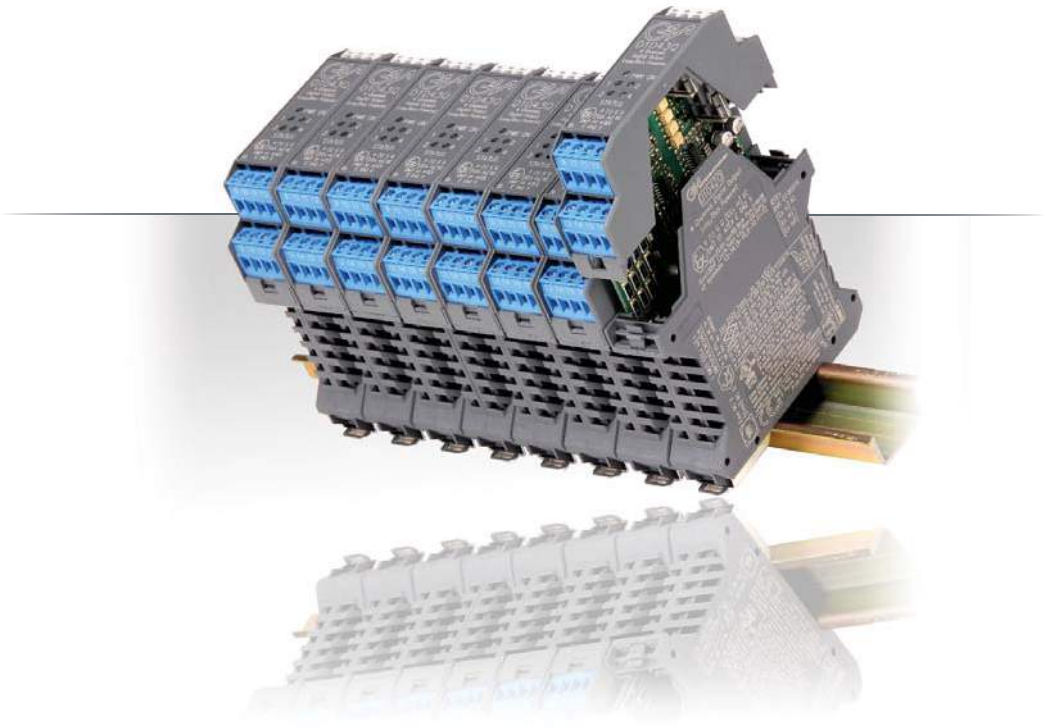
Alarm Functions
Local and remote alarm signalling for all potential failure conditions.

Transparent Line Monitoring
Most modules can transparently reflect load conditions to the PLC/DCS/ESD card without the need for additional channels and wiring.

SIL 3 Relay with Line Monitoring
Specific Relay modules are capable of detecting: load and wire open and short circuit condition; loss of power to the load; wiring ground leakage for any type of AC/DC load.

Completely indipendent Dual Channel units
Each channel is powered through a dedicated and independent power supply circuit preserving single channel integrity with reduced costs and spaces.
Both channels are SIL certified and can be used without any concern regarding common failures in redundant applications such as 1oo2 or 2oo3.

Product Advantages



Low Power Consumption
Use of state of the art technology guarantees lower power consumptions for improved dissipation, lower operating temperatures, greater reliability and extended life.

Permanent Laser Marking
Modules casing are permanently marked using laser etching with detailed information, such as wiring diagrams and terminal blocks numbers, ready for standard or severe installation conditions.

Isolation
Three way galvanic isolation up to 2.5 KV (test voltage), 100% tested. Tests are not only performed on individual transformers but on complete units from terminal to terminal.

Automated Tests on 100% of productions
All products are fully tested in all conditions; test data are stored and linked to each serial number for full traceability.

Standard G3 Conformal Coating
Improved performances and protection in all enviroment conditions according to ISA 71.04 using IPC-CC-830 qualified coating material.

Highest Temperature Rating; -40/+70°C
Widest applications range allowing compliance to an extended range of applications and increased reliability in all temperature conditions.

250 V Maximum Voltage allowed for associated instruments (Um Certified Parameter)
Suitable in any application without the need to use special power supplies.

Worldwide Certifications
G.M. International's products have been granted I.S. certificates from the most credited Notified Bodies in the world.

High Density
G.M. International products offer an extraordinary density for IS interfaces in today's market with as low as 3mm per DI channel or 6 mm per AI, AO, DO channel.

Special characteristics
Most modules offer special characteristics designed to comply with non-standard requirements; such as customization of input and output values and curves. Do not hesitate to enquire with your special applications.

Wide Application range
Many modules are available to cover the majority of applications including vibration, weighing, temperature and encoding.

APPROVALS AND CERTIFICATIONS

Intrinsically Safe Products

G.M. International's products have been granted I.S. certificates from the most credited Notified Bodies in the world.
Certificates are available for:
ATEX (Europe), IECEx (International), USA and Canada, TRCU (Russian and Ukrainian), China, India, Japan, Brazil.
All certificates are available for download from our website.

IEC 61508:2010 SIL Certifications

G.M. International offers a wide range of products that have been proved to comply with the most severe quality and safety requirements. IEC 61508 and IEC 61511 standards represent a milestone in the progress of industry in the achievement of highest levels of safety through the entire instrumented system lifecycle.
The majority of our products are SIL certified as well as our design, manufacturing and administrative facilities (FSM); reports and certificates from TÜV and EXIDA are available for download from our website.

Marine Type Approval

G.M. International offers Type Approval Certificates for its line of Intrinsically Safe Isolators and Power Supplies for use in Marine and Offshore applications.

Certificates have been released by Det Norske Veritas and by Korean Register of Shipping.

WORLDWIDE PRESENCE

G.M. International's products are available through a comprehensive network of Subsidiaries Agents and Distributors. Visit our web site to find an expert near you.

A wide range of services and information can be found online at www.gmintsrl.com.

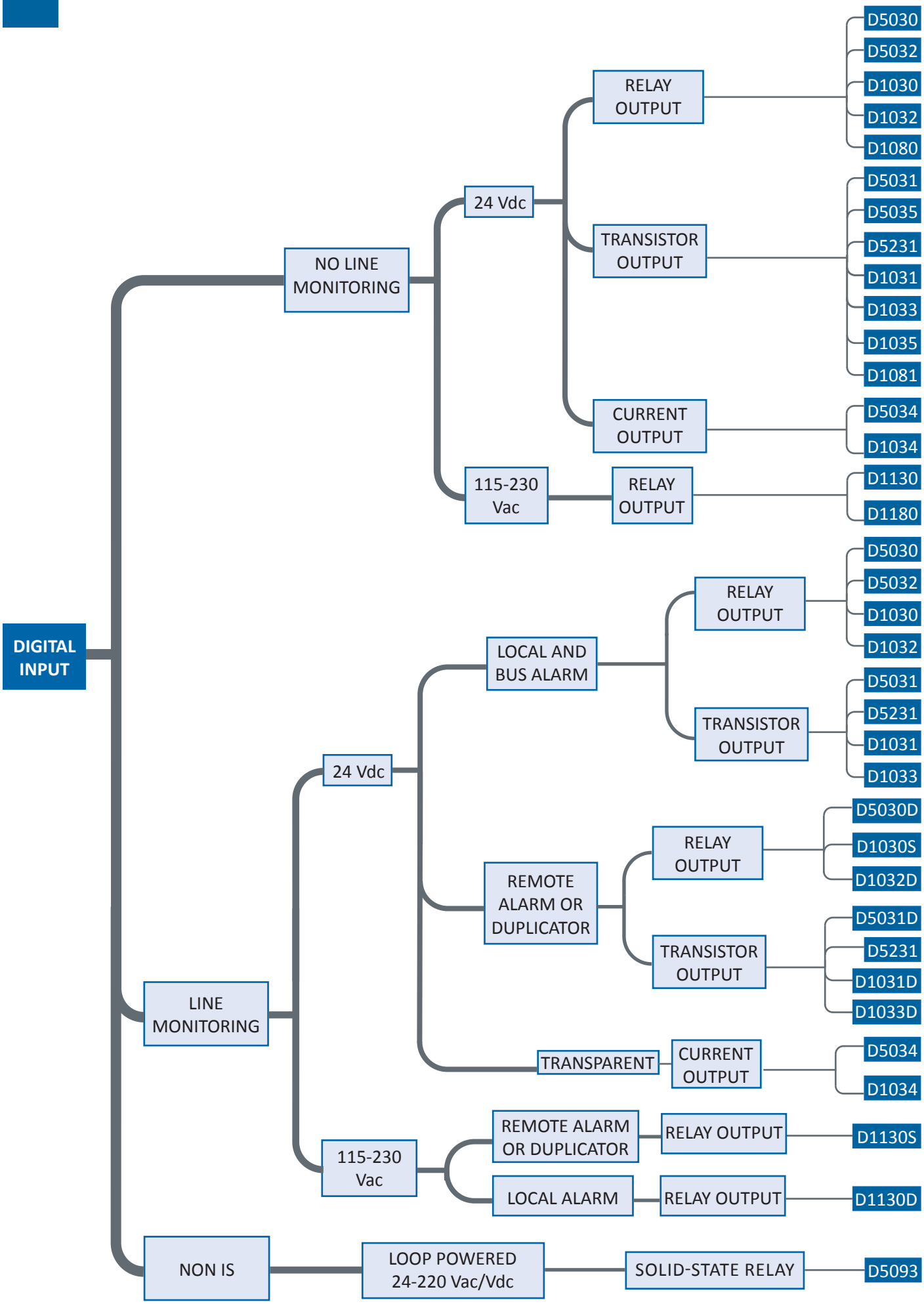
Download:
- Data Sheets
- Instruction Manuals
- Application Notes
- Certificates
- Software

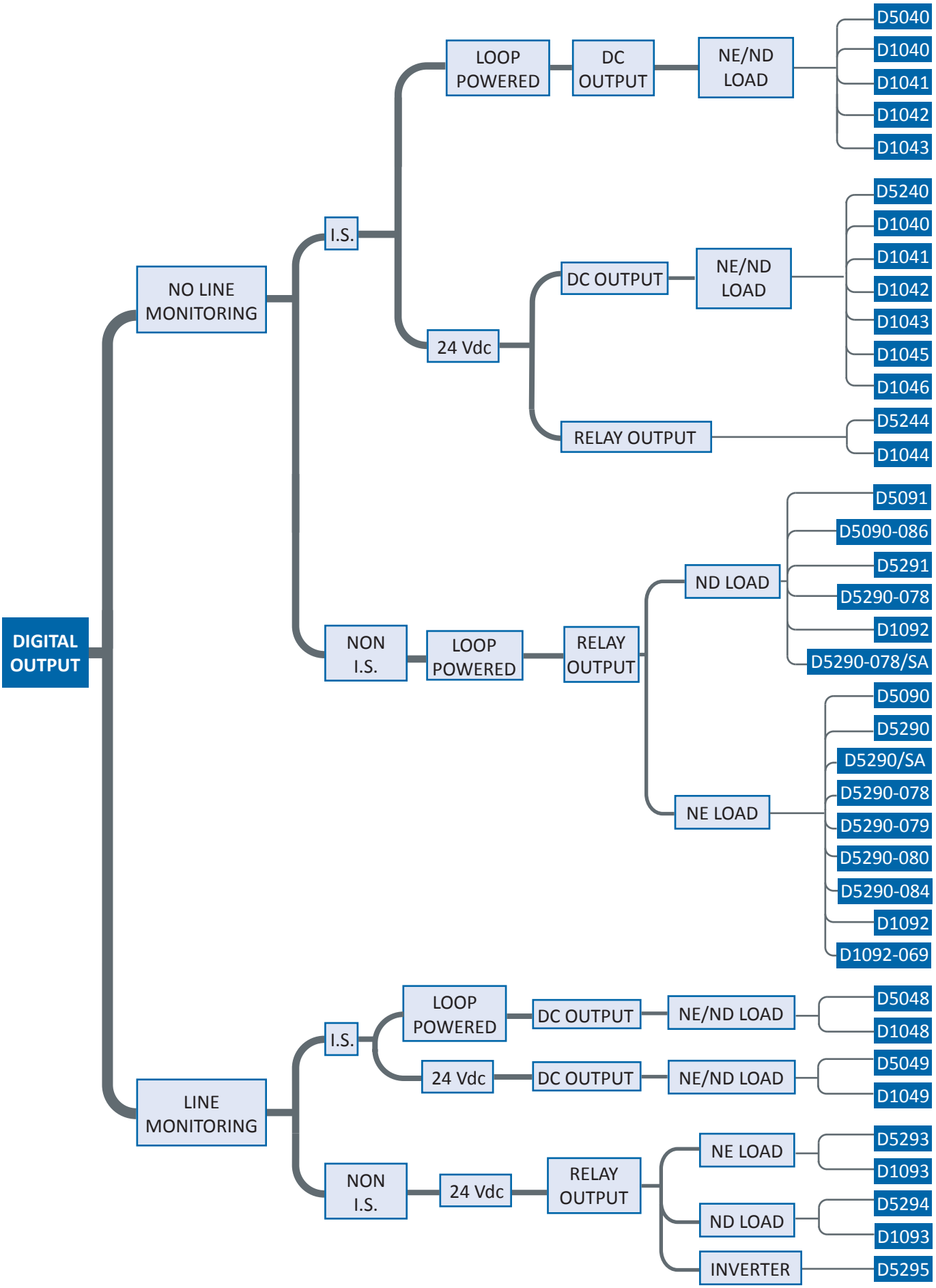
News
- Latest products
- New Certifications
- Worldwide Exhibitions

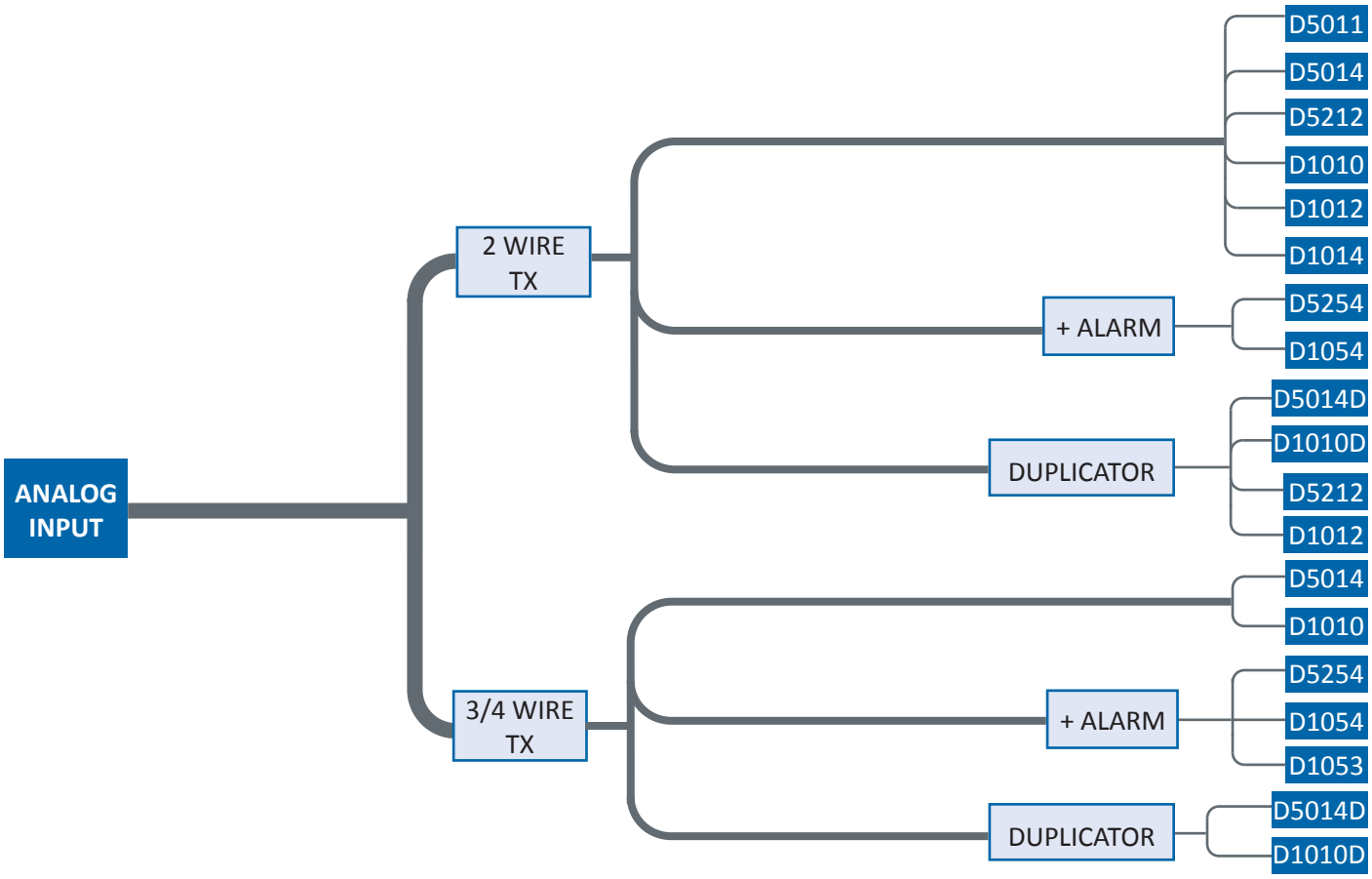
Products:
- Guided model finder
- Series presentation
- Model details
- Advanced search

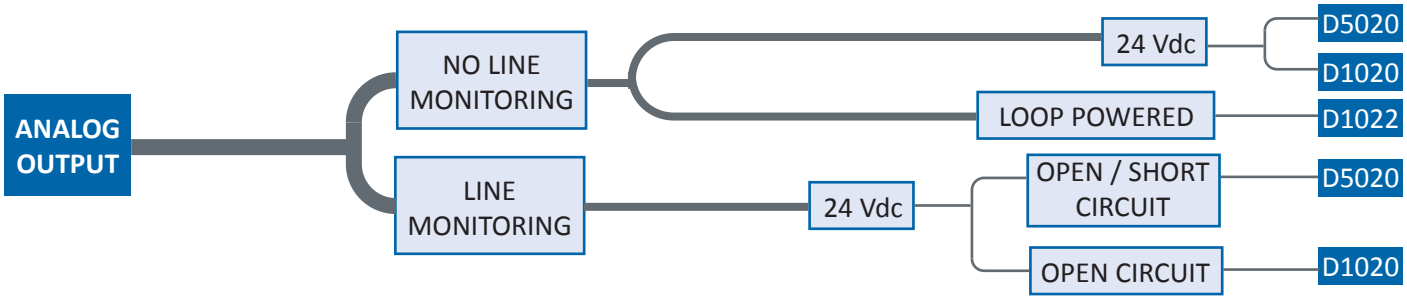
Contacts:
- Agents and Distributors
- Quotation request form
- Technical and Commercial contacts

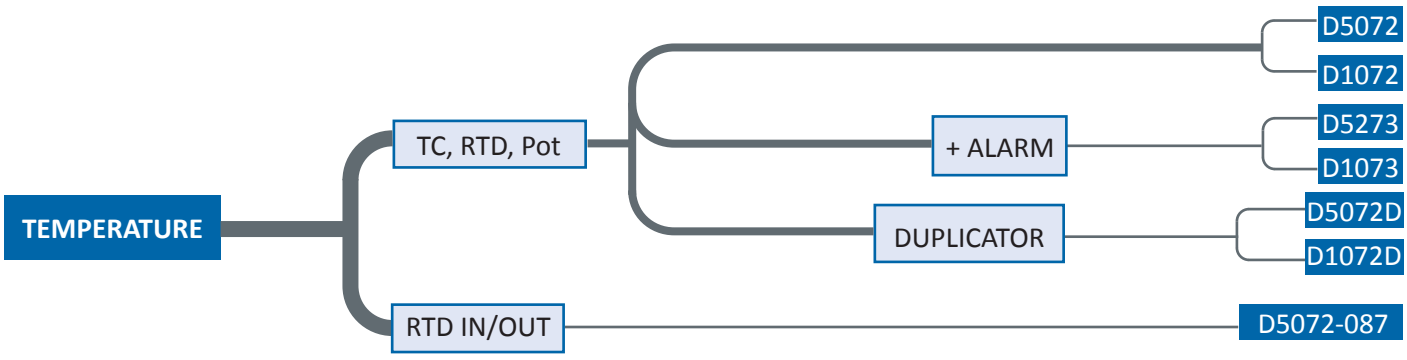
Utilities:
- Online tools for webmasters
- Mailing List
- I.S. Loop verification tool
- Product finder

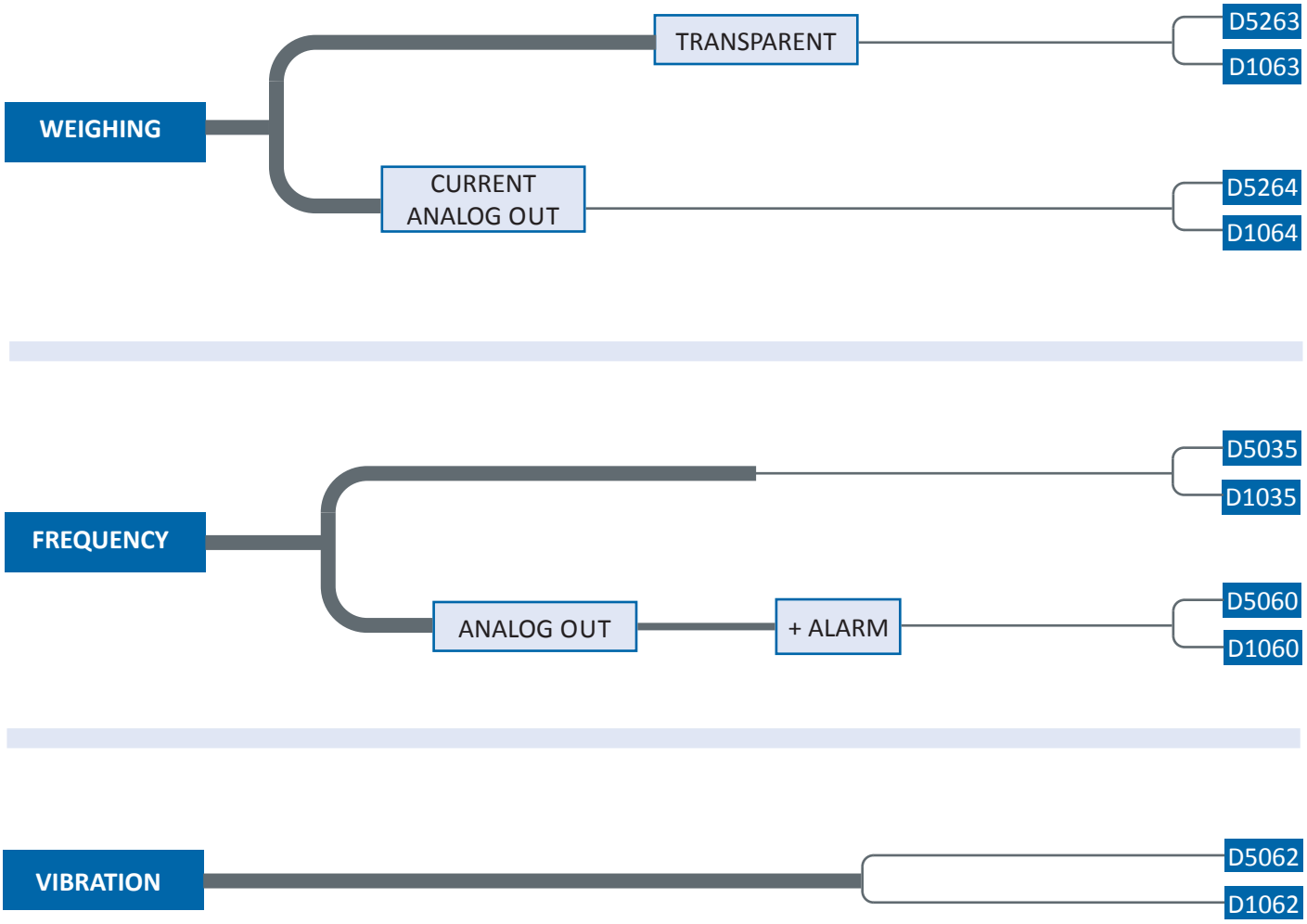

DIGITAL INPUT
NO LINE MONITORING
24 Vdc
RELAY OUTPUT
D5030
D5032
D1030
D1032
D1080
TRANSISTOR OUTPUT
D5031
D5035
D5231
D1031
D1033
D1035
D1081
CURRENT OUTPUT
D5034
D1034
115-230 Vac
RELAY OUTPUT
D1130
D1180
LINE MONITORING
24 Vdc
LOCAL AND BUS ALARM
RELAY OUTPUT
D5030
D5032
D1030
D1032
TRANSISTOR OUTPUT
D5031
D5231
D1031
D1033
REMOTE ALARM OR DUPLICATOR
RELAY OUTPUT
D5030D
D1030S
D1032D
TRANSISTOR OUTPUT
D5031D
D5231
D1031D
D1033D
TRANSPARENT
CURRENT OUTPUT
D5034
D1034
115-230 Vac
REMOTE ALARM OR DUPLICATOR
RELAY OUTPUT
D1130S
LOCAL ALARM
RELAY OUTPUT
D1130D
NON IS
LOOP POWERED 24-220 Vac/Vdc
SOLID-STATE RELAY
D5093


DIGITAL OUTPUT
NO LINE MONITORING
I.S.
LOOP POWERED
DC OUTPUT
NE/ND LOAD
D5040
D1040
D1041
D1042
D1043
24 Vdc
DC OUTPUT
NE/ND LOAD
D5240
D1040
D1041
D1042
D1043
D1045
D1046
RELAY OUTPUT
D5244
D1044
NON I.S.
LOOP POWERED
RELAY OUTPUT
ND LOAD
D5091
D5090-086
D5291
D5290-078
D1092
D5290-078/SA
NE LOAD
D5090
D5290
D5290/SA
D5290-078
D5290-079
D5290-080
D5290-084
D1092
D1092-069
LINE MONITORING
I.S.
LOOP POWERED
DC OUTPUT
NE/ND LOAD
D5048
D1048
24 Vdc
DC OUTPUT
NE/ND LOAD
D5049
D1049
NON I.S.
24 Vdc
RELAY OUTPUT
NE LOAD
D5293
D1093
ND LOAD
D5294
D1093
INVERTER
D5295


ANALOG INPUT
2 WIRE TX
3/4 WIRE TX
+ ALARM
DUPLICATOR
+ ALARM
DUPLICATOR
D5011
D5014
D5212
D1010
D1012
D1014
D5254
D1054
D5014D
D1010D
D5212
D1012
D5014
D1010
D5254
D1054
D1053
D5014D
D1010D


ANALOG OUTPUT
NO LINE MONITORING
LINE MONITORING
24 Vdc
LOOP POWERED
24 Vdc
OPEN / SHORT CIRCUIT
OPEN CIRCUIT
D5020
D1020
D1022
D5020
D1020

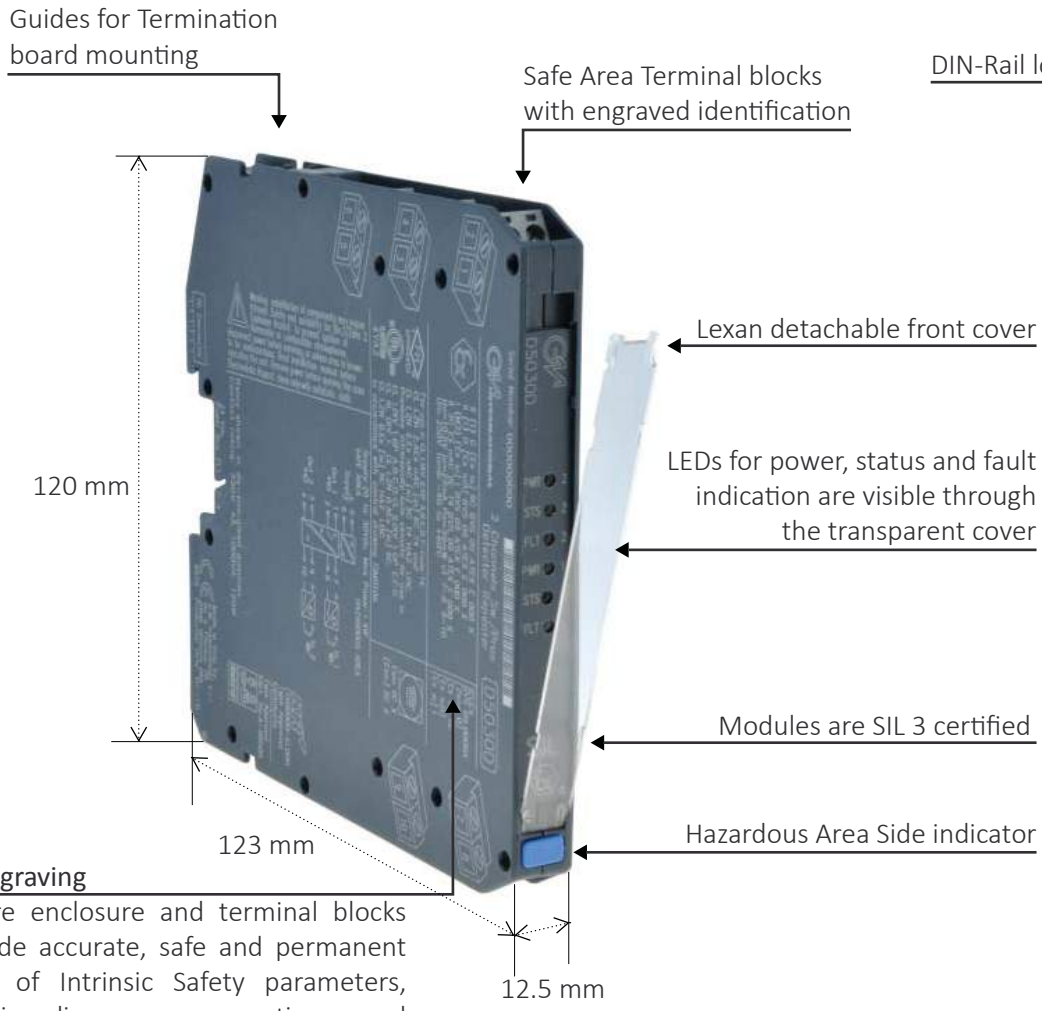

TEMPERATURE
TC, RTD, Pot
RTD IN/OUT
+ ALARM
DUPLICATOR
D5072
D1072
D5273
D1073
D5072D
D1072D
D5072-087


WEIGHING
TRANSPARENT
D5263
D1063
CURRENT
ANALOG OUT
D5264
D1064
FREQUENCY
D5035
D1035
ANALOG OUT
+ ALARM
D5060
D1060
VIBRATION
D5062
D1062

D5000
SERIES

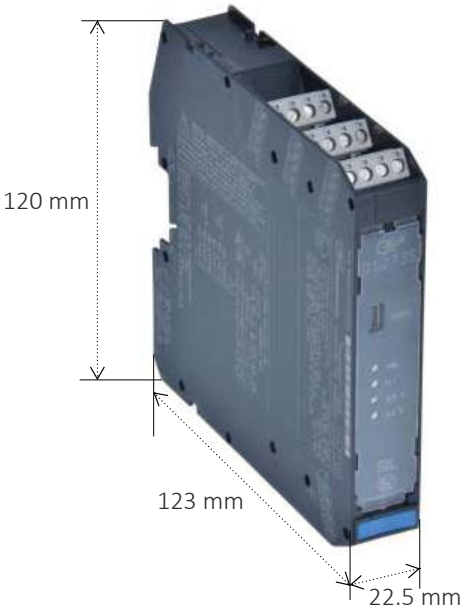
ENHANCED INTRINSICALLY SAFE ISOLATORS
SUITABLE FOR SIL 2 AND SIL 3 APPLICATIONS

D5000
CHARACTERISTICS



Laser engraving
on entire enclosure and terminal blocks to provide accurate, safe and permanent marking of Intrinsic Safety parameters, schematic diagrams, connections and instructions.

D5200
DIMENSIONS



High Performance

- High signal transfer accuracy and repeatability.
- Advanced circuitry provides very low heat dissipation, ensuring modules run cool despite their high density and functionality.
- SMD manufacturing for a long, reliable life.
- Complete absence of electrolytic capacitors ensures minimum 20 years lifetime.

Wide Functionality

- Wide range of digital and analog I/O.
- SIL 3 Safety Relay contacts rated for 4 A or 10 A for direct switching of high loads.
- Three port galvanic isolation to eliminate noise, ground loop problems and to provide Intrinsic Safety without a high integrity safety earth connection.
- Line fault alarm detects open or short circuit of field cables.
- Optional power bus DIN-Rail connector.
- Standard Termination Board with custom connectors for integration into customized Boards.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.

High Packing Density

- High packing density.
- 35 mm (Top Hat) DIN-Rail.
- Ultra slim 2 channels 12 mm wide DIN-Rail and Termination Board mounting modules.
- Power and fault on bus connectors.
- 6 mm per channel means 50% space reduction.
- 3 mm per channel on DI module D5231E

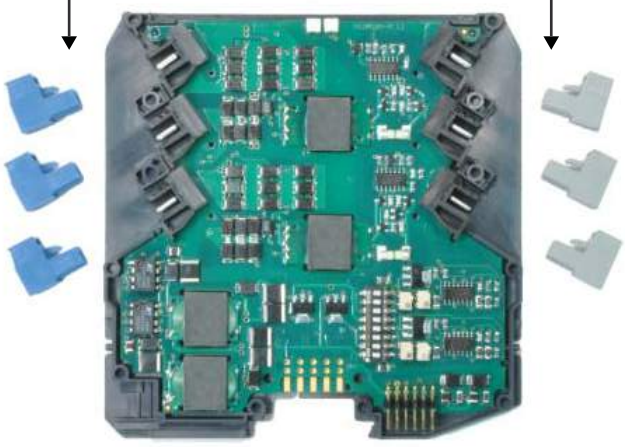
General Features

- More than 25 modules suitable for SIL 3 applications according to IEC 61508, IEC 61511.
- Independent power supply circuits for each channel on most modules.
- Dual channel units are equivalent to two single units because of the absence of common circuitry on most modules.
- Single channel versions available when required, to provide single loop integrity .
- Configuration components are easily accessed by removing the side cover or via connector front panel.
- DIP switch configurability for easy field setup.
- LED indication for power, signal status and line fault conditions.
- Modules accept DC power supply over a wide range for 24 Vdc (18-30 Vdc) applications.
- Wide operating temp. range:-40 to +60/+70 °C.
- Installation in Zone 2 / Division 2.
- Certified for Offshore and Marine applications.

Features

Blue Terminal Blocks for Hazardous Area connections

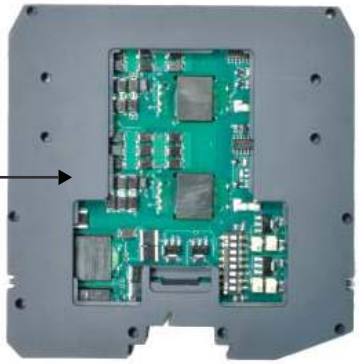
Grey Terminal Blocks for Safe Area connections



Enclosure Characteristics

- High channel density result from innovative circuit design using advanced surface mount components.
- Plug-in screw terminal blocks to secure termination up to 2.5 mm^2.
- Configuration components are easily accessed by removing side cover.

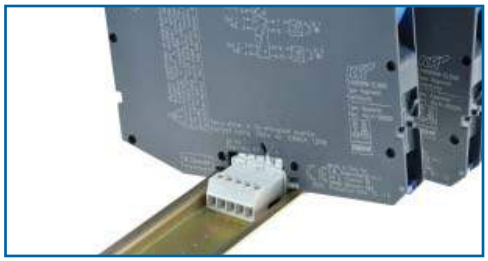
Detachable Cover for direct access to configuration components



Enhanced Power Bus mounting

Power Supply Voltage, 24 Vdc, can be applied to the module by connecting the voltage directly to the plug-in Terminal Block of each module, or via the Power Bus System.
The system consists of standard DIN-Rail modules mounted on DIN-Rail Bus connectors. The maximum allowed powering capacity per trunk is 8 A.
It is always possible to remove modules, without disconnecting the bus connector which remains attached to the DIN-Rail.
Communication bus is provided, on suitable models, to transmit via Modbus to DCS PLC logic solver to read input variables, diagnostic conditions, etc.
Cumulative Fault Alarm indication is provided on the Bus connection. This signal can be fed to a common unit (D5202S) which provides SPST Relay contact for common faults.
Both supply voltages are independently monitored and over or under condition are signaled via SPST Relay contact for power good (supply within operating range).

The D5202S is also capable of operating as a redundant 4 A supply module for the system.



BUS PLUG-IN CONNECTOR

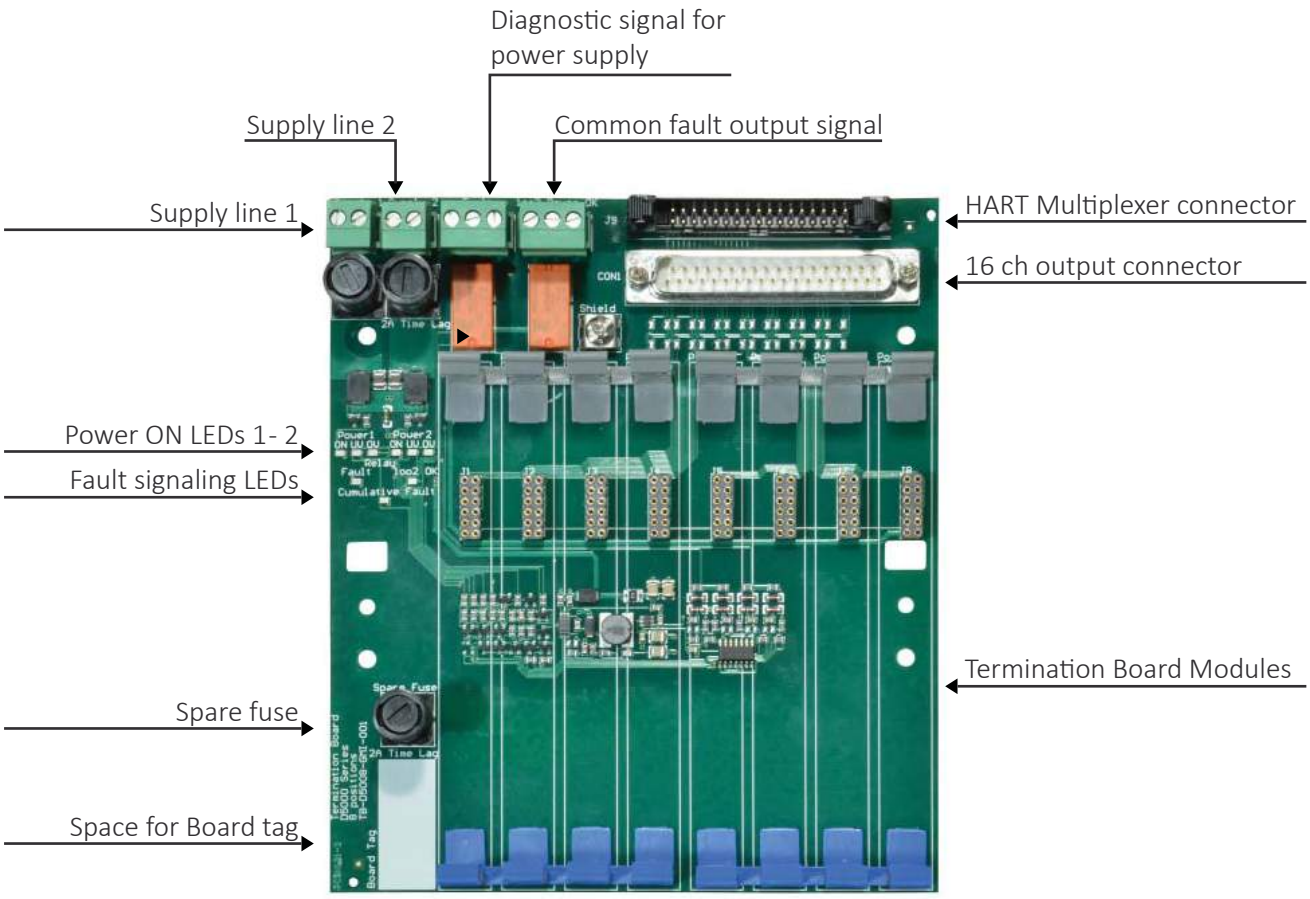
BUS CONNECTOR TERMINAL

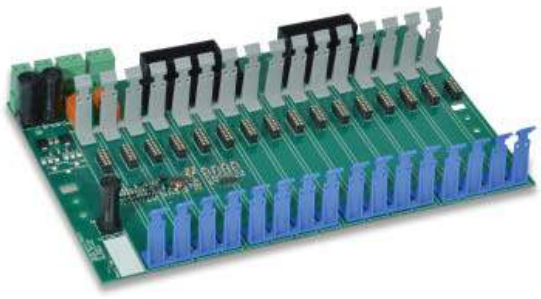
DIN RAIL STOPPER

Termination Boards

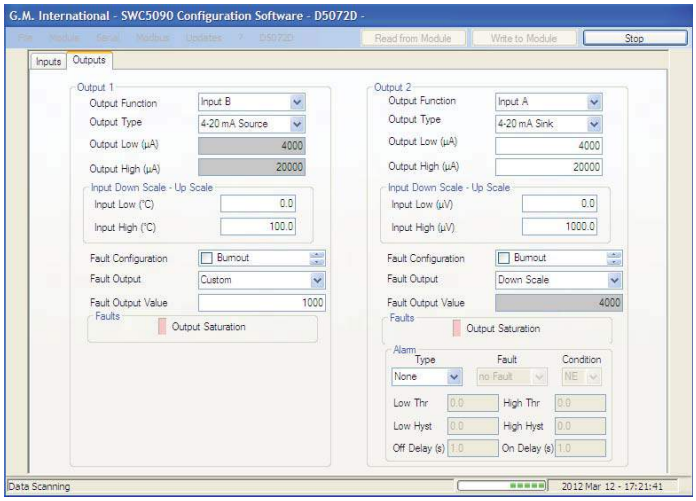
Characteristics

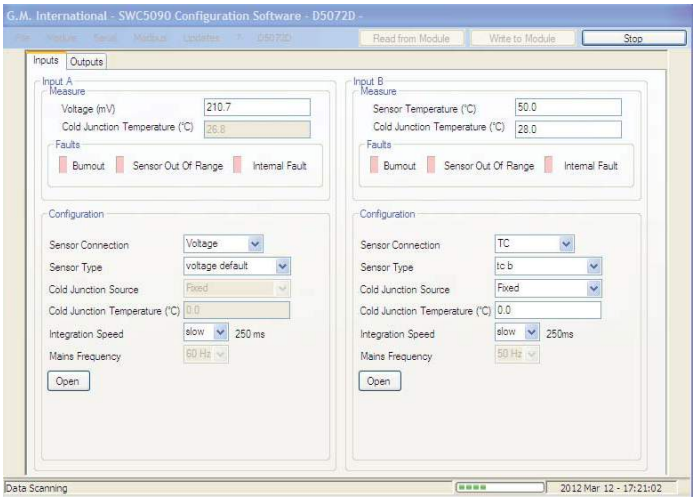
- Suitable to host 8/16/32 D5000 or D5200 SIL 3 modules 12.5mm/22.5mm wide, single or double channel, for up to a total of 32 channels.
- AI - AO - DI - DO Temperature: single or double channels.
- Signal converter, Safety Relay: single channel.
- 24 Vdc redundant power supply, with window voltage monitoring and corresponding relay fault output.
- Boards are available with custom connectors to directly interface any system PLC / DCS / ESD.
- Cumulative fault relay output.





Configuration





SWC5090 Software

The SWC5090 software is designed to provide a PC user interface to configure suitable D5000, D5200 modules, via PPC5092 adapter.

It easily allows the user to:

- Read and write configuration parameters to the unit;
- Store and restore data to and from local hard drive for backup or archive;
- Load factory default configurations;
- Monitor real time Input values for debug or test;
- Print a report sheet containing configuration parameters and additional information.

The SWC5090 is freely distributed at our website: www.gmintsrl.com

PPC5092 USB Adapter

PPC5092 interface allows the configuration of D5000, D5200 modules via SWC5090 software. Modules are supplied via USB for programming and therefore do not need any external power supply. Power Supply is requested for input monitoring or analog output check.

PPC5092 comes with mini-USB dedicated cable and CD-Rom containing SWC5090 software.

D5000 Selection Table

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
ANALOG IN		D5011S	4-20 mA 2-Wires passive Tx; Smart compatible	4-20 mA (source)	1	24 Vdc	SIL 3
		D5011D			2		SIL 3
		D5014S	4-20 mA 2/3/4-Wires Active or Passive Tx; Smart compatible	4-20 mA (source or sink)	1	24 Vdc	SIL 3
		D5014D			2		SIL 3
		D5014D		Two duplicated outputs	1 in 2 out		SIL 3
		D5212Q	4-20 mA 2-Wires Passive Tx	4-20 mA + Modbus	4	24 Vdc	SIL 2
		D5212Q		Two duplicated outputs + Modbus	2 in 4 out		SIL 2
		D5212Q		One Triplicated + One single outputs + Modbus	2 in 4 out		SIL 2
		D5212Q		One Quadriplicated output + Modbus	1 in 4 out		SIL 2
		D5254S	4-20 mA, 2/3/4-Wires Tx Active or Passive; Smart compatible	4-20 mA, 2 Trip Amplifiers each with SPST (relay contact) + Modbus	1	24 Vdc	SIL 2
ANALOG OUT		D5020S	4-20 mA Analog Signal to I/P Converters, Electrovalves, Actuators and Displays; Smart compatible	4-20 mA Bus powered signal from DCS, PLC or other control devices. Two duplicated outputs.	1	24 Vdc	SIL 3
		D5020D			2		SIL 3

Configurable via PPC5092 and SWC5090 Software

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
DIGITAL IN		D5030S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	SPDT (relay contact) + LED (fault status)	1	24 Vdc	SIL 3
		D5030D		SPST (relay contact) + SPST (alarm or duplicator) + LED (fault status)	1 in 2 out		SIL 3
		D5030D		SPST (relay contact) + LED (fault status)	2		SIL 3
		D5031S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	Open Collector + LED (fault status)	1	24 Vdc	SIL 3
		D5031D		Open Collector + O.C. (alarm duplicator) + LED (fault status)	1 in 2 out		SIL 3
		D5031D		Open Collector + LED (fault status)	2		SIL 3
		D5231E	Voltage free Contact, Proximity Switch Line fault detection	Open Collectors + LED (fault status) + Modbus	8	24 Vdc	SIL 2
		D5032S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	SPDT (relay contact) + LED (fault status)	1	24 Vdc	SIL 3
		D5032D		SPST (relay contact) + SPST (alarm or duplicator) + LED (fault status)	1 in 2 out		SIL 3
		D5032D		SPST (relay contact) + LED (fault status)	2		SIL 3
		D5034S	Voltage free Contact, Proximity Switch Isolated inputs	Transparent repeater of input status 0 to 8 mA range	1	24 Vdc	SIL 3
		D5034D			2		SIL 3

Configurable via PPC5092 and SWC5090 Software

D5000 Selection Table

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
DIGITAL OUTPUT DRIVER		D5040S	NE solenoid valve, other control devices.	Loop Powered control signal from safety PLC, DCS	1	Loop	SIL 3
		D5040D			2		SIL 3
		D5048S	NE solenoid valve, other control devices. Line open/short fault detection reflected on PLC.	Loop Powered control signal from safety PLC, DCS	1	Loop	SIL 3
		D5049S		Logic level control signal from safety PLC, DCS	1	24 Vdc	SIL 3
		D5240T	NE solenoid valve, other control devices.	Control signal from safety PLC, DCS	3	24 Vdc	SIL 2
SIGNAL CONV.		D5060S	0-50 KHz Magnetic Pickup or Proximity Switch	mA (source), Pulse repeater Output	1	24 Vdc	SIL 2
		D5254S	4-20 mA / 0-20 mA 2/4 wires Tx 0.3 V to ± 30 V	4-20 mA / 0-20 mA (source/sink) + 2 independent alarms via SPDT relays + Modbus	1	24 Vdc	SIL 2
VIBRATION INTERFACE		D5062S	Vibration Transducers, Accelerometers, 2/3-Wires sensors	Transparent input repeater	1	24 Vdc	SIL 2
LOAD CELLS ISOLATOR CONV.		D5264S	Up to 4, 350 Ω, 6-Wires Load Cells in parallel.	mA (source/sink) Output and Modbus RTU	1	24 Vdc	-
		D5263S		Transparent input repeater	1		-
VARIOUS		D5202S		Power Distribution and Diagnostic Module	1	24 Vdc	SIL 3

Configurable via PPC5092 and SWC5090 Software

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
TEMPERATURE CONVERTERS AND TRIP AMPLIFIERS		D5072S	Universal TC, 3/4-Wires RTD, Potentiometer, mV	4-20 mA (source or sink) + Modbus Independent set point via Solid State Relay	1	24 Vdc	SIL 2
		D5072D	Universal TC, 3-Wires RTD, Potentiometer, mV	4-20 mA (source or sink) + Modbus Duplicator	1 in 2 out	24 Vdc	SIL 2
		D5072D		4-20 mA (source or sink) + Modbus	2		SIL 2
		D5072S -087	2/3/4-Wires RTD	2/3/4-Wires RTD	1	24 Vdc	SIL 2
		D5273S	Universal TC, 3/4-Wires RTD, Pot, mV	4-20 mA (source or sink) Independent set points via SPDT Relay each + Modbus	1	24 Vdc	SIL 2
POWER SUPPLIES		for more information and details about Power Supplies, see section at page 72					
SAFETY RELAYS		for more information and details about Safety Relays, see section at page 33					

Configurable via PPC5092 and SWC5090 Software

Image	Code	Description
	**JDFT049**	12 mm Power Bus Connector for DIN Rail Mounting. 1 needed for each BUS Module.
	**JDFT050**	22 mm Power Bus Connector for DIN Rail Mounting. 1 needed for each BUS Module.
	**MCHP196**	Bus End Stopper. One needed for each end of Bus.
	**MOR015**	Plug-in terminal block male, vertical out, for Power Bus.
	**MOR017**	Plug-in terminal block male, horizontal out, for Power Bus.
	**MOR022**	Plug-in terminal block female, horizontal out, for Power Bus.
	**OPT5096**	Kit for Bus Mounting. Includes: 1 x MOR017, 1 x MOR022, 2 x MCHP196.
	**PPC5092**	PC Adapter required to configure programmable units; Mini USB Male cable to USB Port.
	**SWC5090**	PC Software for Configuration. Freely downloadable from www.gmintsrl.com.

SAFETY RELAYS

HIGH INTEGRITY SAFETY RELAYS
SUITABLE FOR SIL 3 APPLICATIONS ACCORDING TO IEC 61508

SAFETY RELAYS

CHARACTERISTICS

Introduction

When a load cannot be driven directly by a safety controller, an interposing relay becomes a requirement. In example: when the power required to switch the load is greater than what can be handled by the controller; or the voltage is different than the typical 24Vdc provided by the controller; or when multiple contacts are required to be driven by the same control signal.

SIL certified safety relays are a requirement to meet the necessary Risk Reduction Factor (RRF) when switching a load ON or OFF, in an IEC 61508/61511 Safety Instrumented Function (SIF). SIL certified relays guarantee that the safety function is met with a suitable and known probability of failure (PFD).

With the increased implementation of functional safety standards the market for SIL certified relays is growing very fast in all fields and applications and is no longer an exclusivity of the Oil & Gas sector. Controls and braking systems for trains are an example.

Safety Function

In order to properly select an SIL relay, special attention must be given to the Safety Function (SF) of the SIF where the SIL relay will be used, since different relay matrices are used to achieve the required Safety Integrity Level.

The two most typical SFs are De-Energized to Safety or to Trip (DTS) and Energized to Safety or to Trip (ETS); however, combinations of the two are also possible.

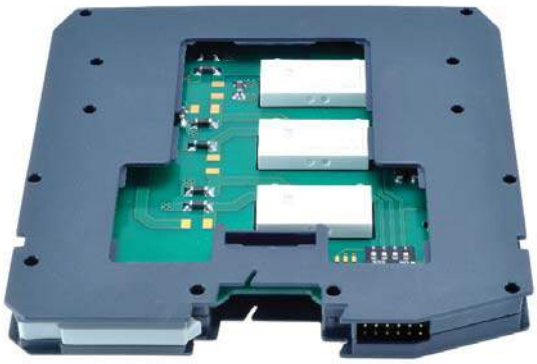
- DTS: Used mostly in ESD system to disconnect power to safety valves which are Normally Energized; it is achieved by removing power to the load through the opening of the DO signal (0 volts or “0”) and the consequential opening of the relay contacts.
- ETS: Used mostly in F&G systems to energize deluge valves which are Normally De-Energized or dormant; it is achieved by providing power to the load through the closing of the DO signal (24 volts or “1”) and the consequential closing of the relay contacts.
- Combinations: Sometimes the relay function must be inverted to achieve the required SF. Meaning that the control signal is 1 but the load must be 0; or vice versa 0 the control signal and 1 the load.

Applications

Some of the most common applications for a SIL 2 or SIL 3 relay are the controlling of:

- Solenoid Valves (SOV) in ESD and F&G systems;
- Beacons, Horns, and similar signaling devices;
- Burner Management Systems (BMS);
- AC or DC Motors.

SIL certified relays are also used for feedback signals and as interposing relays between different systems.



Relay Functions

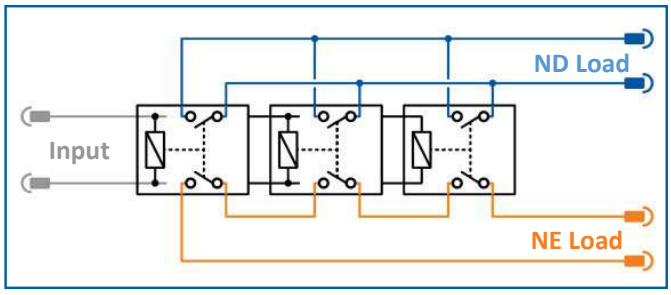
There are four kinds of SIL relay functions defined by the status of the relay coil and the relay contacts in the normal working condition; not during a Safety Demand (SD).

1. Energized Relay Coil (1)- Closed Relay Contacts (1):
   Load Normally Energized; DTS Safety Function.
2. De-Energized Relay Coil (0)- Open Relay Contacts (0):
   Load Normally De-Energized; ETS Safety Function.
3. Energized Relay Coil (1)- Open Relay Contacts (0):
   Load Normally De-Energized; DTS Safety Function.
4. De-Energized Relay Coil (0)- Closed Relay Contacts (1):
   Load Normally Energized; ETS Safety Function.

Energized Relay Coil means a 1 High condition (power ON) at the relay coil terminals; De-Energized Relay Coil means the opposite, a 0 Low condition (power OFF) at the relay coil terminals.

Closed or Open Relay Contacts determine if power is available to the load under normal operating conditions; with closed contacts the load is powered (Normally Energized) and with open contacts the load is not powered (Normally De-Energized).

The Safety Function consists in reverting normal operating conditions. In example, with energized relay coil and closed relay contacts, the load is Normally Energized and the Safety Function is met when power is removed from the load; from High to Low condition.



SAFETY RELAY BASIC OPERATIVE PRINCIPLES
Three relays in series for safety disconnection of NE Loads.
Three relays in parallel for safety connection of ND Loads.

Coil Voltage

SIL certified relays are available with a variety of coil voltages either in DC or AC. The correct one should be chosen to match the coil driving signal.

Contact Form

The contact form and state of the relay output (NO/NC) should be determined by the SF; however, most of the time the SF is not known or not clearly specified.

Additionally, the load can be interfaced by breaking a single wire (+ or-) or both wires (+ and-).

Many solutions are available and in some cases multiple outputs are made available in a single SIL relay for a field configurable solution. However, most of the time, a single load can be driven with a single relay.

Contact Rating

Once the correct SF is chosen, consideration must be given to the relay contacts rating for both AC and DC loads.

Maximum contacts ratings of the SIL certified relay should not be exceeded to retain the certified SIL rating.

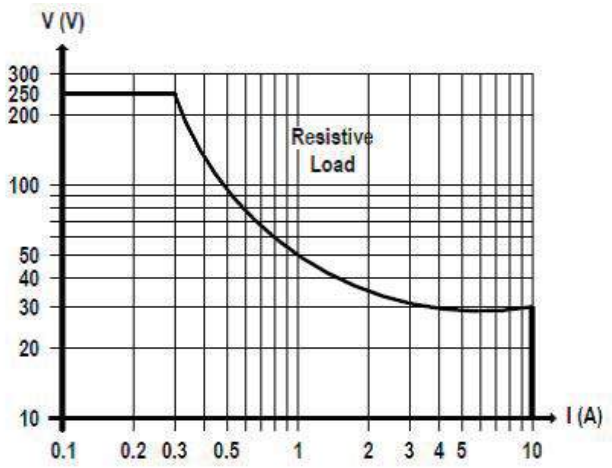
Special care must be given for Inductive (overvoltage) or Capacitive (in-rush current) loads.

SIL relays are typically de-rated and capable of withstanding some in-rush current or overvoltage spikes but the continuous operational load must be below the maximum specified to maintain the required SIL level.

Some additional effort is required for DC loads since relay specification for DC load can be quite confusing.

Let's take in example GMI D5290S SIL 3 relay; it states: DC Rating: 10 A / 250 VDC / 300 W.

However, 10 x 250 is equal to 2.500 W and not 300 W! The difference is that the relay can either handle 250V or 10A and not the combination of the two. The DC load graph provided in the Data Sheet must be used to verify the maximum allowed Load in various DC voltage levels. As shown here:



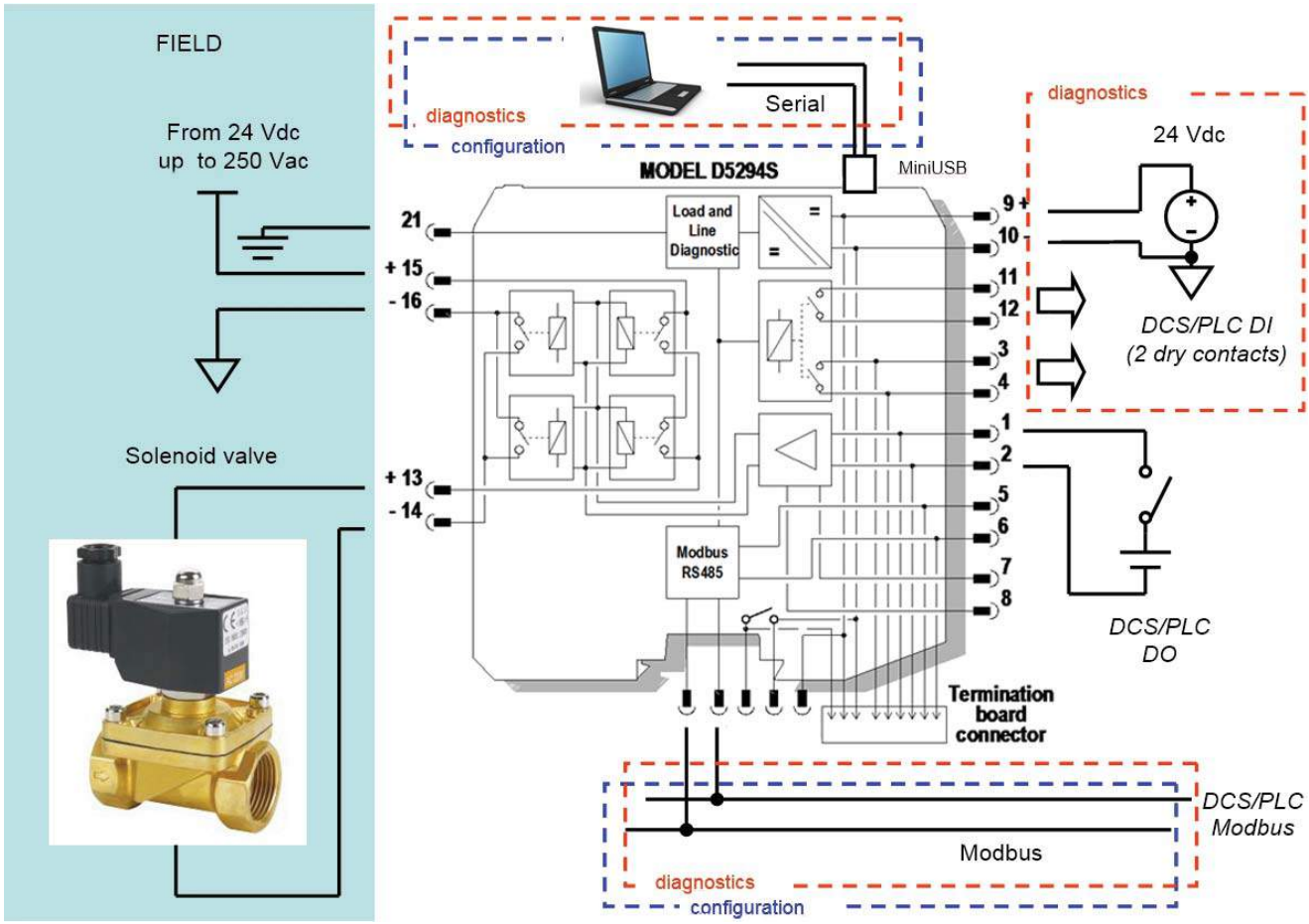
Line & Load Monitoring

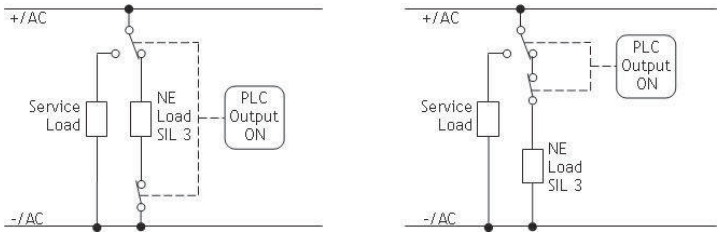
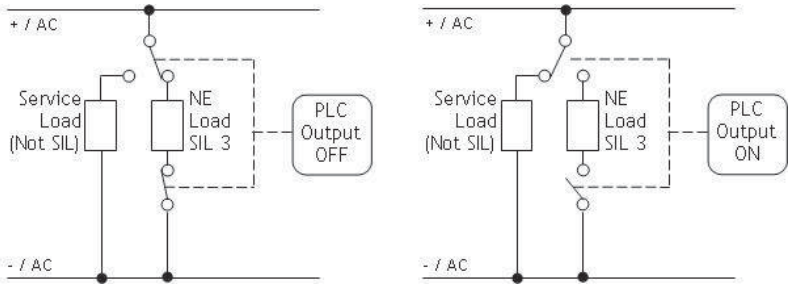
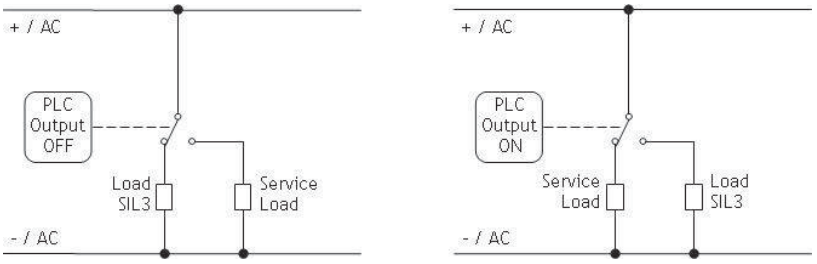
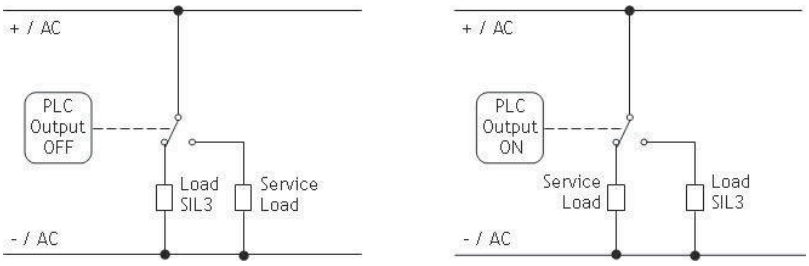
SIL certified relays are used in SIFs which are always critical loops and careful consideration should be given to the requirement of Line and Load Monitoring.

If it is true that in a DTS SF a wire or a coil failure will lead to safety, the same cannot be told of an ETS SF where a failure would lead to a dangerous condition which, if undetected, would lead to an unsafe status and consequential loss of SIL level. Some useful applications for Line Monitoring in DTS SFs are also possible; in example, to monitor the status of the coil to prevent spurious trips or to verify the condition of the individual coil in a redundant coil SOV. A last consideration for Normally De-Energized systems such as F&G where it is not possible to perform line monitoring through conventional methods.

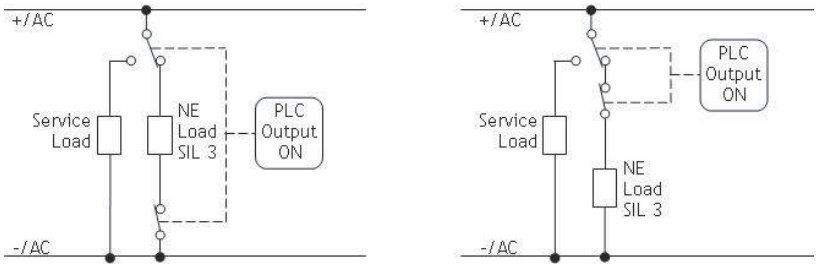
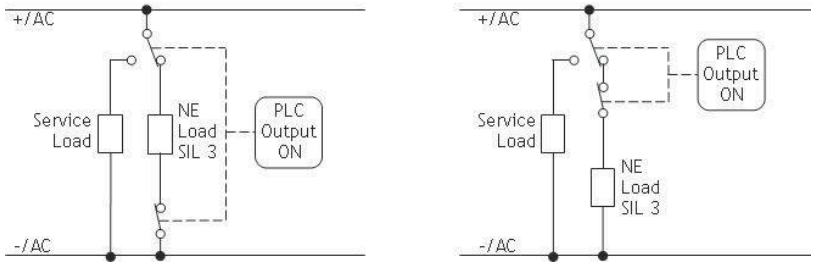
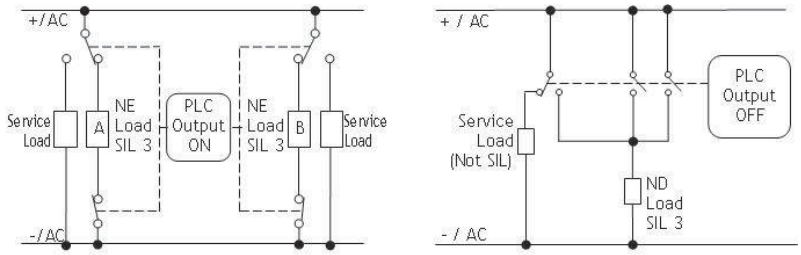
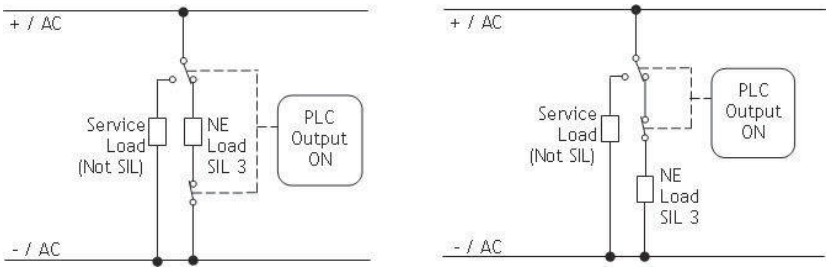
When Line & Load Monitoring is required, three separate considerations must be made:

- Pulse Test Compatibility: The majority of today's control systems such as ESD or F&G can generate a pulse (active or passive) to verify line integrity. The pulse length and frequency varies from system to system but, in all cases, it can negatively affect relay functionality! A relay is not designed to be pulsed and, depending on the pulse length, the relay can change status (spurious trip) or its anchors can partially move degrading and shortening the life of the relay itself. If a pulse test is required, a SIL certified relay with a filtering circuit on the front end should be used. GMI D5000 series are fully compatible to Line Monitoring pulses from all system manufacturers.
- Extension of Line Monitoring through the SIL Relay: Control system diagnostic capabilities discussed above are designed to perform line monitoring when no relay is present between the control system and the load. As soon as a relay is placed in the loop, the diagnostic function stops at the relay input circuit (coil). To perform full line monitoring from the Control System to the Load a SIL relay with built-in diagnostic circuit is required. These relays are able to diagnose a failure in the field wiring and load providing an alarm to the control system or other dedicated alarm channels.
- Line Monitoring Functions: A SIL relay with built-in diagnostics can perform two basic types of line monitoring: detection of open circuit and/or short circuit; both will lead to an unsafe condition for a Normally De-Energized SIF and can lead to a spurious trip in a Normally Energized SIF. Monitoring of the supply line should also be taken into consideration since loss of power leads to unsafe condition in an ETS SF.

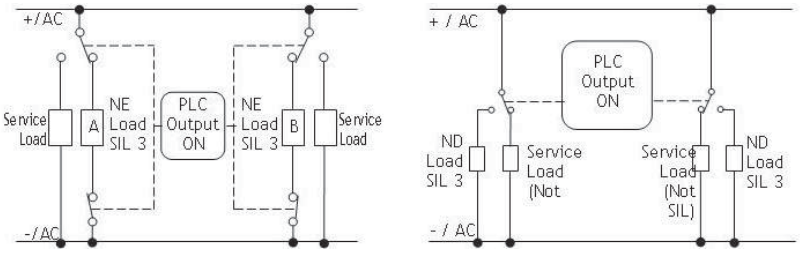
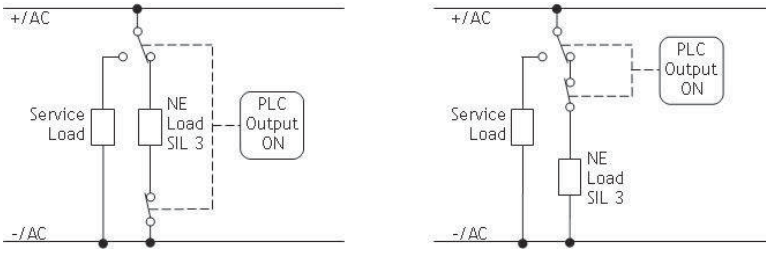
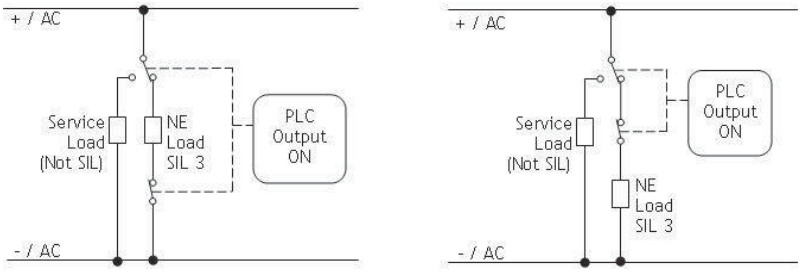
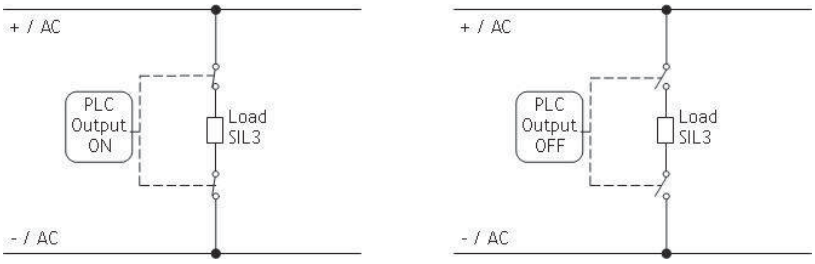


Field device	Model	Connections	Rating	SIL level
SAFETY RELAYS	D5090S	 Relay with NE Coil and Load (1-1). SIL 3 function: disconnect Load by disconnecting input (0-0). Can be used to disconnect one or both supply lines (see figures).	4 A 250 Vac 1000 VA 4 A 250 Vdc 120 W 24 Vdc Coil	SIL 3
	D5090S-086	 Relay with ND Coil and NE Load (0-1). SIL 3 function: disconnect Load by connecting input (1-0). Can be used to disconnect one or both supply lines (see figures).	4 A 250 Vac 1000 VA 4 A 250 Vdc 120 W 24 Vdc Coil	SIL 3
	D5091S	 Relay with ND or NE Coil and ND Load (0-0 or 1-0). SIL 3 function: connect Load by connecting input (1-1) or connect Load by disconnecting input (0-1) (see figures). To disconnect both supply lines, use two D5091S units in parallel.	4 A 250 Vac 1000 VA 4 A 250 Vdc 120 W 24 Vdc Coil	SIL 3
	D5291S	 Relay with ND or NE Coil and ND Load (0-0 or 1-0). SIL 3 function: connect Load by connecting input (1-1) or connect Load by disconnecting input (0-1) (see figures). To disconnect both supply lines, use two D5291S units in parallel.	10 A 250 Vac 2500 VA 10 A 250 Vdc 300 W 24 Vdc Coil	SIL 3

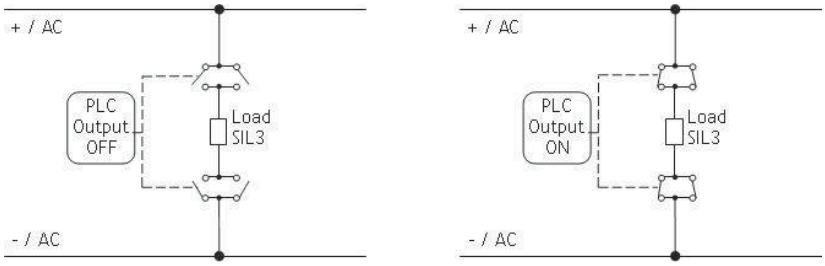
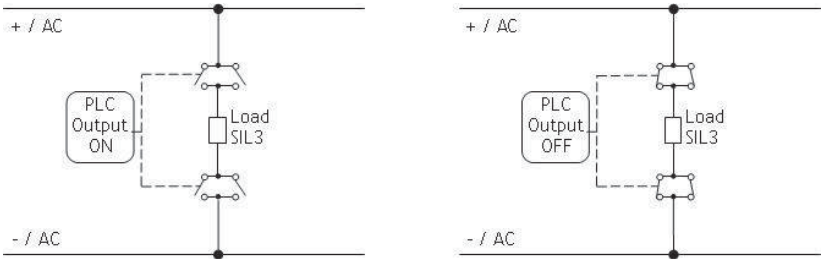
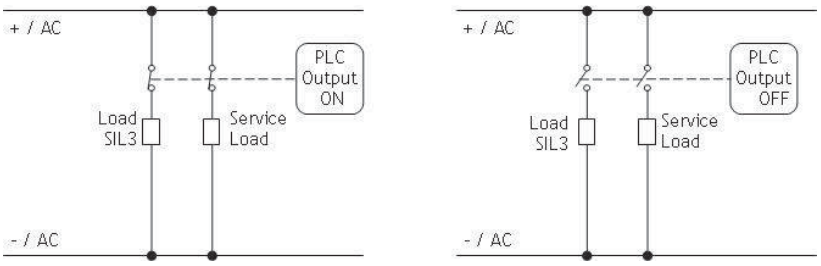
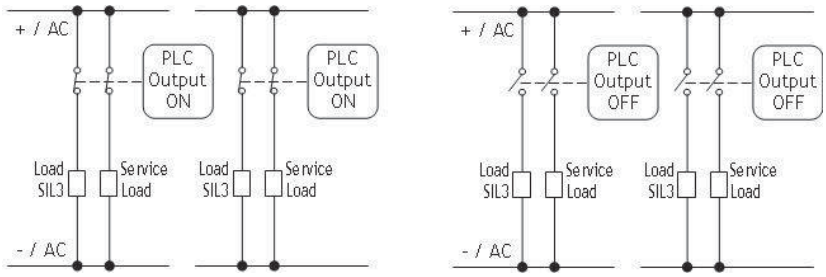
SAFETY RELAYS

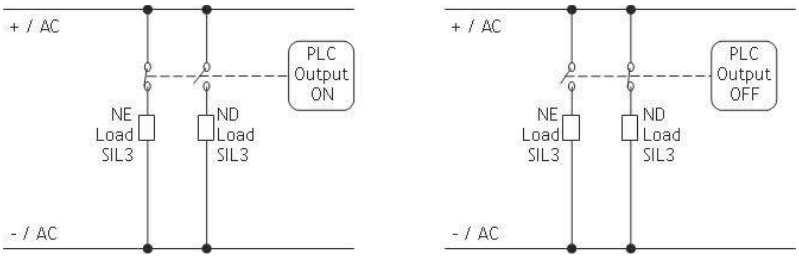
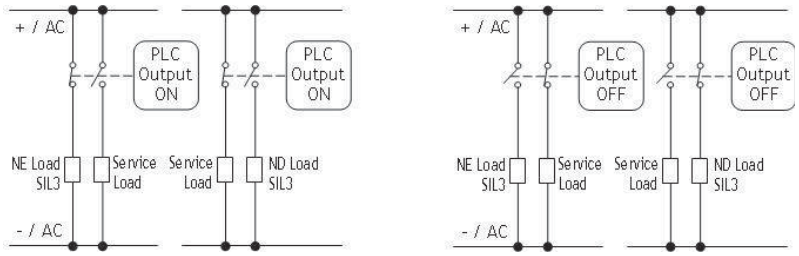
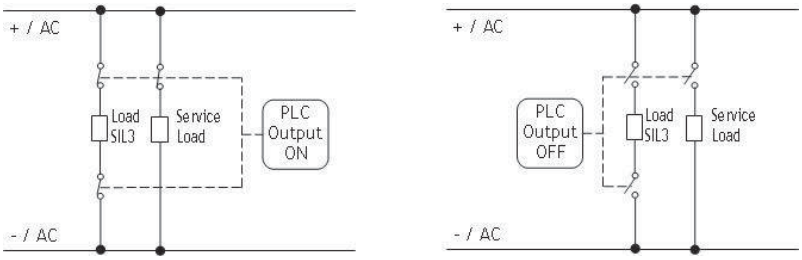
Field device	Model	Connections	Rating	SIL level
	D5290S	 Relay with NE Coil and Load (1-1). SIL 3 function: disconnect Load by disconnecting input (0-0). Can be used to disconnect one or both supply lines (see figures).	10 A 250 Vac 2500 VA 10 A 250 Vdc 300 W 24 Vdc Coil	SIL 3
	D5290S /SA	 Relay with NE Coil and Load (1-1). SIL 3 function: disconnect Load by disconnecting input (0-0). Can be used to disconnect one or both supply lines (see figures). Installation in safe area only and not compatible with pulse diagnostic.	10 A 250 Vac 2500 VA 10 A 250 Vdc 300 W 24 Vdc Coil	SIL 3
	D5290S -078	 Relay for NE/ND Load with NE/ND Coil for interrupting up to 4 loads. SIL 3 function: configurable via external wiring. Can be used to disconnect one or both supply lines (see data sheet).	5 A 250 Vac 1250 VA 5 A 250 Vdc 175 W 24 Vdc Coil	SIL 3
	D5290S -078/SA	 Relay with NE Coil and NE/ND Load for interrupting up to 4 loads. SIL 3 function: configurable via external wiring. Can be used to disconnect one or both supply lines (see data sheet). Installation in safe area only and not compatible with pulse diagnostic.	5 A 250 Vac 1250 VA 5 A 250 Vdc 175 W 24 Vdc Coil	SIL 3

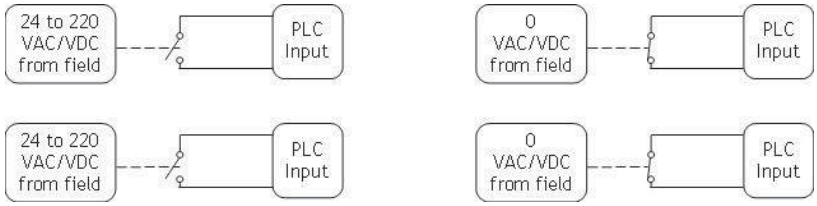
SAFETY RELAYS

Field device	Model	Connections	Rating	SIL level
	D5290S -079	 Relay with NE Coil and NE/ND Load for interrupting up to 4 loads. SIL 3 function: configurable via external wiring. AC Coil. Can be used to disconnect one or both supply lines (see data sheet).	5 A 250 Vac 1250 VA 5 A 250 Vdc 175 W 115 Vac Coil	SIL 3
	D5290S -080	 Relay with NE Coil and Load (1-1). AC Coil. SIL 3 function: disconnect Load by disconnecting input (0-0). Can be used to disconnect one or both supply lines (see figures).	10 A 250 Vac 2500 VA 10 A 250 Vdc 300 W 115 Vac Coil	SIL 3
	D5290S -084	 Relay with NE Coil and NE/ND Load for interrupting up to 4 loads. SIL 3 function: configurable via external wiring. AC Coil. Can be used to disconnect one or both supply lines (see data sheet).	5 A 250 Vac 1250 VA 5 A 250 Vdc 175 W 110 Vdc Coil	SIL 3
	D5293S	 Relay with NE Coil and Load (1-1). SIL 3 function: disconnect Load by disconnecting input (0-0). Can be used to disconnect both supply lines (see figures). With smart line and load diagnostic function. Modbus RS-485 output	4 A 250 Vac 1000 VA 4 A 250 Vdc 120 W 24 Vdc Coil	SIL 3

SAFETY RELAYS

Field device	Model	Connections	Rating	SIL level
	D5294S	 Relay with ND Coil and F&G/ND Load (0-0). SIL 3 function: connect Load by connecting input (1-1). Can be used to disconnect both supply lines (see figures). With smart line and load diagnostic function. Modbus RS-485 output.	4 A 250 Vac 1000 VA 4 A 250 Vdc 120 W 24 Vdc Coil	SIL 3
	D5295S	 Relay with NE Coil and F&G/ND Load (1-0). SIL 3 function: connect Load by disconnecting input (0-1). Can be used to disconnect both supply lines (see figures). With smart line and load diagnostic function. Modbus RS-485 output.	4 A 250 Vac 1000 VA 4 A 250 Vdc 120 W 24 Vdc Coil	SIL 3
	D1092S	 Relay with NE Coil and Load (1-1) or ND Coil and Load (0-0). SIL 3 function NE: disconnect Load by disconnecting input (0-0). SIL 3 function ND: connect Load by connecting input (1-1).	3 A 250 Vac 750 VA 3 A 125 Vdc 120 W 24 Vdc Coil	SIL 3
	D1092D	 Dual channel relay with NE Coil or Load (1-1) and ND Coil and Load (0-0). SIL 3 function NE: disconnect Load by disconnecting input (0-0). SIL 3 function ND: connect Load by connecting input (1-1). Can be used to disconnect two loads.	3 A 250 Vac 750 VA 3 A 125 Vdc 120 W 24 Vdc Coil	SIL 3

Field device	Model	Connections	Rating	SIL level
SAFETY RELAYS	D1092S -069	 Relay with NE Coil and NE Load (1-1) and ND Load (1-0). SIL 3 function NE: disconnect Load by disconnecting input (0-0). SIL 3 function ND: connect Load by disconnecting input (0-1).	3 A 250 Vac 750 VA 3 A 125 Vdc 120 W 24 Vdc Coil	SIL 3
	D1092D -069	 Relay with NE Coil and NE Load (1-1) and ND Load (1-0). SIL 3 function NE: disconnect Load by disconnecting input (0-0). SIL 3 function ND: connect Load by disconnecting input (0-1). Can be used to disconnect two loads.	3 A 250 Vac 750 VA 3 A 125 Vdc 120 W 24 Vdc Coil	SIL 3
	D1093S	 Relay with NE Coil and Load (1-1) or ND Coil and Load (0-0). SIL 3 function NE: disconnect Load by disconnecting input (0-0). SIL 3 function ND: connect Load by connecting input (1-1). With line and load diagnostic function.	3 A 250 Vac 750 VA 3 A 125 Vdc 120 W 24 Vdc Coil	SIL 3

	Field device	Model	Connections	SIL level
SAFETY RELAYS		D5093S	 Solid state NE Relay, configurable from 24 to 220 VAC/VDC input drive, 24 VDC rated voltage free output contact. Input/Output isolation. SIL 3 function NE: remove AC drive to open PLC input circuit.	SIL 3
		D5093D	 Dual Solid state NE Relays, configurable from 24 to 220 VAC/VDC input drive, 24 VDC rated voltage free output contact Input/Output/Channel isolation SIL 3 function NE: remove AC drive to open PLC input circuit.	SIL 3

D1000
SERIES

INTRINSICALLY SAFE ISOLATORS
SUITABLE FOR SIL 2 AND SIL 3 APPLICATIONS

D1000

CHARACTERISTICS

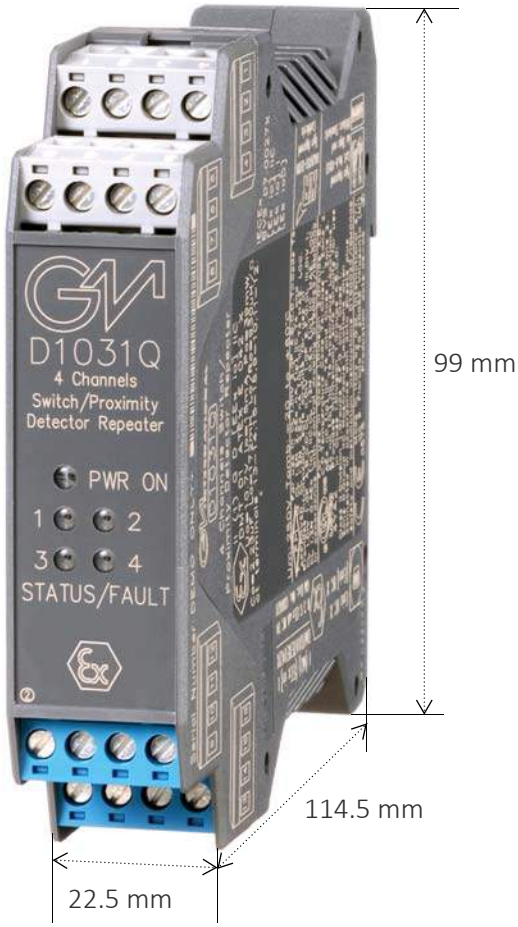
Safe Area Terminal blocks
with engraved identification

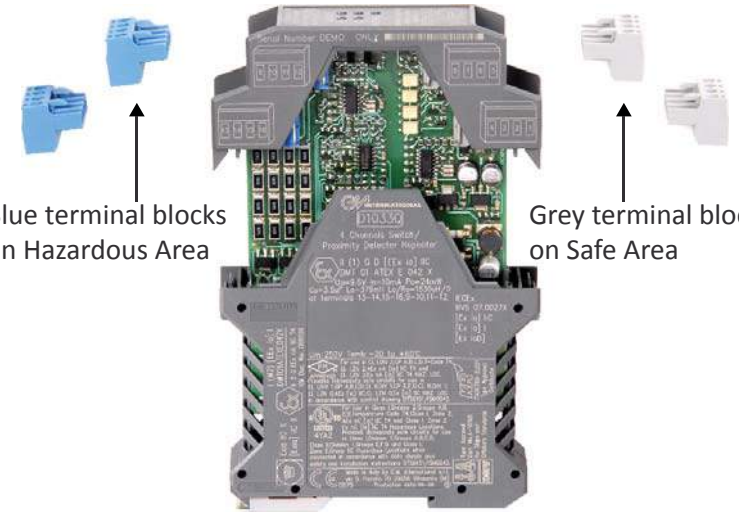
Terminal Block identification

Intrinsic Safety parameters,
schematic diagrams, connections, instructions

LEDs for power, status and fault indication

Laser engraving on entire enclosure and terminal blocks to provide accurate, safe and permanent marking





Blue terminal blocks
on Hazardous Area

Grey terminal blocks
on Safe Area

Front panel and PCB can be plugged out by applying a slight pressure on both sides using a tool.

Features

General Features

- More than 30 modules suitable for SIL 3 - SIL 2 applications according to IEC 61508, IEC 61511.
- Single channel versions available if required, to provide single loop integrity on Emergency Shut Down and Fire & Gas applications.
- Configuration via DIP switch for easy field setup.
- LED indication for power, signal status and line fault conditions.
- Modules accept DC power supply over a wide range for 12 or 24 Vdc applications.
- 2 modules (D1130 - D1180) can be powered from 85 to 264 Vac, 50-400 Hz, or from 100 to 350 Vdc.
- Wide operating temperature range (-20 / +60°C).

Enclosure Characteristics

- High channel density resulting from innovative circuit design using advanced surface mount components.
- Single, dual or quad channel models.
- Plug-in screw terminal blocks to secure terminations up to 2.5 mm^2.
- Plug-in PCB can be removed for configuration operations.

High Performance

- High signal transfer accuracy and repeatability.
- Advanced circuitry provides low heat dissipation, ensuring modules run cool despite their high functionality.
- Low power consumption.
- SMD manufacturing for a long and reliable life.

Wide Functionality

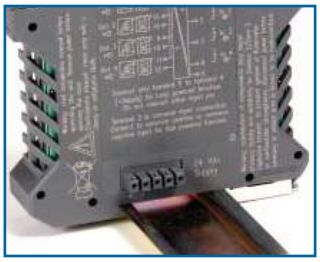
- Wide range of Digital and Analog I/Os.
- Relay contacts rated for 2 A to directly switch high loads.
- Three port galvanic isolation to eliminate noise, ground loop problems and to provide Intrinsic Safety without a high integrity safety earth connection.
- Line fault alarm detects open or short circuit of field cables.
- Optional Power Bus enclosure.

Packing

High Packing Density

- 35 mm (Top Hat) DIN-Rail.
- Ultra slim 4 channels 22.5 mm wide DIN-Rail mounting modules.
- 6 mm per channel.
- Up to 176 I/O channels per meter of DIN-Rail.
- Power Bus enclosure allows a significant reduction in cables, costs and space.

Power Bus



POWER BUS CONNECTOR MALE SIDE

POWER BUS CONNECTOR FEMALE SIDE

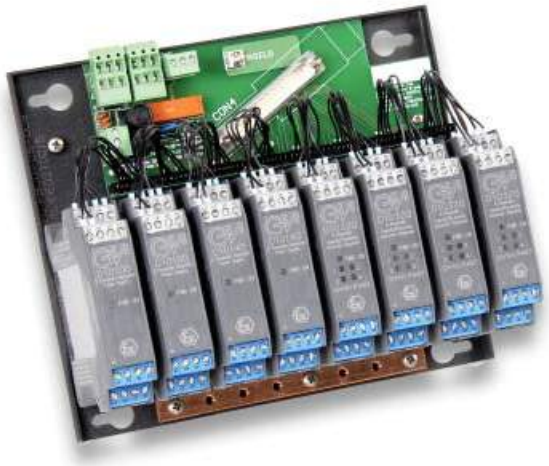
MODULE WITH POWER BUS MALE TERMINATION BLOCK

Enhanced Power Bus Mounting

24 Vdc power supply voltage can be applied to the module, by connecting the voltage directly to the plug-in Terminal Block of each module, or via Power Bus System.

The system consists of a standard Din-Rail Bar and modules with Bus Connectors (female on one side and male on the opposite side) of 8 A Capacity. It is always possible to remove modules, without disconnecting the connectors, because modules are plug-in types. Contacts on the Terminal Block are omitted to avoid accidental short circuits on the Power Bus.

Termination Board



PBCO Series

G.M. International offers many solutions for Customized Boards for an easy integration with instrumentation of manufacturers like Invensys Foxboro, ABB, Triconex, Yokogawa, Honeywell, HIMA and many more.

New Board models are engineered on customer request for any system or application: contact us for details.

Configuration

PPC 1090 Pocket Portable Configurator

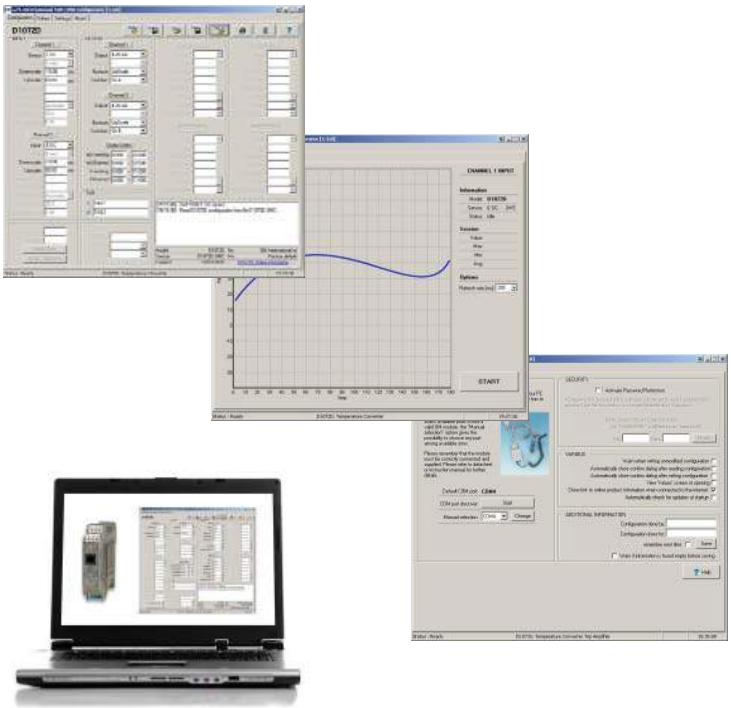
The PPC1090 is a small and handy Pocket Portable Configurator suitable to program configuration parameters of D1000 series modules like:
type of input Sensors, input and output Ranges, Burnout conditions, High/Low Alarm mode, Relay NE/ND, Alarm Trip Point, Hysteresis value and ON/OFF Alarm delays.
The Configurator is powered by the unit and can be plugged in without disconnecting the module.

PPC 1092 Serial Adapter

The PPC1092 adapter is needed to interface the PC with D1000 Series modules for a complete configuration of Input, Output and Alarm parameters.
The package includes necessary cables and a USB to RS-232 Adapter; a CD-Rom with the SWC1090 Software is also provided.
The SWC1090 can also be downloaded from our website.

D1000 Modules which can be configured via PC are:

D1052	Analog Signal Converter, Duplicator, Adder, Subtractor
D1053	Analog Signal Converter and Trip Amplifiers
D1054	Repeater Power Supply and Trip Amplifiers
D1060	Frequency-Pulse Converter, Repeater and Trip Amplifiers
D1064	Load Cell/Strain Gauge Bridge Isolating Converter
D1072	Temperature Signal Converter, Duplicator, Adder, Subtractor
D1073	Temperature Signal Converter and Trip Amplifiers



SWC1090 Software

The SWC1090 software is designed to provide a PC user interface to configure programmable D1000 modules.
It easily allows the user to:

- Read and write configuration parameters to the units;
- Store and restore data to and from local hard drive for backup or archive;
- Load factory default configurations;
- Monitor Input values via USB/COM port;
- Print a report sheet containing configuration parameters and additional information.

The SWC1090 is freely downloadable from our website: www.gmintsrl.com

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
ANALOG IN		D1010S	4-20 mA 0-20 mA 2/3-Wires Tx Smart compatible	4-20 mA 0-20 mA (source or sink) or 1-5 V 0-5 V	1	24 Vdc	SIL 3
		D1010D			2		SIL 3
		D1010D		Two duplicated outputs	1 in 2 out		SIL 3
		D1010S-046	4-20 mA 0-20 mA 2/3-Wires Tx Smart compatible. Certified with lower safety parameters	4-20 mA 0-20 mA (source or sink) or 1-5 V 0-5 V	1	24 Vdc	SIL 2
		D1010D-046			2		SIL 2
		D1012Q	4-20 mA 2-Wires Tx	4-20 mA (source)	4	24 Vdc	-
		D1014S	4-20 mA 2-Wires Tx Hart compatible	4-20 mA (source or sink) or 1-5 V	1	12-24 Vdc	SIL 2
		D1014D			2		SIL 2
ANALOG OUT		D1020S	4-20 mA 0-20 mA Analog Signal to I/P Converters, Electrovalves, Actuators and Displays Smart compatible	4-20 mA 0-20 mA Bus powered signal from DCS, PLC or other control devices.	1	24 Vdc	SIL 2
		D1020D			2		SIL 2
FIRE & GAS DETECTOR		D1022S	1 to 40 mA Fire/Smoke Detector	1 to 40 mA to DCS, PLC or other control devices	1	Loop powered	-
		D1022D			2		-

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
DIGITAL IN		D1030S	Voltage free Contact, Proximity Switch Line fault detection	SPDT (relay contact) + SPDT (alarm or duplicator) + LED (fault status)	1	24 Vdc	-
		D1030D		SPDT (relay contact) + LED (fault status)	2		-
		D1130S	Voltage free Contact, Proximity Switch Line fault detection	SPDT (relay contact) + SPDT (alarm or duplicator) + LED (fault status)	1	110-230 Vac	-
		D1130D		SPDT (relay contact) + LED (fault status)	2		-
		D1031D	Voltage free Contact, Proximity Switch Line fault detection	Open Collectors + OC (alarm or duplicator) + LED (fault status)	2	12-24 Vdc	-
		D1031Q		Open Collectors + LED (fault status)	4		-
		D1032D	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	SPST (relay contact) + SPST (alarm or duplicator) + LED (fault status)	2	24 Vdc	SIL 2
		D1032Q		SPST (relay contact) + LED (fault status)	4		SIL 2
		D1033D	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	Open Collectors + OC (alarm or duplicator) + LED (fault status)	2	24 Vdc	SIL 2
		D1033Q		4 Open Collectors + LED (fault status)	4		SIL 2
		D1034S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	Transparent repeater of input status 0 to 8 mA range	1	12-24 Vdc	SIL 3
		D1034D			2		SIL 3
		D1035S	0-50 KHz Magnetic Pickup or Proximity Switch	Voltage free SPST optocoupled OC transistor	1	12-24 Vdc	-

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
DIGITAL OUT		D1040Q	Electrovalve, Audible Alarm or other devices	Voltage free Contact, Logic Level, Loop powered 24 Vdc from DCS, PLC or other control devices	4	24 Vdc	SIL 2 Bus powered or SIL 3 Loop powered
		D1041Q	LED		4		
		D1042Q	Electrovalve, Audible Alarm or other devices		4		
		D1043Q	Electrovalve, Audible Alarm or other devices		4		
		D1044S	SPDT (relay contact)	Voltage free Contact, Logic Level, Loop powered 24 Vdc from DCS, PLC or other control devices	1	24 Vdc	-
		D1044D			2		SIL 2
		D1045Y	Electrovalve, Audible Alarm or other devices	Voltage free Contact, Logic Level, Loop powered 24 Vdc from DCS, PLC or other control devices	2 alternate	24 Vdc	-
		D1046Y			2 alternate		-
		D1048S	NE Electrovalve, Audible Alarm or other devices Line/Load fault detection	Loop Powered control signal from safety PLC, DCS	1	24 Vdc	SIL 3
		D1049S		Voltage free Contact, Logic Level, from DCS, PLC or other control devices. Bus powered	1		SIL 3
SIGNAL CONV.		D1052S	4-20 mA, 0-20 mA 1-5 V, 0-5 V, 2-10 V, 0-10 V from 3/4-Wires powered Tx or other instrument	4-20 mA, 0-20 mA (source) or 1-5 V, 0-5 V, 2-10 V, 0-10 V	1	12-24 Vdc	-
		D1052D			2		-

Configurable via PPC1090 or PPC1092 and SWC1090 Software

D1000 Selection Table

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
SIGNAL CONV. + TRIP AMPLIFIERS		D1053S	4-20 mA, 0-20 mA 1-5 V, 0-5 V, 2-10 V, 0-10 V	4-20 mA, 0-20 mA (source) or 1-5 V, 0-5 V, 2-10 V, 0-10 V Independent set points via SPST Relays	1	24 Vdc	SIL 2
		D1054S	4-20 mA, 0-20 mA 2/3-Wires Tx, Smart compatible		1	12-24 Vdc	SIL 2
		D1073S	Universal TC, 3/4-Wires RTD, Potentiometer, mV		1	24 Vdc	SIL 2
		D1060S	0-50 KHz Magnetic Pickup or Proximity Switch	mA (source) or V Out, Pulse repeater Output + set point SPST Transistor	1	12-24 Vdc	-
SERIAL CONV.		D1061S	RS-485, RS-422 up to 1.5 Mbit/s	RS-485, RS-422, RS-232	1	24 Vdc	-
VIBRATION INTERFACE		D1062S	Vibration Transducers, Accelerometers, 2/3-Wires sensors	Transparent input repeater	1	24 Vdc	SIL 2
LOAD CELLS ISOLATOR CONV.		D1063S	Up to 4, 350 Ω, 6-Wires Load Cells in parallel.	Transparent input repeater.	1	24 Vdc	-
		D1064S		mA (source or sink) and V Output and MODBUS RTU	1		-
DIGITAL IN 3-WIRES SENSOR		D1080D	3-Wires Sensors, Electro-optic, photo-cells and other devices	SPST (relay contact)	2	24 Vdc	
		D1180D			2	110-230 Vac	
		D1081D		Voltage free SPST optocoupled OC transistor	2	15-24 Vdc	

Configurable via PPC1090 or PPC1092 and SWC1090 Software

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply	SIL level
TEMPERATURE CONVERTRS		D1072S	Universal TC, 3/4-Wires RTD, Potentiometer, mV	4-20 mA, 0-20 mA (source) or 1-5 V, 0-5 V, 2-10 V, 0-10 V	1	12-24 Vdc	SIL 2
		D1072D			2		SIL 2
		D1072D		Two duplicated outputs Adder/Subtractor Low/High pass	1- 2		SIL 2
		D1010S -054	-5 to +55 mV Thermocouple	4-20 mA (source)	1		SIL 3
		D1010S -056	-5 to +35 mV Thermocouple.	Fast response time for temperature measurements in critical applications (i.e: gas turbines)	1	24 Vdc	SIL 3
		D1010S -057	-5 to +10 mV Thermocouple.		1		SIL 3
SHUNT RESISTOR		D1090Q	Separately powered 4-20 mA, 0-20 mA	10 to 50 mV or 0 to 50 mV to D2010M, D2011M	4	-	-
		D1094Q	Separately powered 0-5 V, 0-10 V	0 to 20 mV or 0 to 40 mV to D2010M, D2011M	4	-	-
POWER SUPPLIES		for more information and details about Power Supplies, see section at page 72					
SAFETY RELAYS		for more information and details about Safety Relays, see section at page 33					

Configurable via PPC1090 or PPC1092 and SWC1090 Software

Image	Code	Description
	**MCHP065**	DIN-Rail Anchor for terminal block side of the Power Bus
	**MCHP139**	5 mm spacer for modules on DIN-Rail
	**MOR016**	DIN-Rail Stopper
	**MOR015**	Plug-in terminal block male, vertical out, for Power Bus
	**MOR017**	Plug-in terminal block male, horizontal out, for Power Bus
	**MOR022**	Plug-in terminal block female, horizontal out, for Power Bus
	**OPT1091**	Cold Junction Compensator for TC Input
	**OPT1096**	Kit for Bus Mounting includes: 2 x MOR016, 1 x MOR017, 1 x MOR022, 2 x MCHP065
	**/B**	Power Bus Enclosure
	**D1091S**	Common Bus Alarm Module with SPDT Relay Fault Output indication
	**PPC1090**	Pocket Portable Configurator with cables
	**PPC1092**	RS-232 Serial Adapter for Configuration via PC, includes USBADAPT and cables
	**USBADAPT**	USB to RS-232 Adapter for PC
	**SWC1090**	PC Software for Configuration (free of charge at www.gmintsrl.com)

EI1000ADP SERIES

G.M. International offers continuity in the service of Elcon Instruments 1000 series (no longer available from the manufacturer).

Features

- ATEX, FM, FM-C Certifications.
- Interchangeability with Elcon 1000 Series modules.
- Possibility to replace Elcon modules without modifying any wiring or connections.
- Use of the same Elcon boards.
- Identification using the same Elcon part-number.

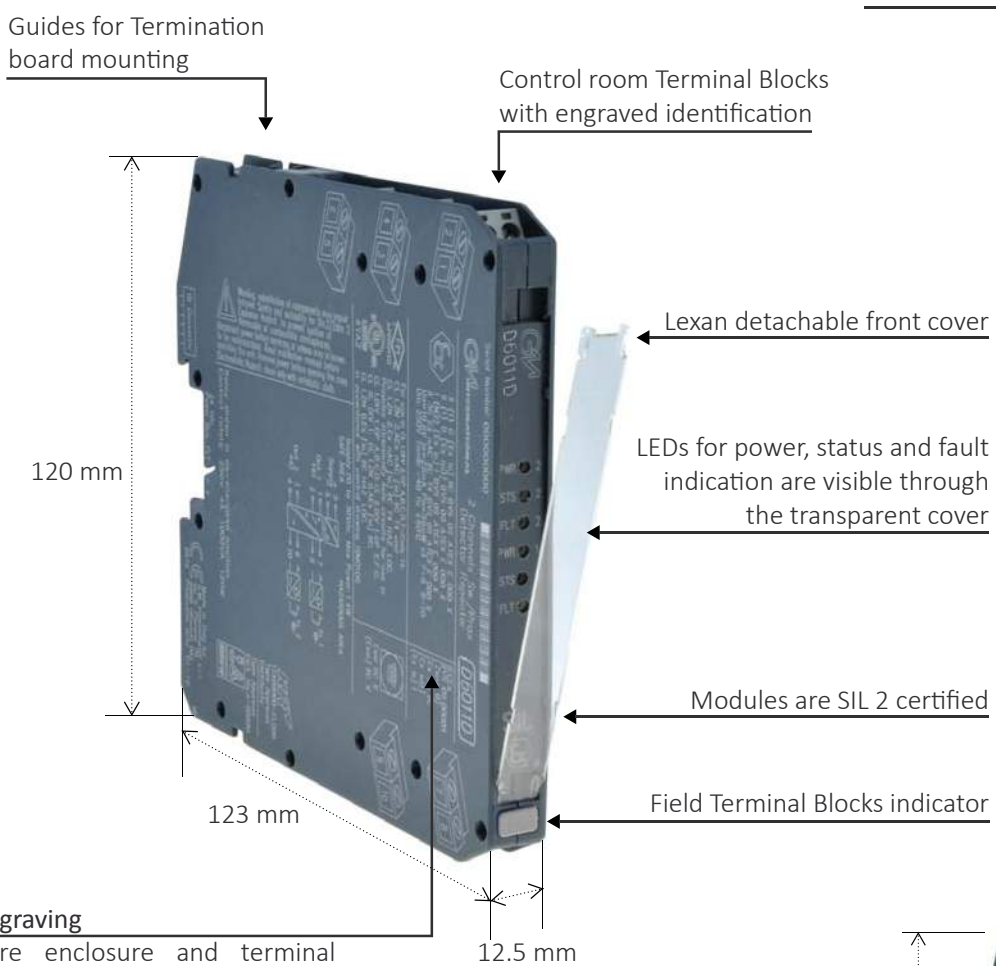
Model	Description	Ch.
	Analog Input, Power Supply Repeaters	
1021	Analog Input Repeater, Smart Tx Compatible (non Honeywell Compatible)	1
1022	Analog Input Repeater, Smart Tx Compatible (non Honeywell Compatible)	2
1023	Analog Input Repeater, Floating Output	1
1025	Analog Input Repeater, Smart Tx Compatible	1
1025G	Analog Input Repeater, Smart Tx Compatible, 3 Port Isolation, Isc=93mA for wider applications	1
1026	Analog Input Repeater, Smart Tx Compatible	2
1026G	Analog Input Repeater, Smart Tx Compatible, 3 Port Isolation, Isc=93mA for wider applications	2
1029	Analog Input Repeater, Smart Tx Compatible Sink/Source Output, Isc=93mA for wider applic.	1
1030	Analog Input Repeater, Smart Tx Compatible Sink/Source Output, Isc=93mA for wider applic.	2
	Analog Input, Power Supply Repeater and Trip Amplifier	
1020	Analog Input (Tx or Current Source), Analog Repeater and 1 Set point Trip Amplifier	1
1027	Analog Input (Tx or Current Source), Analog Repeater and 2 Set point Trip Amplifiers	1
	Analog Output, Powered Isolating Drivers for I/P	
1031	Analog Output Isolating Driver, Bus Powered	1
1032	Analog Output Isolating Driver, Bus Powered	2
1033	Analog Output Isolating Driver, Bus Powered (Not Loop Powered)	1
1034	Analog Output Isolating Driver, Bus Powered (Not Loop Powered)	2
1037	Analog Output Isolating Driver, Bus Powered for Smart I/P and Positioner	1
1038	Analog Output Isolating Driver, Bus Powered for Smart I/P and Positioner	2

Model	Description	Ch.
	Fire and Smoke Detectors Repeaters	
1035	Loop Powered Isolator for Fire and Smoke Detectors	1
1036	Loop Powered Isolator for Fire and Smoke Detectors	2
1039	Loop Powered Isolator for Fire and Smoke Detectors, Isc=93mA for wider applications	1
1040	Loop Powered Isolator for Fire and Smoke Detectors, Isc=93mA for wider applications	2
	Analog Signal and Temperature Converters Fully Programmable	
1011	mA or V Input, mA or V Output	1
1012	mA or V Input, mA or V Output	2
1061	TC or mV Input, mA or V Output (Temperature Linear Output)	1
1062	TC or mV Input, mA or V Output (Temperature Linear Output)	2
1065	TC or mV Input, mV Output (mV Linear Output)	1
1066	TC or mV Input, mV Output (mV Linear Output)	2
1071	RTD or Potentiometer Input, mA or V Output (Temperature Linear Output)	1
1072	RTD or Potentiometer Input, mA or V Output (Temperature Linear Output)	2
1073	RTD or Potentiometer Input, mA or V Output (Temperature Linear Output) and 3 Port Isolation	1
1074	RTD or Potentiometer Input, mA or V Output (Temperature Linear Output) and 3 Port Isolation	2
1090	Strain Gauge or Load Cell Input, mA or V Output	1
	Digital Input Switch/Proximity Repeater	
1821	Switch/Proximity Input Repeater, Relay Output (DPDT)	1
1822	Switch/Proximity Input Repeater, Relay Output (SPDT)	2
1841	Switch/Proximity Input Repeater, Transistor Output	1
1842	Switch/Proximity Input Repeater, Transistor Output	2
	Digital Output Drivers for Solenoid Valves, LEDs, Horns	
1861	SPDT Relay Output	1
1862	SPDT Relay Output	2
1871	Digital Output Driver for Solenoid Valves	1
1872	Digital Output Driver for Solenoid Valves	2
1873	Digital Output Driver for Solenoid Valves	1
1874	Digital Output Driver for Solenoid Valves	2
1881	Digital Output Driver for Solenoid Valves	1
1882	Digital Output Driver for Solenoid Valves	2
	Frequency to Analog Converter + Pulse Repeater	
1891	Pulse Input, Proximity or Magnetic Sensor, mA or V Output and Pulse Repeater	1
1893	Pulse Input, Proximity or Magnetic Sensor, Pulse Repeater	1
	Analog Signal and Temperature Trip Amplifiers Fully Programmable	
1310	mA or V Input, 1 Set point, Relay Output, 1 x DPST	1
1311	mA or V Input, 2 Set points, Relay Output, 2 x SPST	1
1360	TC or mV Input, 1 Set point, Relay Output, 1 x DPST	1
1361	TC or mV Input, 2 Set points, Relay Output, 2 x SPST	1
1370	RTD or Potentiometer Input, 1 Set point, Relay Output, 1 x DPST	1
1371	RTD or Potentiometer Input, 2 Set points, Relay Output, 2 x SPST	1
1901	mA or V Input, 2 Set points, Relay Output, 2 x SPST, Non Intrinsically Safe	1

D6000
SERIES

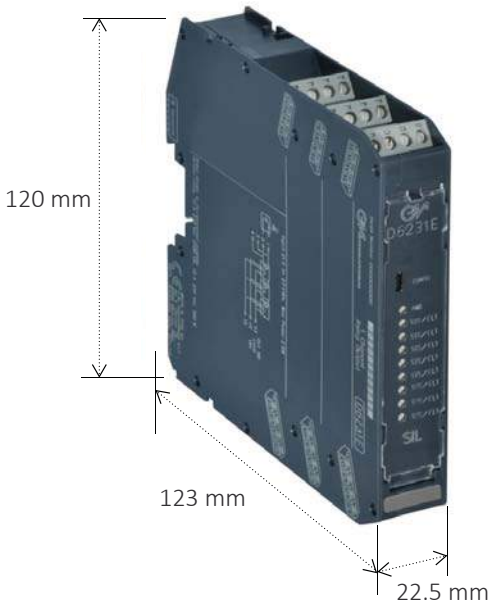
ENHANCED GALVANIC ISOLATORS
SUITABLE FOR SIL 2 APPLICATIONS

D6000
CHARACTERISTICS



Laser engraving
on entire enclosure and terminal blocks to provide accurate, safe and permanent marking of parameters, schematic diagrams, connections and instructions.

D6200
DIMENSIONS



High Performance

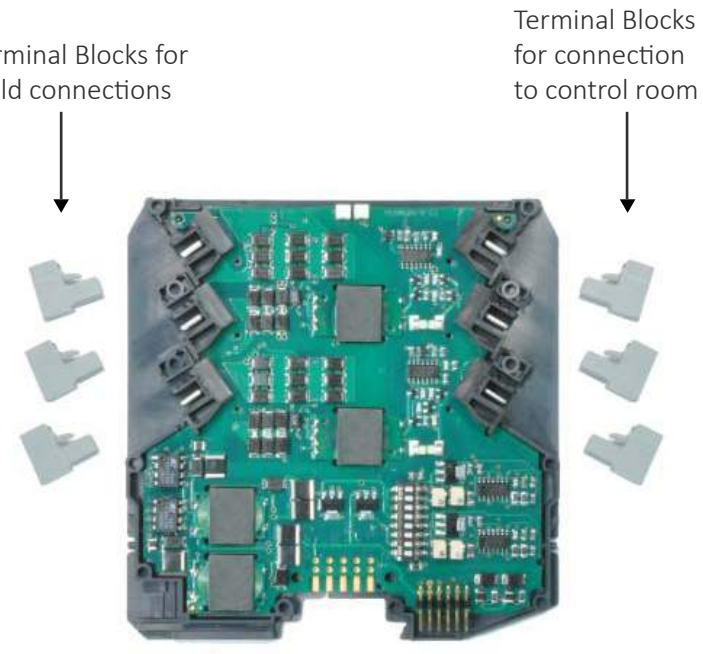
- High signal transfer accuracy and repeatability.
- Advanced circuitry provides very low heat dissipation, ensuring modules run cool despite their high density and functionality.
- SMD manufacturing for a long, reliable life.
- Complete absence of electrolytic capacitors ensures minimum 20 years lifetime.

Wide Functionality

- Wide range of digital and analog I/O.
- Three port galvanic isolation to eliminate noise, ground loop problems.
- Line fault alarm detects open or short circuit of field cables.
- Optional power bus DIN-Rail connector.
- Standard Termination Board with custom connectors for integration into customized Boards.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1, EN61326-3-1 for safety system.

High Packing Density

- High packing density.
- 35 mm (Top Hat) DIN-Rail.
- Ultra slim 2 channels 12 mm wide DIN-Rail and Termination Board mounting modules.
- Power and fault on bus connectors.
- 6 mm per channel means 50% space reduction.



General Features

- Modules suitable for SIL 2 applications according to IEC 61508, IEC 61511.
- Single or multichannel versions available.
- Configuration components are easily accessed by removing the side cover.
- DIP switch configurability for easy field setup.
- LED indication for power, signal status and line fault conditions.
- Modules accept DC power supply over a wide range for 24 Vdc (20-30 Vdc) applications.
- Wide operating temp. range:-40 to +60/+70 °C.

Features

For enclosure characteristics, Power Bus, Termination Board mounting and configuration tools refer to D5000 Series (see pages 20-22)

	Field device	Model	In	Out	Ch. per unit	Supply	SIL level
ANALOG IN		D6011S	4-20 mA 2-Wires passive Tx; Smart compatible	4-20 mA (source)	1	24 Vdc	SIL 2
		D6011D			2		SIL 2
		D6014S	4-20 mA 2-3-4 Wires Active or Passive Tx; Smart compatible	4-20 mA (source or sink)	1	24 Vdc	SIL 2
		D6014D			2		SIL 2
		D6014D		Two duplicated outputs	1 in 2 out		SIL 2
		D6212Q	4-20 mA 2-Wires Passive Tx	4-20 mA + Modbus	4	24 Vdc	SIL 2
		D6212Q		Two duplicated outputs + Modbus	2 in 4 out		SIL 2
		D6212Q		One Triplicated + One single outputs + Modbus	2 in 4 out		SIL 2
		D6212Q		One Quadriplicated output + Modbus	1 in 4 out		SIL 2
		D6254S	4-20 mA, 2/3/4-Wires Tx Active or Passive; Smart compatible	4-20 mA, 2 Trip Amplifiers each whit 1 SPST (relay ontact) + Modbus	1	24 Vdc	SIL 2
ANALOG OUT		D6020S	4-20 mA Analog Signal to I/P Converters, Electrovalves, Actuators and Displays; Smart compatible	4-20 mA Bus powered signal from DCS, PLC or other control devices. Two duplicated outputs.	1	24 Vdc	SIL 2
		D6020D			2		SIL 2

Configurable via PPC5092 and SWC5090 Software

D6000 Selection Table

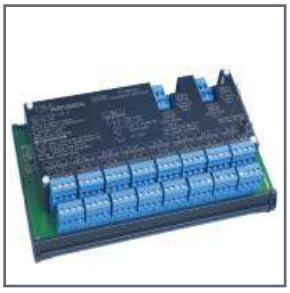
	Field device	Model	In	Out	Ch. per unit	Supply	SIL level
DIGITAL IN		D6030S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	SPDT (relay contact) + LED (fault status)	1	24 Vdc	SIL 2
		D6030D		SPST (relay contact) + SPST (alarm or duplicator) + LED (fault status)	1 in 2 out		SIL 2
		D6030D		SPST (relay contact) + LED (fault status)	2		SIL 2
		D6031S	Voltage free Contact, Proximity Switch Line fault detection Isolated inputs	Open Collector + LED (fault status)	1		SIL 2
		D6031D		Open Collectors + O.C. (alarm duplicator) + LED (fault status)	1 in 2 out	24 Vdc	SIL 2
		D6031D		1 Open Collector + LED (fault status)	2		SIL 2
		D6231E	Voltage free Contact, Proximity Switch Line fault detection	Open Collectors + LED (fault status) + Modbus	8	24 Vdc	SIL 2
TEMPERATURE CONVERTERS AND TRIP AMPLIFIERS		D6072S	Universal TC, 3/4-Wires RTD, Potentiometer, mV	4-20 mA (source or sink) + Modbus Independent set point via Solid State Relay	1	24 Vdc	SIL 2
		D6072D	Universal TC, 3-Wires RTD, Potentiometer, mV	4-20 mA (source or sink) + Modbus Duplicator	1 in 2 out	24 Vdc	SIL 2
		D6072D		4-20 mA (source or sink) + Modbus	2		SIL 2
		D6273S	Universal TC, 3/4-Wires RTD, Pot, mV	4-20 mA (source or sink) independent set points via SPDT Relay each + Modbus	1	24 Vdc	SIL 2

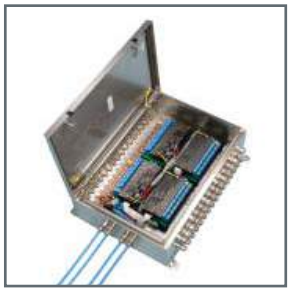
Configurable via PPC5092 and SWC5090 Software

Image	Code	Description
	**JDFT049**	12 mm Power Bus Connector for DIN Rail Mounting 1 needed for each BUS Module
	**JDFT050**	22 mm Power Bus Connector for DIN Rail Mounting 1 needed for each BUS Module
	**MCHP196**	Bus End Stopper One required for each end of Bus
	**MOR017**	Plug-in terminal block male, horizontal out, for Power Bus
	**MOR022**	Plug-in terminal block female, horizontal out, for Power Bus
	**OPT5096**	Kit for Bus Mounting includes: 1 x MOR017, 1 x MOR022, 2 x MCHP196
	**PPC5092**	PC Adapter required to configure programmable units; Mini USB Male cable to USB Port
	**SWC5090**	PC Software for Configuration

D2000
SERIES

INTRINSICALLY SAFE MULTIPLEXER
FOR ANALOG AND DIGITAL INPUTS FROM ZONE 0





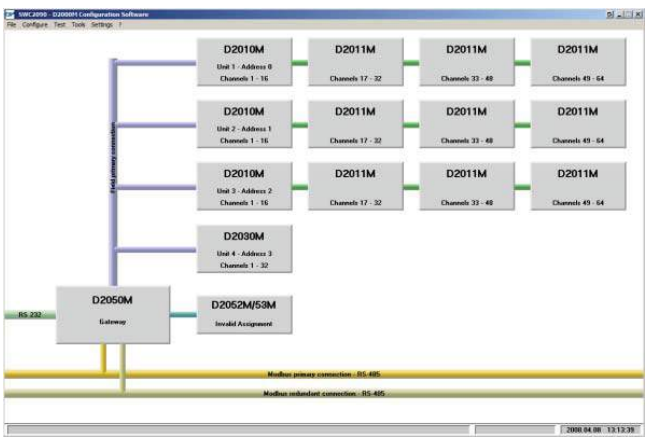
D2000
CHARACTERISTICS

Features

- High density, up to 256 Analog Inputs (TC, RTD, mV) and up to 128 digital inputs (contact / proximity) in the same system (expandable up to 7936 inputs)
- High accuracy 18 bit A/D converter
- Robust Isolation (± 200 V test voltage channel to channel), provides high immunity against interference and ground loops
- Intrinsically safe for installation in Zone 1 or 2
- Field units can be placed up to 4 km from Gateway
- Redundant communication lines
- Programmable via PC (RS232) and Modbus (RS485)
- Repeats input contacts via Relay or Transistor outputs
- Reduces field wiring and installation costs
- Eliminates the need of PLC- DCS I/O cards.
- Field unit operating temperature:- 40 to + 60 °C.
- AISI 316 stainless steel enclosures are available for field units (Series GM2300).
- Gateway D2050M can be installed in Zone 1 / Div. 1 by using an explosion proof enclosure.

Software Configurator for D2000

- Configure and monitor the entire system with your PC / Laptop via RS232 and/or RS485 connections
- Guided user interface
- Print complete report sheets
- Save configurations to file for backup
- Multilanguage



D2050M

- GATEWAY/POWER SUPPLY MULTIPLEXER UNIT
- II (1) G [Ex ia Ga] IIC
- Supply 24 Vdc
- Redundant MODBUS RTU- RS485 lines up to 115200 bauds
- RS-232 line for configuration via PC
- Suitable to drive contact/proximity output repeaters
- Safe Area Installation or Zone 1 / Div 1 when mounted in an explosion proof housing
- Operating Temperature- 20 to + 60 °C.

D2010M - D2011M

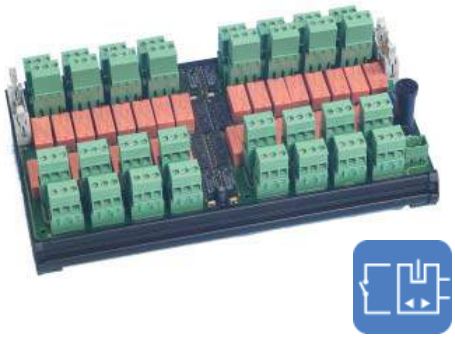
- ANALOG / TEMPERATURE MULTIPLEXER UNIT
- II (1) 2G Ex ia [ia Ga] IIC T4 Gb
- 16 Channels per Unit, each for 2-3-4 wires RTD, Pt100, Pt50, Ni100, Cu100, Cu53, Cu50, Cu46,
  TC Type A1, A2, A3, B, E, J, K, L, Lr, N, R, S, T, U.
- Up to 16 Units per gateway
- 256 Channels are scanned in 1700 ms
- Redundant Communication with D2050M gateway
- PC Programmable via SWC2090 software
- Zone 1 / Div. 1 Installation
- Operating Temperature- 40 to + 60 °C.

D2030M

- SWITCH / PROXIMITY MULTIPLEXER UNIT
- II (1) 2G Ex ia [ia Ga] IIC T4 Gb
- 32 Channels per Unit
- Input from Contact-Proximity Sensors
- Up to 4 Units per System
- 128 Channels are scanned in 50 ms
- Redundant Communication with D2050M Gateway
- PC Programmable via SWC2090 software
- Zone 1 / Div. 1 Installation
- Operating Temperature- 40 to + 60 °C

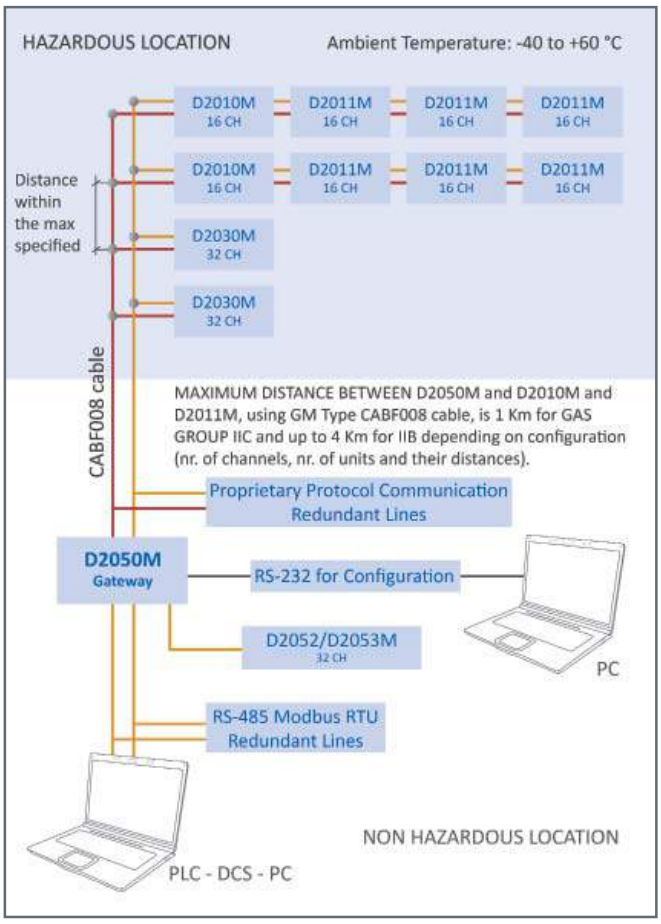
D2052M - D2053M

- CONTACT / PROXIMITY OUTPUT REPEATER
- 32 Isolated Channels with SPDT Relay contacts (D2052M) or Open Collector Transistors (D2053M)
- up to 4 Units per gateway
- 128 Channels are scanned in 50 ms
- Safe Area Installation or Zone 1 / Div. 1 when mounted in an explosion proof housing.
- Operating Temperature- 20 to + 60 °C

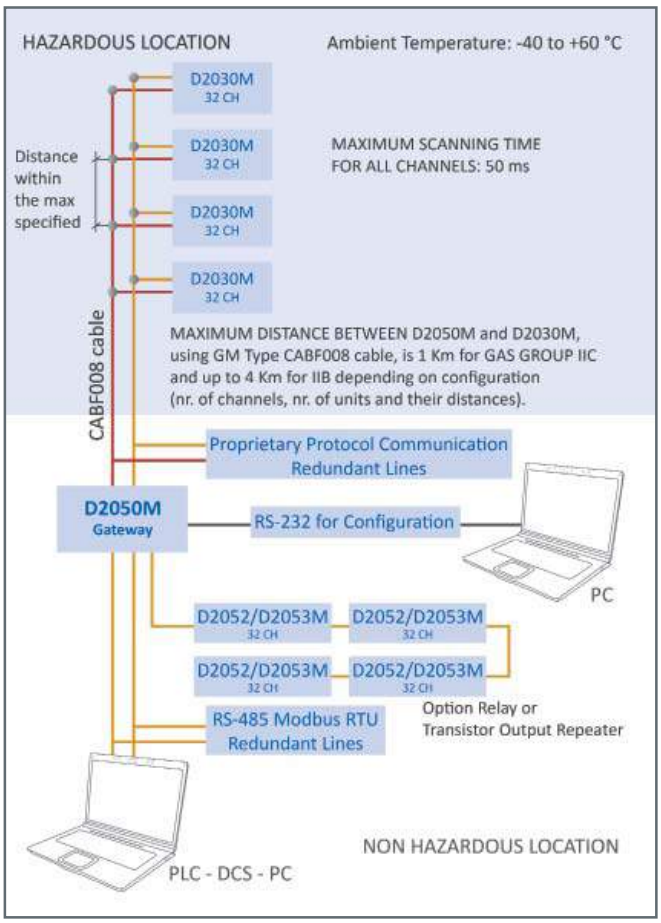


SYSTEM ARCHITECTURE

D2000 Multiplexer accepts both analog and digital inputs in the same system allowing the user to choose whatever configuration fits his application best in terms of cost and cabling.
The following are two examples of achievable system architectures.



128 Analog and 64 Digital Inputs. One of the two D2030M digital units is repeated in safe area through a D2052M or D2053M.



128 Digital Inputs from 4 D2030M slave units in the field and 128 Digital Outputs in Safe Area through repeaters D2052M or D2053M.

MULTIPLEXING TECHNIQUE

Signal Data Acquisition

In industrial processes it is a common need to acquire a relevant number of temperatures, pressures, flows, levels and other process variables as well as the status of switches or proximitors and to collect all these data in a single remote collection area (i.e. in a control room) where a PLC (Programmable Logic Controller) or a Process Computer collects all data for monitoring purposes and availability to operators.
SCADA (Signal Conditioning And Data Acquisition) equipments are particularly suited for this purpose.
Typical applications are Furnaces, Cracking Towers, Gasifiers, Reactors, Distillers, Separators, Oxidizers, Tank Monitoring, Flare Stacks.
Mux system permit fast, accurate and stable Analog to Digital conversion, high speed computing, sophisticated intelligence and powerful measuring capabilities.
All this performance can be packed into compact, reliable units that can operate in harsh environments.
Multiplexers are a typical SCADA multi channel equipment that can be located in the field close to the process area where the input channels can be connected with shorter lines.
All input channel signals are converted in a numeric form and transmitted to a remote location via a single or redundant communication line.

The advantages of multiplexing

When a consistent quantity of variables must be made available to a distant location, instead of wiring each process variable signal with long individual connection lines up to the control room, it is advantageous to connect all input signals to a conveniently located field Multiplexer with short connections lines to the sensors. Data is then sent through a single communication line to the remote monitoring area.
Even when space for cables is available, the saving in cable costs alone justifies, most of the times, a multiplexer solution; in addition, a tidy simple connection is obtained avoiding cluttering of wires in the control room area.
Less cabling is not the only advantage; when using a remote multiplexer there is no longer the need to use Transmitters, Safety Barriers and Analog Input channels providing for a drastic price reduction.

Multiplexing in Hazardous Area

For applications in classified Hazardous Areas each signal must be protected from the risk of causing an ignition of flammable mixtures: this requires a safety barrier for each input channel.
By using an Intrinsically Safe multiplexer solution, protection must be applied only to the communication lines, decreasing complexity, maintenance and costs.

When multiplexing is the only viable solution

In case of revamping or exspantion in the plant, the space for adding cables may be limited or the few existing spare cables may be the only ones that can be used.
Radio Frequency links, beside costs and licensing problems, suffer data security and reliability issues.
Multiplexing often becomes the only practical solution.

	Field device	Model	Hazardous Area	Safe Area	Ch. per unit	Supply
INTRINSICALLY SAFE MULTIPLEXER		D2010M	Universal TC, 3/4-Wires RTD, mV	D2050M Gateway via redundant communication line, up to 4 Km away	16	Supplied by D2050M
		D2011M	Universal TC, 3/4-Wires RTD, mV Connected to D2010M		16	
		D2030M	Voltage free contacts, proximity switches Line Fault Detection		32	
		D2050M	Up to 4 units D2010M, D2030M.	RS-485 MODBUS, RS-232 Serial line	-	24 Vdc
		D2052M	Digital signals from D2030M	Relay, digital repeater	32	24 Vdc
		D2053M		O.C. Transistor, digital repeater	32	

D2000 Accessories

Image	Code	Description
	**D1090Q** **D1094Q**	4 channels shunt module for mA input 4 channels voltage divider module for V input
	**OPT2091**	Cold Junction compensator for TC input
	**MOR016**	DIN-Rail Stopper
	**CABF005** **CABF006** **CABF007**	Flat cable to interconnect D2010M with expander units D2011M. Available in 15, 30, 50 cm lengths.
	**CABF022** **CABF023** **CABF024**	Flat cable to interconnect D2050M with repeater units D2052M/D2053M. Available in 15, 30, 50 cm lengths.
	**CABF008**	Cable to interconnect D2050M with field units D2010M and D2030M

POWER SUPPLIES

INTRINSICALLY SAFE AND NON-INCENDIVE POWER SUPPLIES

POWER SUPPLIES

MODELS

PSD1000

Universal Input Power Supply for D1000 Series Isolators (PS)

- Supply 90- 265 Vac
- Output 24 Vdc, 500 mA
- 2 Units can be paralleled for redundancy or additional power
- Remote indication for Power Failure for PSD1000F
- Installation adjacent to D1000 Series Modules, without Safety distance of 50 mm, because Supply and Output Terminal Blocks are on the same side
- Zone 2 / Div. 2 installation

PSD1001

***SIL 2 / SIL 3** 4 Channels Intrinsically Safe Power Supply (PS)*

- II (1)G [Ex ia Ga] IIC; I (M1) [Ex ia Ma] I; II (1) D [Ex ia Da] IIIC
- 4 Independent Outputs 15 V, 20 mA
- Output to Zone 0 / Div. 1
- Zone 2 / Div. 2 installation
- Flexible modular multiple output capability
- Output short circuit proof and current limited
- High Reliability, SMD components
- High Density, four channels per unit
- Simplified installation using standard DIN Rail and plug-in terminal blocks

PSD1001C

***SIL 2 / SIL 3** 1 Channel Intrinsically Safe Power Supply (PS)*

- II (1)G [Ex ia Ga] IIB; I (M1) [Ex ia Ma] I; II (1) D [Ex ia Da] IIIC
- Output 13.5 V- 100 mA
- Input from Zone 0 / Div. 1
- Zone 2 / Div. 2 installation
- Output short circuit proof and current limited

PSD5201

***SIL 3** 1 Channel Intrinsically Safe Power Supply (PS)*

- II 3(1)G Ex nA [ia Ga] IIB T4 Gc;
  II (1) D [Ex ia Da] IIIC; I (M1) [Ex ia Ma] I
- 1 Output 14.5 V- 150 mA
- Output to Zone 0 / Div. 1
- Zone 2 / Div. 2 installation

PSW1250

SIL 2 / SIL 3 *Universal Input Power Supply*

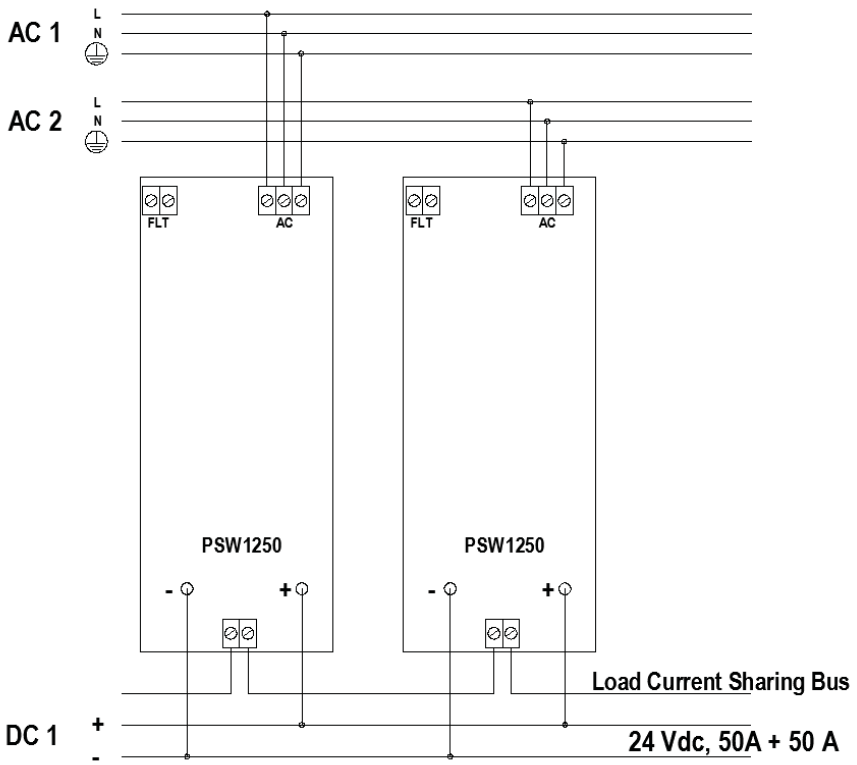
24 Vdc, 50 A, Zone 2 / DIV. 2 Installation Suitable for Parallel Operations

- Supply 90- 265 Vac
- Output 24 Vdc, 50 A; regulated and adjustable from 21 to 28 Vdc.
- Efficency better than 87% at 230 Vac supply
- Two or more Units can be paralleled for Redundancy or additional power with automatic load sharing
- Remote indication for Power Failure
- Zone 2 / Div. 2 installation
- ATEX Category 3 for Zone 2;
  II 3 G Ex nA nC IIC T3 Gc;
  IECEx Ex nA nC IIC T3 Gc
- Three over-voltage redundant protections
- Reduces Power dissipation by replacing a Schottky diode with Mosfet Active Ideal Diode
- Wall or DIN-Rail mounting
- Two Units in parallel offer AC1 or AC2 redundancy
- Power Factor correction
- High load fuse breaking capability without interrupting operations

Function Diagram Dual AC Supply wiring architecture for PSW1250:

PSW1250, dual AC supply, one 50 A Output + one redundant 50 A Output.

Two modules connected in parallel to provide full redundancy on AC lines (AC1 and AC2); one 50 A redundant output.



PSW1230

SIL 2 / SIL 3 *Universal Input Power Supply*

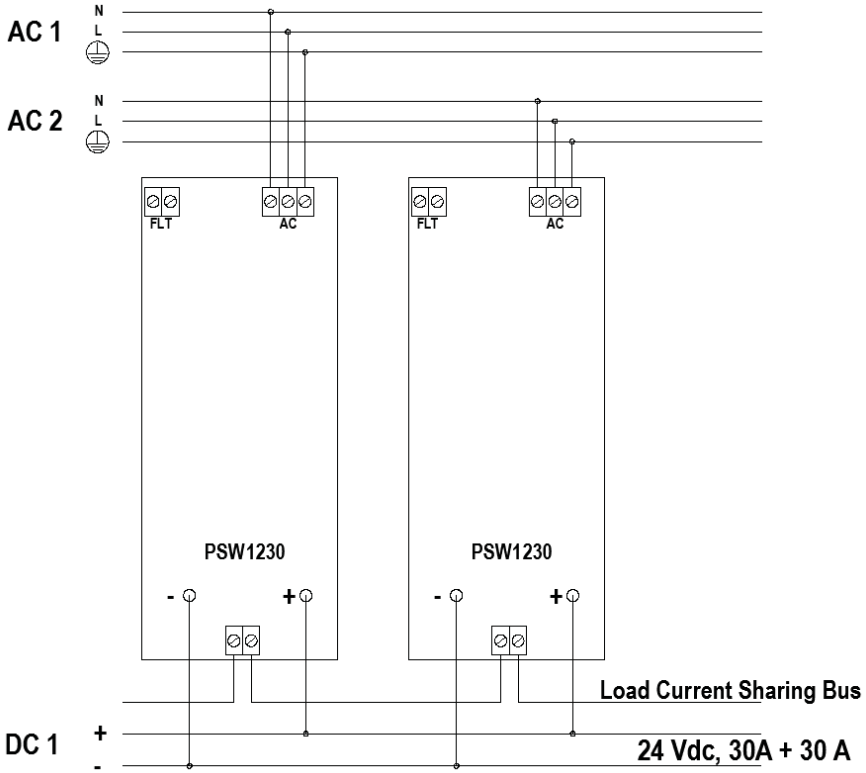
24 Vdc, 30 A Zone 2 / DIV. 2 Installation Suitable for Parallel Operations

- Supply 100- 264 Vac
- Output 24 Vdc, 30 A; regulated and adjustable from 21 to 28 Vdc
- Efficency better than 87% at 230 Vac supply
- Two or more Units can be paralleled for Redundancy or additional power with automatic load sharing
- Remote indication for Power Failure
- Zone 2 / Div. 2 installation
- ATEX Category 3 for Zone 2;
  II 3G Ex nA nC IIC T3 Gc;
  IECEx Ex nA nC IIC T3 Gc
- Three over voltage redundant protections
- Reduces Power dissipation by replacing a Schottky diode with Mosfet Active Ideal Diode
- Wall or DIN-Rail mounting
- Two Units in parallel offer AC1 or AC2 redundancy
- Power factor correction
- High load fuse breaking capability without interrupting operations

Function Diagram Dual AC Supply wiring architecture for PSW1230:

PSW1230, dual AC supply, one 30 A Output + one redundant 30 A Output.

two modules connected in parallel to provide full redundancy on AC lines (AC1 and AC2); one 30 A redundant output.



PSS1250

SIL 3 *Power Supply System Universal Input,*
24 Vdc, 50-100-150 A, Zone 2 / DIV. 2 Installation

The Power Supply System type PSS1250 is an anodized aluminum 19" or 9" Rack unit (4U high) suitable to accept up to 6 (for 19" rack) or 2 (for 9" rack) plug-in Power Supply Modules type PSM1250 and 1 Overview module for diagnostic functions.

- Supply 90- 265 Vac
- Output 24 Vdc, 50 A; regulated and adjustable from 21 to 28 Vdc each module
- Efficency better than 87% at 230 Vac supply
- Two or more Units can be paralleled for Redundancy or additional power with automatic load sharing
- Remote indication for Power Failure
- Zone 2 / Div. 2 installation
- ATEX Category 3 for Zone 2;
  II 3G Ex nA nC IIC T3 Gc;
  IECEx Ex nA nC IIC T3 Gc
- Three over voltage redundant protections
- Reduces Power dissipation by replacing a Schottky diode with Mosfet Active Ideal Diode
- Wall mounting
- Two Units in parallel offer AC1 or AC2 redundancy
- Power factor correction
- High load fuse breaking capability without interrupting operations
- Hot swappable modules

9"Rack Enclosure

Notes

Power Supply Systems can be ordered with:

- 19" or 9" Rack enclosure.
- Hot Swapping (HS) capability or not.
- Diagnostic Module (PSO1250) or not.
- 16 different configurations (see data sheet DTS0412)

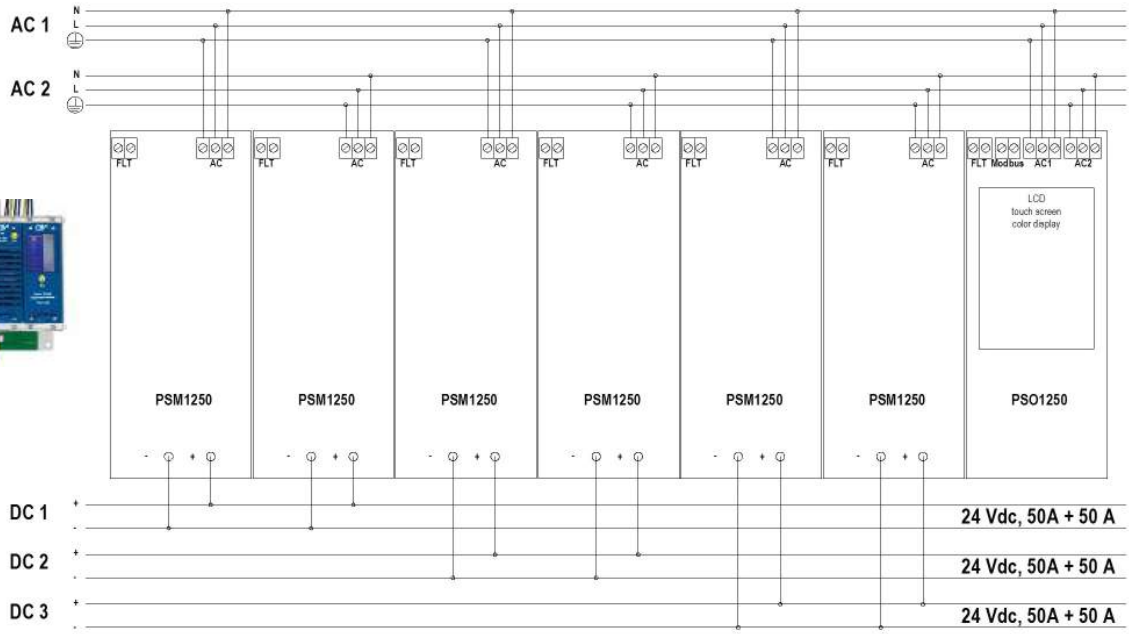
19"Rack Enclosure

Configuration Examples, taken from total 16 available

Function Diagram Dual AC Supply wiring architecture for PSS1250-HS-7-3:

PSS1250-HS-7, dual AC supply, three redundant 50 A Outputs, PSO1250 overview module

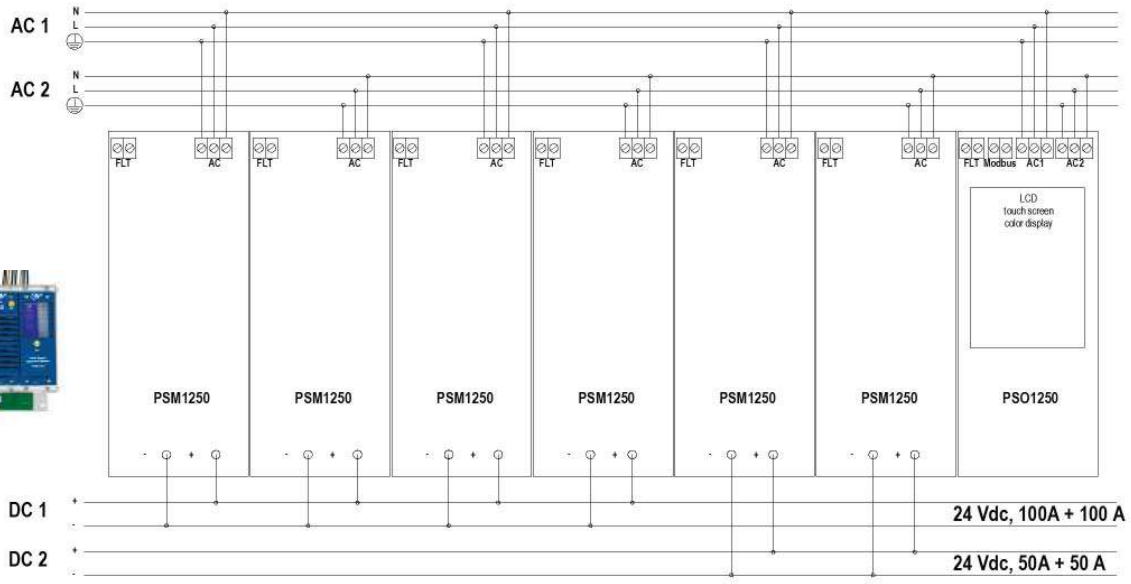
Six modules connected in parallel in groups of two, to provide full redundancy on AC lines (AC1 and AC2).
Three independent 24 Vdc, 50 A redundant outputs.



Function Diagram Dual AC Supply wiring architecture for PSS1250-HS-7-2:

PSS1250-HS-7, dual AC supply, one redundant 100 A Output + one redundant 50 A Output, PSO1250 overview module

Four modules connected in parallel to provide full redundancy on AC lines (AC1 and AC2); one 100 A redundant output.
Two modules connected in parallel to provide full redundancy on AC lines (AC1 and AC2); one 50 A redundant output.

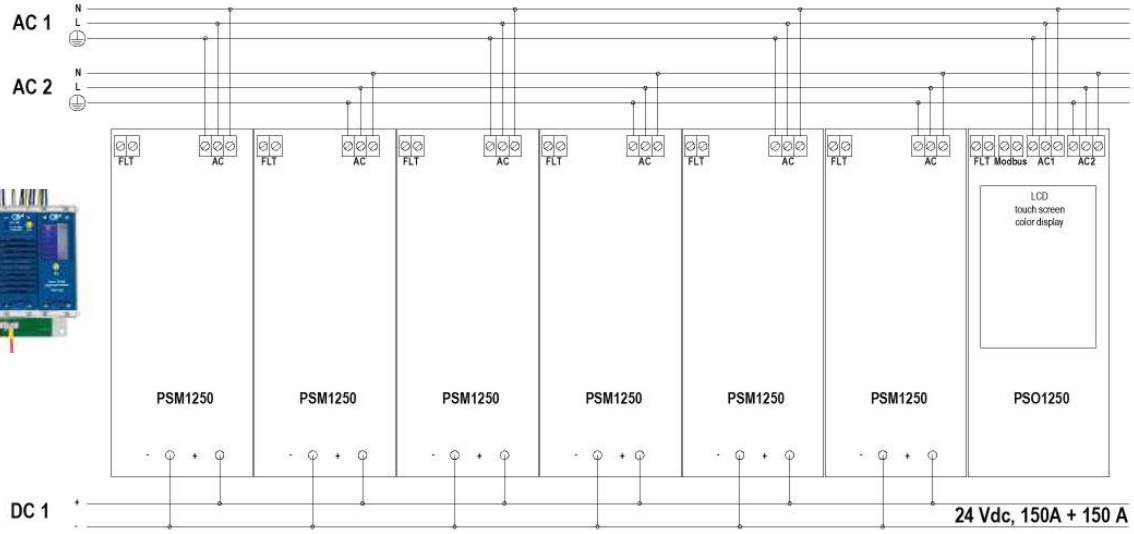


Configuration Examples, taken from total 16 available

Function Diagram Dual AC Supply wiring architecture for PSS1250-HS-7-1:

PSS1250-HS-7, dual AC supply, one redundant 150 A Output, PSO1250 overview module

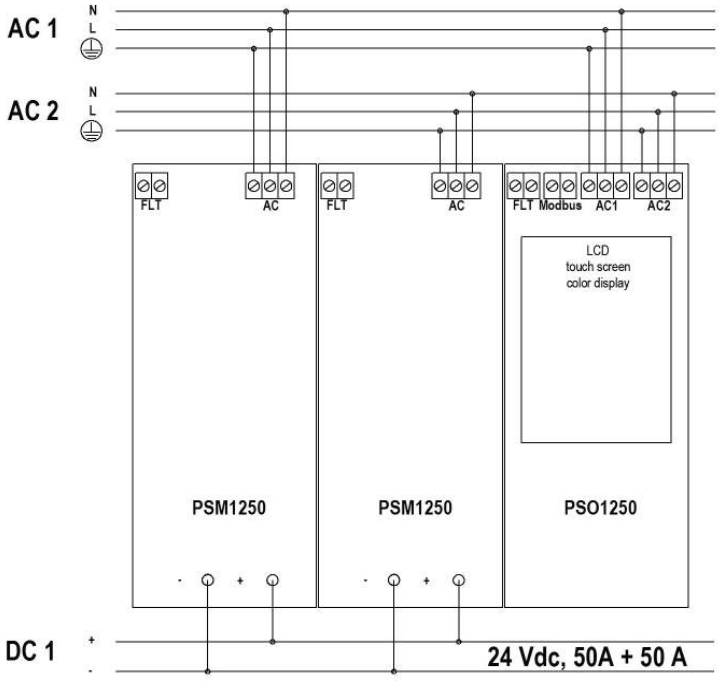
Six modules connected in parallel in groups of three to provide full redundancy on AC lines (AC1 and AC2).
One 24 Vdc, 150 A redundant output.



Function Diagram Dual AC Supply wiring architecture for PSS1250-HS-3:

PSS1250-HS-3, dual AC supply, one 50 A Output + one redundant 50 A Output, PSO1250 overview module

Two modules connected in parallel to provide full redundancy on AC lines (AC1 and AC2); one 50 A redundant output.



Power Supplies - Selection Table

	Model	Hazardous Area	Output	Ch. per unit	Supply	SIL level
POWER SUPPLIES	PSD1000	Zone 2 / Div. 2	24 V, 500 mA to power D1000 Series Modules	1	95-264 Vac	-
	PSD1001	Zone 2 / Div. 2	15 V, 20 mA	4	24 Vdc	SIL2 / SIL3
	PSD1001C	Zone 2 / Div. 2	100 mA at 13.5 V	1		
	PSD5201	Zone 2 / Div. 2	14.5 V, 150 mA	1	24 Vdc	SIL 3
	PSW1230	Zone 2 / Div. 2	24 V, 30 A	1	100-264 Vac	SIL2 / SIL3
	PSW1250	Zone 2 / Div. 2	24 V, 50 A	1	100-264 Vac	SIL2 / SIL3
	PSS1250	Zone 2 / Div. 2	24 V, 50-100-150 A Redundant	up to 6	100-264 Vac	SIL 3

T3000
SERIES

4 ½ DIGIT LOOP INDICATOR
INSTALLATION IN ZONE 0

T3000
CHARACTERISTICS

Signal Data Acquisition

- ATEX, FM & FM-C, Russian certifications
- Large LCD Display, 20 mm high
- Limited voltage drop (less than 1 V)
- IP66 Enclosure with 2 separated chambers
- Wall, Pipe-Post, or Panel mounting
- Zone 0, IIC T5 / T6 or Div. 1 Installation
- In-field configurability via dedicated push-buttons
  - decimal point
  - indicated range between-19999 and +19999
  - direct or reverse indication
- Under and Over range detection via blinking display
- Protected slot available for engineering value label

Mounting options

4 ½ Digit Loop Powered Indicator

T3010S offers process variable reading in Hazardous Area. It is a loop powered 4-20 mA unit with less than 1 V voltage drop and monitors 4-20 mA current, 0-100 % percentage or process variables between -19999 to +19999 range with a 20 mm height 7-segments LCD display.
Blinking display indicates over-range or under-range condition.
An internal protected slot-in label is provided, after the last digit, to allow unit measurement indication.
Loop tag indication can be also provided.
The indicator is housed in a molded reinforced polyamide 66 / polycarbonate IP 66 case to allow installation in field area. It can be mounted on flat surface, front panel or 2” pipe or post. The housing is divided in two parts, one for cable connection and the other for indicator parameters setting.

Function Diagram

T3010S units can be connected in series to a 4-20 mA loop (figure A) or can be driven from Safe Area to provide local indication in Hazardous Areas up to Zone 0 / Div. 1 (figure B).

In both cases, the unit must be protected by a suitable intrinsically safe barrier.
Please check data sheet for further information.

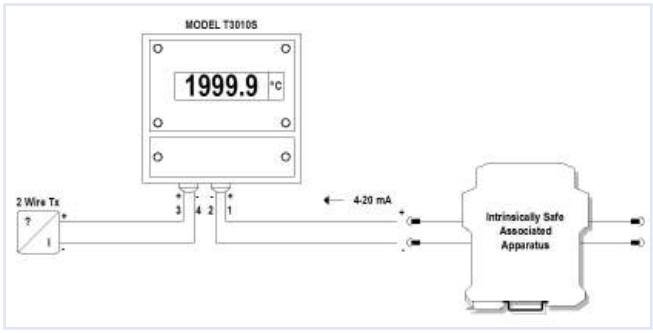


Figure A

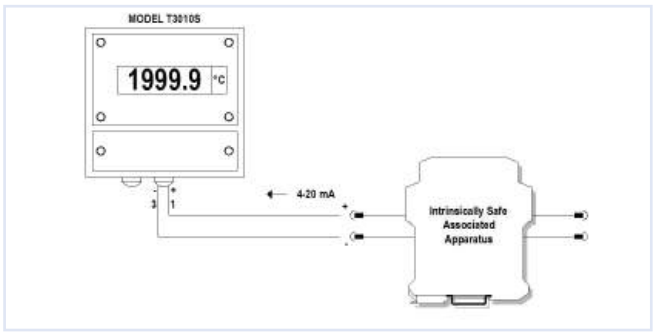


Figure B

I.S. Basic Principles

The basic principle, on which **Intrinsic Safety** works, is to limit, under normal conditions, the amount of electrical energy in Hazardous Area circuits so that any sparks or arcs or high surface temperatures cannot ignite the explosive atmosphere. Electrical equipment, in Hazardous Area, as well as interconnected instrumentation in Safe Area, must be designed to reduce Open Circuit voltage (Voc) and Short Circuit current (Isc) to values that cannot cause ignition by opening, closing or earthing the circuit or by heating of any parts belonging to the circuit.

ATEX AND IECEx: GROUPS, CATEGORIES, ZONES AND EPLs

Protection Level	Definition	Explosive atmosphere		94/9/EC (ATEX)		99/92/EC (ATEX)	IECEx	
				Group	Equipment Category	Area classification	Group	EPL
Very High two independent means of protection or one protection allowing two independent faults	Place where an explosive atmosphere is frequently or for long periods or continuously present	Coal mine	→	I	M1	-	I	Ma
		Gas	→	II	1G	Zone 0 *	II	Ga
		Dust	→	II	1D	Zone 20 **	III	Da
High single mean of protection allowing only one fault	Place where an explosive atmosphere is occasionally present during normal operation	Coal mine	→	I	M2	-	I	Mb
		Gas	→	II	2G	Zone 1 *	II	Gb
		Dust	→	II	2D	Zone 21 **	III	Db
Normal safe during normal operation	Place where an explosive atmosphere is not present during normal operation, and eventually for short periods	Gas	→	II	3G	Zone 2 *	II	Gc
		Dust	→	II	3D	Zone 22 **	III	Dc

** according to IEC/EN 60079-10-1; ** according to IEC/EN 60079-10-2*

ELECTRICAL APPARATUS FOR IS APPLICATIONS

Field Equipment:

SIMPLE APPARATUS:
Less than 1.5 V; 0.1 A; 20 µJ; 25 mW (TC, RTD, Pot, Switch...).
Simple apparatus is considered not to require certification by a notified body; certification to the ATEX Directive is not required because of the low levels of energy, which are added to the intrinsically safe circuit by this apparatus. A simple apparatus is required to be clearly identified when it is installed. Simple apparatus shall conform to all relevant requirements of the standard.

INTRINSICALLY SAFE APPARATUS:
- Requires certification. (TX, I/P, Solenoid Valve, Proximity, Field Display...)
- Safety Parameters to be matched by **Associated Apparatus**:
  Ui / Vmax (Max. Input Voltage); **Ii / Imax** (Max. Input Current);
  Pi (Max. Input Power); **Ci** (Internal Capacitance); **Li** (Internal Inductance)

Control Room Equipment:

ASSOCIATED APPARATUS:
- Requires certification.
  (Galvanic Isolators, Zener Barriers, Signal Conditioners)
- Safety Parameters to be matched with **Intrinsically Safe Apparatus**:
  Uo / Voc (Open Circuit Voltage); **Io / Isc** (Short Circuit Current);
  Po (Max. Output Power); **Co / Ca** (Allowed Capacitance);
  Lo / La (Allowed Inductance);

NON INTRINSICALLY SAFE APPARATUS:
All Apparatuses without Approval (PLC, DCS, Computers, Controllers...)

GROUPS

Atmosphere	Class *	Group *	Group **	Representative element
Gas	Class I	-	Group I	Methane
		Group D	Group IIA	Propane
		Group C	Group IIB	Ethylene
		Group B	Group IIC (except C_2H_2)	Hydrogen
		Group A	Group IIC	Acetylene
Dust	Class II	Group G	Group IIIB	Non-conductive dusts
		Group F	Group IIIB	Carbonaceous dusts
		Group E	Group IIIC	Metal dusts
Fiber	Class III	-	Group IIIA	Fibers or flyings

** according to NEC 500 / CEC Annex J; ** according to IEC / NEC 505 / CEC 18*

DIVISIONS / ZONES

Atmosphere	Class *	Division *	Zone **	Area Classification
Gas	Class I	Div. 1	Zone 0	Continuous Hazard
			Zone 1	Intermittent Hazard
		Div. 2	Zone 2	Abnormal Conditions Hazard
Dust	Class II	Div. 1	Zone 20	Continuous Hazard
			Zone 21	Intermittent Hazard
		Div. 2	Zone 22	Abnormal Conditions Hazard
Fiber	Class III	Div. 1	Zone 20	Continuous Hazard
			Zone 21	Intermittent Hazard
		Div. 2	Zone 22	Abnormal Conditions Hazard

** according to NEC 500 / CEC Annex J; ** according to IEC / NEC 505 / CEC 18*

PROTECTION DEGREE

IP (IEC/EN 60529)

First numeral Protection against solids		Second numeral Protection against water	
0	No protection	0	No protection
1	Greater than 50 mm	1	Vertical dripping
2	Greater than 12,5 mm	2	Angled dripping (15°)
3	Greater than 2,5 mm	3	Spraying
4	Greater than 1 mm	4	Splashing
5	Dust protected	5	Jetting
6	Dust tight	6	Powerful jetting
		7	Temporary immersion
		8	Continuous immersion

Nema (Standards Publication 250)

Type	Application	Protection against
1	Indoor	General purpose
2	Indoor	Dripping water, falling dust
3, 3R, 3S	Outdoor	Rain, snow, windblown dust
4, 4X	Indoor / Outdoor	Hose-Directed water, Corrosion (X)
5	Indoor	Angled dripping water, settling dust
6	Indoor / Outdoor	Temporary Submersion
6P	Indoor / Outdoor	Prolonged Submersion
7	Indoor	Hazardous Location Class I
8	Indoor / Outdoor	Hazardous Location Class I
9	Indoor	Hazardous Location Class II
12, 12K	Indoor	Dripping non-corrosive liquid, Dust
13	Indoor	Water, oil, dust, seepage

TEMPERATURE CLASS

Max surface Temperature	T class *	T class **
450 °C	T1	T1
300 °C	T2	T2
280 °C	T2A	
260 °C	T2B	
230 °C	T2C	
215 °C	T2D	
200 °C	T3	T3
180 °C	T3A	
165 °C	T3B	
160 °C	T3C	
135 °C	T4	T4
120 °C	T4A	
100 °C	T5	T5
85 °C	T6	T6

** according to NEC 500 / CEC Annex J*
*** according to IEC / NEC 505 / CEC 18*

MINIMUM SIL FOR ATEX SAFETY RELATED DEVICES (EN 50495)

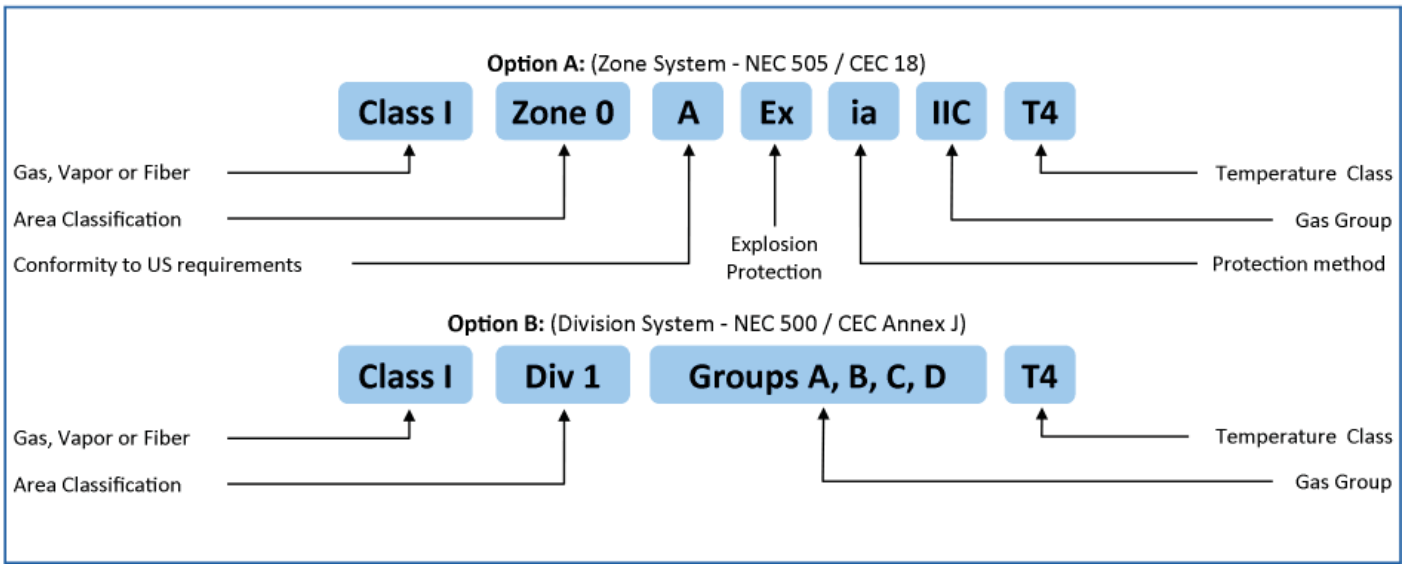
		Combined equipment desired category		
		1 / M1	2 / M2	3
Fault Tolerance of Equipment (number of single faults that cause the apparatus to fail)	2	- -	- -	- -
	1	HFT 0 SIL 1	- -	- -
	0	HFT 1 SIL 2	HFT 0 SIL 1	- -

"-" means that no safety device is required.
"SIL 1" or "SIL 2" is required Safety Integrity Level of safety related device according to EN 61508.

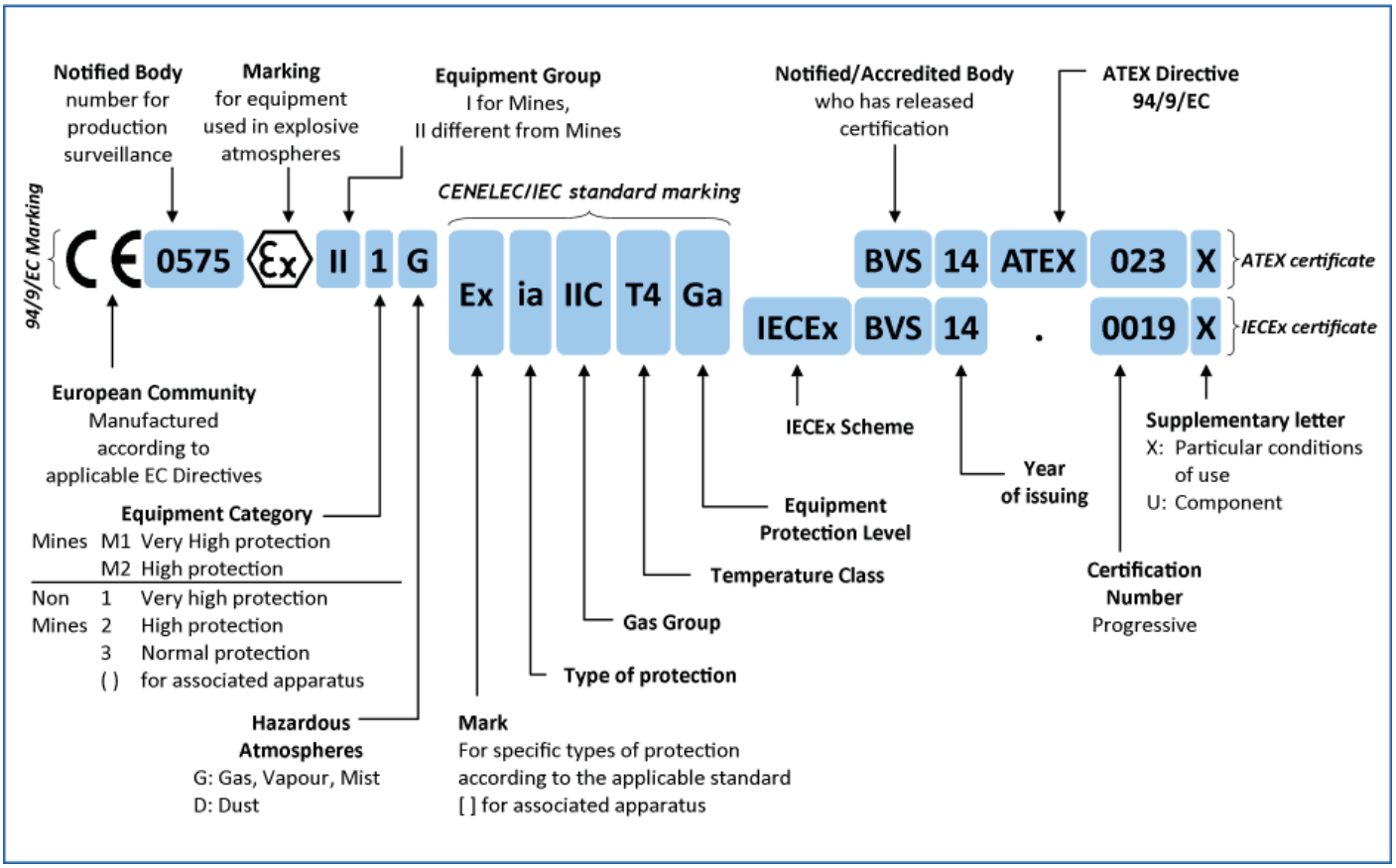
ELECTRICAL APPARATUS FOR GAS AND DUST EXPLOSIVE ATMOSPHERES

Type of protection	Concept	Code	EPL	IEC /CENELEC standard	US Division Standard	US Zone Standard	Canadian Div. Standard	Canadian Zone Standard
Gas								
General requirements		-	-	60079-0	FM3600	60079-0	-	60079-0
Intrinsic Safety	Energy limitation	Ex ia Ex ib Ex ic	Ga or Ma Gb or Mb Gc	60079-11	FM3610/UL913	60079-11	C22.2 No. 157	60079-11
Intrinsically Safe systems	Energy limitation	Ex ia Ex ib Ex ic	Ga Gb Gc	60079-25	-	-	-	-
Increased Safety	Non sparking	Ex e	Gb or Mb	60079-7	-	60079-7	-	60079-7
Type n (non sparking/non incendive)	Non sparking	Ex nA Ex nC	Gc	60079-15	FM3611	60079-15	C22.2 No. 213	60079-15
Flameproof / Expl. Proof	Explosion containment	Ex d	Gb or Mb	60079-1	FM3615/UL1203	60079-1	C22.2 No. 30	60079-1
Powder filling	Explosion containment	Ex q	Gb or Mb	60079-5	-	60079-5	-	60079-5
Type n (enclosed-break)	Explosion containment	Ex nC	Gc	60079-15	FM3611	60079-15	C22.2 No. 213	60079-15
Encapsulation	Separation of explosive atmosphere from ignition	Ex ma Ex mb Ex mc	Ga or Ma Gb or Mb Gc	60079-18	-	60079-18	-	60079-18
Type n (sealed/hermetically sealed)	Separation of explosive atmosphere from ignition	Ex nC	Gc	60079-15	FM3611	60079-15	C22.2 No. 213	60079-15
Pressurization	Separation of explosive atmosphere from ignition	Ex pv Ex px Ex py Ex pz	Gb or Gc Gb or Mb Gb Gc	60079-2	FM3620/ NFPA 496	-	-	60079-2
Oil immersion	Separation of explosive atmosphere from ignition	Ex o	Gb	60079-6	-	60079-6	-	60079-6
Type n (restricted breathing)	Separation of explosive atmosphere from ignition	Ex nR	Gc	60079-15	-	-	-	60079-15
Special requirements		-	Ga	60079-26	-	-	-	-
Dust								
Intrinsic Safety	Energy limitation	Ex ia Ex ib Ex ic	Da Db Dc	60079-11	FM3610/UL913	60079-11	C22.2 No. 157	60079-11
Dust ignition proof	Separation of explosive atmosphere from ignition	Ex ta Ex tb	Da Db	60079-31	FM3616/UL1203	-	C22.2 No. 25	60079-31
Dust tight	Separation of explosive atmosphere from ignition	Ex tc	Dc	60079-31	FM3611/ ANSI/ISA 12.12.01	-	C22.2 No. 25	60079-31
Encapsulation	Separation of explosive atmosphere from ignition	Ex ma Ex mb Ex mc	Da Db Dc	60079-18	-	60079-18	-	60079-18
Pressurization	Separation of explosive atmosphere from ignition	Ex pD	Db or Dc	61241-4	NFPA 496	-	-	61241-4

MARKING FOR NORTH AMERICA ACCORDING NEC / CEC

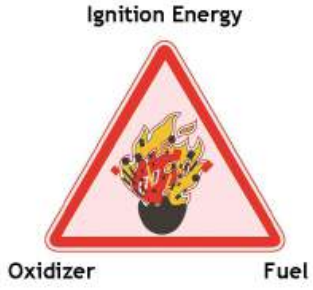


MARKING ACCORDING ATEX DIRECTIVE 94/9/EC AND IECEX CERTIFICATION SCHEME



Ignition Triangle

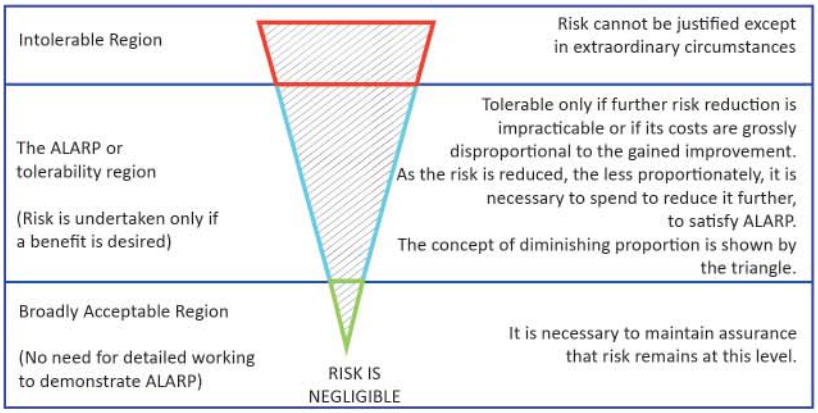
From a chemical point of view, oxidation, combustion and explosion are all exothermic reactions with different reaction speeds. For such reactions to take place, it is essential that the following three components be present simultaneously in due proportions: Fuel, Oxidizer, Energy



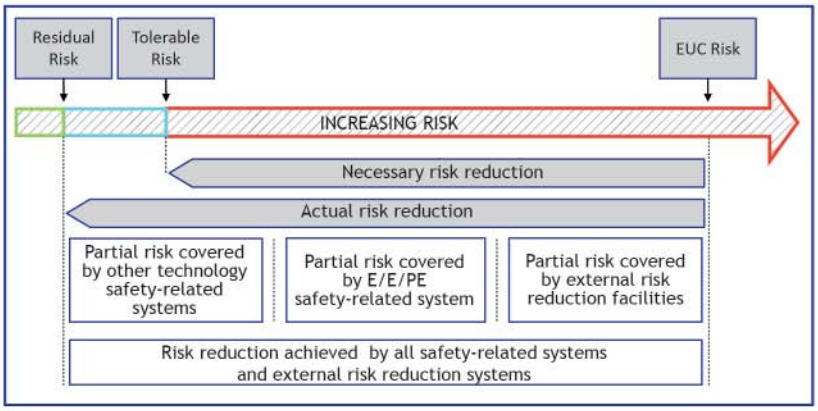
SIL LEVELS ACCORDING IEC 61508 / IEC 61511

SIL Safety Integrity Level	PFDavg Average probability of failure on demand per year (low demand)	RRF Risk Reduction Factor	PFDavg Average probability of failure on demand per hour (high demand)
SIL 4	≥ 10^{-5} and < 10^{-4}	100000 to 10000	≥ 10^{-9} and < 10^{-8}
SIL 3	≥ 10^{-4} and < 10^{-3}	10000 to 1000	≥ 10^{-8} and < 10^{-7}
SIL 2	≥ 10^{-3} and < 10^{-2}	1000 to 100	≥ 10^{-7} and < 10^{-6}
SIL 1	≥ 10^{-2} and < 10^{-1}	100 to 10	≥ 10^{-6} and < 10^{-5}

TOLERABLE RISKS AND ALARP (IEC 61508-5 ANNEX 'C')



RISK REDUCTION (IEC 61508-5 ANNEX 'A')



SAFE FAILURE FRACTION (IEC 61508-2 CLAUSE 7.4)

$$SFF = \frac{\sum\lambda_{DD} + \sum\lambda_{SD} + \sum\lambda_{SU}}{\sum\lambda_{DD} + \sum\lambda_{DU} + \sum\lambda_{SD} + \sum\lambda_{SU}} = 1 - \frac{\sum\lambda_{DU}}{\sum\lambda_{TOT}}$$

	Hardware Fault Tolerance 0	Hardware Fault Tolerance 1	Hardware Fault Tolerance 2
TYPE A Components Simple devices with well-known failure modes and a solid history of operation			
< 60%	SIL 1	SIL 2	SIL 3
60% - < 90%	SIL 2	SIL 3	SIL 4
90% - < 99%	SIL 3	SIL 4	SIL 4
≥ 99%	SIL 3	SIL 4	SIL 4
TYPE B Components Complex components with potentially unknown failure modes			
< 60%	Not allowed	SIL 1	SIL 2
60% - < 90%	SIL 1	SIL 2	SIL 3
90% - < 99%	SIL 2	SIL 3	SIL 4
≥ 99%	SIL 3	SIL 4	SIL 4

Failure rates categories: λ_{DD}: Dangerous Detected; λ_{DU}: Dangerous Undetected; λ_{SD}: Safe Detected; λ_{SU}: Safe Undetected

IEC 61508-61511 FACTS AND FORMULAE

IEC 61508 and IEC 61511 standards represent a milestone in the progress of industry in the achievement of supreme levels of safety through the entire instrumented system lifecycle.
The benefits of these new standards include details and a greater effectiveness for what concerns:

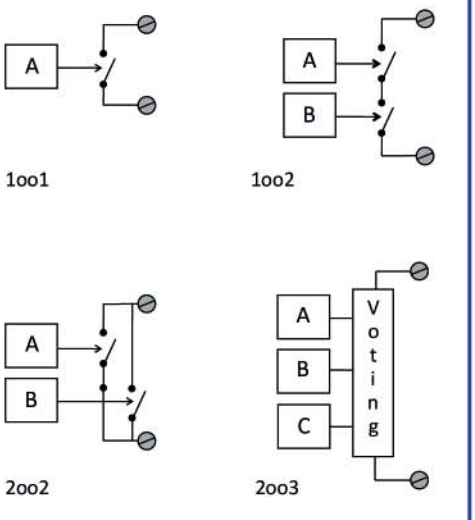
- the definition of risk reduction and related requirements;
- system design and implementation;
- documentation management;
- safety assessment and validation;
- plant maintenance;
- cost management.

The majority of our products are SIL 3 or SIL 2 certified.

MEAN TIME TO SPURIOUS FAILURE

MTTFs	
1oo1	$\frac{1}{\lambda_S}$
1oo2	$\frac{1}{2\lambda_S}$
2oo2	$\frac{1}{2\lambda_S^2 \times MTTR}$
2oo3	$\frac{1}{6\lambda_S^2 \times MTTR}$

SYSTEM ARCHITECTURES



AVAILABILITY AND RELIABILITY

Basic Concepts:

$$\lambda = \frac{\text{Failures per unit time}}{\text{Components exposed to functional failure}}$$

$1\ \text{FIT} = 1\times10^{-9}$ Failures per hour

MTBF = MTTF + MTTR

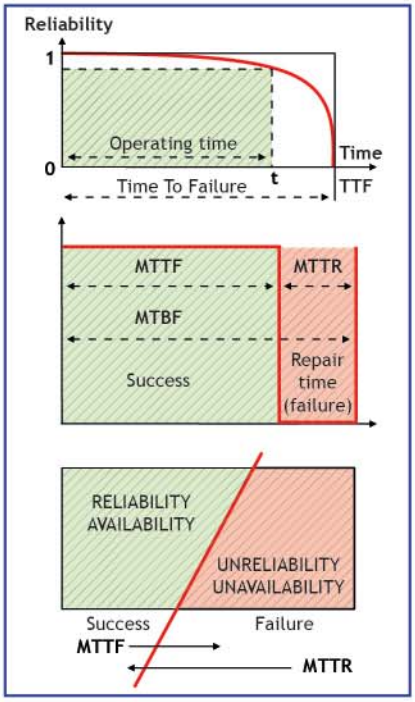
$$\text{MTTF} = \text{MTBF} - \text{MTTR} = \frac{1}{\lambda}$$

$$\text{Availability} = \frac{\text{Operating Time}}{\text{Operating Time} + \text{Repair Time}} = \frac{\text{MTTF}}{\text{MTTF} + \text{MTTR}} = \frac{\text{MTTF}}{\text{MTBF}} = \frac{\mu}{\mu+\lambda} = \frac{\text{MTBM}}{\text{MTBM} + \text{MSD}}$$

$$\text{Unavailability} = 1 - \text{Availability} = \frac{\lambda}{\mu}$$

Acronyms:

MTBF:	Mean Time Between Failures
MTTF:	Mean Time To Failure
MTTR:	Mean Time To Repair
MTBM:	Mean Time Between Maintenance
MSD:	Expected Mean System Downtime
λ:	Failure rate
μ:	Repair rate

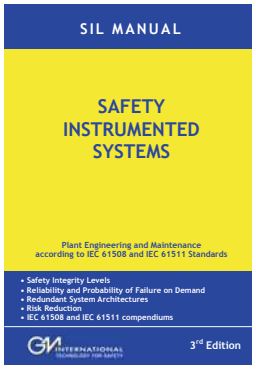


AVERAGE PROBABILITY OF FAILURE ON DEMAND

$$\text{PFDavg} = \frac{\text{Tolerable accident frequency } (F_T)}{\text{Frequency of accidents without protection } (F_{NP})} = \frac{1}{\text{RRF}}$$

Simplified equations

	Without common causes	With common causes (Beta factor)
1oo1	$\lambda_{DU} \times \frac{TI}{2}$	not applicable
1oo2 1oo2D	$\lambda_{DU_1} \times \lambda_{DU_2} \times \frac{TI^2}{3}$	$\frac{\left[(1-\beta)\times(\lambda_{DU}\times TI)\right]^2}{3} + \frac{(\beta\times\lambda_{DU}\times TI)}{2}$
1oo3	$\lambda_{DU_1} \times \lambda_{DU_2} \times \lambda_{DU_3} \times \frac{TI^3}{4}$	$\frac{\left[(1-\beta)\times(\lambda_{DU}\times TI)\right]^3}{4} + \frac{(\beta\times\lambda_{DU}\times TI)}{2}$
2oo2	$(\lambda_{DU_1} + \lambda_{DU_2}) \times \frac{TI}{2}$	$\left[(1-\beta)\times(\lambda_{DU}\times TI)\right] + \frac{(\beta\times\lambda_{DU}\times TI)}{2}$
2oo3	$\left[(\lambda_{DU_1}\times\lambda_{DU_2}) + (\lambda_{DU_1}\times\lambda_{DU_3}) + (\lambda_{DU_2}\times\lambda_{DU_3})\right] \times \frac{TI^2}{3}$	$\left[(1-\beta)\times(\lambda_{DU}\times TI)\right]^2 + \frac{(\beta\times\lambda_{DU}\times TI)}{2}$
1oo1 (Et < 100%)	$\lambda_{DU}\left[\left(Et\times\frac{TI}{2}\right) + (1-Et)\frac{SL}{2}\right]$	TI: Proof Test Time Interval Et: Test Effectiveness λ_{DU}: Dangerous Undetected Failures



SAFETY INSTRUMENTED SYSTEMS

The experience in safety and electronics acquired during the years has lead us to the writing of a comprehensive manual on IEC61508 and IEC 61511.
This effort has already proven to be a great benefit for engineers, maintenance personnel and whoever wishes to approach the concept of functional safety.

Boiling Liquid Expanding Vapor Explosion (BLEVE)

Flash Fire

Jet Fire

Pool Fire

Fireball

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