

# INSTRUCTION & SAFETY MANUAL

SIL 2 Powered Isolating Driver  
Smart-Hart compatible  
DIN-Rail Models D1020S, D1020D

## Characteristics

**General Description:** The single and dual channel DIN Rail Isolating Driver, D1020S and D1020D, isolates and transfers a 4-20, 0-20 mA signal from a controller located in Safe Area to a load of up to 750  $\Omega$  in Hazardous Area. It has a high output capacity of 15 V at 20 mA combined with a low drop across its input terminals. The circuit allows bi-directional communication signals, for Smart I/P. In the 4-20 mA input range, a field open circuit reflects a high impedance to the control device output circuit.

**Function:** 1 or 2 channels I.S. mA analog output for 2 wire I/P Smart converters or valve positioners, provides 3 port isolation (input/output/supply).

**Signalling LED:** Power supply indication (green).

**Smart Communication Frequency Band:** 0.5 to 40 KHz within 3 dB (Hart and higher frequency protocols).

**EMC:** Fully compliant with CE marking applicable requirements.

**Functional Safety Management Certification:**

G.M. International is certified by TUV to conform to IEC61508:2010 part 1 clauses 5-6 for safety related systems up to and included SIL3.



## Technical Data

**Supply:** 24 Vdc nom (20 to 30 Vdc) reverse polarity protected, ripple within voltage limits  $\leq 5$  Vpp.

**Current consumption @ 24 V:** 95 mA for 2 channels D1020D, 50 mA for 1 channel D1020S with 20 mA output typical.

**Power dissipation:** 1.9 W for 2 channels D1020D, 1.0 W for 1 channel D1020S with 24 V supply voltage and 20 mA output typical.

**Max. power consumption:** at 30 V supply voltage and overload condition, 2.7 W for 2 channels D1020D, 1.4 W for 1 channel D1020S.

**Isolation (Test Voltage):** I.S. Out/In 1.5 KV; I.S. Out/Supply 1.5 KV; I.S. Out/I.S. Out 500 V; In/Supply 500 V; In/In 500 V.

**Input:** 0/4 to 20 mA with  $\leq 2.0$  V voltage drop, reverse polarity protected.

**Output:** 0/4 to 20 mA, on max. 750  $\Omega$  load, current limited at  $\approx 23$  mA.

**Response time:** 50 ms (10 to 90 % step change).

**Output ripple:**  $\leq 20$  mVrms on 250  $\Omega$  communication load on 0.5 to 40 KHz band.

**Frequency response:** 0.5 to 40 KHz bidirectional within 3 dB (Hart and higher frequency protocols).

**Performance:** Ref. Conditions 24 V supply, 250  $\Omega$  load,  $23 \pm 1$  °C ambient temperature.

**Calibration accuracy:**  $\leq \pm 0.1$  % of full scale.

**Linearity error:**  $\leq \pm 0.05$  % of full scale.

**Supply voltage influence:**  $\leq \pm 0.05$  % of full scale for a min to max supply change.

**Load influence:**  $\leq \pm 0.05$  % of full scale for a 0 to 100 % load resistance change.

**Temperature influence:**  $\leq \pm 0.01$  % on zero and span for a 1 °C change.

**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 95 %.

**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 nA IIC T4 Gc

**IECEx / INMETRO:** [Ex ia Ga] IIC, [Ex ia Da] IIIC, [Ex ia Ma] I; Ex nA IIC T4 Gc

**UL:** NI / I / 2 / ABCD / T4, AIS / I, II, III / 1 / ABCDEFG, AEx nC [ia] IIC

**C-UL:** NI / I / 2 / ABCD / T4, AIS / I, II, III / 1 / ABCDEFG, Ex nC [ia] IIC

**FM:** NI / I / 2 / ABCD / T4, NI / I / 2 / IIC / T4, AIS / I, II, III / 1 / ABCDEFG, AEx [ia] IIC

**FM-C:** NI / I / 2 / ABCD / T4, NI / I / 2 / IIC / T4, AIS / I, II, III / 1 / ABCDEFG, Ex [ia] IIC

**EAC-EX:** 2Ex nA [ia Ga] IIC T4 Gc X, [Ex ia Da] IIIC X, [Ex ia Ma] I X

**UKR TR n. 898:** 2Ex nA IIC T4 X, Exial X

associated apparatus and non-sparking electrical equipment.

Uo/Voc = 25.2 V, Io/Isc = 87 mA, Po/Po = 548 mW at terminals 14-15, 10-11.

Um = 250 Vrms, -20 °C  $\leq$  Ta  $\leq$  60 °C.

**Approvals:**

DMT 01 ATEX E 042 X conforms to EN60079-0, EN60079-11, EN60079-26.

IECEx BVS 07.0027X conforms to IEC60079-0, IEC60079-11, IEC60079-26.

IMQ 09 ATEX 013 X conforms to EN60079-0, EN60079-15.

IECEx IMQ 13.0011X conforms to IEC60079-0, IEC60079-15.

INMETRO DNV 13.0108 X conforms to ABNT NBR IEC60079-0, ABNT NBR IEC60079-11, ABNT NBR IEC60079-15, ABNT NBR IEC60079-26, ABNT NBR IEC 61241-11.

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,

ANSI/ISA 12.12.02, ANSI/ISA 60079-0, ANSI/ISA 60079-11, C22.2 No.142,

C22.2 No.157, C22.2 No.213, E60079-0, E60079-11, E60079-15.

C-IT.MH04.B.00306 conforms to GOST R IEC 60079-0, GOST R IEC 60079-11, GOST R IEC 60079-15.

CL 16.0034 X conforms to DCTV 7113, GOCT 22782.5-78, DCTV IEC 60079-15.

TÜV Certificate No. C-IS-236198-03, SIL 2 conforms to IEC61508:2010 Ed.2.

TÜV Certificate No. C-IS-236198-09, SIL 3 Functional Safety Certificate conforms to IEC61508:2010 Ed.2, for Management of Functional Safety.

DNV No.A-13778 and KR No.MIL20769-EL001 Certificates for maritime applications.

**Mounting:** T35 DIN Rail according to EN50022.

**Weight:** about 180 g D1020D, 120 g D1020S.

**Connection:** by polarized plug-in disconnect screw terminal blocks to accommodate terminations up to 2.5 mm<sup>2</sup>.

**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.

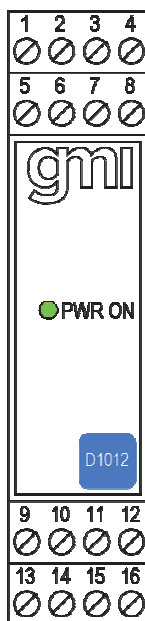
**Dimensions:** Width 22.5 mm, Depth 99 mm, Height 114.5 mm.

## Ordering information

Model:	D1020		
1 channel		S	
2 channels		D	
Power Bus enclosure			/B

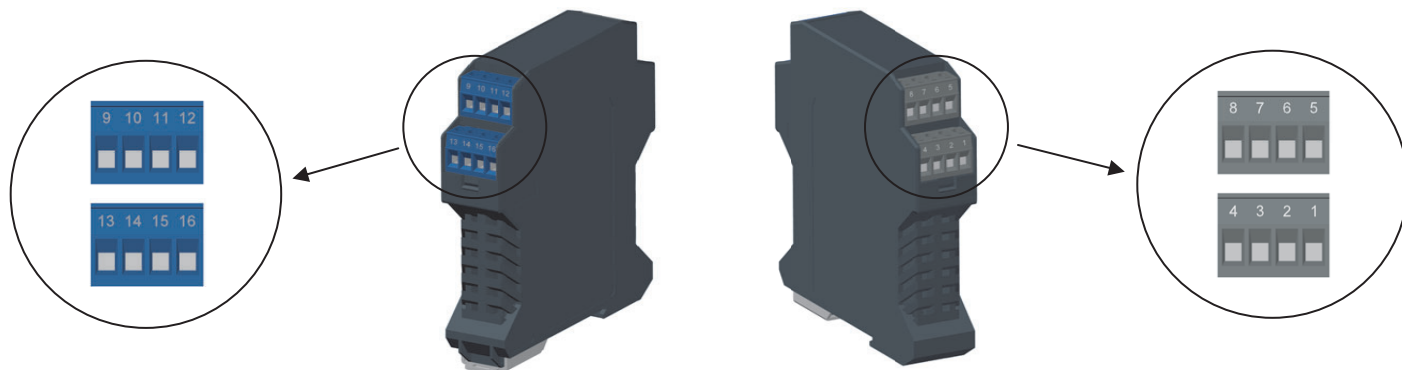
Power Bus and DIN-Rail accessories:  
 DIN rail anchor MCHP065      DIN rail stopper MOR016  
 Terminal block male MOR017      Terminal block female MOR022

## Front Panel and Features



- SIL 2 according to IEC 61508:2010 Ed.2 for Tproof = 3 / 10 years ( $\leq 10\%$  /  $> 10\%$  of total SIF).
- PFDavg (1 year) 2.60 E-04, SFF 62.04 %.
- SIL 3 Systematic capability.
- 2 fully independent channels.
- Output to Zone 0 (Zone 20), Division 1, installation in Zone 2, Division 2.
- 4-20 or 0-20 mA Input, Output Signal.
- Wide Band Smart Communication, Hart compatible.
- Field open circuit detection.
- High Accuracy.
- Three port isolation, Input/Output/Supply.
- EMC Compatibility to EN61000-6-2, EN61000-6-4, EN61326-1.
- ATEX, IECEx, UL & C-UL, FM & FM-C, INMETRO, EAC-EX, UKR TR n. 898, TÜV Certifications.
- TÜV Functional Safety Certification.
- Type Approval Certificate DNV and KR for maritime applications.
- High Reliability, SMD components.
- High Density, two 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	Not used
10	+ Output Ch 2 for I/P Converter
11	- Output Ch 2 for I/P Converter
12	Not used
13	Not used
14	+ Output Ch 1 for I/P Converter
15	- Output Ch 1 for I/P Converter
16	Not used

### SAFE AREA

1	+ Input Ch 1 for Current Source mode
2	- Input Ch 1 for Current Source mode
3	+ Ch1 Power Supply 24 Vdc
4	- Ch1 Power Supply 24 Vdc
5	+ Input Ch 2 for Current Source mode
6	- Input Ch 2 for Current Source mode
7	+ Ch2 Power Supply 24 Vdc
8	- Ch2 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 ( $U_i/V_{max}$ ,  $I_i/I_{max}$ ,  $P_i/P_i$ ) are not exceeded by the safety parameters ( $U_o/V_{oc}$ ,  $I_o/I_{sc}$ ,  $P_o/P_o$ ) of the D1020 series 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 ( $C_o/C_a$ ,  $L_o/L_a$ ,  $L_o/R_o$ ) given in the Associated Apparatus parameters for the effective gas group. See parameters on enclosure side and the ones indicated in the table below:

D1020 Terminals		D1020 Associated Apparatus Parameters		Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	14 - 15	Uo / Voc = 25.2 V		≤	Ui / Vmax
Ch2	10 - 11				
Ch1	14 - 15	Io / Isc = 87 mA		≤	Ii/ Imax
Ch2	10 - 11				
Ch1	14 - 15	Po / Po = 548 mW		≤	Pi / Pi
Ch2	10 - 11				
D1020 Terminals		D1020 Associated Apparatus Parameters		Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
Ch1	14 - 15	Co / Ca = 105 nF Co / Ca = 819 nF Co / Ca = 2.899 μF	IIC (A, B) IIB (C) IIA (D)	≥	Ci / Ci device + C cable
Ch2	10 - 11	Co / Ca = 4.15 μF Co / Ca = 819 nF	I IIIC		
Ch1	14 - 15	Lo / La = 4.6 mH Lo / La = 18.7 mH Lo / La = 37.5 mH	IIC (A, B) IIB (C) IIA (D)	≥	Li / Li device + L cable
Ch2	10 - 11	Lo / La = 61.5 mH Lo / La = 18.7 mH	I IIIC		
Ch1	14 - 15	Lo / Ro = 64.9 μH/Ω Lo / Ro = 259.6 μH/Ω Lo / Ro = 519.3 μH/Ω	IIC (A, B) IIB (C) IIA (D)	≥	Li / Ri device and L cable / R cable
Ch2	10 - 11	Lo / Ro = 851.9 μH/Ω Lo / Ro = 259.6 μH/Ω	I IIIC		

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

**For installations in which both the  $C_i$  and  $L_i$  of the Intrinsically Safe apparatus exceed 1 % of the  $C_o$  and  $L_o$  parameters of the Associated Apparatus (excluding the cable), then 50 % of  $C_o$  and  $L_o$  parameters are applicable and shall not be exceeded (50 % of the  $C_o$  and  $L_o$  become the limits which must include the cable such that  $C_i \text{ device} + C \text{ cable} \leq 50 \% \text{ of } C_o$  and  $L_i \text{ device} + L \text{ cable} \leq 50 \% \text{ of } L_o$ ).**

If the cable parameters are unknown, the following value may be used: Capacitance 60pF per foot (180pF per meter), Inductance 0.20 $\mu\text{H}$  per foot (0.60 $\mu\text{H}$  per meter).

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);

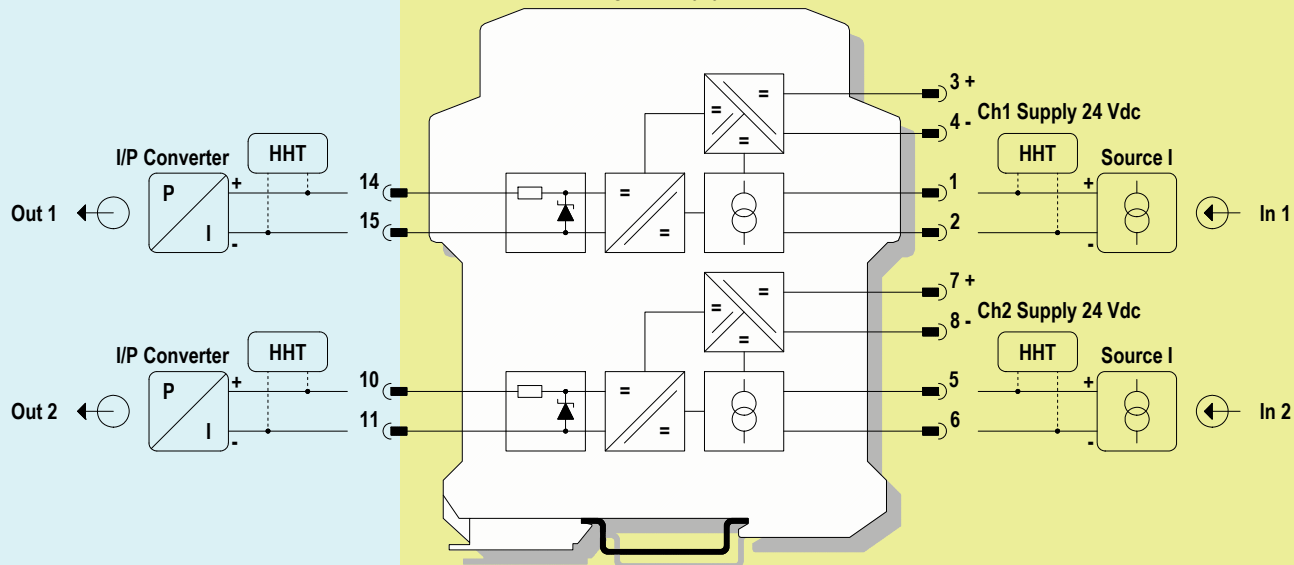
for Division 2 installations, the configuration of Intrinsically Safe Equipment must be FM approved under non-incendive field wiring or Entity Concept (or third party approved).

# Function Diagram:

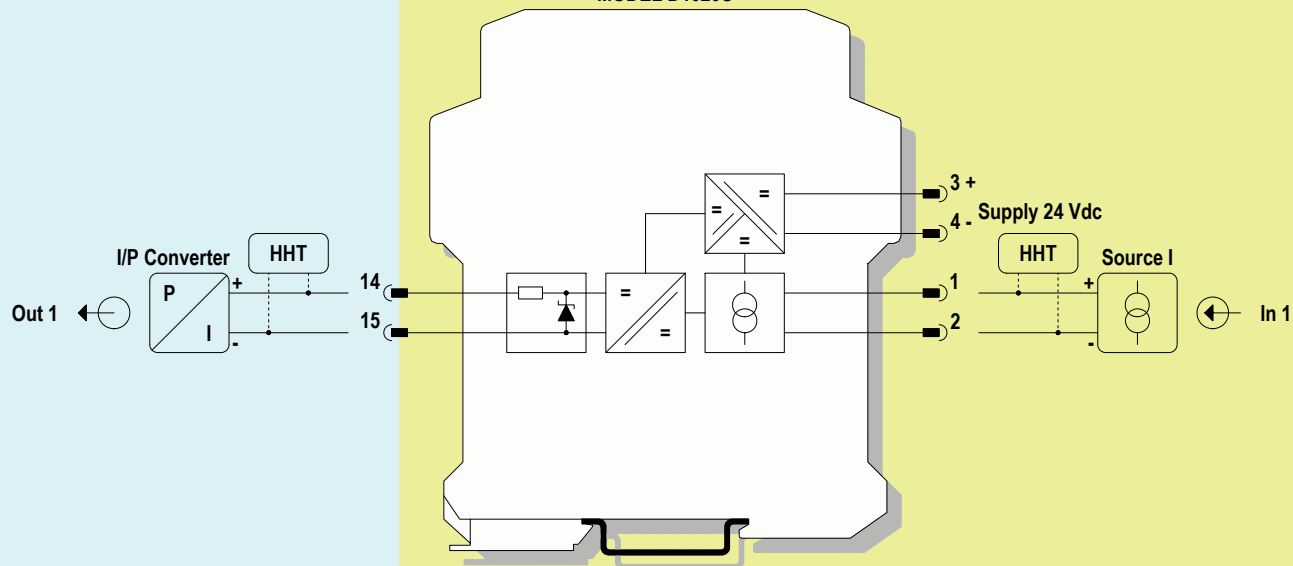
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,  
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,  
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,  
CLASS I, ZONE 0, GROUP IIC

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

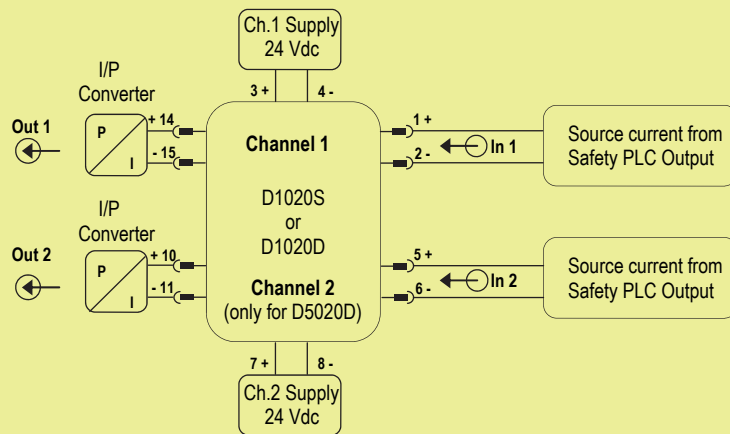
MODEL D1020D



MODEL D1020S



## Application for D1020S or D1020D

**Description:**

The module is powered by connecting 24 Vdc power supply to Pins 3 (+ positive) - 4 (- negative) for Channel 1 and Pins 7 (+ positive) - 8 (- negative) for Channel 2.

The green LEDs are lit in presence of each power supply line.

The current input signals from the Safety PLC outputs are applied to Pins 1-2 (In 1 - Ch.1) and Pins 5-6 (In 2 - Ch.2).

The source output currents for I/P converters are applied to Pins 14-15 (for Channel 1) and Pins 10-11 (for Channel 2).

**Safety Function and Failure behavior:**

D1020 is considered to be operating in Low Demand mode, as a Type A module, having Hardware Fault Tolerance (HFT) = 0.

The failure behaviour of the D1020 S and D1020D modules (when the output current range is 4 to 20 mA) is described by the following definitions:

- ☐ Fail-Safe State: it is defined as the output going to Fail Low.
- ☐ Fail Safe: failure mode that causes the module / (sub)system to go to the defined Fail-Safe state without a demand from the process.
- ☐ Fail Dangerous: failure mode that does not respond to a demand from the process (i.e. being unable to go to the defined Fail-Safe state) or deviates the output current by more than 5% full span (+/- 0.8 mA).
- ☐ Fail High: failure mode that causes the output signal to go above the maximum output current (> 20 mA). This failure mode is considered as a Dangerous Undetected failure.
- ☐ Fail Low: failure mode that causes the output signal to go below the minimum output current (< 4 mA). This failure mode is considered as a Safe Undetected failure.
- ☐ Fail "No Effect": failure mode of a component that plays a part in implementing the Safety Function but that is neither a safe failure nor a dangerous failure. When calculating the SFF, this failure mode is not taken into account.
- ☐ Fail "Not part": failure mode of a component that is not part of the Safety Function but is part of the circuit diagram and is listed for completeness. When calculating the SFF, this failure mode is not taken into account.

The 2 channels of D1020D module could be used to increase the hardware fault tolerance, needed for a higher SIL of a certain Safety Function, as they are completely independent each other, not containing common components. In fact, the analysis results got for D1020S (single channel) are also valid for each channel of D1020D (double channel). Failure rate data: taken from Siemens Standard SN29500.

**Failure rate table:**

Failure category	Failure rates (FIT)
$\lambda_{dd}$ = Total Dangerous Detected failures	0.00
$\lambda_{du}$ = Total Dangerous Undetected failures	59.27
$\lambda_{sd}$ = Total Safe Detected failures	0.00
$\lambda_{su}$ = Total Safe Undetected failures	96.85
<b><math>\lambda_{tot\ safe}</math> = Total Failure Rate (Safety Function) = <math>\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}</math></b>	<b>156.12</b>
<b>MTBF (Safety Function, one channel) = <math>(1 / \lambda_{tot\ safe}) + MTTR</math></b>	<b>731 years</b>
$\lambda_{no\ effect}$ = "No Effect" failures	238.29
$\lambda_{not\ part}$ = "Not Part" failures	10.80
<b><math>\lambda_{tot\ device}</math> = Total Failure Rate (Device) = <math>\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}</math></b>	<b>405.21</b>
<b>MTBF (Device, one channel) = <math>(1 / \lambda_{tot\ device}) + MTTR</math></b>	<b>281 years</b>

**Failure rates table according to IEC 61508:2010 Ed.2 :**

$\lambda_{sd}$	$\lambda_{su}$	$\lambda_{dd}$	$\lambda_{du}$	SFF
0.00 FIT	96.85 FIT	0.00 FIT	59.27 FIT	62.04%

**PFDavg vs T[Proof] table** (assuming Proof Test coverage of 99%), with determination of SIL supposing module contributes  $\leq 10\%$  of total SIF dangerous failures:

T[Proof] = 1 year	T[Proof] = 3 years
PFDavg = 2.60 E-04 Valid for <b>SIL 2</b>	PFDavg = 7.80 E-04 Valid for <b>SIL 2</b>

**PFDavg vs T[Proof] table** (assuming Proof Test coverage of 99%), with determination of SIL supposing module contributes  $> 10\%$  of total SIF dangerous failures:

T[Proof] = 10 years
PFDavg = 2.60 E-03 - Valid for <b>SIL 2</b>

Systematic capability SIL 3.

## Testing procedure at T-proof

The proof test must be performed to reveal dangerous faults which cannot be otherwise detected. This means that it is necessary to specify how dangerous undetected faults, which have been noted during the FMEDA analysis, can be revealed during the proof test.

The **Proof Test 1** consists of the following steps:

Steps	Action
1	Bypass the Safety-related PLC or take any other appropriate action to avoid a false trip.
2	Provide a 20 mA control signal to the driver to open/close the valve and verify that the valve is open / closed. This test is for voltage compliance problems, such as a loop power supply voltage or increased wiring resistance, and for other possible failures. It requires, however, that the positioner has already been tested without the driver and does not contain any dangerous undetected failures.
3	Provide a 4mA control signal to the driver to close/open the valve and verify that the valve is closed /open. This test is for possible quiescent current related failures. It requires, however, that the positioner has already been tested without the driver and does not contain any dangerous undetected failures
4	Restore the loop to full operation.
5	Remove the bypass from the Safety-related PLC or restore normal operation.

This test will detect approximately 70% of possible Dangerous Undetected failures in the repeater.

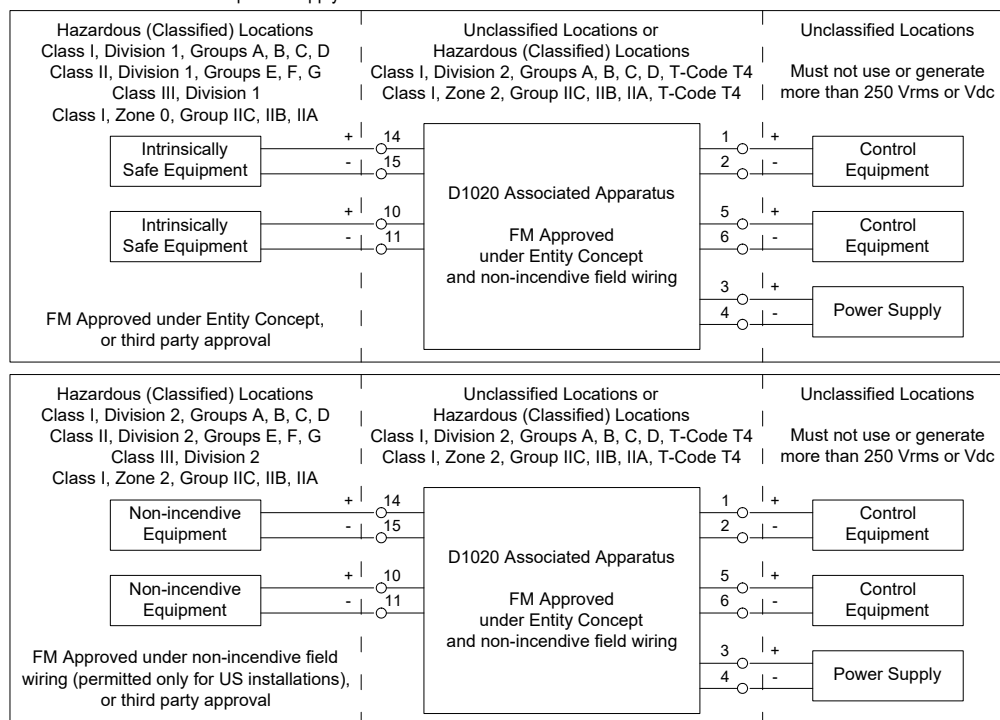
The **Proof Test 2** consists of the following steps:

Steps	Action
1	Bypass the Safety-related PLC or take any other appropriate action to avoid a false trip.
2	Perform steps 2 and 3 of the <b>Proof Test 1</b> .
3	Perform a two-point calibration of the positioner (i.e. 4 mA and 20 mA) and verify that the output current from the module is within the specified accuracy. This test requires, however, that the positioner has already been tested without the driver and does not contain any dangerous undetected failures.
4	Restore the loop to full operation.
5	Remove the bypass from the Safety-related PLC or restore normal operation.

This test will detect approximately 99% of possible Dangerous Undetected failures in the repeater.

## Warning

D1020 series are isolated Intrinsically Safe Associated Apparatus installed into standard EN50022 T35 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 EN/IEC60079-15, 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.



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 D1020 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. D1020 series 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

D1020 isolates and transfers a 0/4-20 mA signal from a controller located in Safe Area/Non Hazardous Locations to an I/P converter, displays or similar equipment located in Hazardous Area/Hazardous Locations. The circuit allows bi-directional communication signals for smart/hart converters. In the 4-20 mA input range, a field open circuit presents a high impedance to the control device. A "POWER ON" green led lights when input power is present.

## Installation

D1020 series are powered isolating driver smart/hart compatible housed in a plastic enclosure suitable for installation on T35 DIN Rail according to EN50022.

D1020 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 mm<sup>2</sup> 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 number of channels of the specific card (e.g. D1020S is a single channel model and D1020D is a dual channel model), 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".

For Model D1020D connect 24 Vdc power supply positive at terminal "7" and negative at terminal "8" for channel 2.

For Model D1020S connect positive input of channel 1 at terminal "1" and negative input at "2".

For Model D1020D in addition to channel 1 connections above, connect positive input of channel 2 at terminal "5" and negative input at "6".

For Model D1020S connect output at terminal "14" for positive and "15" for negative.

For Model D1020D in addition to channel 1 connections above, connect terminal "10" for positive and "11" for negative on channel 2.

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 EN60529, an IP20 minimum degree of mechanical protection (or similar to NEMA Standard 250 type 1) for indoor installation, outdoor installation requires an additional enclosure with higher degree of protection (i.e. IP54 to IP65 or NEMA type 12-13) consistent with the effective operating environment of the specific installation.

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

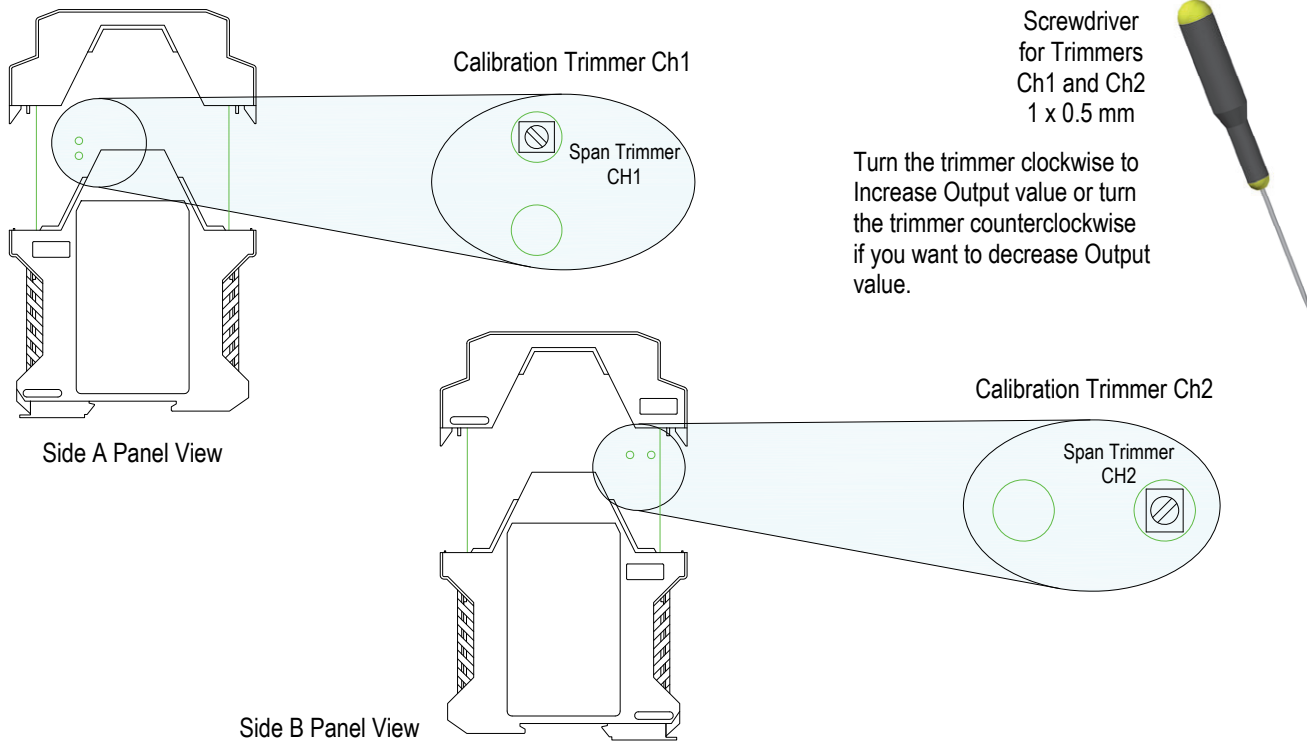
cloth lightly moistened by a mixture of detergent in water. **Electrostatic Hazard: to avoid electrostatic hazard, the enclosure of D1020 must be cleaned only with a damp or antistatic cloth.** Any penetration of cleaning liquid must be avoided to prevent damage to the unit. Any unauthorized card modification must be avoided. According to EN61010, D1020 series 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, output signal should be corresponding to the input from the controller. If possible change the input value and check the corresponding Hazardous Area output.



## Configuration

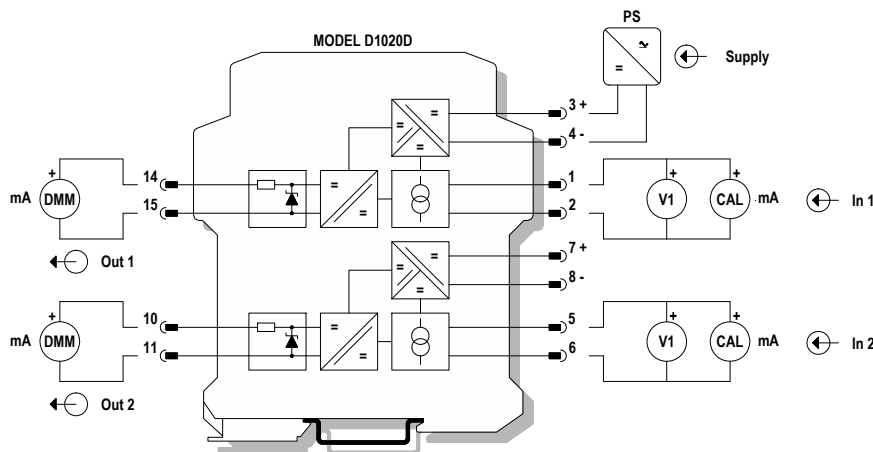


## Calibration instruction and Troubleshooting

In case a calibration check or readjustment is necessary the following equipment is required:

Equipment Required	Instrument	Identification
Adjustable Power Supply Range 0-35 V Resolution 0.1 V, Accuracy 1% Output Capability 200 mA	Agilent E3611A	PS
Current Meter range 20 mA, Resolution 1 $\mu$ A Accuracy 0.01% or Voltage Meter Range 10 V, Resolution 1 mV Accuracy 0.01%	Agilent 34410A	DMM
Voltage Meter range 30 V, Resolution 1 mV Accuracy 0.05 %	Fluke 175	V1
Current Calibrator range 20 mA, Resolution 1 $\mu$ A Accuracy 0.01 %	Yokogawa 7651	CAL

- Connect the unit as shown below:



- Set power supply (PS) at 24.0 V at terminals 3 (+) and 4 (-), the calibrator (CAL) in the function "mA" 20 mA range at terminals 1 (+) and 2 (-), the multimeter (V1) for the reading in DC supply 30 V range at terminals 1 (+) and 2 (-), the multimeter (DMM) for the reading in DC supply 20 mA range at terminals 14 (+) and 15 (-).
- Execute the next test to verify D1020S unit channel or execute it twice to verified both D1020D unit channels.
- Verify that green led on the front panel is ON.

If the power ON Led is off, check supply voltage, polarity and wiring.

- Set calibrator (CAL) at 4.000 mA and verify that the output current, read by multimeter (DMM), is correspondent with a maximum deviation presented in the section "Technical Data".
- Set calibrator (CAL) at 20.000 mA and verify that the output current, read by multimeter (DMM), is correspondent with a maximum deviation presented in the section "Technical Data".

If the maximum deviation is exceeded, repeat the board calibration and proceed in the following way:

- Set the calibrator (CAL) at 20.000 mA and regulate the current, read by multimeter (DMM), by turning the span trimmer of the unit (see "Configuration" section) until reading 20.000 mA  $\pm$  5  $\mu$ A value.
- To execute a linearity test: set the calibrator (CAL) at 4.000, 8.000, 12.000, 16.000, 20.000 mA and verify current output is correspondent with a maximum deviation presented in the section "Technical Data".
- Set calibrator (CAL) at 20.000 mA and power supply (PS) at 20.0 V; verify that multimeter (V1) reads input voltage as presented in the section "Technical Data".