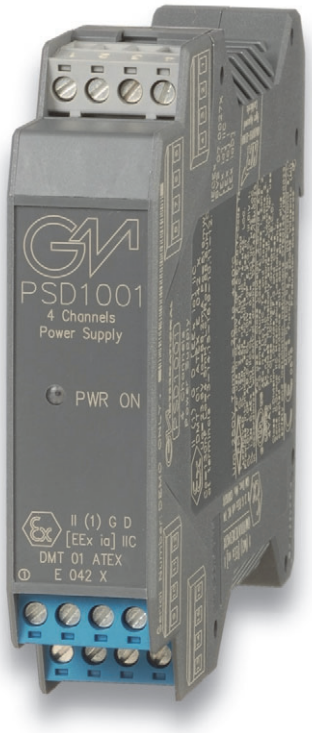


INSTRUCTION MANUAL

SIL 3 - SIL 2 Quad channel Power Supply for Hazardous Area Equipment DIN-Rail Model PSD1001

SIL Applications

For Safety Related System and SIL2, SIL3 Applications according IEC61508 & IEC61511 Standards refer to “Functional Safety Manual” document number ISM0071

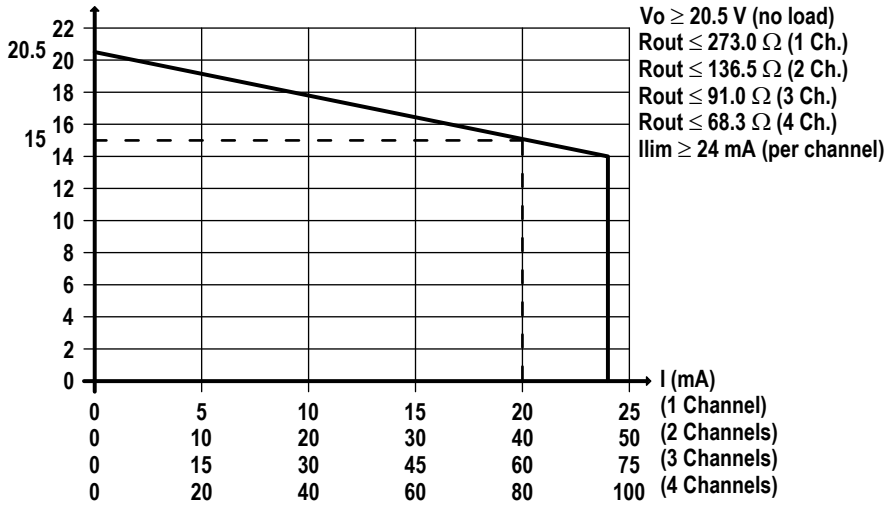
Characteristics

General Description: The PSD1001 is a quad channel DIN Rail Power Supply to drive measuring, process control equipments in Hazardous Area;
it provides isolation between input and output. Typical application is to drive 4-20 mA 2 wires transmitter with local indication (current is not repeated in Safe Area).
Output channels can be paralleled if more power is required.
Function: I.S. power supply, 4 output parallelable channels to operate Hazardous Area loads providing isolation (input/output).
Signalling LED: Power supply indication (green).
EMC: Fully compliant with CE marking applicable requirements.

Technical Data

Supply: 24 Vdc nom (21.5 to 30 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp.
Current consumption @ 24 V: 110 mA with four channels at 20 mA nominal load, 140 mA with short circuit output.
Power dissipation: 1.4 W with 24 V supply voltage and four channels at 20 mA nominal load.
Max. power consumption: at 30 V supply voltage and short circuit output, 3.8 W.
Isolation (Test Voltage): I.S. Out/Supply 1.5 KV.
Output: 20 mA at 15 V per channel (20.5 V no load, 273 Ω series resistance).

PSD1001 Output Diagram



Short circuit current: ≥ 24 mA per channel (26 mA typical).
Compatibility:
CE mark compliant, conforms to Directive:
2014/34/EU ATEX, 2014/30/EU EMC, 2014/35/EU LVD, 2011/65/EU RoHS.
Environmental conditions:
Operating: temperature limits -20 to + 60 °C,
relative humidity max 90 % non condensing, up to 35 °C.
Storage: temperature limits - 45 to + 80 °C.
Safety Description:
ATEX: II (1)G [Ex ia Ga] IIC, II (1)D [Ex ia Da] IIIC, I (M1) [Ex ia Ma] I; II 3G Ex ec IIC T4 Gc
IECEx: [Ex ia Ga] IIC, [Ex ia Da] IIIC, [Ex ia Ma] I; Ex ec IIC T4 Gc
Uo/Voc = 23.6 V, Io/Isc = 88.2 mA, Po/Po = 519 mW
at terminals 13-14, 15-16, 9-10, 11-12.
Um = 250 Vrms, -20 °C ≤ Ta ≤ 60 °C.
Approvals:
DMT 01 ATEX E 042 X conforms to EN60079-0, EN60079-11.
IECEx BVS 07.0027X conforms to IEC60079-0, IEC60079-11.
IMQ 09 ATEX 013 X conforms to EN60079-0, EN60079-7.
IECEx IMQ 13.0011X conforms to IEC60079-0, IEC60079-7.
UL & C-UL E222308 conforms to UL913, UL 60079-0, UL60079-11, UL60079-15, ANSI/ISA 12.12.01 for UL and CSA-C22.2 No.157-92, CSA-E60079-0, CSA-E60079-11, CSA-C22.2 No. 213 and CSA-E60079-15 for C-UL.
FM & FM-C No. 3024643, 3029921C, conforms to Class 3600, 3610, 3611, 3810 and C22.2 No.142, C22.2 No.157, C22.2 No.213, E60079-0, E60079-11, E60079-15,
EXIDA Report No. GM04/10-26 R002, SIL 2 / SIL 3 according to IEC 61508, IEC 61511.
Please refer to Functional Safety Manual for SIL applications.
DNV No. TAA00002BM and KR No.MIL20769-EL001 Cert. for maritime applications.
Mounting:
EN/IEC60715 TH 35 DIN-Rail.
Weight: about 120 g.
Connection: by polarized plug-in disconnect screw terminal blocks to accomodate terminations up to 2.5 mm².
Location: Safe Area/Non Hazardous Locations or Zone 2, Group IIC T4,
Class I, Division 2, Groups A, B, C, D Temperature Code T4 and
Class I, Zone 2, Group IIC, IIB, IIA T4 installation.
Protection class: IP 20.
Dimensions: Width 22.5 mm, Depth 99 mm, Height 114.5 mm.

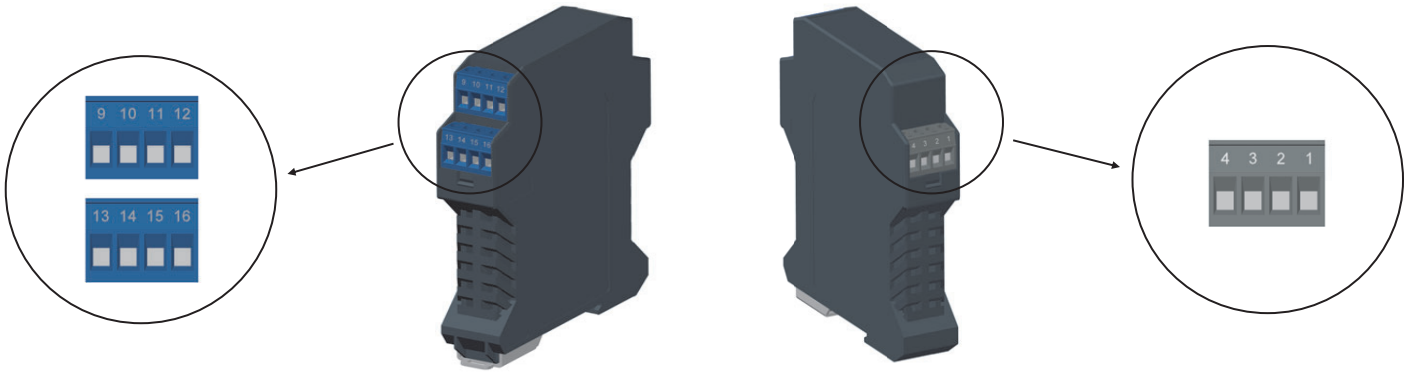
Ordering information

Model:	PSD1001	
Power Bus enclosure		/B

Front Panel and Features

- SIL 3 according to IEC 61508, IEC 61511 in Loop Powered mode for Lifetime = 10 years.
- SIL 2 according to IEC 61508, IEC 61511 in Bus Powered mode for Tproof = 2 / 5 years (10 / 20 % of total SIF).
- PFDavg (1 year) 0.00 E-00, SFF 100 % (Loop Powered mode).
- PFDavg (1 year) 3.64 E-04, SFF 80.12 % (Bus Powered mode).
- Output to Zone 0 (Zone 20), Division 1, installation in Zone 2, Division 2.
- 4 channels Power Supply for Hazardous Area equipment.
- Flexible modular multiple output capability.
- Output short circuit proof and current limited.
- Isolation Input/Output.
- EMC Compatibility to EN61000-6-2, EN61000-6-4.
- ATEX, IECEx, UL & C-UL, FM & FM-C Certifications.
- Type Approval Certificate DNV and KR for maritime applications.
- High Reliability, SMD components.
- High Density, four channels per unit.
- Simplified installation using standard DIN Rail and plug-in terminal blocks.
- 250 Vrms (Um) max. voltage allowed to the instruments associated with the barrier.

Terminal block connections



HAZARDOUS AREA

9	+ Output Ch 3 for Solenoid Valve or + Output Ch 3 for 2 wire Device
10	- Output Ch 3 for Solenoid Valve or - Output Ch 3 for 2 wire Device
11	+ Output Ch 4 for Solenoid Valve or + Output Ch 4 for 2 wire Device
12	- Output Ch 4 for Solenoid Valve or - Output Ch 4 for 2 wire Device
13	+ Output Ch 1 for Solenoid Valve or + Output Ch 1 for 2 wire Device
14	- Output Ch 1 for Solenoid Valve or - Output Ch 1 for 2 wire Device
15	+ Output Ch 2 for Solenoid Valve or + Output Ch 2 for 2 wire Device
16	- Output Ch 2 for Solenoid Valve or - Output Ch 2 for 2 wire Device

SAFE AREA

1	Not used
2	Not used
3	+ Output Power Supply 24 Vdc
4	- Output Power Supply 24 Vdc

Parameters Table

In the system safety analysis, always check the Hazardous Area/Hazardous Locations devices to conform with the related system documentation, if the device is Intrinsically Safe check its suitability for the Hazardous Area/Hazardous Locations and gas group encountered and that its maximum allowable voltage, current, power (Ui/Vmax, Ii/Imax, Pi/Pi) are not exceeded by the safety parameters (Uo/Voc, Io/Isc, Po/Po) of the PSD1001 Associated Apparatus connected to it. Also consider the maximum operating temperature of the field device, check that added connecting cable and field device capacitance and inductance do not exceed the limits (Co/Ca, Lo/La, Lo/Ro) given in the Associated Apparatus parameters for the effective gas group. See parameters on enclosure side and the ones indicated in the table below:

PSD1001 Terminals		PSD1001 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	13 - 14	Uo / Voc = 23.6 V	≤	Ui / Vmax
Ch2	15 - 16			
Ch3	9 - 10			
Ch4	11 - 12			
Ch1	13 - 14	Io / Isc = 88.2 mA	≤	Ii/ Imax
Ch2	15 - 16			
Ch3	9 - 10			
Ch4	11 - 12			
Ch1	13 - 14	Po / Po = 519 mW	≤	Pi / Pi
Ch2	15 - 16			
Ch3	9 - 10			
Ch4	11 - 12			

PSD1001 Terminals		PSD1001 Associated Apparatus Parameters		Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
Ch1	13 - 14	Co / Ca = 130 nF	(IIC-A, B)	≥	Ci / Ci device + C cable
Ch2	15 - 16	Co / Ca = 970 nF	(IIB-C)		
Ch1	9 - 10	Co / Ca = 3.5 µF	(IIA-D)		
Ch2	11 - 12				
Ch1	13 - 14	Lo / La = 4.5 mH	(IIC-A, B)	≥	Li / Li device + L cable
Ch2	15 - 16	Lo / La = 18.2 mH	(IIB-C)		
Ch1	9 - 10	Lo / La = 36.5 mH	(IIA-D)		
Ch2	11 - 12				
Ch1	13 - 14	Lo / Ro = 68.6 µH/Ω	(IIC-A, B)	≥	Li / Ri device and L cable / R cable
Ch2	15 - 16	Lo / Ro = 274.4 µH/Ω	(IIB-C)		
Ch1	9 - 10	Lo / Ro = 548.9 µH/Ω	(IIA-D)		
Ch2	11 - 12				

NOTE for USA and Canada:
IIC equal to Gas Groups A, B, C, D, E, F and G
IIB equal to Gas Groups C, D, E, F and G
IIA equal to Gas Groups D, E, F and G

To increase the power to the load, is possible to connect the output channels in parallel. The table below indicates the corresponding configurations:

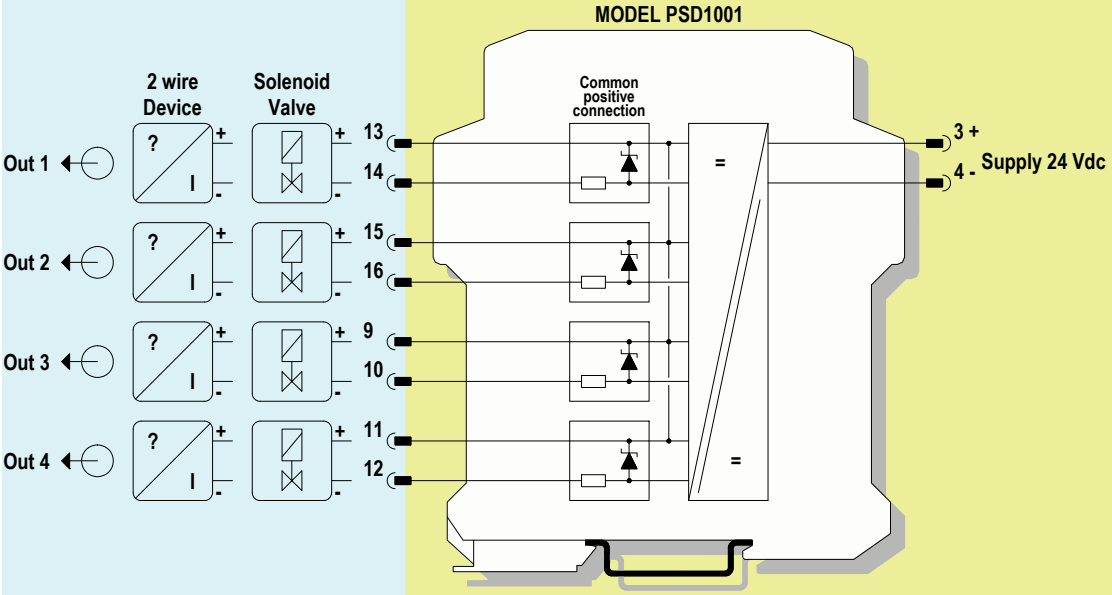
	PSD1001 Associated Apparatus Parameters 2 channels in parallel	**PSD1001 Associated Apparatus Parameters 3 channels in parallel**	**PSD1001 Associated Apparatus Parameters 4 channels in parallel**
Io / Isc mA	176.4	264.6	352.8
Po / Po mW	1038	1556	1674
Lo / La mH	IIC-A,B = 1.1, IIB-C = 4.5, IIA-D = 9.1	IIC-A,B = NA, IIB-C = 2.0, IIA-D = 4.0	IIC-A,B = NA, IIB-C = 1.1, IIA-D = 2.2
Lo / Ro µH/Ω	IIC-A,B = 34.3, IIB-C = 137.2, IIA-D = 274.4	IIC-A,B = NA, IIB-C = 91.4, IIA-D = 182.9	IIC-A,B = NA, IIB-C = 68.6, IIA-D = 137.2

For installations in which both the Ci and Li of the Intrinsically Safe apparatus exceed 1% of the Co and Lo parameters of the Associated Apparatus (excluding the cable), then 50% of Co and Lo parameters are applicable and shall not be exceeded (50% of the Co and Lo become the limits which must include the cable such that Ci device + C cable ≤ 50 % of Co and Li device + L cable ≤ 50 % of Lo). The reduced capacitance of the external circuit (including cable) shall not be greater than 1 µF for Groups I, IIA, IIB and 600 nF for Group IIC. If the cable parameters are unknown, the following value may be used: Capacitance 200 pF per meter (60 pF per foot), Inductance 1 µH per meter (0.20 µH per foot).
The Intrinsic Safety Entity Concept allows the interconnection of Intrinsically Safe devices approved with entity parameters not specifically examined in combination as a system when the above conditions are respected.
For Division 1 and Zone 0 installations, the configuration of Intrinsically Safe Equipment must be FM approved under Entity Concept (or third party approved);
for Division 2 installations, the configuration of Intrinsically Safe Equipment must be FM approved under non-incendive field wiring or Entity Concept (or third party approved).

Function Diagram

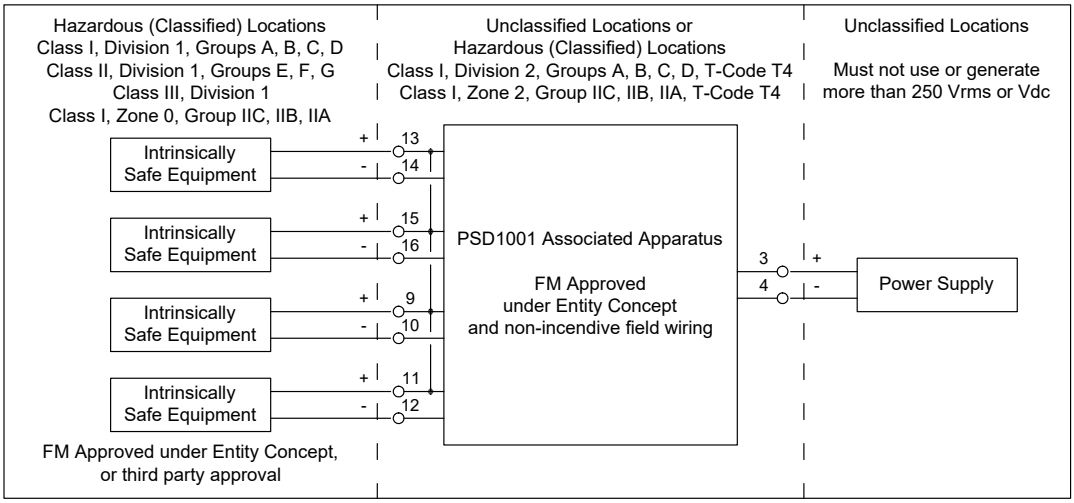
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,
CLASS I, ZONE 0, GROUP IIC

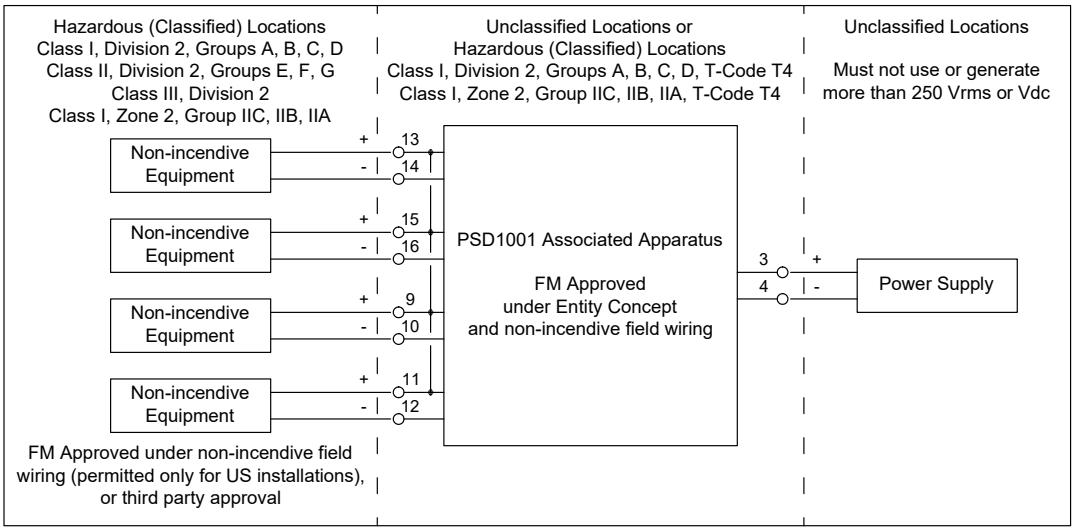
SAFE AREA, ZONE 2 GROUP IIC T4,
NON HAZARDOUS LOCATIONS, CLASS I, DIVISION 2,
GROUPS A, B, C, D T-Code T4, CLASS I, ZONE 2, GROUP IIC T4



Warning

PSD1001 is an isolated Intrinsically Safe Associated Apparatus installed into standard EN/IEC60715 TH 35 DIN-Rail located in Safe Area/Non Hazardous Locations or Zone 2, Group IIC, Temperature Classification T4, Class I, Division 2, Groups A, B, C, D, Temperature Code T4 and Class I, Zone 2, Group IIC, IIB, IIA Temperature Code T4 Hazardous Area/ Hazardous Locations (according to FM Class No. 3611, CSA-C22.2 No. 213-M1987, CSA-E60079-15) within the specified operating temperature limits Tamb -20 to +60 °C, and connected to equipment with a maximum limit for AC power supply Um of 250 Vrms.





NOTE: outputs can be paralleled to increase output power. When combining outputs, consider Safety Parameters matching with the field device and allowable Group as shown in the Safety Parameters Table and check that requirements are met.
Non-incendive field wiring is not recognized by the Canadian Electrical Code, installation is permitted in the US only.
For installation of the unit in a Class I, Division 2 or Class I, Zone 2 location, the wiring between the control equipment and the PSD1001 associated apparatus shall be accomplished via conduit connections or another acceptable Division 2, Zone 2 wiring method according to the NEC and the CEC.
Not to be connected to control equipment that uses or generates more than 250 Vrms or Vdc with respect to earth ground.
PSD1001 must be installed, operated and maintained only by qualified personnel, in accordance to the relevant national/international installation standards (e.g. IEC/EN60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines), BS 5345 Pt4, VDE 165, ANSI/ISA RP12.06.01 Installation of Intrinsically Safe System for Hazardous (Classified) Locations, National Electrical Code NEC ANSI/NFPA 70 Section 504 and 505, Canadian Electrical Code CEC) following the established installation rules, particular care shall be given to segregation and clear identification of I.S. conductors from non I.S. ones.
De-energize power source (turn off power supply voltage) before plug or unplug the terminal blocks when installed in Hazardous Area/Hazardous Locations or unless area is known to be nonhazardous.
Warning: substitution of components may impair Intrinsic Safety and suitability for Division 2, Zone 2.
Explosion Hazard: to prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or unless area is known to be nonhazardous.
Failure to properly installation or use of the equipment may risk to damage the unit or severe personal injury.
The unit cannot be repaired by the end user and must be returned to the manufacturer or his authorized representative. Any unauthorized modification must be avoided.

Operation

Each of the four independent channels provides an output (see the output diagram on data sheet for details of voltage and current to the load) in Hazardous Area/Hazardous Locations to drive Intrinsically Safe loads, typically 4-20 mA transmitter for multiplexer unit or local indication without signal repetition. Presence of supply power is displayed by a green signaling LED.

Installation

PSD1001 is a power supply for field devices housed in a plastic enclosure suitable for installation on EN/IEC60715 TH 35 DIN-Rail.
PSD1001 unit can be mounted with any orientation over the entire ambient temperature range, see section “Installation in Cabinet” and "Installation of Electronic Equipments in Cabinet" Instruction Manual D1000 series for detailed instructions.
Electrical connection of conductors up to 2.5 mm² are accommodated by polarized plug-in removable screw terminal blocks which can be plugged in/out into a powered unit without suffering or causing any damage **(for Zone 2 or Division 2 installations check the area to be nonhazardous before servicing)**.
The wiring cables have to be proportionate in base to the current and the length of the cable.
On the section “Function Diagram” and enclosure side a block diagram identifies all connections.
Identify the function and location of each connection terminal using the wiring diagram on the corresponding section, as an example:
Connect 24 Vdc power supply positive at terminal “3” and negative at terminal “4”.
Connect positive output of channel 1 at terminal “13” and negative output at “14”.
Connect positive output of channel 2 at terminal “15” and negative output at “16”.
Connect positive output of channel 3 at terminal “9” and negative output at “10”.
Connect positive output of channel 4 at terminal “11” and negative output at “12”.
If output current required is higher than the capability of a single channel (see output diagram on data sheet for details) you can connect two or more channels in parallel by wiring outputs of two or more channels in parallel and use the combined output, consider however the Gas Group allowable and Safety Parameter matching with the field device for this combined output as shown in the Safety Parameters on the data sheet and check that it meets your actual Installation.

Intrinsically Safe conductors must be identified and segregated from non I.S. and wired in accordance to the relevant national/international installation standards (e.g. EN/IEC60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines), BS 5345 Pt4, VDE 165, ANSI/ISA RP12.06.01 Installation of Intrinsically Safe System for Hazardous (Classified) Locations, National Electrical Code NEC ANSI/NFPA 70 Section 504 and 505, Canadian Electrical Code CEC), make sure that conductors are well isolated from each other and do not produce any unintentional connection.
The enclosure provides, according to EN/IEC 60529, an IP20 minimum degree of protection. The equipment shall only be used in an area of at least pollution degree 2, as defined in EN/IEC 60664-1. For hazardous location, the unit shall be installed in an enclosure that provides a minimum ingress protection of IP54 in accordance with EN/IEC 60079-0, that must have a door or cover accessible only by the use of a tool. Units must be protected against dirt, dust, extreme mechanical (e.g. vibration, impact and shock) and thermal stress, and casual contacts.
If enclosure needs to be cleaned use only a cloth lightly moistened by a mixture of detergent in water.
Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of PSD1001 must be cleaned only with a damp or antistatic cloth.
Any penetration of cleaning liquid must be avoided to prevent damage to the unit. Any unauthorized card modification must be avoided.
According to EN61010, PSD1001 must be connected to SELV or SELV-E supplies.

Start-up

Before powering the unit check that all wires are properly connected, particularly supply conductors and their polarity, input and output wires, also check that Intrinsically Safe conductors and cable trays are segregated (no direct contacts with other non I.S. conductors) and identified either by color coding, preferably blue, or by marking. Check conductors for exposed wires that could touch each other causing dangerous unwanted shorts. Turn on power, the “power on” green led must be lit and the four outputs must provide output power to the Hazardous Area.