INSTRUCTION & SAFETY MANUAL

SIL 2 Repeater Power Supply and Trip Amplifiers Din-Rail Model D1054S

technology for safety

Characteristics

General Description: The single channel DIN Rail Repeater Power Supply and Trip Amplifier D1054S, provides a fully floating dc supply for energizing conventional 2 wires 4-20 mA transmitters, or separately powered 3, 4 wires 4-20, 0-20 mA transmitters located in Hazardous Area, and repeats the current in floating circuit to drive a Safe Area load. Output signal can be direct or reverse. The circuit allows bi-directional communication signals, for Hart-Smart transmitters. Two independent Alarm Trip Amplifiers are also provided. Each alarm energizes, or de-energizes, an SPST relay for high, low, low-startup or burnout alarm functions. The two alarm relays trip points are settable over the entire input signal range.

Function: 1 channel I.S. analog input for 2 wires loop powered or separately powered Smart transmitters, provides 3 port isolation (input/output/supply) and current (source mode) or voltage output signal. In addition it provides two SPST relay alarm contacts with adjustable alarm trip point.

Signalling LEDs: Power supply indication (green), burnout (red), alarm A (red), alarm B (red).

Configurability: Totally software configurable, no jumpers or switches, mA or V output signal, linear or reverse, alarm trip point, high, low, low-startup or burnout alarm mode, NE/ND relay operation, hysteresis, delay time, by GM Pocket Portable Configurator PPC1090, powered by the unit or configured by PC via RS-232 serial line with PPC1092 Adapter and SWC1090 Configurator software.

Smart Communication Frequency Band: 0.5 to 40 KHz within 3 dB (Hart and higher frequency protocols), only with mA direct current output.

EMC: Fully compliant with CE marking applicable requirements.

Technical Data

Supply: 12-24 Vdc nom (10 to 30 Vdc) reverse polarity protected, ripple within voltage limits ≤ 5 Vpp.
Current consumption @ 24 V: 90 mA with 20 mA input/output and relays energized.
Current consumption @ 12 V: 190 mA with 20 mA input/output and relays energized.
Power dissipation: 1.7 W with 24 V supply, 20 mA input/output and relays energized.
Max. power consumption: at 30 V supply voltage, input short circuit, overload condition, relays energized and PPC1090 connected, 2.9 W.
Isolation (Test Voltage): I.S. In/Outs 1.5 KV; I.S. In/Supply 1.5 KV; Analog Out/Supply 500 V; Analog Out/Alarm Outs 1.5 KV; Alarm Outs/Supply 1.5 KV; Alarm Out/Alarm Out 1.5 KV.
Input: 0/4 to 20 mA (separately powered input, voltage drop ≤ 1 V) or 4 to 20 mA (2 wire Tx current limited at ≈ 25 mA).
Integration time: 100 ms.
Resolution/Visualization: 1 µA.
Input range: 0 to +22 mA.
Transmitter line voltage: ≥ 15.0 V at 20 mA with max. 20 mVrms ripple on 0.5 to 40 KHz frequency band.
Burnout: enabled or disabled. Analog output can be programmed to detect burnout condition with downscale or highscale forcing. Alarms can be programmed to detect burnout condition.
Burnout range: low and high separated trip point value programmable between -5 to +25 mA.
Output: 0/4 to 20 mA, on max. 600 Ω load source mode, current limited at 22 mA or 0/1 to 5 V or 0/2 to 10 V signal, limited at 11 V.
Resolution: 1 µA current output or 1 mV voltage output.
Transfer characteristic: linear or reverse.
Response time: ≤ 50 ms (10 to 90 % step change).
Output ripple: ≤ 20 mVrms on 250 Ω 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) only with mA direct current output.
Alarm:
Trip point range: within rated limits of input sensor (see input for step resolution).
ON-OFF delay time: 0 to 1000 s, 100 ms step, separate setting.
Hysteresis: 0 to 5 mA (see input for step resolution).
Output: voltage free SPST relay contact.
Contact rating: 2 A 250 Vac 500 VA, 2 A 250 Vdc 80 W (resistive load).
Performance: Ref. Conditions 24 V supply, 250 Ω load, 23 ± 1 °C ambient temperature.

Input:	Calibration and linearity accuracy: ≤ ± 20 µA
	Temperature influence: ≤ ± 1 µA of input for a 1 °C change.
Analog: Output:	Calibration accuracy: ≤ ± 0.1 % of full scale.
	Linearity error: ≤ ± 0.05 % of full scale.
	Supply voltage influence: ≤ ± 0.05% of full scale for min to max supply change
	Load influence: ≤ ± 0.05% of full scale for 0 to 100 % load resistance change
	Temperature influence: ≤ ± 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 ec nC IIC T4 Gc.
IECEx: [Ex ia Ga] IIC, [Ex ia Da] IIIC, [Ex ia Ma] I, Ex ec nC IIC T4 Gc
INMETRO: [Ex ia Ga] IIC, [Ex ia Da] IIIC, [Ex ia Ma] I
UL: AIS / I, II, III / 1 / ABCDEFG, [AEx ia] IIC
C-UL: AIS / I, II, III / 1 / ABCDEFG, [Ex 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 nC [ia Ga] IIC T4 Gc X, [Ex ia Da] IIIC X, [Ex ia Ma] I X
UKR TR n. 898: 2ExnAnCiaIICT4 X, ExiaI X
associated electrical apparatus.
Uo/Voc = 26.3 V, Io/Isc = 91 mA, Po/Po = 597 mW at terminals 14-15.
Uo/Voc = 1.1 V, Io/Isc = 56 mA, Po/Po = 16 mW at terminals 15-16.
Ui/Vmax = 30 V, Ii/Imax = 128 mA, Ci = 1.05 nF, Li = 0 nH at terminals 15-16.
Um = 250 Vrms, -20 °C ≤ Ta ≤ 60°C.
Approvals:
Presafe 16ATEX8917 conforms to EN60079-0, EN60079-11, EN50303.
IECEx PRE 16.0084 conforms to IEC60079-0, IEC60079-11.
IMQ 09 ATEX 013 X conforms to EN60079-0, EN60079-7, EN60079-15.
IECEx IMQ 13.0011X conforms to IEC60079-0, IEC60079-7, IEC60079-15.
INMETRO DNV 22.0245 conforms to ABNT NBR IEC60079-0, ABNT NBR IEC60079-11.
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.
ЕАЭС RU C-IT.HA67.B.00113/20 conforms to GOST 31610.0, GOST 31610.11, GOST 31610.15.
СЦ 16.0034 X conforms to ДСТУ 7113, ГОСТ 22782.5-78, ДСТУ IEC 60079-15.
TÜV Declaration of Compliance No. C-IS-722238330, SIL 2 according to IEC 61508:2010 Ed.2.
SIL 3 Functional Safety TÜV Certificate conforms to IEC61508:2010 Ed.2, for Management of Functional Safety.
DNV No. TAA00002BM and KR No.MIL20769-EL001 Cert. for maritime applications.
Mounting: EN/IEC60715 TH 35 DIN-Rail.
Weight: about 175 g.
Connection: by polarized plug-in disconnect screw terminal blocks to accomodate terminations up to 2.5 mm^2.
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.

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 D1054 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:

D1054 Terminals		D1054 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	14 - 15	Uo / Voc = 26.3 V	≤	Ui / Vmax
Ch1	15 - 16	Uo / Voc = 1.1 V		
Ch1	14 - 15	Io / Isc = 91 mA	≤	Ii/ Imax
Ch1	15 - 16	Io / Isc = 56 mA		
Ch1	14 - 15	Po / Po = 597 mW	≤	Pi / Pi
Ch1	15 - 16	Po / Po = 16 mW		

D1054 Terminals		D1054 Associated Apparatus Parameters		Must be	Hazardous Area/ Hazardous Locations Device + Cable Parameters
Ch1	14 - 15	Co / Ca = 95 nF	(IIC-A, B)	≥	Ci / Ci device + C cable
		Co / Ca = 738 nF	(IIB-C)		
		Co / Ca = 2.5 µF	(IIA-D)		
		Co / Ca = 4.39 µF	(I)		
		Co / Ca = 0.738 µF	(IIIC)		
Ch1	15 - 16	Co / Ca = 100 µF	(IIC-A, B)		
		Co / Ca = 1000 µF	(IIB-C)		
		Co / Ca = 1000 µF	(IIA-D)		
		Co / Ca = 1000 µF	(I)		
		Co / Ca = 1000 µF	(IIIC)		
Ch1	14 - 15	Lo / La = 4.3 mH	(IIC-A, B)	≥	Li / Li device + L cable
		Lo / La = 17.2 mH	(IIB-C)		
		Lo / La = 34.5 mH	(IIA-D)		
		Lo / La = 60 mH	(I)		
		Lo / La = 17.2 mH	(IIIC)		
Ch1	15 - 16	Lo / La = 11.3 mH	(IIC-A, B)		
		Lo / La = 45.3 mH	(IIB-C)		
		Lo / La = 90.7 mH	(IIA-D)		
		Lo / La = 148 mH	(I)		
		Lo / La = 45.3 mH	(IIIC)		
Ch1	14 - 15	Lo / Ro = 59.6 µH/Ω	(IIC-A, B)	≥	Li / Ri device and L cable / R cable
		Lo / Ro = 238.4 µH/Ω	(IIB-C)		
		Lo / Ro = 476.8 µH/Ω	(IIA-D)		
		Lo / Ro = 782.2 µH/Ω	(I)		
		Lo / Ro = 238.4 µH/Ω	(IIIC)		
Ch1	15 - 16	Lo / Ro = 2327 µH/Ω	(IIC-A, B)		
		Lo / Ro = 9309 µH/Ω	(IIB-C)		
		Lo / Ro = 18618 µH/Ω	(IIA-D)		
		Lo / Ro = 30550 µH/Ω	(IIB-C)		
		Lo / Ro = 9309 µH/Ω	(IIA-D)		

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

When used with separate powered intrinsically safe devices, check that maximum allowable voltage, current (Ui/Vmax, Ii/Imax) of the D1054 Associated Apparatus are not exceeded by the safety parameters (Uo/Voc, Io/Isc) of the Intrinsically Safe device, indicated in the table below:

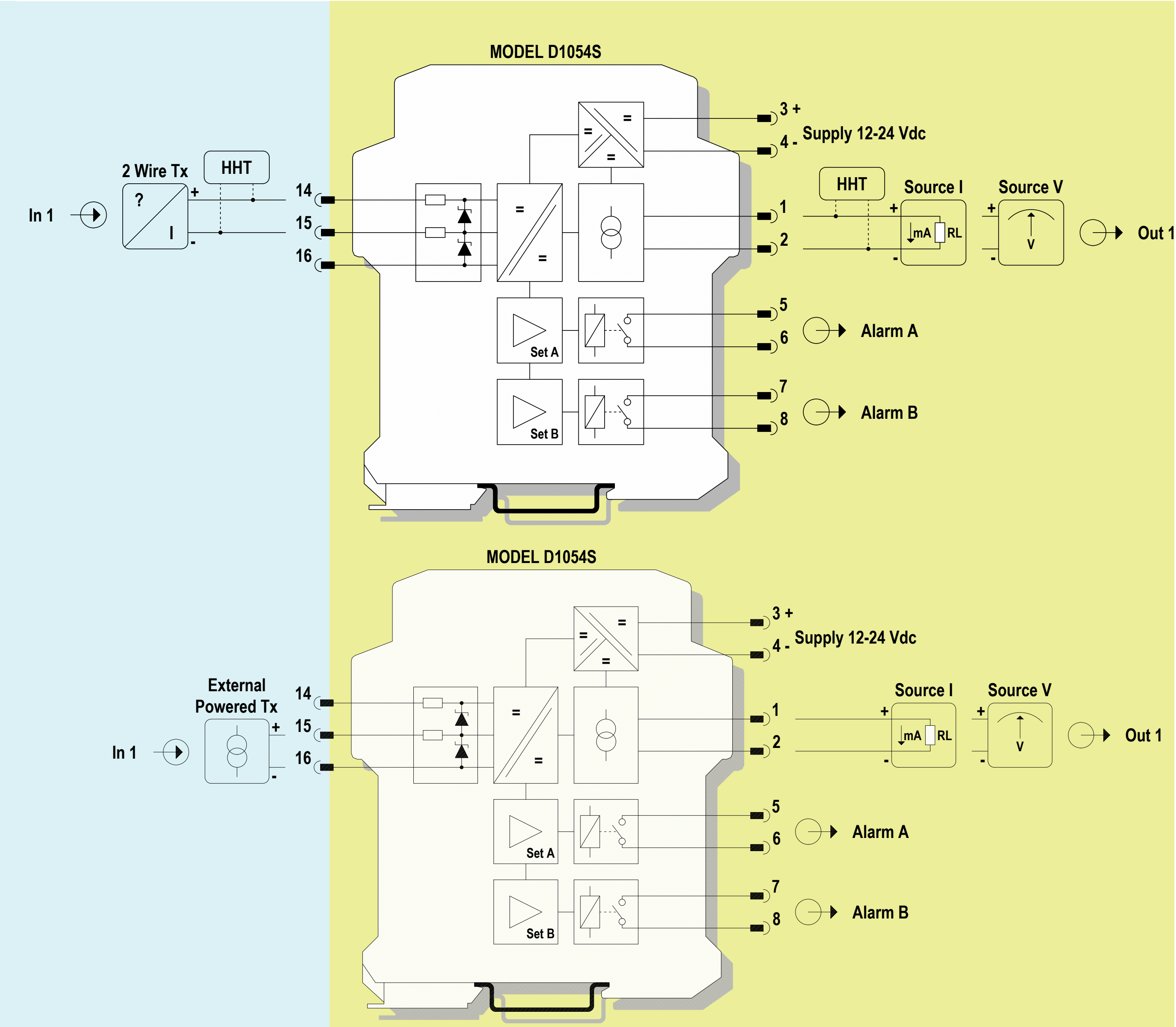
D1054 Terminals		D1054 Associated Apparatus Parameters	Must be	Hazardous Area/ Hazardous Locations Device Parameters
Ch1	15 - 16	Ui / Vmax = 30V	≥	Uo / Voc
Ch1	15 - 16	Ii / Imax = 128 mA	≥	Io / Ioc
Ch1	15 - 16	Ci = 1.05 nF, Li= 0 nH		

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

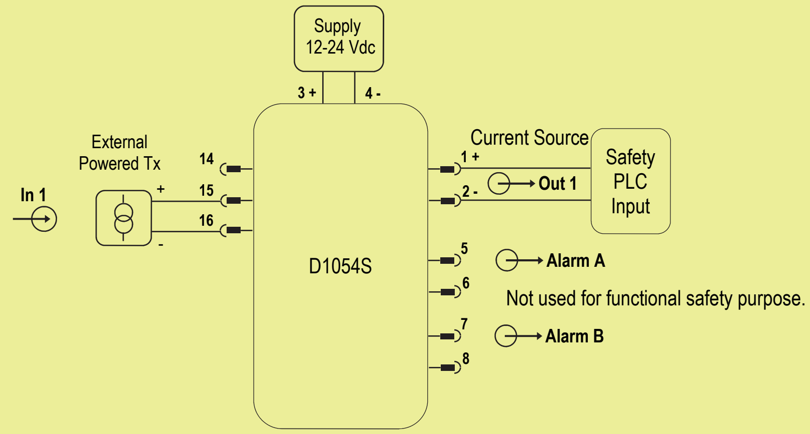
HAZARDOUS AREA ZONE 0 (ZONE 20) GROUP IIC,
HAZARDOUS LOCATIONS CLASS I, DIVISION 1, GROUPS A, B, C, D,
CLASS II, DIVISION 1, GROUPS E, F, G, CLASS III, DIVISION 1,
CLASS I, ZONE 0, GROUP IIC

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



For SIL applications, alarm contacts must be used in series with equal configuration.
Relay contacts shown in de-energized position.

Application for D1054S , active input and 4-20 mA analog current output



Description:

For this application, enable 4 - 20 mA Source mode (see pages 12 and 13 for more information).
The module is powered by connecting 12-24 Vdc power supply to Pins 3 (+ positive) - 4 (- negative). The green LED is lit in presence of supply power.
Active input signal from external powered Tx is applied to Pins 15-16.
Source output current is applied to Pins 1-2. Alarm A and Alarm B Outputs are not used for functional safety purpose.

Safety Function and Failure behavior:

D1054S is considered to be operating in Low Demand mode, as a Type B module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of module (only the 4 - 20 mA current output configuration is used for safety application) is described from the following definitions:

- Fail-Safe State: is defined as the output going to 0 mA due to module shutdown.
- 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 or deviates the output current by more than 3 % (± 0.5 mA) of full span.
- Fail High: failure mode that causes the output signal to go above the maximum output current (> 20 mA). Assuming that the application program in the Safety logic solver is configured to detect High failure, this failure has been classified as a dangerous detected (DD) failure.
- Fail Low: failure mode that causes the output signal to go below the minimum output current (< 4 mA). Assuming that the application program in the Safety logic solver is configured to detect Low failure, this failure has been classified as a dangerous detected (DD) failure.
- Fail Dangerous Detected: it's a dangerous failure which has been detected from module internal diagnostic so that output signal is forced below the minimum output current < 4 mA (as Fail Low) or above the maximum output current > 20mA (as Fail High).
- 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 which is not part of the safety function but part of the circuit diagram and is listed for completeness. When calculating the SFF this failure mode is not taken into account.

As the module has been evaluated in accordance with Route 2H (proven-in-use) of the IEC 61508:2010, Diagnostic Coverage DC ≥ 60% is required for Type B elements.
Being HFT = 0, in Low Demand mode the maximum achievable functional safety level is SIL 2.
Failure rate data: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	**Failure rates (FIT)**
λ_{dd} = Total Dangerous Detected failures	105.54
λ_{du} = Total Dangerous Undetected failures	42.58
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	112.15
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**260.27**
MTBF (safety function, single channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**439 years**
$\lambda_{no\ effect}$ = "No Effect" failures	195.43
$\lambda_{not\ part}$ = "Not Part" failures	269.40
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**725.10**
MTBF (device) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**157 years**

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

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	DC	SFF
0.00 FIT	112.15 FIT	105.54 FIT	42.58 FIT	71.25%	83.64%

where DC means the diagnostic coverage for the input sensor by module internal diagnostic circuits and by Safety logic solver. This type "B" system, operating in Low Demand mode with HFT = 0, has got DC = 71.25 % ≥ 60 % as required by Route 2H evaluation (proven-in-use) of the IEC 61508:2010.

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

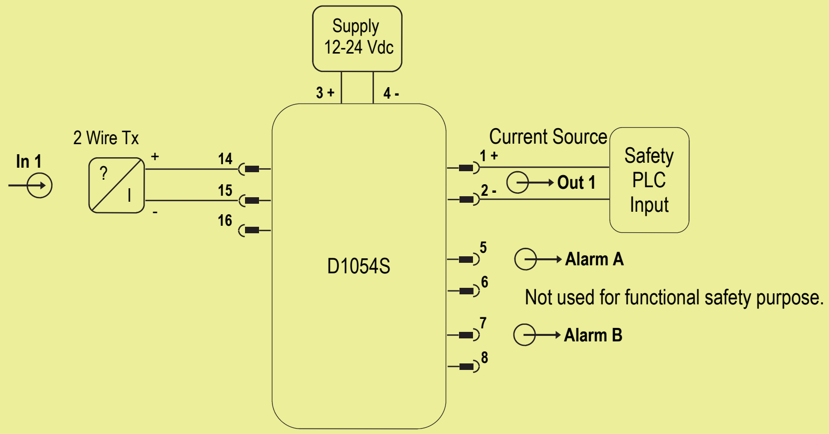
T[Proof] = 1 year	T[Proof] = 5 years
PFDavg = 1.88 E-04 Valid for **SIL 2**	PFDavg = 9.40 E-04 Valid for **SIL 2**

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 = 1.88 E-03 Valid for **SIL 2**

SC 2: Systematic capability SIL 2.

Application for D1054S , passive input and 4-20 mA analog current output



Description:

For this application, enable 4 - 20 mA Source mode (see pages 12 and 13 for more information).
The module is powered by connecting 12-24 Vdc power supply to Pins 3 (+ positive) - 4 (- negative). The green LED is lit in presence of supply power.
Passive input signal from 2 wires Tx is applied to Pins 14-15.
Source output current is applied to Pins 1-2. Alarm A and Alarm B Outputs are not used for functional safety purpose.

Safety Function and Failure behavior:

D1054S is considered to be operating in Low Demand mode, as a Type B module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of module (only the 4 - 20 mA current output configuration is used for safety application) is described from the following definitions:

- Fail-Safe State: is defined as the output going to 0 mA due to module shutdown.
- 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 or deviates the output current by more than 3 % (± 0.5 mA) of full span.
- Fail High: failure mode that causes the output signal to go above the maximum output current (> 20 mA). Assuming that the application program in the Safety logic solver is configured to detect High failure, this failure has been classified as a dangerous detected (DD) failure.
- Fail Low: failure mode that causes the output signal to go below the minimum output current (< 4 mA). Assuming that the application program in the Safety logic solver is configured to detect Low failure, this failure has been classified as a dangerous detected (DD) failure.
- Fail Dangerous Detected: it's a dangerous failure which has been detected from module internal diagnostic so that output signal is forced below the minimum output current < 4 mA (as Fail Low) or above the maximum output current > 20mA (as Fail High).
- 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 which is not part of the safety function but part of the circuit diagram and is listed for completeness. When calculating the SFF this failure mode is not taken into account.

As the module has been evaluated in accordance with Route 2H (proven-in-use) of the IEC 61508:2010, Diagnostic Coverage DC ≥ 60% is required for Type B elements.
Being HFT = 0, in Low Demand mode the maximum achievable functional safety level is SIL 2.
Failure rate data: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	**Failure rates (FIT)**
λ_{dd} = Total Dangerous Detected failures	125.61
λ_{du} = Total Dangerous Undetected failures	45.02
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	112.01
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**282.64**
MTBF (safety function, single channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**404 years**
$\lambda_{no\ effect}$ = "No Effect" failures	212.86
$\lambda_{not\ part}$ = "Not Part" failures	229.60
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**725.10**
MTBF (device) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**157 years**

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

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	DC	SFF
0.00 FIT	112.01 FIT	125.61 FIT	45.02 FIT	73.62%	84.07%

where DC means the diagnostic coverage for the input sensor by module internal diagnostic circuits and by Safety logic solver. This type "B" system, operating in Low Demand mode with HFT = 0, has got DC = 73.62 % ≥ 60 % as required by Route 2H evaluation (proven-in-use) of the IEC 61508:2010.

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

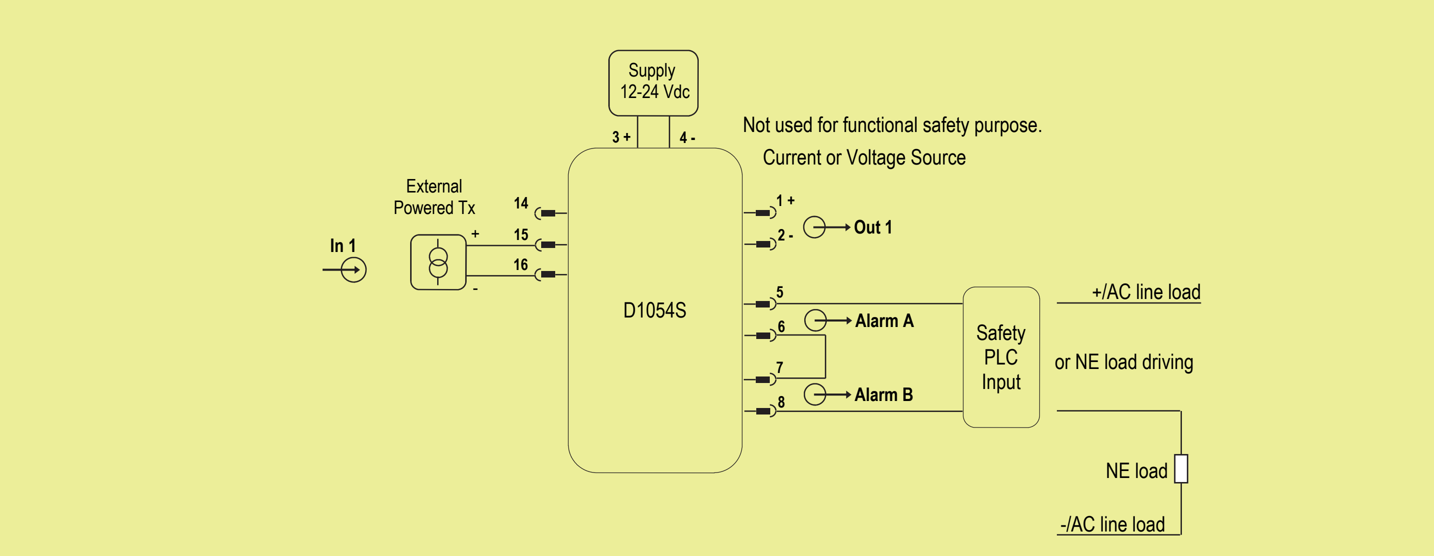
T[Proof] = 1 year	**T[Proof] = 5 years**
PFDavg = 1.99 E-04 Valid for **SIL 2**	PFDavg = 9.95 E-04 Valid for **SIL 2**

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 = 1.99 E-03 Valid for **SIL 2**

SC 2: Systematic capability SIL 2.

Application for D1054S , active input and 1oo2 architecture of alarm trip amplifiers with relay outputs for NE load



Description:

For this application, enable both alarm A and B trip amplifiers programmed with equal configuration, using NE relay condition (see pages 12 and 13 for more information).
The module is powered by connecting 12-24 Vdc power supply to Pins 3 (+ positive) - 4 (- negative). The green LED is lit in presence of supply power.
Active input signal from external powered Tx is applied to Pins 15-16.
Relay contacts of Alarm A and Alarm B Outputs must be connected in series: Pins 6-7 are connected together by external wired jumper. Therefore between Pins 5-8 there are 2 relay contacts in 1oo2 series architecture which could be connected to safety PLC input or used to driving a NE load. In this case, relays are normally energized, their contacts are closed and load is normally energized; in case of alarm, the system de-energized to trip, so that relays are de-energized, contacts are open and load is de-energized.
To prevent relay contacts from damaging, connect an external protection (fuse or similar), chosen according to the relay breaking capacity (see page 2 for relay contact rating).
Analog (current or voltage) output is not used for functional safety purpose.

Safety Function and Failure behavior:

D1054S is considered to be operating in Low Demand mode, as a Type B module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of module (only Alarm A and Alarm B trip amplifiers is used for safety application) is described from the following definitions:

- Fail-Safe State: it's defined as the relay outputs being de-energized or relay contacts remaining open (user must program for both alarm amplifiers the same trip point value, in accordance with input measured value, at which both output relays must be de-energized).
- 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 leads to a measurement error of more than 3 % of correct value and therefore has the potential to not respond to a demand from the process (i.e. being unable to go to the defined Fail-Safe state), so that the output relays remain energized or relay contacts remain closed.
- Fail Dangerous Detected: a dangerous failure which has been detected from module internal diagnostic so that output relays are forced to be de-energized (that is to Fail-Safe state), with relay contacts open.
- 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 which is not part of the safety function but part of the circuit diagram and is listed for completeness.
  When calculating the SFF this failure mode is not taken into account.

Both alarm A and B trip amplifiers must be programmed with equal configuration (the same trip values).
As the module has been evaluated in accordance with Route 2H (proven-in-use) of the IEC 61508:2010, Diagnostic Coverage DC ≥ 60% is required for Type B elements.
Being HFT = 0, in Low Demand mode the maximum achievable functional safety level is SIL 2.
Failure rate data: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	Failure rates (FIT)
λ_{dd} = Total Dangerous Detected failures	65.62
λ_{du} = Total Dangerous Undetected failures	31.35
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	212.94
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**309.91**
MTBF (safety function, 1oo2 alarm channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**368 years**
$\lambda_{no\ effect}$ = "No Effect" failures	239.39
$\lambda_{not\ part}$ = "Not Part" failures	175.80
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**725.10**
MTBF (device) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**157 years**

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

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	DC	SFF
0.00 FIT	212.94 FIT	65.62 FIT	31.35 FIT	67.67%	89.88%

where DC means the diagnostic coverage for the input sensor by module internal diagnostic circuits. This type "B" system, operating in Low Demand mode with HFT = 0, has got DC = 67.67 % ≥ 60 % as required by Route 2H evaluation (proven-in-use) of the IEC 61508:2010.

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

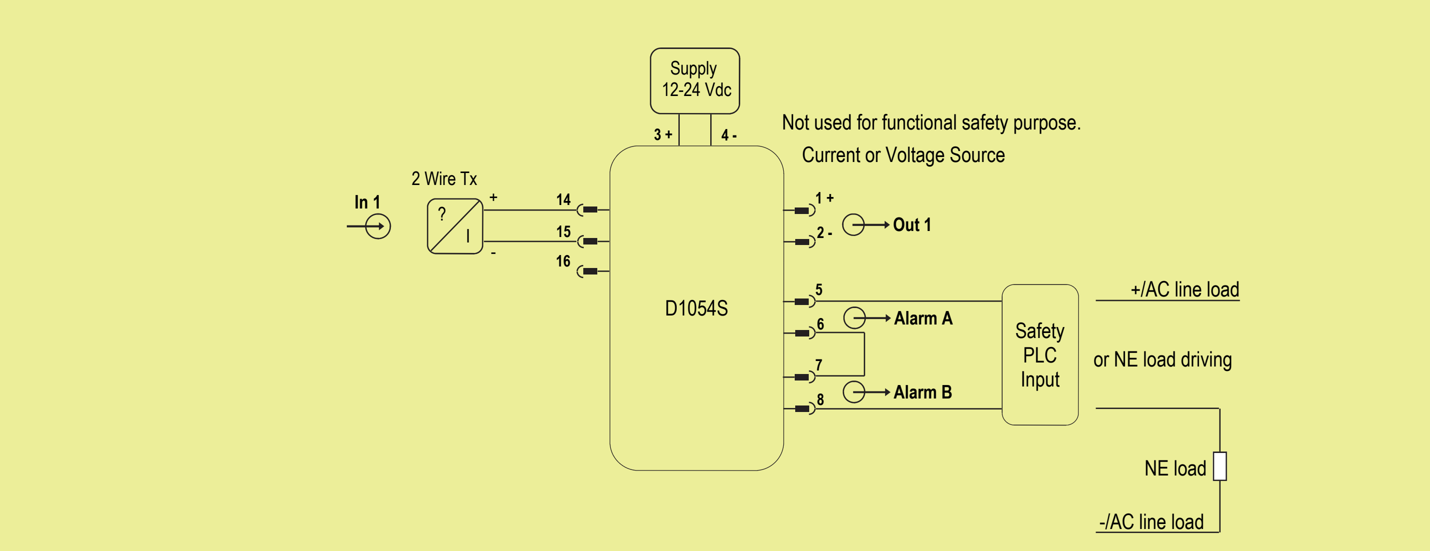
T[Proof] = 1 year	T[Proof] = 7 years
PFDavg = 1.38 E-04 Valid for **SIL 2**	PFDavg = 9.67 E-04 Valid for **SIL 2**

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 = 1.38 E-03 Valid for **SIL 2**

SC 2: Systematic capability SIL 2.

Application for D1054S , passive input and 1oo2 architecture of alarm trip amplifiers with relay outputs for NE load



Description:

For this application, enable both alarm A and B trip amplifiers programmed with equal configuration, using NE relay condition (see pages 12 and 13 for more information).
The module is powered by connecting 12-24 Vdc power supply to Pins 3 (+ positive) - 4 (- negative). The green LED is lit in presence of supply power.
Passive input signal from 2 wires Tx is applied to Pins 14-15.
Relay contacts of Alarm A and Alarm B Outputs must be connected in series: Pins 6-7 are connected together by external wired jumper. Therefore between Pins 5-8 there are 2 relay contacts in 1oo2 series architecture which could be connected to safety PLC input or used to driving a NE load. In this case, relays are normally energized, their contacts are closed and load is normally energized; in case of alarm, the system de-energized to trip, so that relays are de-energized, contacts are open and load is de-energized.
To prevent relay contacts from damaging, connect an external protection (fuse or similar), chosen according to the relay breaking capacity (see page 2 for relay contact rating).
Analog (current or voltage) output is not used for functional safety purpose.

Safety Function and Failure behavior:

D1054S is considered to be operating in Low Demand mode, as a Type B module, having Hardware Fault Tolerance (HFT) = 0.
The failure behaviour of module (only Alarm A and Alarm B trip amplifiers is used for safety application) is described from the following definitions:

- Fail-Safe State: it's defined as the relay outputs being de-energized or relay contacts remaining open (user must program for both alarm amplifiers the same trip point value, in accordance with input measured value, at which both output relays must be de-energized).
- 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 leads to a measurement error of more than 3 % of correct value and therefore has the potential to not respond to a demand from the process (i.e. being unable to go to the defined Fail-Safe state), so that the output relays remain energized or relay contacts remain closed.
- Fail Dangerous Detected: a dangerous failure which has been detected from module internal diagnostic so that output relays are forced to be de-energized (that is to Fail-Safe state), with relay contacts open.
- 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 which is not part of the safety function but part of the circuit diagram and is listed for completeness.
  When calculating the SFF this failure mode is not taken into account.

Both alarm A and B trip amplifiers must be programmed with equal configuration (the same trip values).
As the module has been evaluated in accordance with Route 2H (proven-in-use) of the IEC 61508:2010, Diagnostic Coverage DC ≥ 60% is required for Type B elements.
Being HFT = 0, in Low Demand mode the maximum achievable functional safety level is SIL 2.
Failure rate data: taken from Siemens Standard SN29500.

Failure rate table:

Failure category	Failure rates (FIT)
λ_{dd} = Total Dangerous Detected failures	85.69
λ_{du} = Total Dangerous Undetected failures	33.79
λ_{sd} = Total Safe Detected failures	0.00
λ_{su} = Total Safe Undetected failures	212.80
$\lambda_{tot\ safe}$ = Total Failure Rate (Safety Function) = $\lambda_{dd} + \lambda_{du} + \lambda_{sd} + \lambda_{su}$	**332.28**
MTBF (safety function, 1oo2 alarm channel) = (1 / $\lambda_{tot\ safe}$) + MTTR (8 hours)	**344 years**
$\lambda_{no\ effect}$ = "No Effect" failures	256.82
$\lambda_{not\ part}$ = "Not Part" failures	136.00
$\lambda_{tot\ device}$ = Total Failure Rate (Device) = $\lambda_{tot\ safe} + \lambda_{no\ effect} + \lambda_{not\ part}$	**725.10**
MTBF (device) = (1 / $\lambda_{tot\ device}$) + MTTR (8 hours)	**157 years**

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

λ_{sd}	λ_{su}	λ_{dd}	λ_{du}	DC	SFF
0.00 FIT	212.80 FIT	85.69 FIT	33.79 FIT	71.72%	89.83%

where DC means the diagnostic coverage for the input sensor by module internal diagnostic circuits. This type "B" system, operating in Low Demand mode with HFT = 0, has got DC = 71.72 % ≥ 60 % as required by Route 2H evaluation (proven-in-use) of the IEC 61508:2010.

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] = 1 year	T[Proof] = 6 years
PFDavg = 1.49 E-04 Valid for **SIL 2**	PFDavg = 8.94 E-04 Valid for **SIL 2**

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 = 1.49 E-03 Valid for **SIL 2**

SC 2: Systematic capability SIL 2.

Testing procedure at T-proof

The proof test shall be performed to reveal dangerous faults which are undetected by diagnostic. This means that it is necessary to specify how dangerous undetected fault, which have been noted during the FMEDA, can be detected during the proof test.

Test for D1054S (analog current output):

Proof test 1A (to detect approximately 50 % of possible Dangerous Undetected failures)	
Steps	**Action**
1	Bypass the Safety PLC or take other appropriate action to avoid a false trip.
2	Connect a mA signal generator to the input terminals ('14'-'15' as passive input transmitter or '15'-'16' as active input transmitter) of the repeater.
3	Force an input current signal value to go module current output to full scale value (≥ 20 mA) and verify that the analog current reaches that value. This tests is for voltage compliance problems, such as low supply voltage or increased wiring resistance, and for other possible failures.
4	Force an input current signal value to go module current output to low scale value (≤ 4 mA) and verify that the analog current reaches that value. This tests is for possible quiescent current related failures.
5	Restore the loop to full operation.
6	Remove the bypass from the Safety PLC or restore normal operation.

Proof test 2A (to detect approximately 99 % of possible Dangerous Undetected failures)	
Steps	**Action**
1	Bypass the Safety PLC or take other appropriate action to avoid a false trip.
2	Perform steps 2, 3 and 4 of **Proof Test 1A**.
3	Force some input current signal values, included in the range 4-20 mA, verifying that the module output current related values are within the specified accuracy (3 % (± 0.5 mA) of full span) as defined in the Safety Function. This test requires that mA signal generator has already been tested without the repeater and that it works correctly according to its specifications.
4	Restore the loop to full operation.
5	Remove the bypass from the Safety PLC or restore normal operation.

Test for D1054S (for each alarm trip amplifier with relay output):

Proof test 1B (to detect approximately 50 % of possible Dangerous Undetected failures)	
Steps	**Action**
1	Bypass the Safety PLC or take other appropriate action to avoid a false trip.
2	Connect a mA signal generator to the input terminals ('14'-'15' as passive input transmitter or '15'-'16' as active input transmitter) of the repeater.
3	For each trip amplifier, force an input current signal value to go module to the high alarm current output and verify that the related relay contact (on terminal blocks 5-6 for trip amplifier 1 or terminal blocks 7-8 for trip amplifier 2) is switched respect to previous normal condition.
4	For each trip amplifier, force an input current signal value to go module to the low alarm current output and verify that the related relay contact (on terminal blocks 5-6 for trip amplifier 1 or terminal blocks 7-8 for trip amplifier 2) is switched respect to previous normal condition.
5	Restore the loop to full operation.
6	Remove the bypass from the Safety PLC or restore normal operation.

Proof test 2B (to detect approximately 99 % of possible Dangerous Undetected failures)	
Steps	**Action**
1	Bypass the Safety PLC or take other appropriate action to avoid a false trip.
2	Perform steps 2, 3 and 4 of **Proof Test 1B**.
3	Force some input current signal values, included in the range 4-20 mA, and for each trip amplifier set an alarm current value in the range 4-20 mA. Verify that the related relay contact (on terminal blocks 5-6 for trip amplifier 1 or terminal blocks 7-8 for trip amplifier 2) is switched when input signal increases / decreases (according to high / low alarm setting) above / below the alarm current value, considering a maximum error of 3% between input signal value and set alarm current value.
4	Restore the loop to full operation.
5	Remove the bypass from the Safety PLC or restore normal operation.

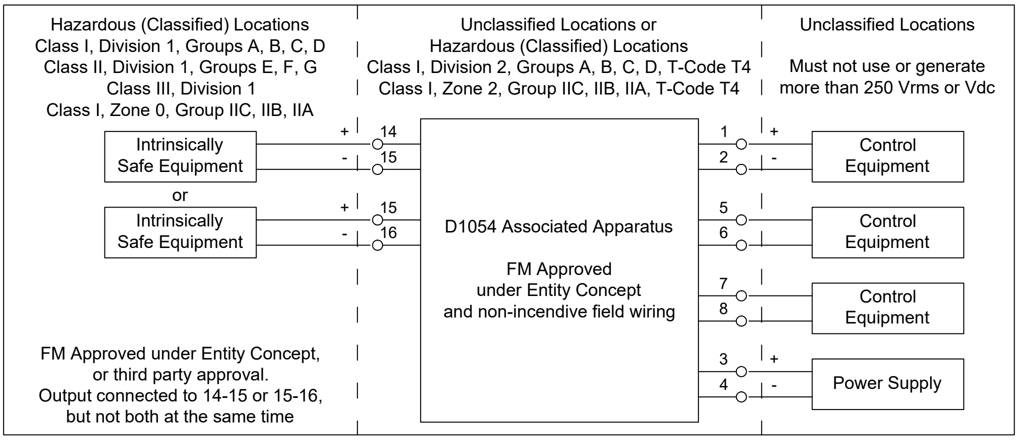
Installation

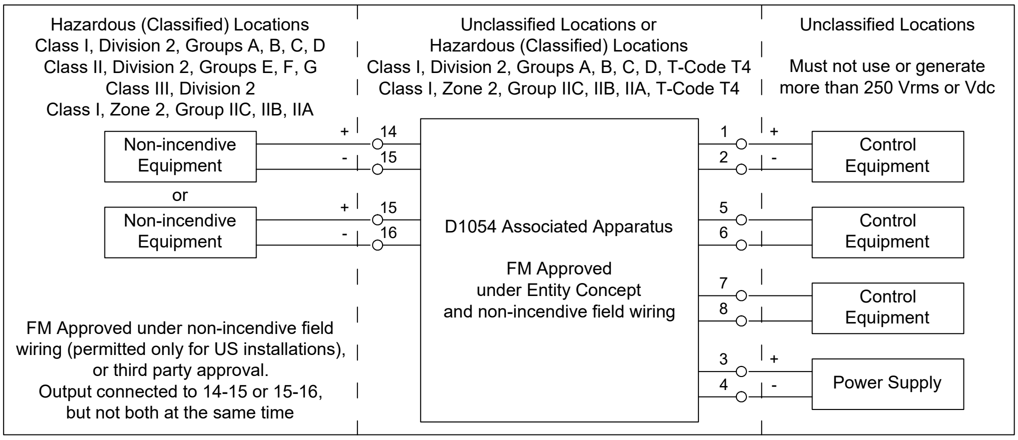
D1054 is a repeater power supply with trip amplifiers housed in a plastic enclosure suitable for installation on EN/IEC60715 TH 35 DIN-Rail.
D1054 unit can be mounted with any orientation over the entire ambient temperature range, see section "Installation in Cabinet" and "Installation of Electronic 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 12-24 Vdc power supply positive at terminal "3" and negative at terminal "4".
Connect positive output of analog channel at terminal "1" and negative output at "2".
Connect trip amplifier output of alarm A at terminal "5" and "6" and trip amplifier output of alarm B at terminal "7" and "8".
In case of a 2 wire input transmitter, connect the wires at terminal "14" for positive and "15" for negative.
For separately powered transmitters, connect input signal at terminal "15" for positive and "16" for negative.

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.
Connect SPST alarm contacts checking the load rating to be within the contact maximum rating (2 A, 250 V, 500 VA 80 W resistive load).
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 D1054 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, D1054 series must be connected to SELV or SELV-E supplies.
Relay output contact must be connected to loads non exceeding category I, pollution degree I overvoltage limits.
Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.

Warning

D1054 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.





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 D1054 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.
D1054 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 onhazardous.
Warning: substitution of components may impair Intrinsic Safety and suitability for Division 2, Zone 2.
Warning: de-energize main power source (turn off power supply voltage) and disconnect plug-in terminal blocks before opening the enclosure to avoid electrical shock when connected to live hazardous potential.
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

D1054 provides fully floating DC supply for energizing 2 wire 4-20 mA transmitters, or separately powered 3, 4 wire, 0/4-20 mA transmitters located in Hazardous Area/Hazardous Locations, and repeats and converts the current to a 0/4-20 mA or 0/1-5 V or 0/2-10 V floating output to drive a load in Safe Area/Non Hazardous Locations. The circuit in the 4-20 mA input, 4-20 mA output allows bi-directional communication signal for smart/hart transmitters. In addition to the analog output the barrier has also a two channel trip amplifiers providing two relay SPST contacts, alarm A and B, that can be configured as HIGH, LOW, LOW start-up, BURNOUT alarm operating mode and NE or ND relay operating mode. Presence of supply power is displayed by a green signaling LED, status of alarm output A and B is displayed by two red LED and also burnout condition of input lines is displayed by a red LED (if enabled detection).

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, for 2 wire transmitter connection the supply voltage on each channel must be ≥ 15 V, output signal should be corresponding to the input from the transmitter, alarm LED should reflect the input variable condition with respect to trip points setting.
If possible change the transmitter output and check the corresponding Safe Area output.

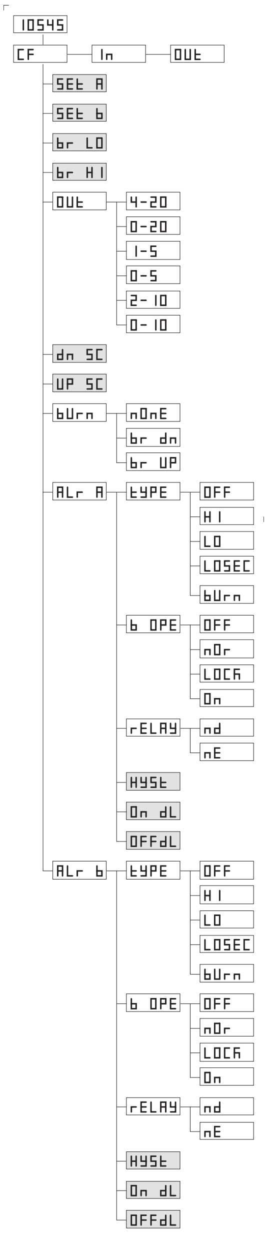
PPC1090 Operation

The Pocket Portable Configurator type PPC1090 is suitable to configure the “smart” barrier of D1000 series. The PPC1090 unit is not ATEX, UL or FM approved and is only to be used in Safe Area/Non Hazardous Locations and prior to installation of the isolator and prior to connection of any I.S. wiring. Do not use PPC1090 configurator in Hazardous Area/Hazardous Locations. The PPC1090 configurator is powered by the unit (no battery power) when the telephone jack is plugged into the barrier (RJ12 6 poles connecto type with 1:1 connection).
It has a 5 digit display, 4 leds and four push buttons with a menu driven configuration software and can be used in Safe Area/Non Hazardous Locations without any certification because it plugs into the non intrinsically safe portion of circuit.

PPC1090 Configuration

The configuration procedure follows a unit specific menu. The display shows the actual menu item, the led shows the channel configured and the push button actuates as “Enter”, “Select”, “Down” and “Up” key. The “Enter” key is pressed to confirm the menu item, the “Select” key is pressed to scroll the menu item, the “Down” and “Up” keys are pressed to decrement or increment the numeric value of menu item. The “Up” key is also pressed to decrement the menu level. When the PPC1090 is plugged into the unit, the display shows the barrier model (first level menu). Then press the “Enter” key to the second level menu and the “Select” key to scroll the menu voice. When the selected menu item is displayed press the “Enter” key to confirm the choice. Follow this procedure for every voice of the menu. When a numeric menu item is to be changed, press the “Select” key to highlight the character and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key. To return to a higher level menu press the “Up” key.

D1054S Menu



Menu item description

1) **D1054S** [1 Level Menu]
Displays Model D1054S single channel smart repeater power supply plus trip amplifier. Press “Enter” key to second level menu.

2) **CF** [2 Level Menu]
Displays the parameters configuration menu. Press “Enter” key to configure the functional parameters, press the “Select” key to the next menu level item or “Up” key to return to first level.

3) **In** [2 Level Menu]
Displays the input variable monitoring. Press “Enter” to display the current input value reading, press the “Select” key to the next menu level item or “Up” key to return to first level.

4) **Out** [2 Level Menu]
Displays the analog output variable monitoring. Press “Enter” to display the current output value reading, press the “Select” key to the next menu level item or “Up” key to return to first level.

5) **Set A** [3 Level Menu]
Displays the SET A Trip Point Value configuration. Press “Enter” to set the trip point value, press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can set the set value; press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

6) **Set B** [3 Level Menu]
Displays the SET B Trip Point Value configuration. Press “Enter” to set the trip point value, press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can set the set value; press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

7) **Br LO** [3 Level Menu]
Displays the Burnout LOW Trip Point Value configuration. Press “Enter” to set the burnout condition trip point value (below this value indicate a burnout fault condition, set –5.000 to disable), press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can set the value; press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

8) **Br HI** [3 Level Menu]
Displays the Burnout HIGH Trip Point Value configuration. Press “Enter” to set the burnout condition trip point value (above this value indicate a burnout fault condition, set 25.000 to disable), press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can set the value; press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

9) **Out** [3 Level Menu]
Displays the analog output type configuration. Press “Enter” to set the analog output type and range, press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can choose between 6 different output types; press “Select” key to change the output type and range and then the “Enter” key to confirm the choice. The output types are:

4-20	4 to 20 mA current output (<u>for SIL applications</u>)	0-20	0 to 20 mA current output
1-5	1 to 5 V voltage output	0-5	0 to 5 V voltage output
2-10	2 to 10 V voltage output	0-10	0 to 10 V voltage output

10) **Dn Sc** [3 Level Menu]
Displays the input low scale configuration. Press “Enter” to set the low scale input value, press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can set the low input value; press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

11) **Up Sc** [3 Level Menu]
Displays the input high scale configuration. Press “Enter” to set the high scale input value, press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can set the high input value; press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

12) **Burn** [3 Level Menu]
Displays the burnout configuration. Press “Enter” to set the burnout condition, press the “Select” key to the next menu level item or “Up” key to return to second level. If you pressed “Enter” key, you can choose between 3 different burnout conditions; press “Select” key to change the burnout and then the “Enter” key to confirm the choice. The condition types are:

none	no burnout detection, the analog output follow the input value
br dn	when in burnout condition, the analog output goes to down scale (0 mA or 0 V)
br up	when in burnout condition, the analog output goes to high scale (22 mA or 11 V)

13) **Alr A / Alr B** [3 Level Menu]
Displays the Alarm A / Alarm B configuration menu. Press “Enter” to set the alarm condition, press the “Select” key to the next menu level item or “Up” key to return to second level.

14) **Type** [4 Level Menu]
Displays the alarm type (A or B) configuration. Press “Enter” to set the alarm condition, press the “Select” key to the next menu level item or “Up” key to return to third level. If you pressed “Enter” key, you can choose between 5 different alarm conditions; press “Select” key to change the type and then the “Enter” key to confirm the choice.
The condition types are:

OFF	no alarm detection, the relay output is always in normal condition
HI	high alarm condition, the relay output change status when an alarm condition is detected (input variable goes above the set value)
LO	low alarm condition, the relay output change status when an alarm condition is detected (input variable goes below the set value)
LOSEC	low with start-up alarm condition, the relay output change status when an alarm condition after the start-up is detected (input variable starts below the set value but no alarm condition is signaled, after the warm-up the variable goes above the set value arming the alarm detection, then when the variable goes below the set value the alarm condition is signaled)
BURN	burnout alarm condition, the alarm condition change status when a burnout condition appear in the input variable (input variable goes below the “Br LO” set value or goes above the “Br HI” set value).

15) **B Ope** [4 Level Menu]
Displays the functionality of alarm in burnout condition (A or B) configuration. Press “Enter” to set the burnout alarm condition, press the “Select” key to the next menu level item or “Up” key to return to third level. If you pressed “Enter” key, you can choose between 4 different alarm burnout conditions; press “Select” key to change the type and then the “Enter” key to confirm the choice. The types are:

OFF	the alarm goes in disabled condition when a burnout is detected
NOR	the alarm follow the condition of input variable (not relevant burnout)
LOCK	the alarm is locked in the same position as before a burnout is detected
ON	the alarm goes in enabled condition when a burnout is detected

Note that a minimum of 1 second delay (“On dl” and OFF dl” item) is necessary to obtain the burnout detection on alarm conditions.

16) **Relay** [4 Level Menu]
Displays the relay normal condition (A or B) configuration. Press “Enter” to set the relay condition, press the “Select” key to the next menu level item or “Up” key to return to third level. If you pressed “Enter” key, you can choose between 2 different relay conditions; press “Select” key to change the type and then the “Enter” key to confirm the choice. The condition types are:

ND	relay normally de-energized (energized in alarm condition)
NE	relay normally energized (de-energized in alarm condition), (for SIL applications)

17) **Hyst** [4 Level Menu]
Displays the alarm hysteresis value (A or B) configuration. Press “Enter” to set the deadband value, press the “Select” key to the next menu level item or “Up” key to return to third level. If you pressed “Enter” key, you can set the hysteresis value (engineering value); press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

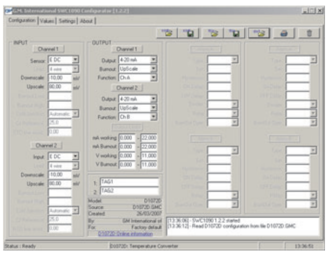
18) **On dl** [4 Level Menu]
Displays the alarm activation delay (A or B) configuration. Press “Enter” to set the delay time value, press the “Select” key to the next menu level item or “Up” key to return to third level. If you pressed “Enter” key, you can set the delay value (100 ms step); press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

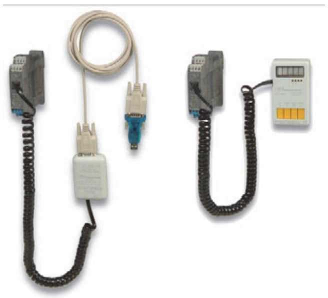
19) **OFF dl** [4 Level Menu]
Displays the alarm de-activation delay (A or B) configuration. Press “Enter” to set the delay time value, press the “Select” key to the next menu level item or “Up” key to return to third level. If you pressed “Enter” key, you can set the delay value (100 ms step); press the “Select” key to highlight the character you want to change and then the “Up” and “Down” keys to select the number; confirm the modification with the “Enter” key

PPC1092, SWC1090 Configuration

INPUT SECTION:

Input range is from 0 to +22 mA from loop powered or externally powered transmitter.
Downscale: input value of measuring range corresponding to defined low output value.
Upscale: input value of measuring range corresponding to defined high output value.
Burnout Low: low burnout condition trip point value;
below this value a burnout fault condition is activated and the analog output is driven to the configured state (see Burnout in Output Section).
Setting this value outside the measuring range will disable this function.
Burnout High: high burnout condition trip point value;
above this value a burnout fault condition is activated and the analog output is driven to the configured state (see Burnout in Output Section).
Setting this value outside the measuring range will disable this function.





OUTPUT SECTION:

Output: analog output type

☐ 4-20 mA	current output range from 4 to 20 mA (for SIL applications)
☐ 0-20 mA	current output range from 0 to 20 mA
☐ 1-5 V	voltage output range from 1 to 5 V
☐ 0-5 V	voltage output range from 0 to 5 V
☐ 2-10 V	voltage output range from 2 to 10 V
☐ 0-10 V	voltage output range from 0 to 10 V

Burnout: analog output burnout state

☐ None	burnout function is disabled; analog output represents the input measure as configured
☐ Downscale	analog output is forced at zero
☐ Upscale	analog output is forced to 22 mA for current output or 11 V for voltage output

ALARM SECTION:

Type: alarm type configuration

☐ Off	alarm functionality is disabled
☐ High	alarm is set to high condition, the alarm output is triggered whenever the input variable goes above the trip point value (Set)
☐ Low	alarm is set to low condition, the alarm output is triggered whenever the input variable goes below the trip point value (Set)
☐ Low & Sec	alarm is set to low condition with start-up, the alarm output is inhibited until the input variable goes above the trip point value (Set); afterwards it behaves as a Low configuration; typically used to solve start-up issues
☐ Burnout	a burnout condition of the input triggers the alarm output

Set: input value of measuring range at which the alarm output is triggered
Hysteresis: alarm hysteresis value, valid range: 0 to 5 mA
ON Delay: time for which the input variable has to be in alarm condition before the alarm output is triggered; configurable from 0 to 1000 seconds in steps of 100 ms.
OFF Delay: time for which the input variable has to be in normal condition before the alarm output is deactivated; configurable from 0 to 1000 seconds in steps of 100 ms.
Relay: relay condition

☐ ND	the relay is in normally de-energized condition, it energizes (the output contact is closed) in alarm condition
☐ NE	the relay is in normally energized condition (for SIL applications) it de-energizes (the output contact is opened) in alarm condition

BurnOut Oper: alarm status when a burnout condition is detected

☐ Nor	the burnout detection on the alarm output is disabled, the alarm follows the condition of the input variable
☐ Lock	maintain the same alarm condition as before the burnout detection
☐ On	the alarm condition is activated when a burnout is detected
☐ Off	the alarm condition is deactivated when a burnout is detected

Each alarm output has independent configurations.