TSDI-16UNI

Safe digital input FTA (24/48 Vdc, NAMUR, 16 channels)

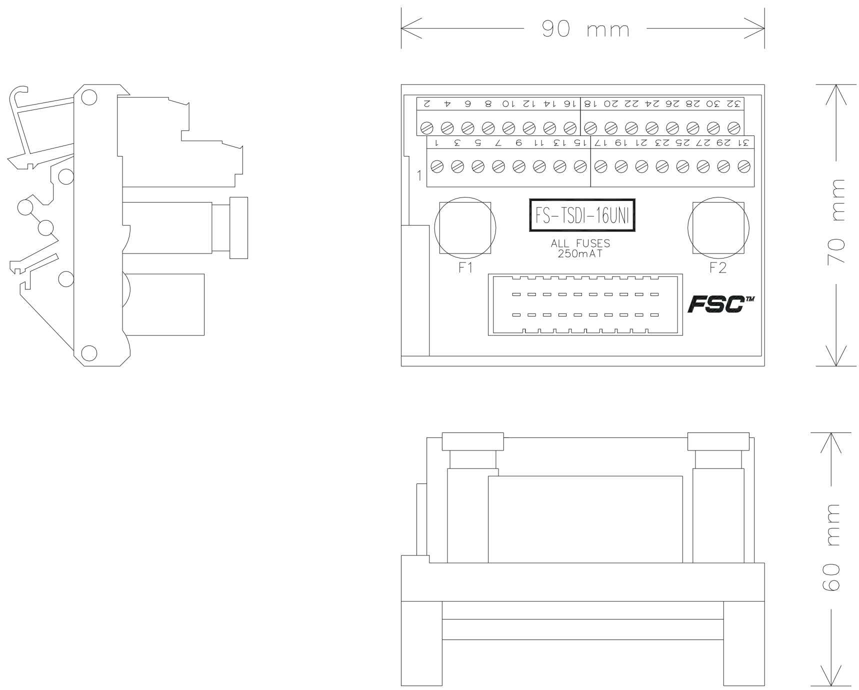
Description

Field termination assembly module TSDI-16UNI is the interface between system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals).

Sixteen channels (separated into two groups of eight channels with a 250 mA fuse in the common +) can be connected to the TSDI-16UNI module via a system interconnection cable (SICC-0001/Lx). This cable is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SDIL-1608 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 304 Mechanical layout



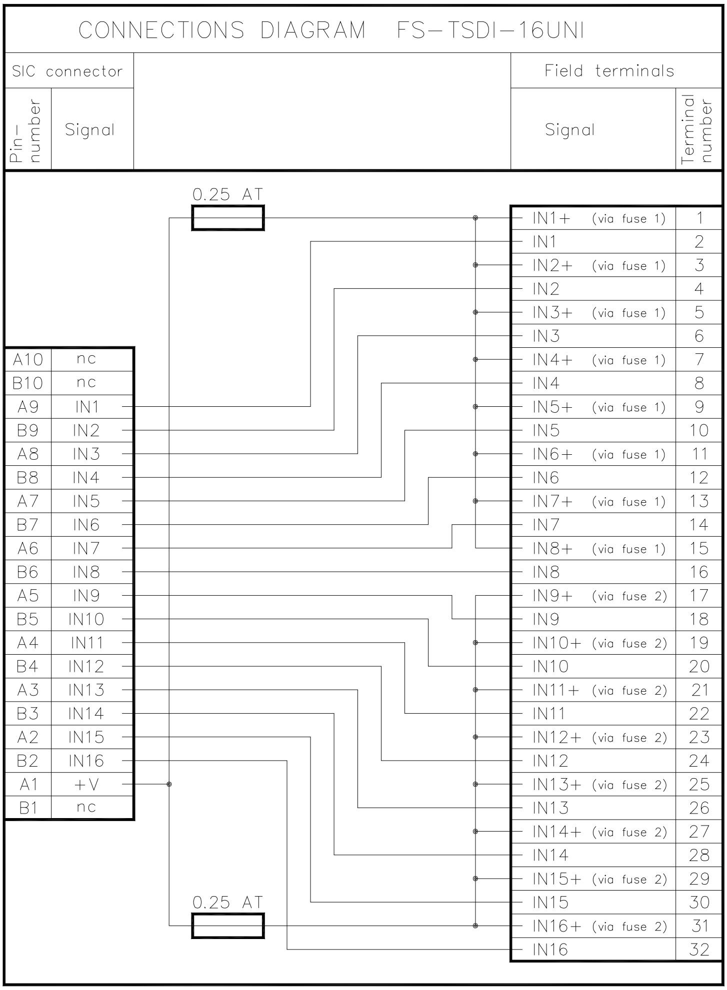
Applications

For details on applications and connection options for the TSDI-16UNI module see section “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSDI-16UNI module is as follows:

Figure 305 Connections diagram



Technical data

The TSDI-16UNI module has the following specifications:

General	Type numbers[1] :	FS-TSDI-16UNI
		FC-TSDI-16UNI
	Approvals:	CE, TUV, UL, CSA, FM
Power	Number of channels:	16 (2 groups of 8)
	Maximum voltage:	50 Vdc – IEC 61010-1 (1990), over voltage category 3 (Table D.12) 150 Vdc – IEC 61010-1 (1990), over voltage category 2 (Table D.10)
	Actual maximum voltage defined by the connected input module	
Physical	Module dimensions:	90 × 70 × 60 mm (L × W × H) 3.54 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	91 mm (3.58 in)
Fuse	Rating:	250 mAT (slow-acting)
	Dimensions:	5 × 20 mm (0.2 × 0.79 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules.

TSDI-1624C

Safe current-limited digital input FTA (24 Vdc, 16 channels)

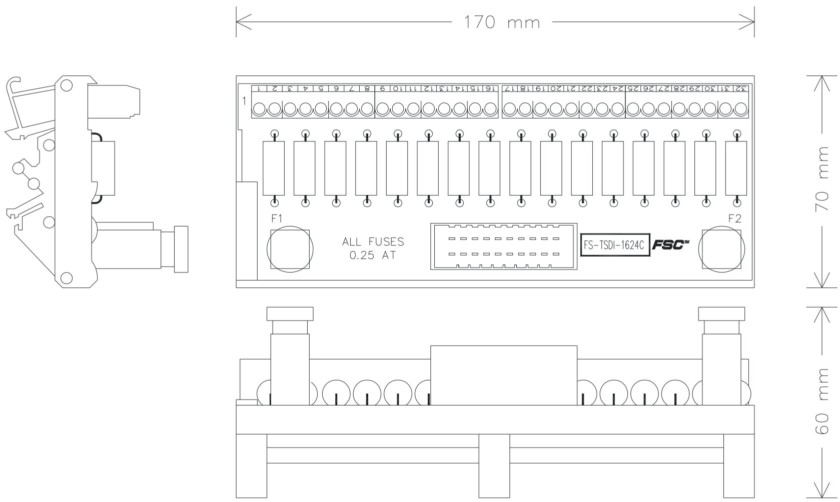
Description

Field termination assembly module TSDI-1624C is the interface between system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). It can be used for interfacing digital input signals from Class I, Division 2 Hazardous Locations.

Sixteen channels (separated into two groups of eight channels with a 250 mA fuse in the common +) can be connected to the TSDI-1624C module via a system interconnection cable (SICC-0001/Lx). This cable is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SDI-1624 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 306 Mechanical layout



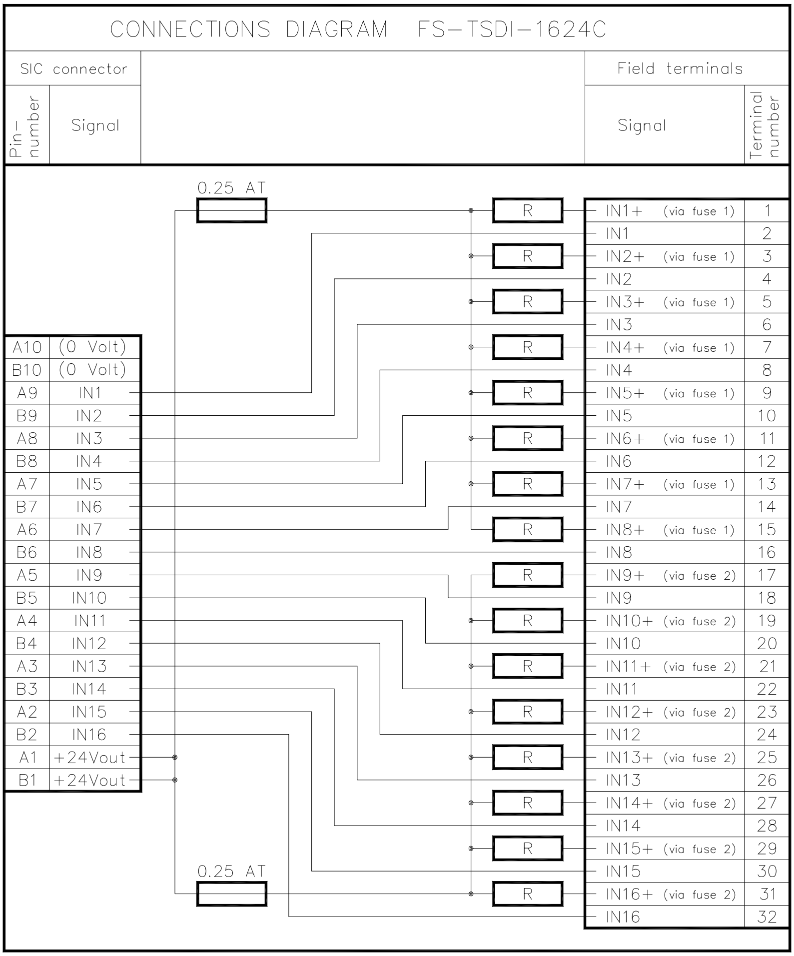
Applications

For details on applications and connection options for the TSDI-1624C module, see section “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSDI-1624C module:

Figure 307 Connections diagram



Technical data

The TSDI-1624C module has the following specifications:

General	Type numbers[1] :	FS-TSDI-1624C
		FC-TSDI-1624C
	Approvals:	CE, TUV, UL, CSA, FM
Input	Number of input channels:	16 (2 groups of 8)
	Input voltage:	24 Vdc, –15%—+30%
	Input current:	≤ 15 mA at 24 Vdc (with a redundant pair of safe digital input modules SDI-1624 as load)
	Igniting current per channel:	< 100 mA at 24 Vdc +30%
Physical	Module dimensions:	170 × 70 × 60 mm (L × W × H) 6.69 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	171 mm
Fuse	Rating:	250 mAT (slow acting)
	Dimensions:	5 × 20 mm (0.2 × 0.79 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)
Field signal specifications for non-incendiary field circuits to Class 1 Division 2	Max. closed loop resistance:	250 Ω
	Min. open loop resistance:	15 kΩ
	HYDROGEN (Group A & B):	
	• Max. loop inductance	8 mH
	• Max. loop capacitance	0.3 µF
	NON-HYDROGEN (Group C & D):	
	• Max. loop inductance	22 mH
	• Max. loop capacitance	7 µF

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules.

TSDI-16115

Safe active/passive digital input FTA (115 Vac/dc, 16 channels)

Description

Field termination assembly module TSDI-16115 is a 16-channel safe input converter module, universal for both 115 Vac and/or 115 Vdc. All inputs are galvanically isolated.

Each channel converts an externally supplied 115 V input signal into a 24 Vdc input signal which can be connected to the 24 Vdc safe input module SDI-1624, thus creating a safe 115 V input for Safety Manager.

Sixteen channels can be connected to the TSDI-16115 module via the system interconnection cable SICC-0001/Lx. This cable is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SDI-1624 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 308 Mechanical layout

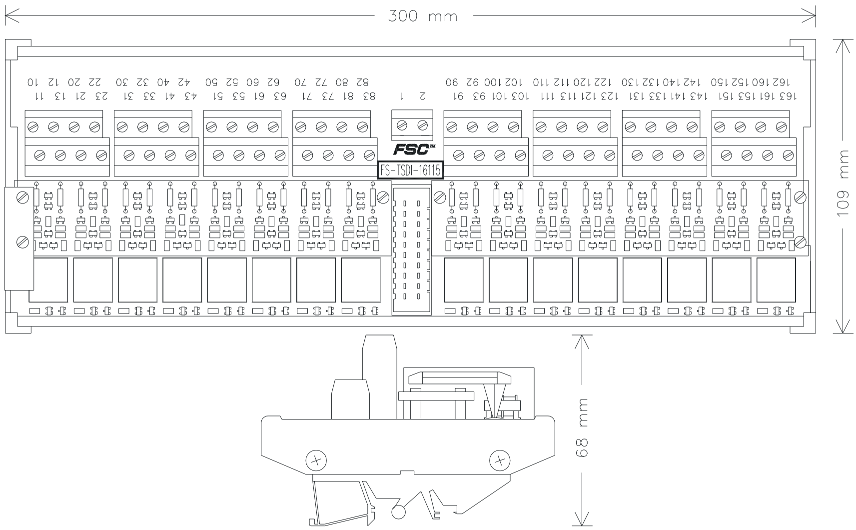
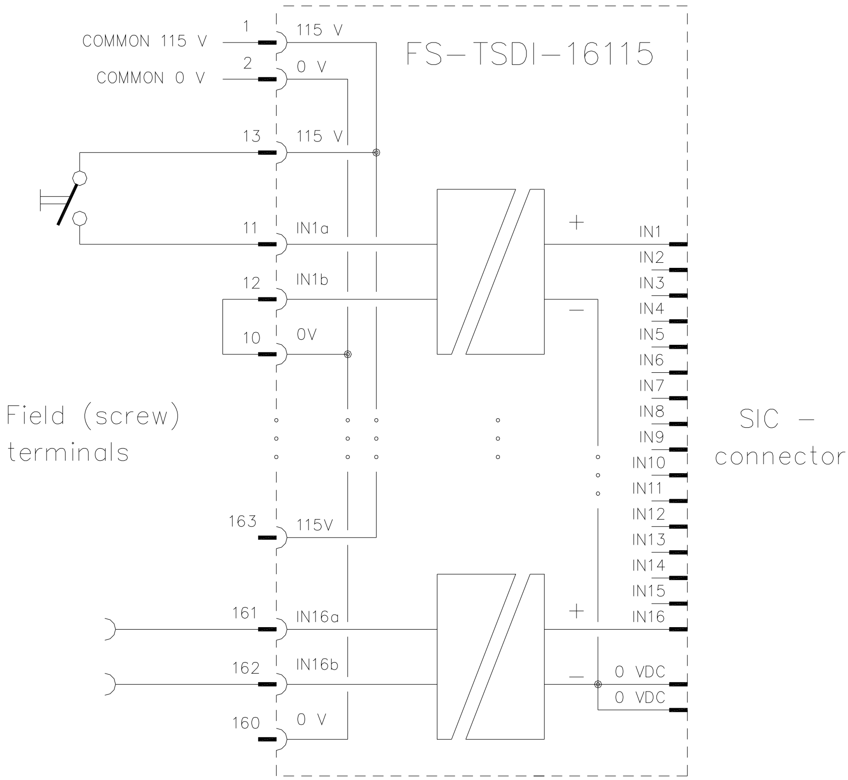


Figure 309 Schematic diagram



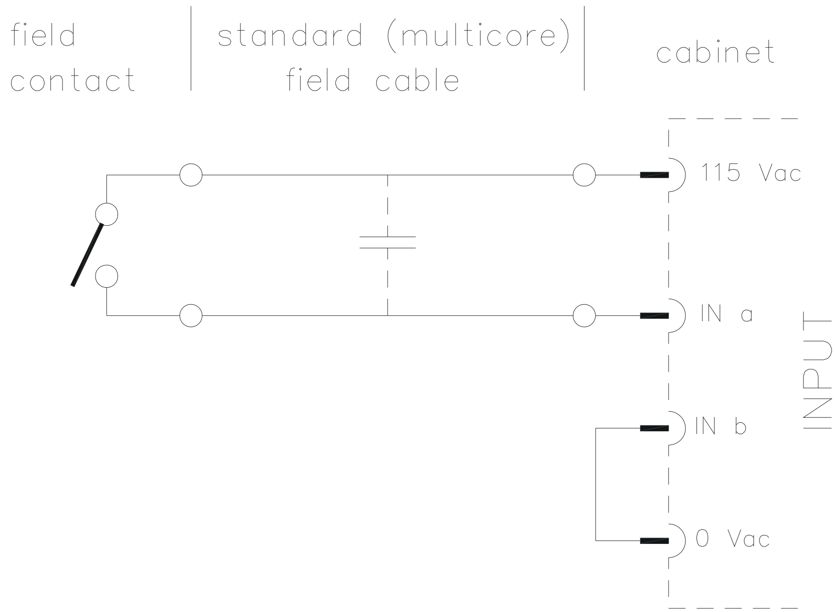
Applications

For details on applications and connection options for the TSDI-16115 module see section "SICC-0001/Lx" on page 715.

Field cable lengths

High-impedance AC inputs (like the inputs on this FTA) have a limited capability of handling the wire capacitance of standard multi-core field cables. The wire capacitance of the field cable acts as a shunt impedance over the field contact (see Figure 310 on page 521).

Figure 310 Standard (multi-core) field cable



When the current through this shunt impedance exceeds the maximum ‘LOW’ current, the input may be activated by this shunt impedance, thus disabling the input function (by keeping the input activated continuously, i.e. ON). Every AC input will have a maximum ‘LOW’ current that it can handle.

The maximum allowable cable length depends on the maximum ‘LOW’ current (for example 1.2 mA), the typical cable capacitance (for example 120 pF/m), the maximum supply voltage (for example 130 Vac) and the supply frequency (for example 60 Hz).

The maximum length (in meters) can be calculated using the following formula:

$$L_{max} = \frac{I_{low}}{V_{max} \cdot 2 \cdot \pi \cdot f \cdot C_{typ}}$$

where:

L_{max} = maximum allowable cable length

I_{low} = maximum ‘LOW’ current

V_{max} = maximum supply voltage

f = supply frequency

C_{typ} = typical cable capacitance

As an example, we will calculate the maximum field cable length (in meters) using the values mentioned above:

$$L_{max} = \frac{1.2 \cdot 10^{-3}}{130 \cdot 2 \cdot \pi \cdot 60 \cdot (120 \cdot 10^{-12})} = 204 \text{ m}$$

In this example, the maximum allowable field cable length is 204 meters (223 yards).

The field cable length limit can be eliminated by using field cables with wires that are shielded separately (see Figure 311 on page 522). The only (relevant) capacitance of the input wire is to the shield (0 Vac or earth) and this will not activate a ‘LOW’ input. However, this type of cable is rather unusual.

Field cables with shielded wire pairs are more commonly used (see Figure 312 on page 523). This allows for two connections methods:

1. Use the method of Figure 311 on page 522 and leave the second wire of each pair unconnected, or
2. Connect the second wire of each pair to 0 Vac (as shown in Figure 312 on page 523). The 115 Vac / 0 Vac supply pair can be used for more than one input.

Figure 311 Field cable with separately shielded wires

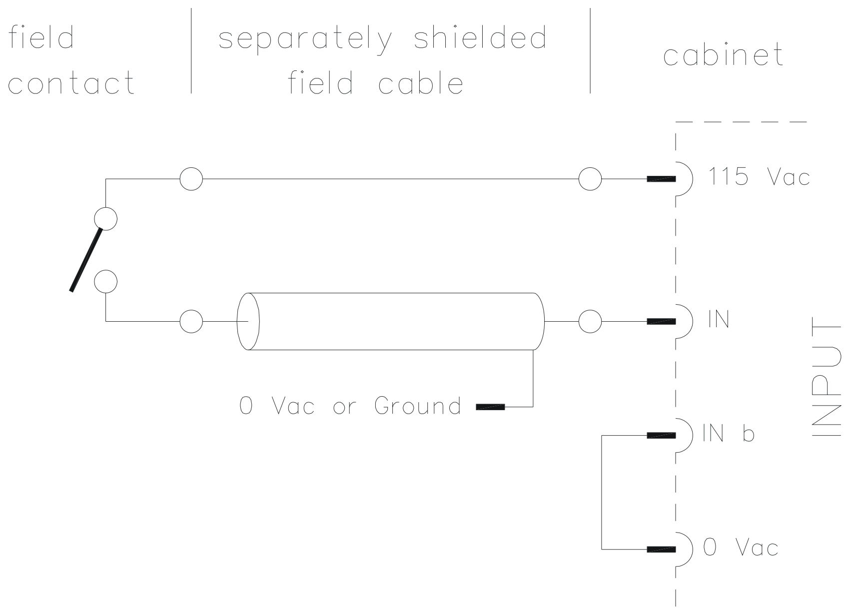
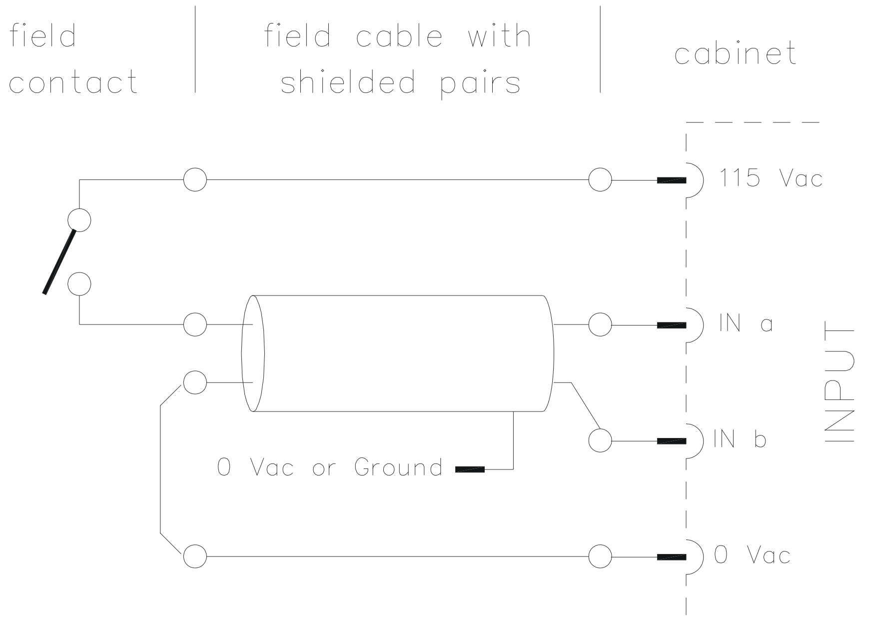


Figure 312 Field cable with shielded pairs



In practice, a mix of wiring methods may be used. For example, use a cable with shielded pairs between the control cabinet and a distribution box close to the process. This cable may be long, for example 3 km (1.8 mi). Then use a standard (multi-core) cable for the connection between the distribution box and the field contact. This cable length is limited to the value calculated using the formula mentioned above.

Connecting active / passive inputs

The TSDI-16115 module supports inputs for both active and passive signals. Figure 313 on page 524 shows the schematic diagram for connecting active inputs. Figure 314 on page 525 shows the diagram for connecting passive inputs.

Figure 313 Schematic diagram for connecting active inputs

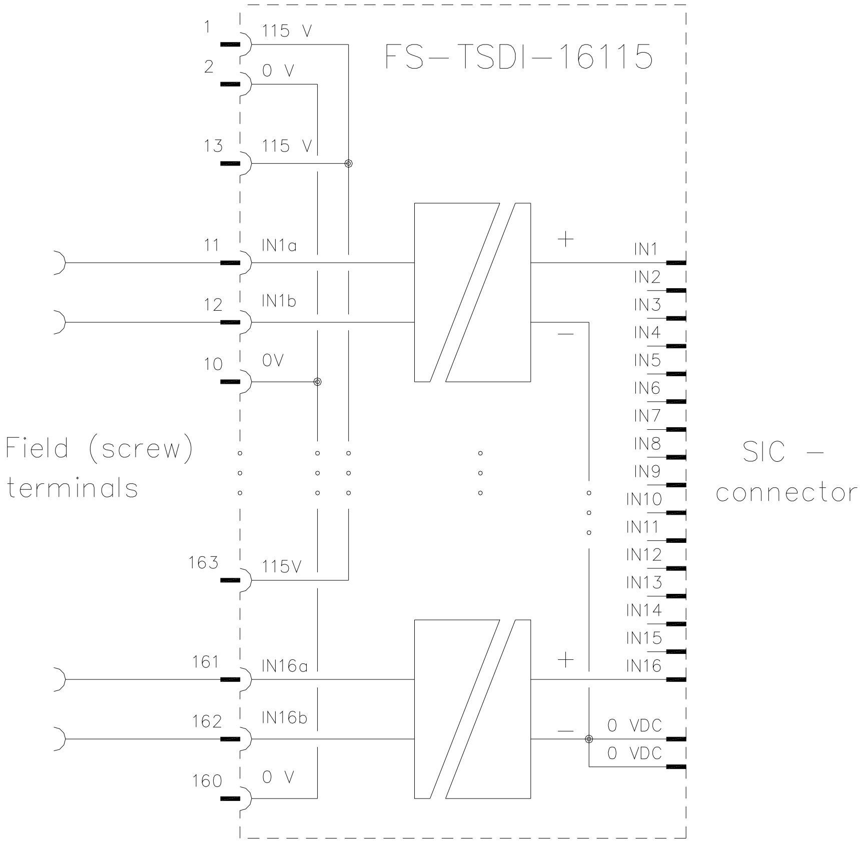
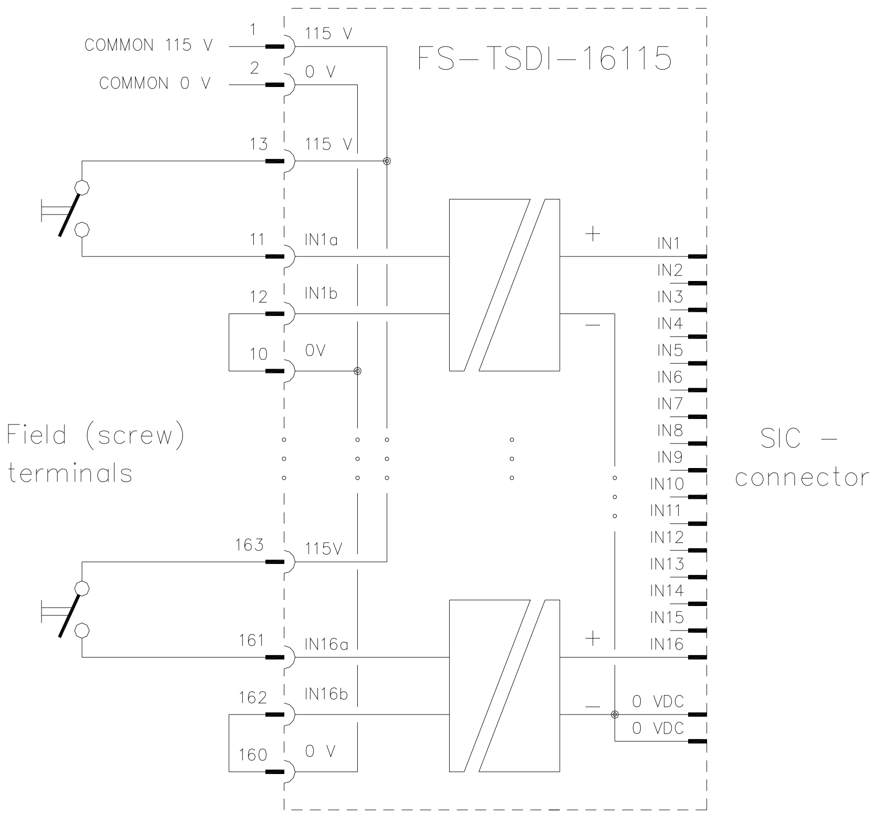


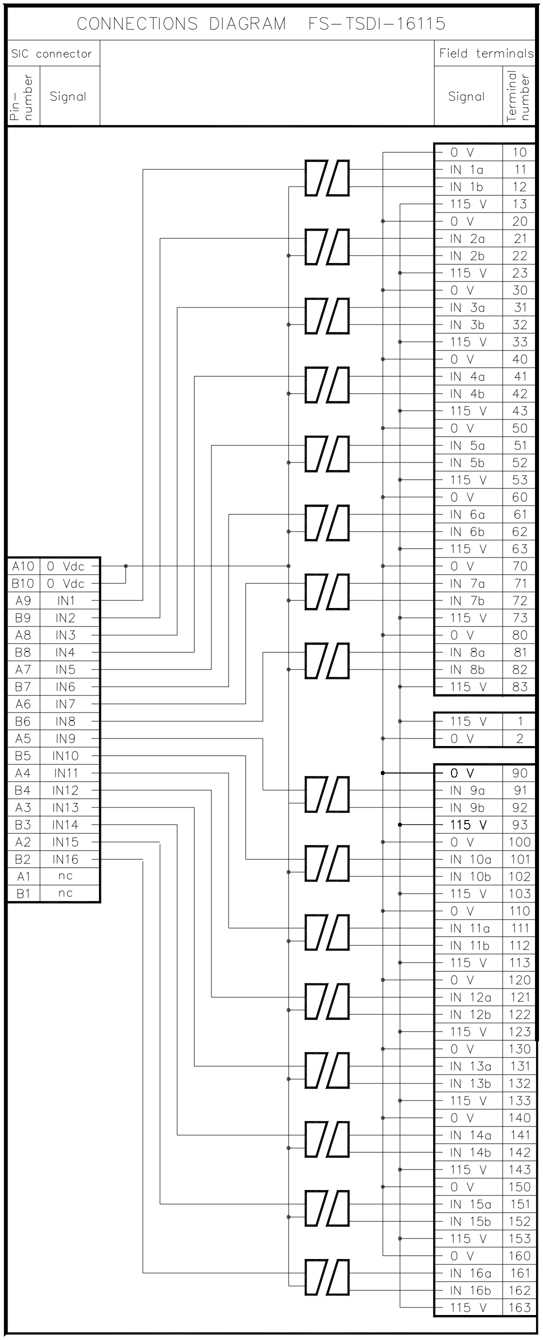
Figure 314 Schematic diagram for connecting passive inputs



Connections

The connections diagram of the TSDI-16115 module is as follows:

Figure 315 Connections diagram



Technical data

The TSDI-16115 module has the following specifications:

General	Type numbers[1] :	FS-TSDI-16115
		FC-TSDI-16115
	Approvals:	UL, CE, TUV, CSA
Input	Number of input channels:	16
	Input voltage:	115 V, –15%—+30%
	Input frequency:	DC or 40—300 Hz
	Input current:	7.5 mA (± 1 mA) at 115 V
	Input impedance:	non-inductive, > 9 kΩ
	Input LOW:	U ≤ 15 V or I ≤ 1.2 mA *(see "Field cable lengths" on page 520 in this data sheet)*
Physical	Module dimensions:	300 × 109 × 68 mm (L × W × H) 11.81 × 4.29 × 2.68 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	301 mm (11.85 in)
Environment	Max. ambient temperature:	50°C (122°F) at 115 V, –15% — +30%
		60°C (140°F) at 115 V, –15%—+10%
		70°C (158°F) at 115 V, –15%—+0%
Isolation	Isolation input to output:	2 kV
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules.

TIDI-1624

Non-safe Isolated passive digital input FTA (16 channels)

Description

Field termination assembly module TIDI-1624 is the interface between the system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). It has sixteen non-safe isolated 24 Vdc input channels.

Sixteen channels can be connected to the TIDI-1624 module via the system interconnection cable SICC-0001/Lx. This cable is plugged into the SIC connector on the FTA module and connects to a (redundant pair of) SDI-1624 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 316 Mechanical layout

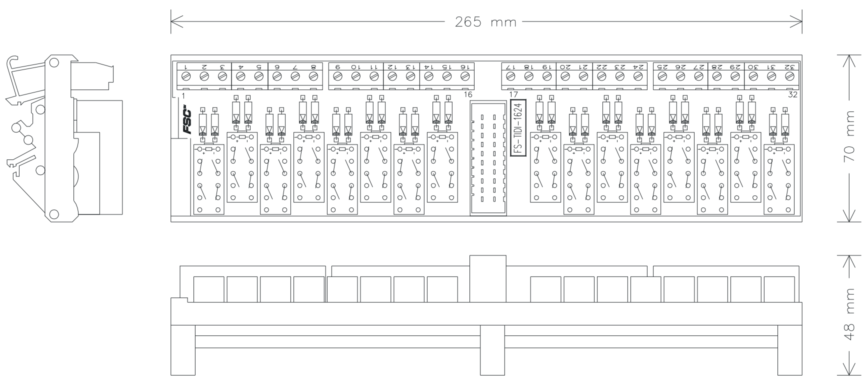
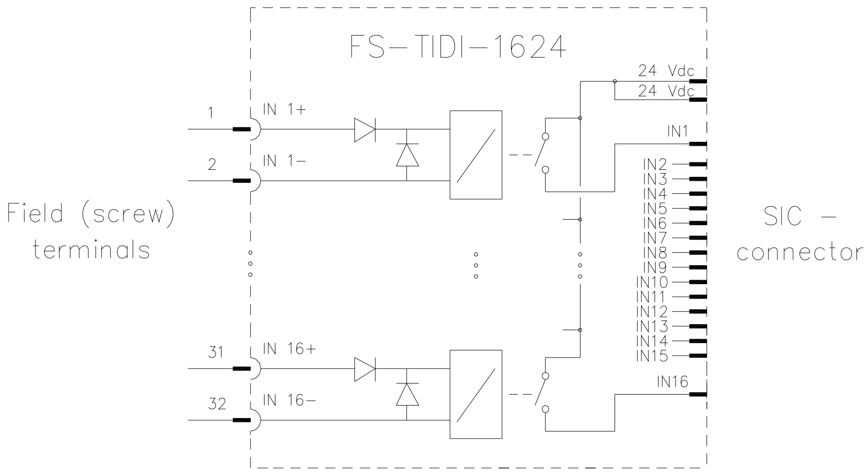


Figure 317 Schematic diagram



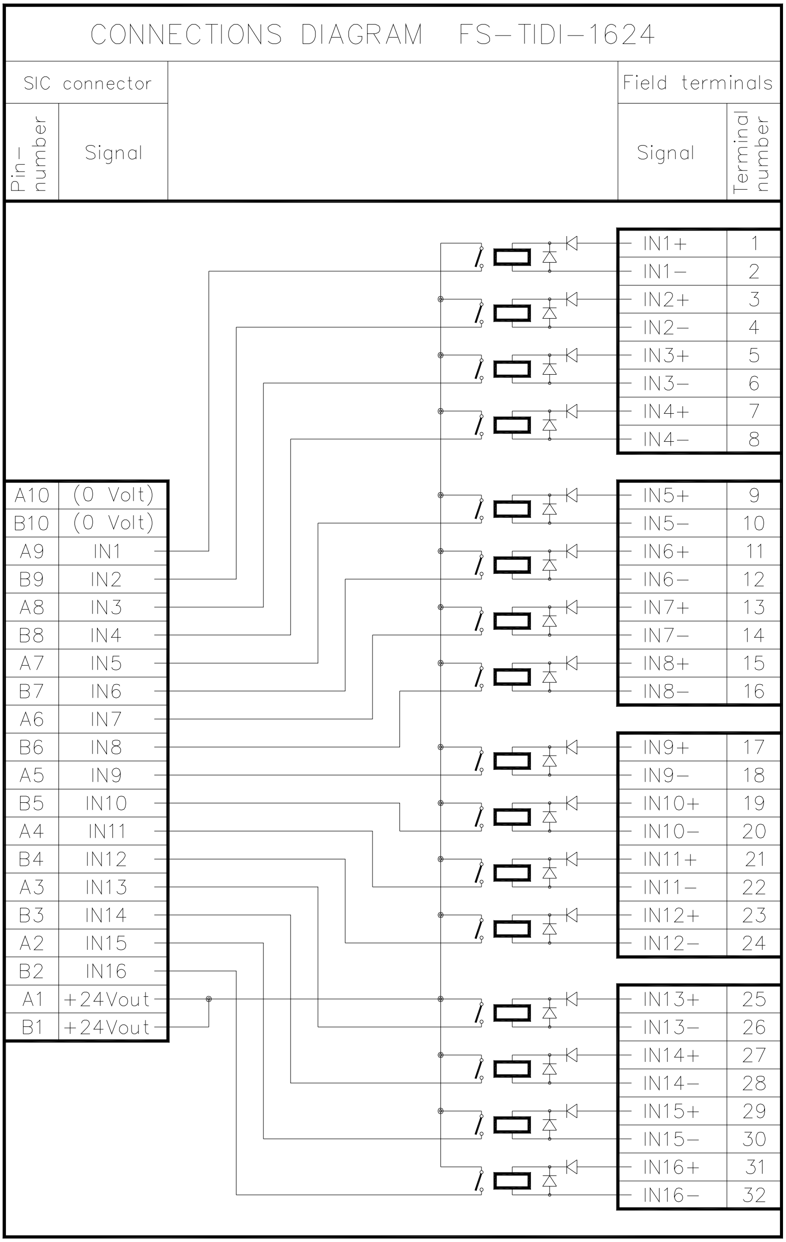
Applications

For details on applications and connection options for the TIDI-1624 module, see section “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TIDI-1624:

Figure 318 Connections diagram



Technical data

The TIDI-1624 module has the following specifications:

General	Type numbers[1] :	FS-TIDI-1624
		FC-TIDI-1624
	Approvals:	CE, TUV, UL, CSA
Input	Number of input channels:	16
	Nominal input voltage:	24 Vdc
	Drop-out voltage:	2.8 Vdc
	Pick-up voltage:	17.5 Vdc
	Max. input voltage:	47.5 Vdc
	Reverse polarity protection:	Series diode
	Max. reverse voltage:	300 V
	Input current:	Typically 9 mA at 24 Vdc
	Max. switching frequency:	20 Hz
Physical	Module dimensions:	265 × 70 × 48 mm (L × W × H) 10.43 × 2.76 × 1.89 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	266 mm (10.47 in)
Relay contact	Expected life: • electrical • mechanical	 1,000,000 switch operations 10,000,000 switch operations
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)
Isolation	Galvanic isolation:	
	• Input to output	1000 Vac
	• Input to input	1000 Vac

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules.

TSAI-0410

Safe analog input FTA (4 channels)

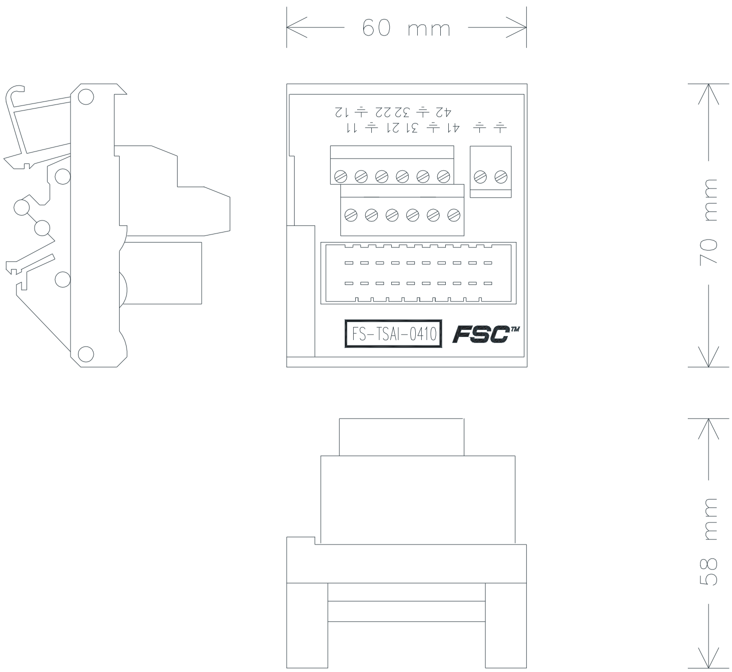
Description

Field termination assembly module TSAI-0410 is the interface between system interconnection cable SICC-0001/Lx and external field wiring (screw terminals).

The four channels of a (redundant pair of) SAI-0410 module(s) can be connected to the TSAI-0410 module via system interconnection cable SICC-0001/Lx. Range selection (active, passive, volts/current) is set per module (4 channels) using an BSAI-04x or BSDIL-0426 board.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 319 Mechanical layout



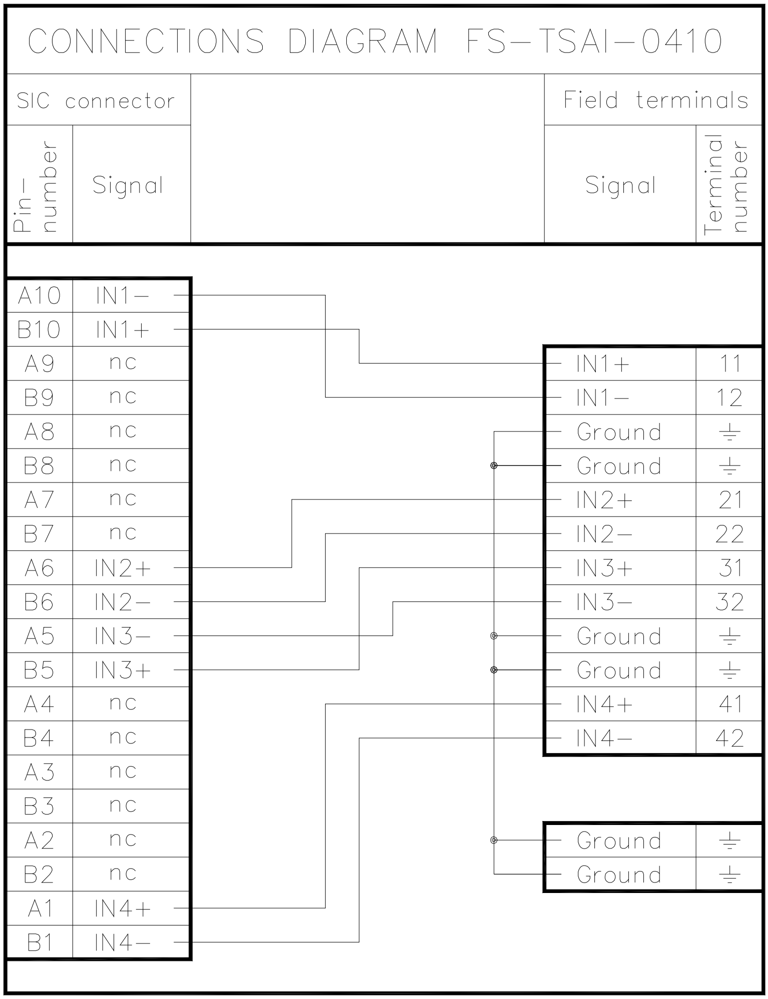
Applications

For details on applications and connection options for the TSAI-0410 module, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSAI-0410 module is as follows:

Figure 320 Connections diagram



Technical data

The TSAI-0410 module has the following specifications:

General	Type numbers[1] :	FS-TSAI-0410
		FC-TSAI-0410
	Approvals:	CE, TUV, UL, CSA, FM
Power	Number of channels:	4
	Maximum voltage:	50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum continuous current/voltage per channel:	50 mA (for 0(4)—20 mA setting) 10 V (for 0(2)—10V setting)
Physical	Module dimensions:	60 × 70 × 58 mm (L × W × H) 2.36 × 2.76 × 2.28 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	61 mm (2.40 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TSAI-1620m

Safe 0-20 mA and 4-20 mA analog input FTA (16 channels)

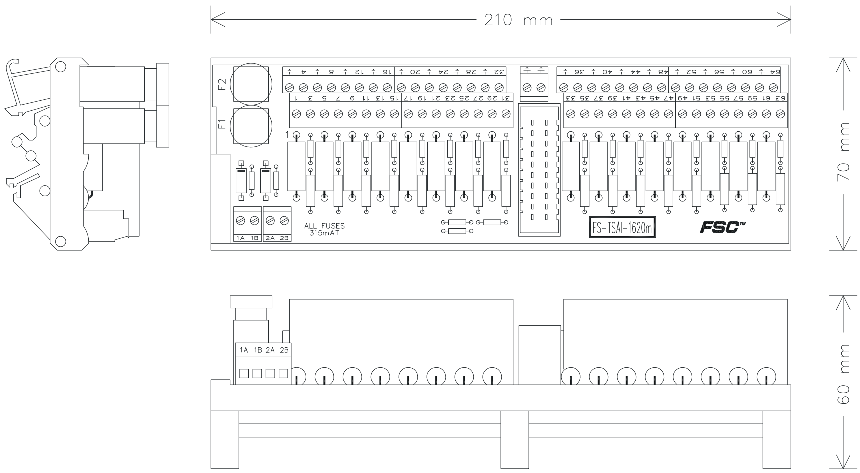
Description

Field termination assembly module TSAI-1620m is the interface between field components (such as sensors) and the safe high-density analog input module SAI-1620m in Safety Manager. It can be used for interfacing signals from Class I, Division 2 Hazardous Locations.

The TSAI-1620m module has sixteen analog input channels, which may be used for both safety-related and non-safety-related applications. These sixteen channels (separated into two groups of eight channels with common 0 V) are connected via a system interconnection cable (SICC-0001/Lx), which is plugged into the SIC connector on the FTA module.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connection of power supply, ground and field wiring.

Figure 321 Mechanical layout



Main functions

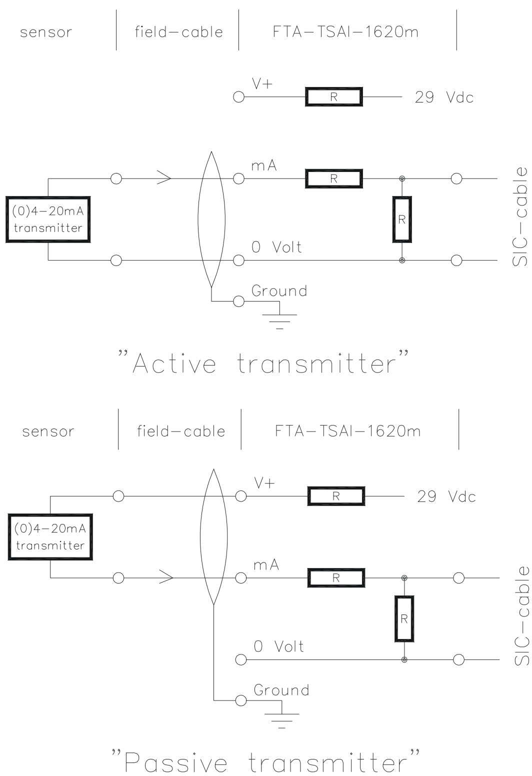
TSAI-1620m module has three main functions:

- Linear direct conversion of 0(4)—20 mA DC field signals to the signal levels of the safe high-density analog input module SAI-1620m
- Power supply distribution to each transmitter with voltage-current limitation in compliance with Hazardous Area Class I Division 2
- Enabling monitoring of the external power connected to the FTA module

Linear direct conversion

The input circuit of each channel consists of a high-precision resistor, which converts the input current (0—20 mA) to the input voltage for the high-density analog input module SAI-1620m. Power is supplied to the analog transmitter via a series resistor. Each analog signal has its own terminal for the field cable shield. Figure 322 on page 536 shows the schematic diagram for connecting a transmitter (active and passive).

Figure 322 Schematic diagram for connecting a transmitter



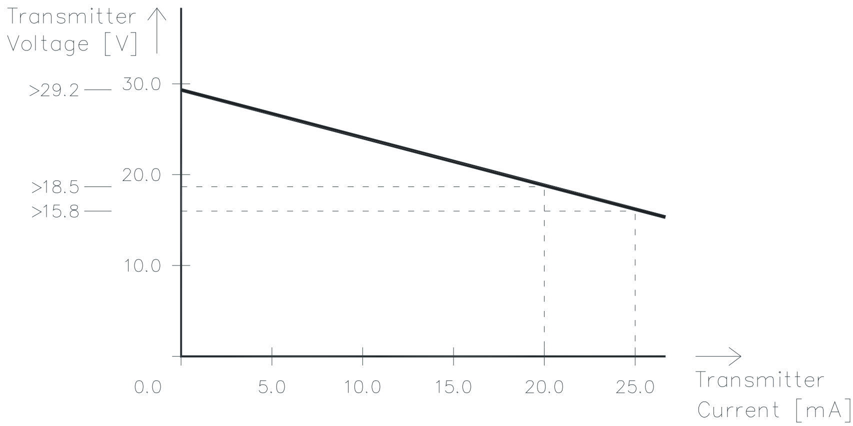
Class I division 2

The TSAI-1620m module may be used for non-incendiary field circuits for Class I, Division 2 applications. The external output voltage (V+) is current-limited by means of a series resistor.

Transmitter voltage

Figure 323 on page 537 shows the available transmitter voltage for passive transmitters.

Figure 323 Transmitter voltage for passive transmitters



External power

If all inputs are active, no external power is required.

For loops, which contain passive transmitters, analog process data is only available if the supply voltage to the electronics is guaranteed. The high-density analog input concept (using TSAI-1620m / TPSU-2430 modules) offers full monitoring of power that is provided externally. If DC/DC converter modules TPSU-2430 are used, even redundant power supplies are covered.

Redundant external power can be connected to the TSAI-1620m module via two screw terminal pairs marked ‘1A’, ‘1B’, ‘2A’ and ‘2B’. The external power supplies are de-coupled via diodes (see Figure 324 on page 538). The sixteen channels on the FTA module are divided into two groups of eight channels, with each group being protected by a 315 mA fuse. Single-channel errors (shorts from V+ to 0 V) cannot blow the group fuse.

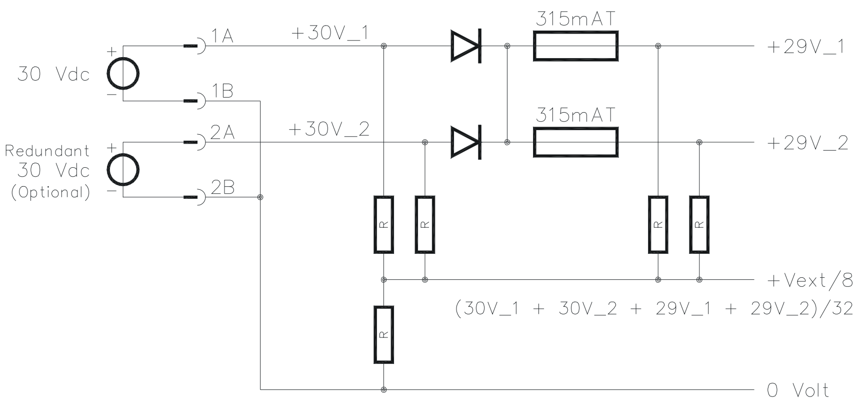
Note

The 0 V connection of the external power is directly connected to the common 0 V of all sixteen analog inputs.

The Safety Manager application software must monitor the external power voltage via the safe high-density analog input module SAI-1620m when safety-related analog input signals are connected to the TSAI-1620m.

Figure 324 on page 538 shows the schematic diagram for power distribution with monitoring.

Figure 324 Schematic diagram for power distribution with monitoring



Applications

For details on applications and connection options for the TSAI-1620m module, see section “SICC-0001/Lx” on page 715.

Connections

External power and ground

The redundant external supply voltage (Vext) and ground are connected to the following screw terminals (marked '1A', '1B', '2A', '2B' and '⏚' on the FTA):

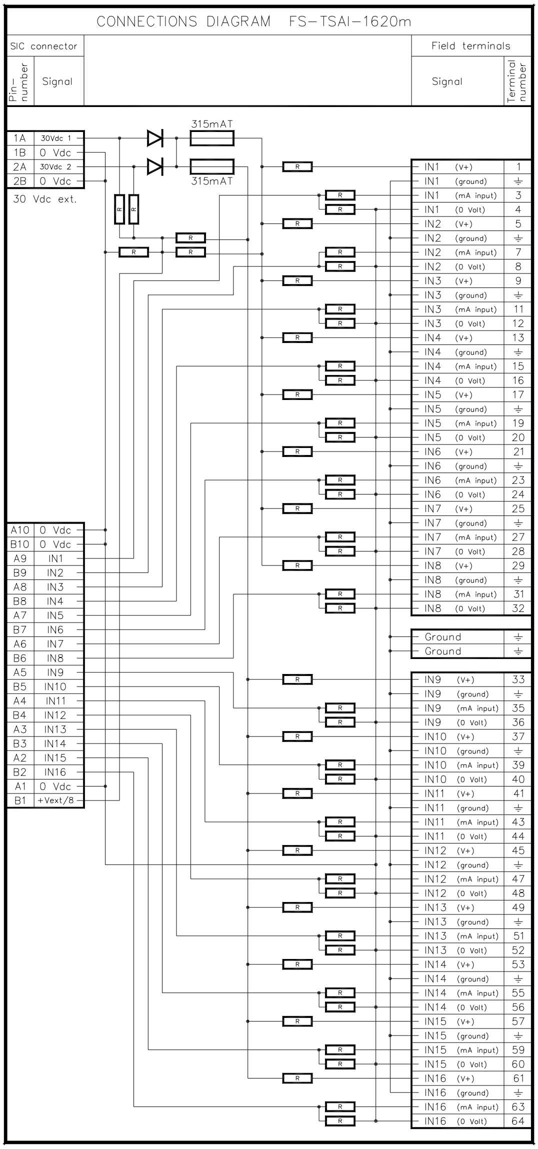
Screw terminal	Function
1A	30 Vdc Vext feeder 1
1B	0 Vdc Vext feeder 1
2A	30 Vdc Vext feeder 2
2B	0 Vdc Vext feeder 2
⏚	Ground connection
⏚	Ground connection (1 ground wire is enough)

Connections diagram

TSAI-1620m has 16 groups (= 16 channels) of four screw terminals to provide optimum connection of field wiring, with a ground terminal per channel for screening of analog input cables. The screw terminals are numbered 1 to 64.

The connections diagram of the TSAI-1620m module:

Figure 325 Connections diagram



Technical data

The TSAI-1620m module has the following specifications:

General	Type numbers[1] :	FS-TSAI-1620m
		FC-TSAI-1620m
	Approvals:	CE, TUV, UL, CSA, FM
Input	Number of input channels:	16 (2 groups of 8 with common 0 V)
	Power requirements:	30 Vdc external, 3 mA (without input loop loads)
	Input current:	0—25 mA
	Input resistance:	250 Ω (± 1%)
Output	To passive transmitters (Vext):	
	• Output resistance:	270 Ω (± 5%)
	• Igniting current per channel:	< 120 mA at 30 Vdc
	To SAI-1620m module:	
	• Output voltage	0—4 Vdc
	• Accuracy	0.1%
Fuses	Rating:	315 mAT (slow-acting)
	Dimensions:	5 × 20 mm (0.20 × 0.79 in)
Physical	Module dimensions:	210 × 70 × 60 mm (L × W × H) 8.26 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	211 mm (8.30 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

The TSAI-1620m module has the following for non-incendive field circuits, Class1 Division 2 specifications:

Field signal specifications for non-incendive field circuits, Class1 Division 2	HYDROGEN (Group A & B):	
	• Max. loop inductance	6 mH
	• Max. loop capacitance	0.25 μF
	NON-HYDROGEN (Group C & D):	
	• Max. loop inductance	20 mH
	• Max. loop capacitance	5 μF

TSHART-1620m

Safe 0-20 mA and 4-20 mA analog input FTA with HART interface (16 channels)

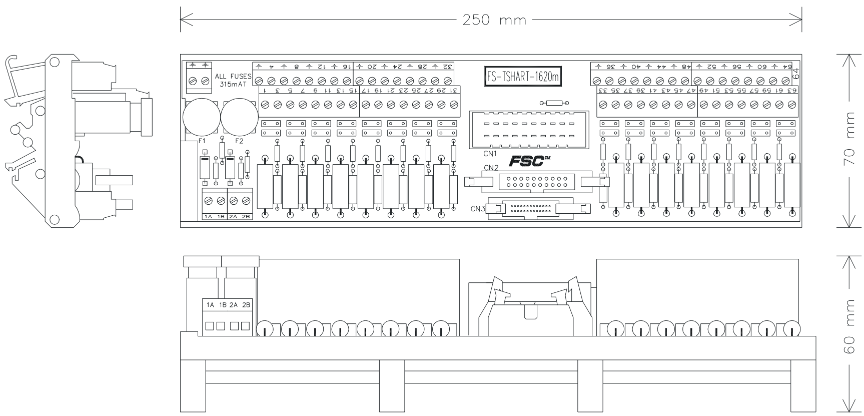
Description

Field termination assembly module TSHART-1620m is the interface between field components (sensors, etc.) and the safe high-density analog input module SAI-1620m in Safety Manager. The FTA provides HART interface. It can be used for interfacing signals from Class I, division 2 Hazardous Locations.

The TSHART-1620m module has sixteen analog input channels, which may be used for both safety-related and non-safety-related applications. These sixteen channels (separated into two groups of eight channels with common 0 V) are connected via a system interconnection cable (SICC-0001/Lx), which is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SAI-1620m module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connection of power supply, ground and field wiring.

Figure 326 Mechanical layout



Main functions

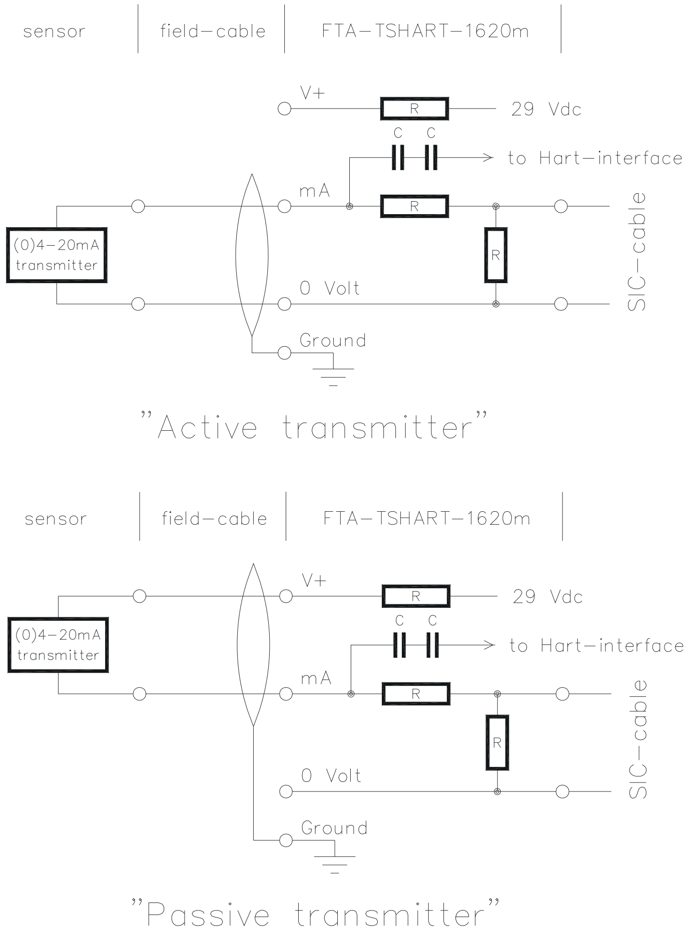
The TSHART-1620m module has four main functions:

- Linear direct conversion of 0(4)—20 mA DC field signals to the signal levels of the safe high-density analog input module SAI-1620m
- Enable connection to HART multiplex units of MTL or Pepperl+Fuchs (P+F)
- Power supply distribution to each transmitter with voltage-current limitation in compliance with Hazardous Area Class I Division 2
- Enable monitoring of the external power connected to the FTA module

Linear direct conversion

The input circuit of each channel consists of a high-precision resistor, which converts the input current (0—20 mA) to the input voltage for the high-density analog input module SAI-1620m. The power to the analog transmitter is supplied via a series resistor. Each analog signal has its own terminal for the field cable shield. Figure 327 on page 545 shows the schematic diagram for connecting a transmitter (active and passive).

Figure 327 Schematic diagram for connecting a transmitter



HART interface

Warning:

Suggested HART multiplexers have *no* galvanic isolation between (24 Vdc) supply and the HART signals (common 0 Vdc).

The TSHART-1620m module provides an interface to HART multiplex units from MTL and P+F. Special connectors are installed on the FTA for connection of the standard cables from these suppliers.

The following connections and equipment can be used:

MTL solution:

- Multiplex unit MTL4842
- Cable: MTL FLAT20-2.2
- Connector on FTA: CN2 (see Figure 326 on page 543)

P+F solution:

- Multiplex unit KFD0-HMS-16 or KFD2-HMM-16
- Cable: K-HM26
- Connector on FTA: CN3 (see Figure 326 on page 543)

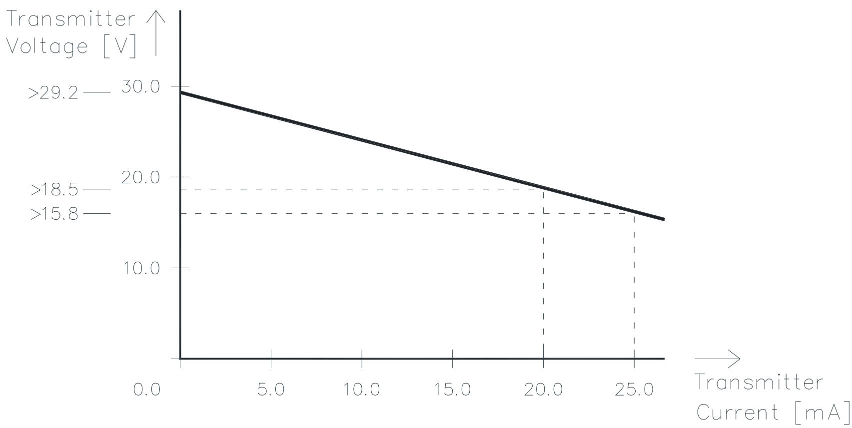
Class I division 2

The TSHART-1620m module may be used for non-incendiary field circuits to Class I, division 2 applications. The external output voltage (V+) is current-limited by means of a series resistor.

Transmitter voltage

Figure 328 on page 546 shows the available transmitter voltage for passive transmitters.

Figure 328 Transmitter voltage for passive transmitters



External power

If all inputs are active, no external power is required.

For loops, which contain passive transmitters, analog process data is only available if the supply voltage to the electronics is guaranteed. The high-density analog input concept (using TSHART-1620m / TPSU-2430 modules) offers full monitoring of power that is provided externally. If DC/DC converter modules TPSU-2430 are used, even redundant power supplies are covered.

Redundant external power can be connected to the TSHART-1620m module via two screw terminal pairs marked ‘1A’, ‘1B’, ‘2A’ and ‘2B’. The screw terminal pairs are interconnected on the FTA module but de-coupled via diodes. The sixteen channels on the FTA module are divided into two groups of eight channels, with each group being protected by a 315 mA fuse. Single-channel errors (shorts from V+ to 0 V) cannot blow the group fuse.

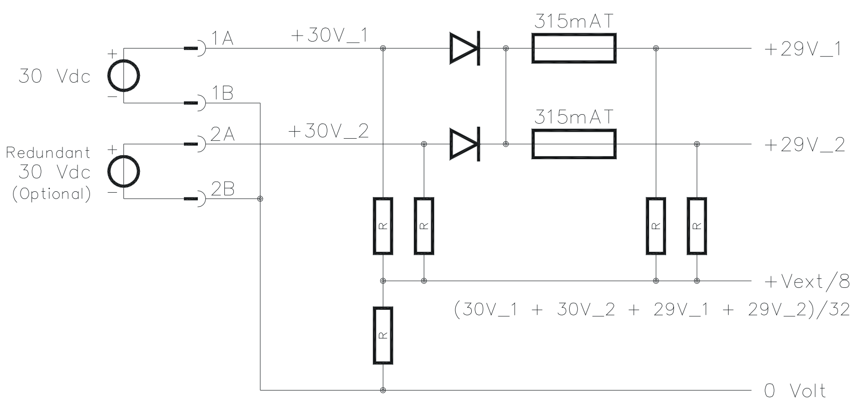
Note

The 0 V connection of the external power is directly connected to the common 0 V of all sixteen analog inputs.

The Safety Manager application software must monitor the external power voltage via the safe high-density analog input module SAI-1620m when safety-related analog input signals are connected to the TSHART-1620m.

Figure 329 on page 547 shows the schematic diagram for power distribution with monitoring.

Figure 329 Schematic diagram for power distribution with monitoring



Applications

For details on applications and connection options for the TSHART-1620m module see “SICC-0001/Lx” on page 715.

Connections

External power and ground

The redundant external supply voltage (Vext) and ground are connected to the following screw terminals (marked ‘1A’, ‘1B’, ‘2A’, ‘2B’ and ‘⏚’ on the FTA):

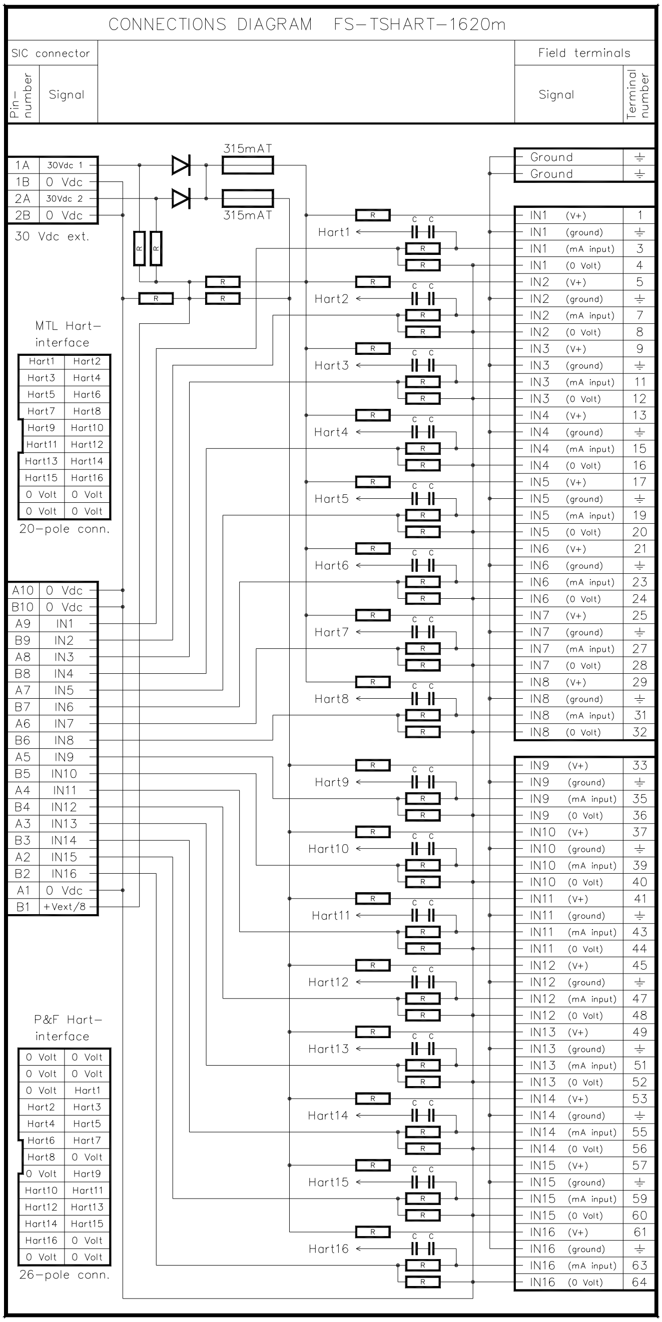
Screw terminal	Function
1A	30 Vdc Vext feeder 1
1B	0 Vdc Vext feeder 1
2A	30 Vdc Vext feeder 2
2B	0 Vdc Vext feeder 2
⏚	Ground connection
⏚	Ground connection (1 ground wire is enough)

Connections diagram

Figure 330 on page 549 shows the connections diagram of the TSHART-1620m module.

The TSHART-1620m module has sixteen groups (= sixteen channels) of four screw terminals to provide optimum connection of field wiring, with a ground terminal per channel for screening of analog input cables. The screw terminals are numbered 1 to 64.

Figure 330 Connections diagram



Technical data

The TSHART-1620m module has the following general specifications:

General	Type numbers[1] :	FS-TSHART-1620m
		FC-TSHART-1620m
	Approvals:	CE, TUV, UL, CSA, FM
Input	Number of input channels:	16 (2 groups of 8 with common 0 V)
	Power requirements:	30 Vdc external, 3 mA (without input loop loads)
	Input current:	0—25 mA
	Input resistance:	250 Ω (± 1%)
Output	To passive transmitters (Vext):	
	• Output resistance:	270 Ω (± 5%)
	• Igniting current per channel:	< 120 mA at 30 Vdc
	To SAI-1620m module:	
	• Output voltage	0—4 Vdc
	• Accuracy	0.1%
	To HART multiplex unit:	
	• Output voltage	Max. 5 V peak-peak
	• Series impedance	> 100 nF
Fuses	Rating:	315 mAT (slow-acting)
	Dimensions:	5 × 20 mm (0.20 × 0.79 in)
Physical	Module dimensions:	250 × 70 × 60 mm (L × W × H) 9.84 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	251 mm (9.87 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

The TSHART-1620m module has the following specifications for non-incendive field circuits, Class1 Division 2:

Field signal specifications for non-incendive field circuits, Class1 Division 2	HYDROGEN (Group A & B):	
	• Max. loop inductance	6 mH
	• Max. loop capacitance	0.25 µF
	NON-HYDROGEN (Group C & D):	
	• Max. loop inductance	20 mH
	• Max. loop capacitance	5 µF

TSGAS-1624

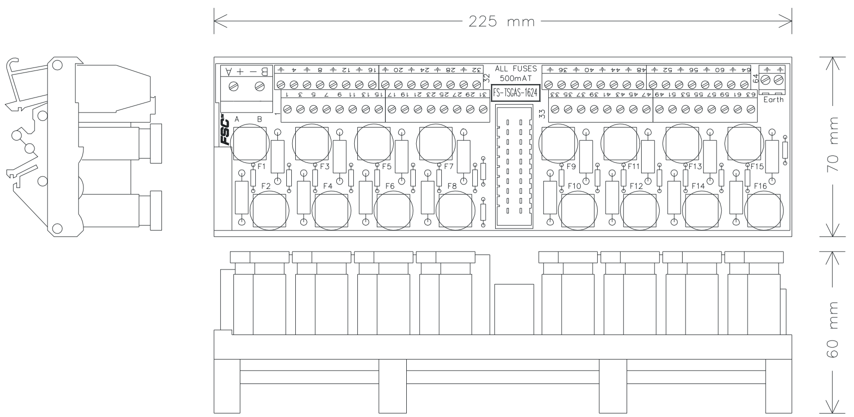
Safe gas / flame detector input FTA (0-20 mA, 16 channels)

Description

The field termination assembly module TSGAS-1624 is the interface between gas/flame detectors in the field and the safe high-density analog input module SAI-1620m in Safety Manager. The TSGAS-1624 module has sixteen analog input channels which may be used for both safety-related and non-safety-related applications. The TSGAS-1624 module uses a SICC-0001/Lx system interconnection cable to transfer the 16 input signals to a (redundant pair of) SAI-1620m module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connection of power supply, ground and field wiring.

Figure 331 Mechanical layout



Main functions

The TSGAS-1624 module has three main functions:

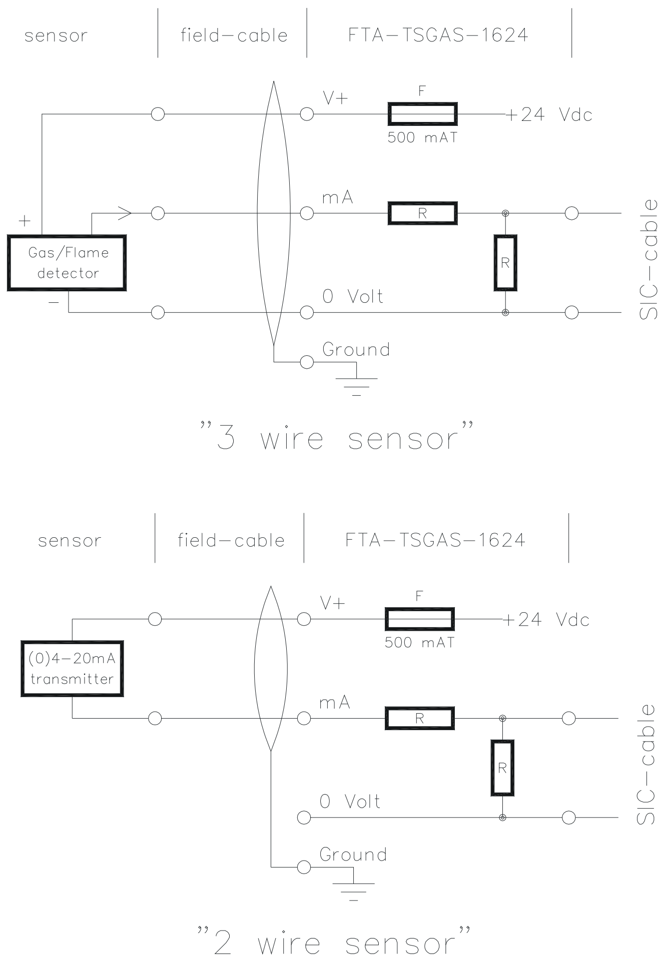
- Linear direct conversion of 0(4)—20 mA DC field signals to the signal levels of the safe high-density analog input module SAI-1620m
- Power supply distribution to each transmitter (500 mAT fused)
- Enable monitoring of the external power connected to the TSGAS-1624 module

Linear direct conversion

The input circuit of each channel consists of a high-precision resistor which converts the input current (0—20 mA) to the input voltage for the high-density analog input module SAI-1620m. The power to the analog transmitter is fused (500 mAT) per channel. Each analog input has its own terminal for the field cable shield.

Figure 332 on page 553 shows the schematic diagram for connecting a transmitter (active and passive).

Figure 332 Schematic diagram for connecting a transmitter



External power

External power can be connected to the TSGAS-1624 module via the power screw terminal pair marked ‘A’ and ‘B’.

Note

The 0 V connection of the external power is directly connected to the common 0 V of all sixteen analog inputs.

The Safety Manager software can monitor the external power voltage via the safe high-density analog input module SAI-1620m.

Applications

For details on applications and connection options for the TSGAS-1624 module, see section “SICC-0001/Lx” on page 715.

Connections

External power and ground

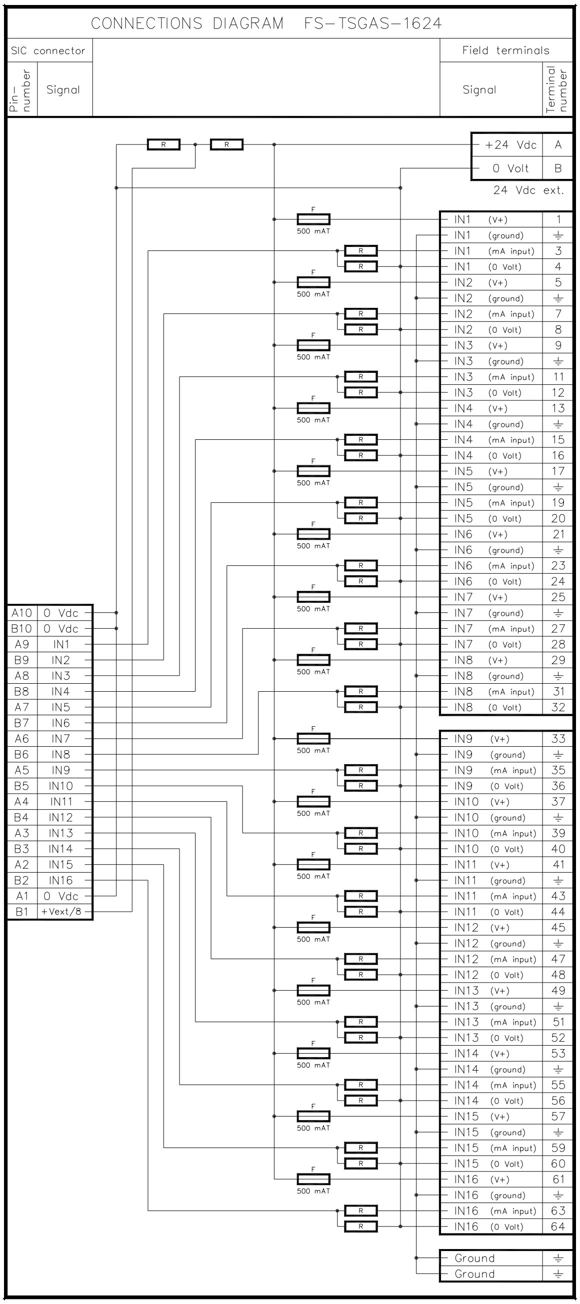
The external supply voltage (Vext) and ground are connected to the following screw terminals (marked ‘A’ and ‘B’ and ‘⏚’ on the FTA):

Screw terminal	Function
A	24 Vdc Vext
B	0 Vdc Vext
⏚	Ground connection
⏚	Ground connection (1 ground wire is enough)

Connections diagram

The TSGAS-1624 module has sixteen groups (= sixteen channels) of four screw terminals to provide optimum connection of field wiring, with a ground terminal per channel for screening of analog input cables. The screw terminals are numbered 1 to 64. The connections diagram of the TSGAS-1624 module is as follows:

Figure 333 Connections diagram



Technical data

The TSGAS-1624 module has the following specifications:

General	Type numbers[1] :	FS-TSGAS-1624
		FC-TSGAS-1624
	Approvals:	CE, TUV, UL, CSA, FM
Input	Number of input channels:	16 (with common 0 V)
	Power requirements:	24 Vdc external, 3 mA (without field loads)
	Input current:	0—25 mA
	Input resistance:	500 Ω (± 5%)
Output	To SAI-1620m module:	
	• Output voltage	0—4 Vdc
	• Accuracy	0.1%
Fuses	Rating:	500 mAT (slow-acting)
	Dimensions:	5 × 20 mm (0.20 × 0.79 in)
Physical	Module dimensions:	225 × 70 × 60 mm (L × W × H) 8.86 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	226 mm (8.90 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)
	Power screw terminals (A, B):	
	• Max. wire diameter	16 mm² (AWG 8)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	1.2 Nm (0.88 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TSGASH-1624

Safe gas/flame detector input FTA with HART interface (0-20 mA, 16 channels)

Description

The field termination assembly module TSGASH-1624 is the interface between gas/flame detectors with HART interface in the field and the safe high-density analog input module SAI-1620m in Safety Manager.

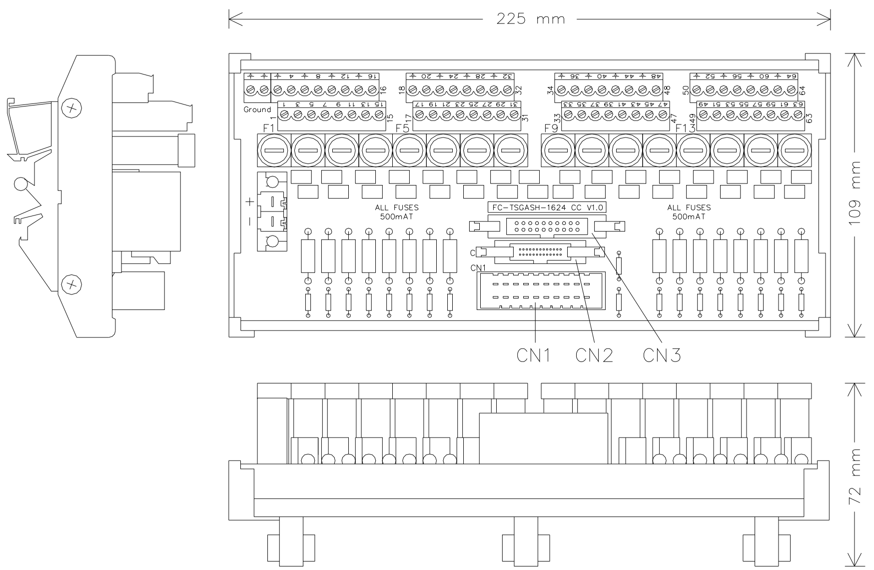
The TSGASH-1624 module has sixteen analog input channels which may be used for both safety-related and non-safety-related applications.

The TSGASH-1624 module provides HART interface on all 16 channels. The module uses a SICC-0001/Lx system interconnection cable to transfer the 16 input signals to a (redundant pair of) SAI-1620m module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connection of ground and field wiring.

The FTA module has a 2-pole power connector to connect the module with a 24Vdc power source.

Figure 334 Mechanical layout



Main functions

The TSGASH-1624 module has the following functions:

- Linear direct conversion of 0(4)-20mA DC field signals to signal levels of the safe high-density analog input module SAI-1620m
- Power supply distribution to each transmitter (500mAT fused)
- Enable connection to HART multiplex units of MTL or Pepperl+Fuchs (P+F)
- Enable monitoring of the external power connected to the TSGASH-1624 module.

Linear direct conversion

The input circuit of each channel consists of a high-precision resistor which converts the input current (0-20mA) to the input voltage for the high-density analog input module SAI-1620m. The power to the analog transmitter is fused (500mAT) per channel.

Each analog input has its own terminal for the field cable shield.

Figure 335 on page 559 shows the schematic diagram for connecting a transmitter (active or passive).

HART interface

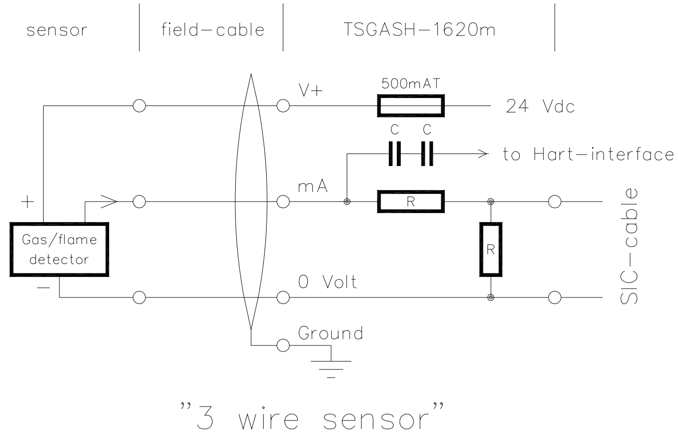
The TSGASH-1624 module provides interfaces to HART multiplex units from MTL and Pepperl+Fuchs (P+F). Dedicated connectors are installed on the FTA to enable the use of the standard cables from these suppliers.

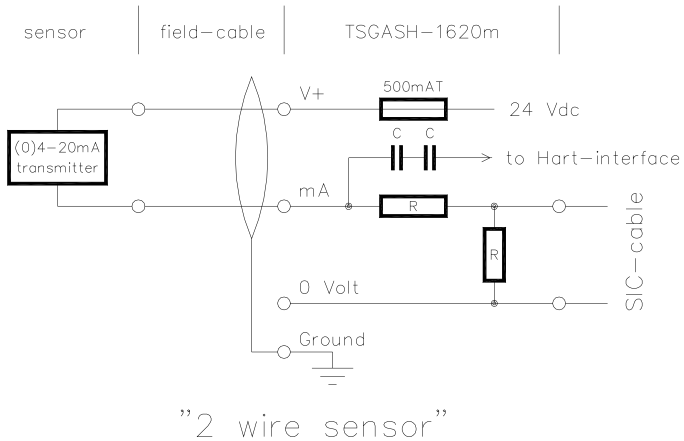
The following equipment can be connected:

	MTL Solution	P+F solution
Multiplexer unit	MTL4842	KFD0-HMS-16 or KFD2-HMM-16
Cable	MTL FLAT20-2.2	K-MH26
Connector on FTA[1]	CN3	CN2

1 See Figure 334 on page 557

Figure 335 Schematic diagram for connecting a transmitter





External power

A 24 Vdc power distribution cable (see data sheet "PDC-MB24-x" on page 812 for details) can be used to connect the main bus bar with the power connector on the TSGASH-1624 module.

- When using other connection cables, make sure the wire size is adequate and the supplied Weidmuller BL 5.08/SN OR connector is used.

Note

The 0 V connection of the external power is directly connected to the common 0 V of all sixteen analog inputs.

The Safety Manager software can monitor the external power voltage via the safe high-density analog input module SAI-1620m.

Applications

For applications and connection options for the TSGASH-1624 module, see section “SICC-0001/Lx” on page 715.

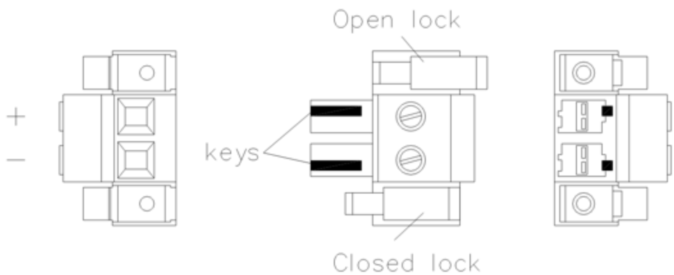
Connections

External power and ground

Figure 336 on page 560 shows the top, side & bottom view and the pin assignment of the power input connector.

- The pin marked '+' is pin 1: connected to +24Vdc bus bar.
- The pin marked '-' is pin 2: connected to the 0Vdc bus bar.

Figure 336 Power input connector (Weidmuller BVZ 7.62/02F SW) top, side and bottom view



The two (orange) locking slides of the cable-connector in Figure 336 on page 560 keep the cable-connector locked when inserted into the power connector.

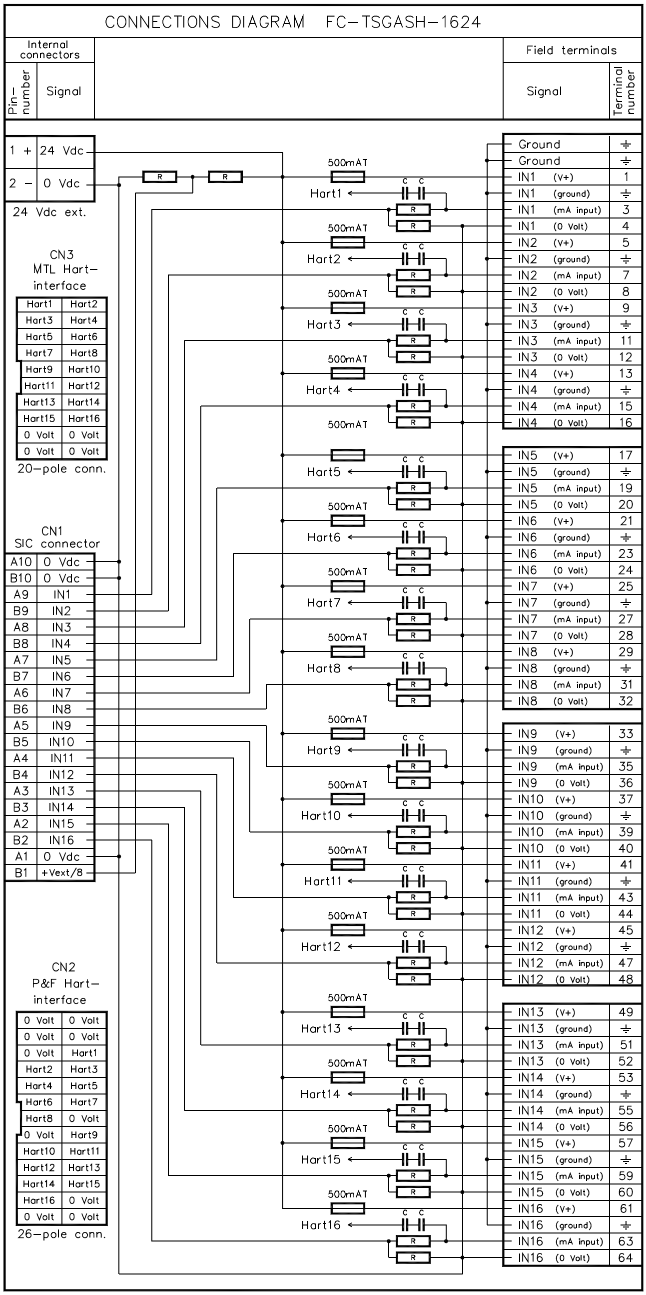
The (two) Ground screw connections on the top left side in Figure 334 on page 557 are used to connect Ground with the "ground" pins of the channels. One ground wire is enough.

Connections diagram

The TSGASH-1624 module has sixteen groups (= sixteen channels) of four screw terminals to provide optimum connection of field wiring, with a ground terminal per channel for screening of analog input cables. The screw terminals are numbered 1 to 64.

The connections diagram of the TSGASH-1624 module is as follows:

Figure 337 Connections diagram



Technical data

The TSGASH-1624 module has the following specifications:

General	Type numbers[1] :	FC-TSGASH-1624 CC V1.0
	Approvals:	CE; TUV, UL, CSA pending
Input	Number of input channels:	16 (with common 0 V)
	Power requirements:	24 Vdc external, 2.5mA (without field loads)
	Input current:	0—25 mA
	Input resistance:	500 Ω (± 5%)
Output	To SAI-1620m module:	
	• Output voltage	0—4 Vdc
	• Accuracy	0.1%
	To HART multiplexer unit:	
	• Output voltage	Max. 11 V peak-peak
	• Series impedance	> 2µF
Fuses	Rating:	500 mAT (slow-acting)
	Dimensions:	5 × 20 mm (0.20 × 0.79 in)
Physical	Module dimensions:	225 × 109× 60 mm (L × W × H) 8.86 × 4.29 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	226 mm (8.90 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)
	Power connector:	
	• model	2 pole header with keying
	• Make and type	Weidmuller: BVZ 7.62/02F SW (con.) Weidmuller: KO BV/SV7.62 (keys)
	• Strip length	8 mm (0.28 in)
	• connectable conductors	0.5—6 mm^2 (AWG20—AWG10)

1 FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

TSGASH-1624P

Safe gas/flame detector input FTA with HART interface (0-20 mA, 16 channels)

Description

The field termination assembly module TSGASH-1624P is the interface between gas/flame detectors with HART interface in the field and the safe high-density analog input module SAI-1620m in Safety Manager.

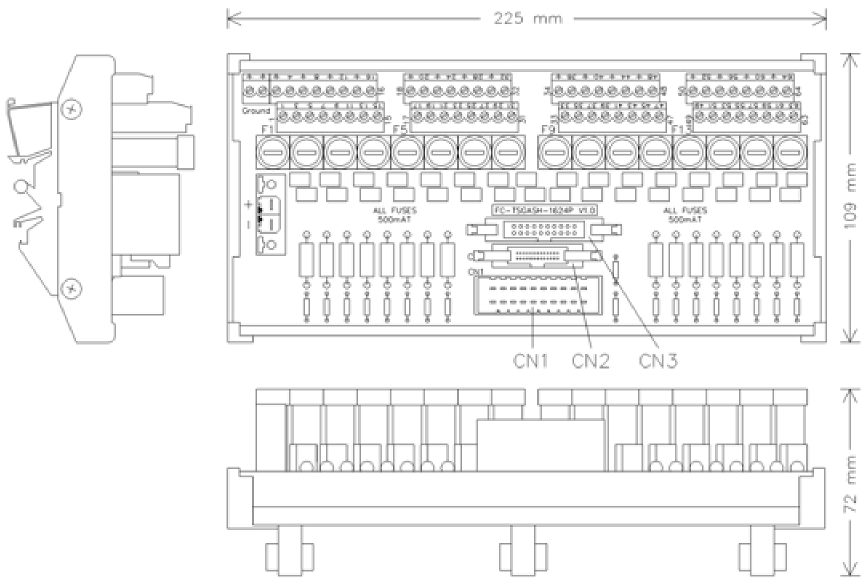
The TSGASH-1624P module has sixteen analog input channels which may be used for both safety-related and non-safety-related applications.

The TSGASH-1624P module provides HART interface on all 16 channels. The module uses a SICC-0001/Lx system interconnection cable to transfer the 16 input signals to a (redundant pair of) SAI-1620m module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connection of ground and field wiring.

The FTA module has a 2-pole power connector to connect the module with a 24Vdc power source.

Figure 338 Mechanical layout



Main functions

The TSGASH-1624P module has the following functions:

- Linear direct conversion of 0(4)-20mA DC field signals to signal levels of the safe high-density analog input module SAI-1620m
- Power supply distribution to each transmitter (500mAT fused)
- Enable connection to HART multiplex units of MTL or Pepperl+Fuchs (P+F)
- Enable monitoring of the external power connected to the TSGASH-1624P module.

Linear direct conversion

The input circuit of each channel consists of a high-precision resistor which converts the input current (0-20mA) to the input voltage for the high-density analog input module SAI-1620m. The power to the analog transmitter is fused (500mAT) per channel.

Each analog input has its own terminal for the field cable shield.

Figure 339 on page 565 shows the schematic diagram for connecting a transmitter (active or passive).

HART interface

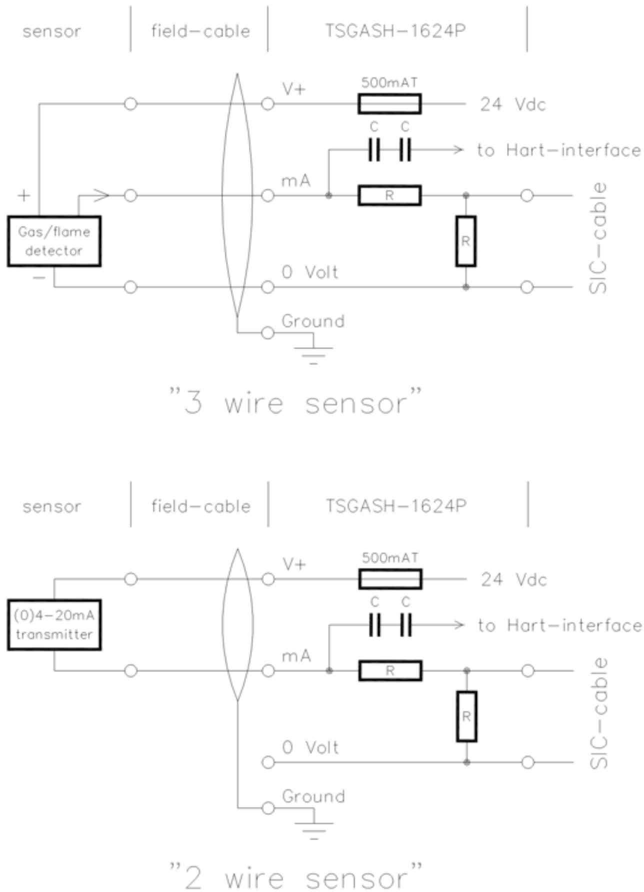
The TSGASH-1624P module provides interfaces to HART multiplex units from MTL and Pepperl+Fuchs (P+F). Dedicated connectors are installed on the FTA to enable the use of the standard cables from these suppliers.

The following equipment can be connected:

	MTL Solution	**P+F solution**
Multiplexer unit	MTL4842	KFD0-HMS-16 or KFD2-HMM-16
Cable	MTL FLAT20-2.2	K-MH26
Connector on FTA[1]	CN3	CN2

1 See Figure 338 on page 563

Figure 339 Schematic diagram for connecting a transmitter



External power

A 24 Vdc power distribution cable (see data sheet "PDC-MB24-y" on page 814 for details) can be used to connect the main bus bar with the power connector on the TSGASH-1624P module.

- When using other connection cables, make sure the wire size is adequate and the supplied Weidmuller BVZ 7.62HP/02/180F SN connector is used.

Note

The 0 V connection of the external power is directly connected to the common 0 V of all sixteen analog inputs.

The Safety Manager software can monitor the external power voltage via the safe high-density analog input module SAI-1620m.

Applications

For applications and connection options for the TSGASH-1624P module, see section “SICC-0001/Lx” on page 715.

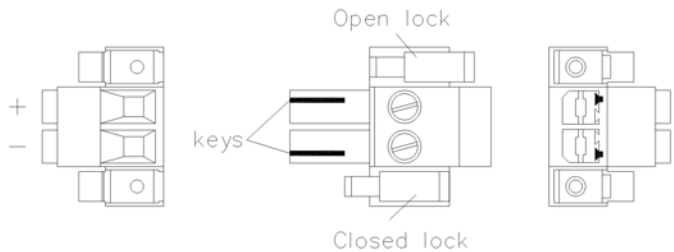
Connections

External power and ground

Figure 340 on page 566 shows the top, side & bottom view and the pin assignment of the power input connector.

- The pin marked '+' is pin 1: connected to +24Vdc bus bar.
- The pin marked '-' is pin 2: connected to the 0Vdc bus bar.

Figure 340 Power input connector (Weidmuller BVZ 7.62HP/02/180F SN) top, side and bottom view



The two (red) locking slides of the cable-connector in Figure 340 on page 566 keep the cable-connector locked when inserted into the power connector.

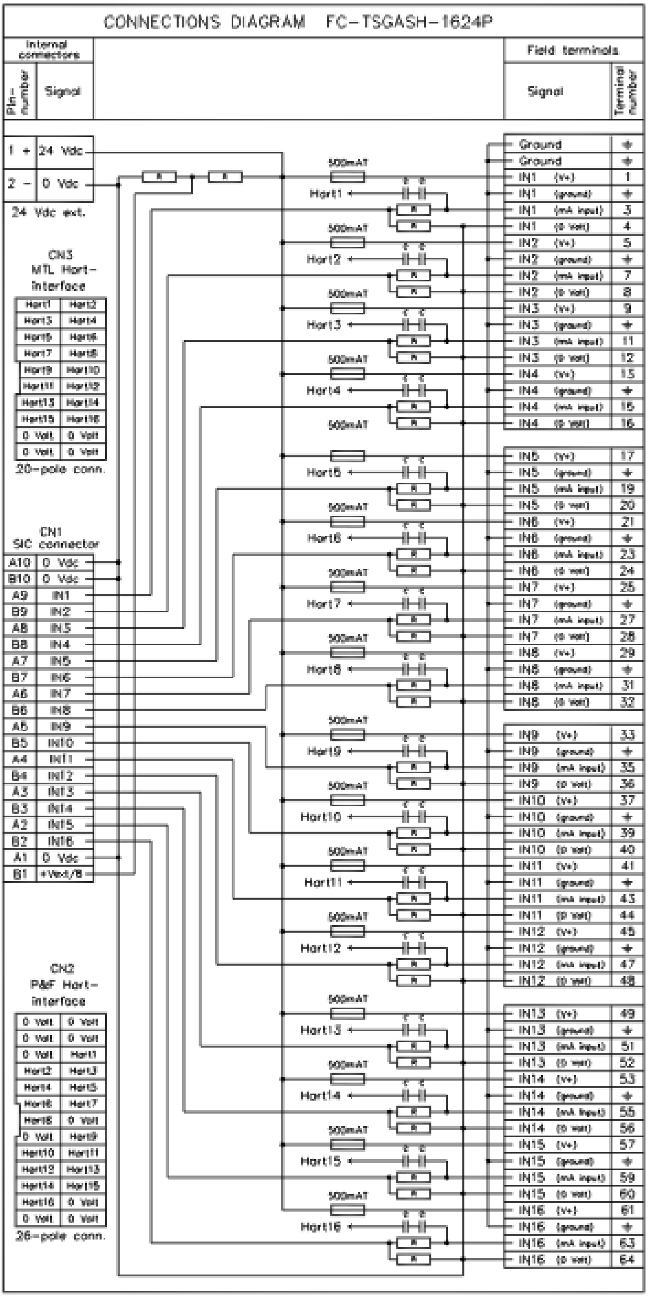
The (two) Ground screw connections on the top left side in Figure 338 on page 563 are used to connect Ground with the "ground" pins of the channels. One ground wire is enough.

Connections diagram

The TSGASH-1624P module has sixteen groups (= sixteen channels) of four screw terminals to provide optimum connection of field wiring, with a ground terminal per channel for screening of analog input cables. The screw terminals are numbered 1 to 64.

The connections diagram of the TSGASH-1624P module is as follows:

Figure 341 Connections diagram



Technical data

The TSGASH-1624P module has the following specifications:

General	Type numbers[1] :	FC-TSGASH-1624P V1.0
	Approvals:	CE; TUV, UL, CSA pending
Input	Number of input channels:	16 (with common 0 V)
	Power requirements:	24 Vdc external, 2.5mA (without field loads)
	Input current:	0—25 mA
	Input resistance:	500 Ω (± 5%)
Output	To SAI-1620m module:	
	• Output voltage	0—4 Vdc
	• Accuracy	0.1%
	To HART multiplexer unit:	
	• Output voltage	Max. 11 V peak-peak
	• Series impedance	> 2µF
Fuses	Rating:	500 mAT (slow-acting)
	Dimensions:	5 × 20 mm (0.20 × 0.79 in)
Physical	Module dimensions:	225 × 109× 60 mm (L × W × H) 8.86 × 4.29 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	226 mm (8.90 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)
	Power connector:	
	• model	2 pole header with keying
	• Make and type	Weidmuller: BVZ 7.62HP/02/180F SN (con.) Weidmuller: BV/SV7.62HP KO (keys)
	• Strip length	8 mm (0.28 in)
	• connectable conductors	0.5—6 mm^2 (AWG20—AWG10)

1 FC-type modules are conformal coated modules.

TSFIRE-1624

Safe fire detector input FTA with line monitoring (24 Vdc, 16 channels)

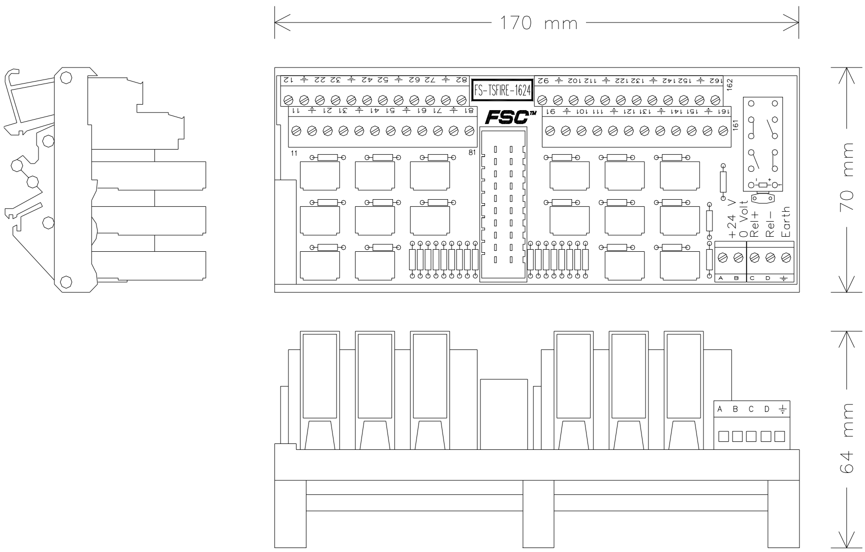
Description

Field termination assembly module TSFIRE-1624 is the interface between (digital) fire detectors and the safe high-density analog input module SAI-1620m in Safety Manager. It may be used for installations in, and interfacing signals to Class I, Division 2 Hazardous Locations.

The TSFIRE-1624 module has sixteen digital detector input channels which may be used for both safety-related and non-safety-related applications. The TSFIRE-1624 module uses a SICC-0001/Lx system interconnection cable to transfer the 16 input signals to a (redundant pair of) SAI-1620m module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connection of power supply and field wiring.

Figure 342 Mechanical layout



Main functions

The TSFIRE-1624 module has three main functions:

- Power supply to each detector with voltage-current limitation in compliance with Hazardous Area Class I Division 2
- Fire detection input function
- Global reset of the connected sensors

Power supply detector

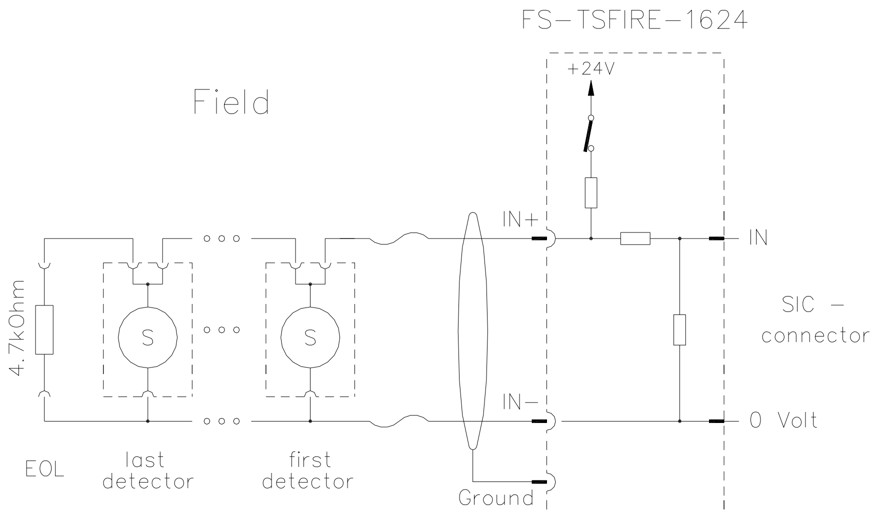
The TSFIRE-1624 module requires an external 24 Vdc power supply. This provides a field signal with open voltage of approximately 24 Vdc and a short-circuit current of approximately 35 mA. Normal operating voltage (with a 4.7 kΩ EOL resistor) is approximately 20.5 Volts.

Fire detector input

The TSFIRE-1624 module converts an input for 24 V fire detectors to levels suitable for the SAI-1620m module.

Figure 343 on page 570 shows the schematic diagram for the connection of fire detectors or manual call points.

Figure 343 Typical schematic diagram for TSFIRE-1624 input



Global reset

The relay on the TSFIRE-1624 module enables a reset of all connected detectors by removing the supply voltage to the field. The relay is normally de-energized (energized = reset detectors). The Global Reset function is non-safety related.

Applications

For details on applications and connection options for the TSFIRE-1624 module, see section “SICC-0001/Lx” on page 715.

Connections

Common signals

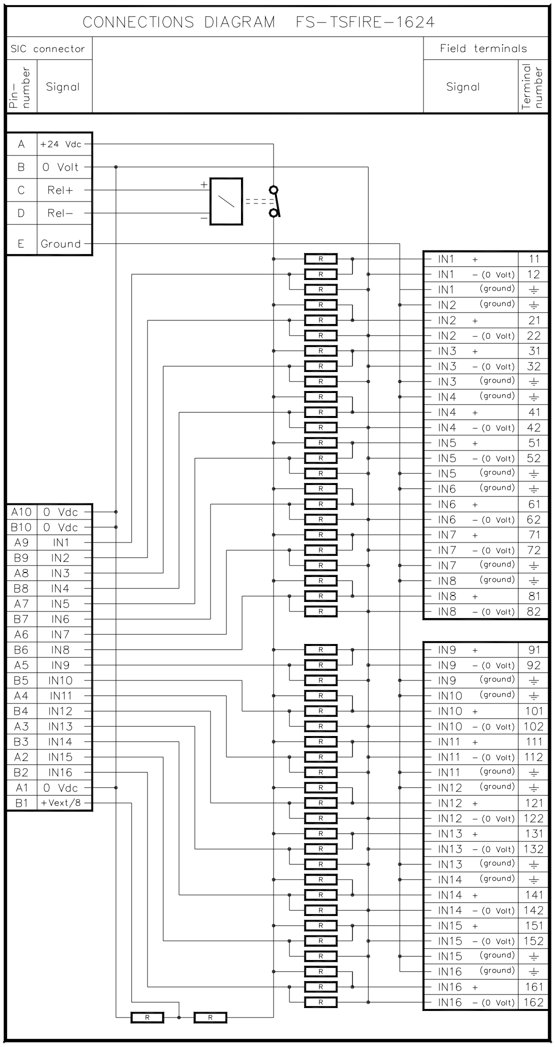
The connections for common signals are as follows:

Screw terminal	Function
A	+24 Vdc Vext
B	0 Vdc Vext
C	Rel+
D	Rel–
E	Ground

Connections diagram

The TSFIRE-1624 module has 48 screw terminals for connection of field wiring. The connections diagram of the TSFIRE-1624 module is as follows:

Figure 344 Connections diagram



Technical data

The TSFIRE-1624 module has the following specifications:

General	Type numbers[1 2]:	FS-TSFIRE-1624 V1.1
		FC-TSFIRE-1624 V1.1
	Approvals	CE, TUV, UL, CSA, FM
Pwr requirements 24 Vdc ext.	Voltage	24 Vdc +25% / –15%
	Current • With EOL resistors • No load	Max. 570 mA (at 24 Vdc ext.) • Typ. 70mA (at 24 Vdc ext.) • Typ. 11mA (at 24 Vdc ext.)
Input	Number of channels	16
	Input Voltage • With EOL resistor (4k7) • No load	 • Typ. 20.5 Vdc (at 24 Vdc ext.) • Typ. 23.5 Vdc (at 24 Vdc ext.)
	Channel resistance	680 Ω +/–5%
	Shorted current	35 mA (at 24 Vdc ext.)
Relay	Relay voltage	17 – 39 Vdc
	Current	Typ. 8.5 mA at 24 Vdc
Termination	Screw terminals	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)
Field signal specifications	Field wire resistance	< 100 Ω
	End-of-line (EOL) resistor	For example 4k7, ± 5% (0.25 W) (see F&G Application Manual, PM.MAN.8163)
	HYDROGEN (Group A & B)	
	• Max. loop inductance	60 mH
	• Max. loop capacitance	0.3 μF
	NON-HYDROGEN (Group C & D)	
	• Max. loop inductance	230 mH
	• Max. loop capacitance	7 μF

Physical	Module dimensions	170 × 70 × 64 mm (L × W × H) 6.72 × 2.76 × 2.52 in (L × W × H)
	DIN EN rails	TS32 / TS35 × 7.5
	Used rail length	171 mm (6.73 in)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

2 Modules with suffix code V1.1 or CCV1.1 and higher have an improved PCB design; these versions of the module are equipped with rectangular white resistors.
For earlier versions of the module the +Vext/8 read back (pin B1) is connected with the +24Vdc (screw terminal A).

TSDO-0824

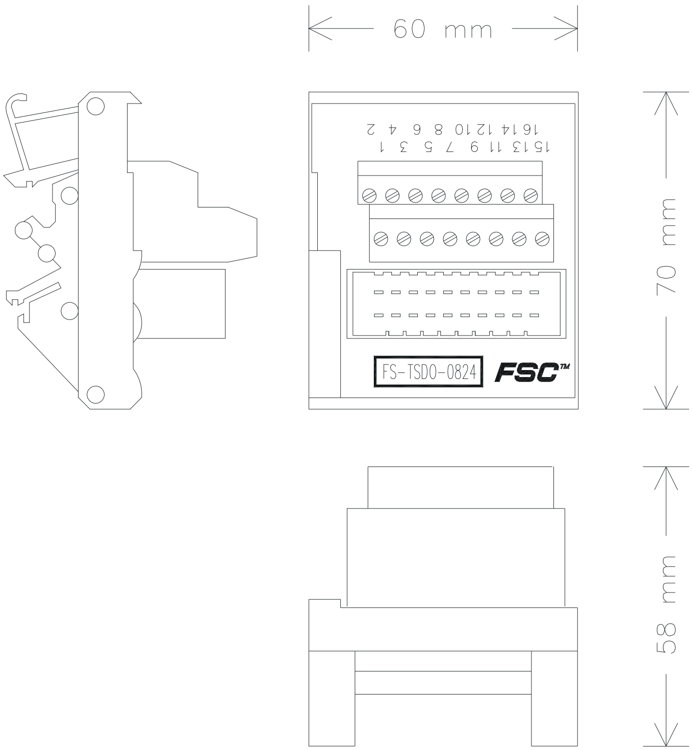
Safe digital output FTA (24 Vdc, 8 channels)

Description

Field termination assembly module TSDO-0824 is the interface between system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). The eight channels of a (redundant pair of) SDO-0824 module(s) can be connected to the TSDO-0824 module via the system interconnection cable SICC-0001/Lx.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 345 Mechanical layout



Applications

For details on applications and connection options for the TSDO-0824 module, see section “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSDO-0824 module:

Figure 346 Connections diagram

CONNECTIONS DIAGRAM FS-TSDO-0824

SIC connector		Field terminals	
Pin-number	Signal	Signal	Terminal number
A10	nc		
B10	nc		
A9	OUT1+	OUT1+	1
B9	OUT1–	OUT1– (0 Volt)	2
A8	OUT2+	OUT2+	3
B8	OUT2–	OUT2– (0 Volt)	4
A7	OUT3+	OUT3+	5
B7	OUT3–	OUT3– (0 Volt)	6
A6	OUT4+	OUT4+	7
B6	OUT4–	OUT4– (0 Volt)	8
A5	OUT5+	OUT5+	9
B5	OUT5–	OUT5– (0 Volt)	10
A4	OUT6+	OUT6+	11
B4	OUT6–	OUT6– (0 Volt)	12
A3	OUT7+	OUT7+	13
B3	OUT7–	OUT7– (0 Volt)	14
A2	OUT8+	OUT8+	15
B2	OUT8–	OUT8– (0 Volt)	16
A1	nc		
B1	nc		

Technical data

The TSDO-0824 module has the following specifications:

General	Type numbers[1] :	FS-TSDO-0824
		FC-TSDO-0824
	Approvals:	CE, TUV, UL, CSA, FM
Power	Number of channels:	8
	Maximum voltage:	36 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum continuous current per channel:	1.5 A
	Actual maximum current defined by connected output module	
Physical	Module dimensions:	60 × 70 × 58 mm (L × W × H) 2.36 × 2.76 × 2.28 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	61 mm (2.40 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TSDO-0824C

Conformal coated safe digital output FTA, current limited (24 Vdc, 8 channels)

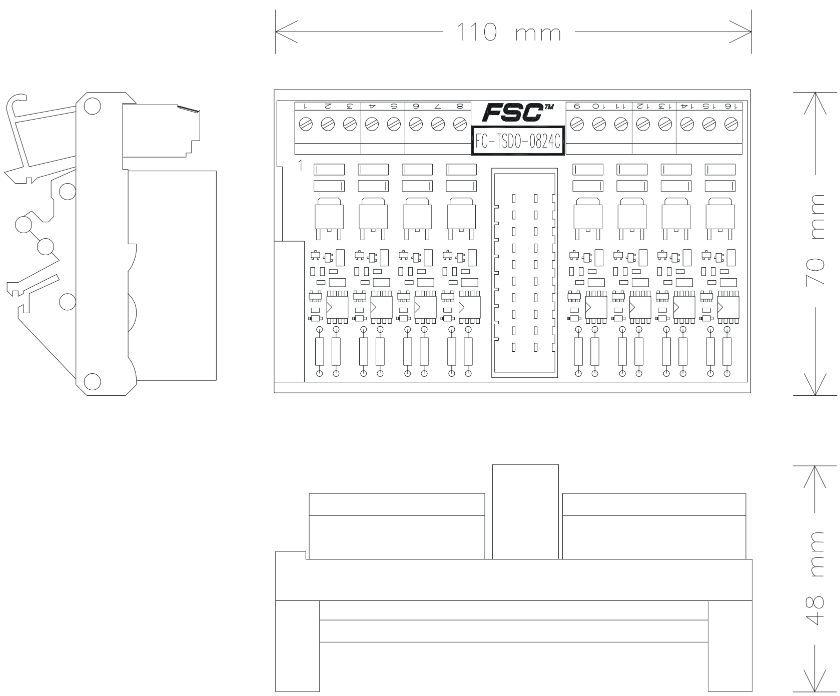
Description

Field termination assembly module TSDO-0824C is the interface between safe digital output module SDO-0824 with a system interconnection cable (SICC-0001/Lx) and the external field wiring (screw terminals). It can be used for interfacing to Class I, Division 2 Hazardous locations.

The TSDO-0824C provides eight current limited safe digital outputs to the field. Each output is capable of supplying 110 mA (= 2.5 Watt at 24 Vdc).

The FTA module is coated conform the requirements for type A coatings given in IEC 60664-3 (the values for POLLUTION DEGREE 1 apply), has a universal snap-in provision for standard DIN EN rails, and screw terminals for the field wiring.

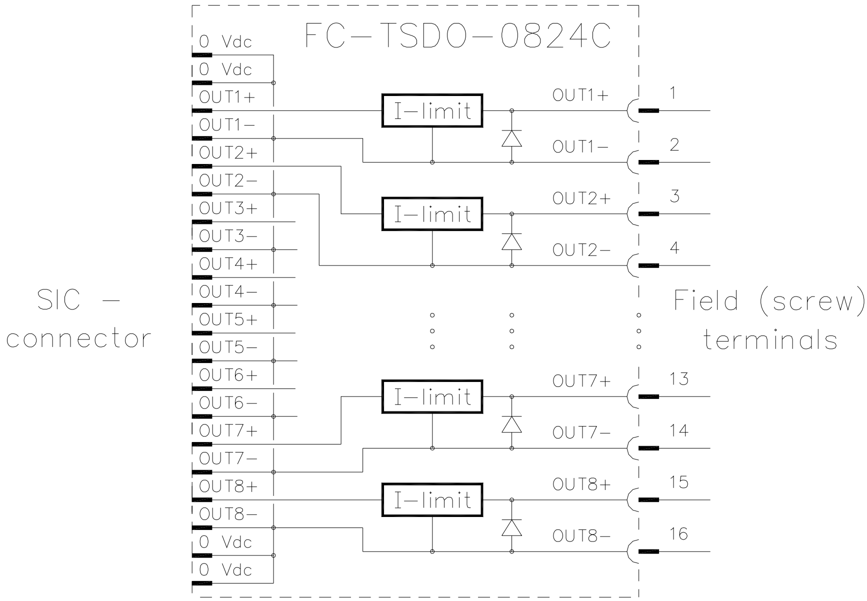
Figure 347 Mechanical layout



Applications

For details on applications and connection options for the TSDO-0824C module, see section “SICC-0001/Lx” on page 715.

Figure 348 Schematic diagram



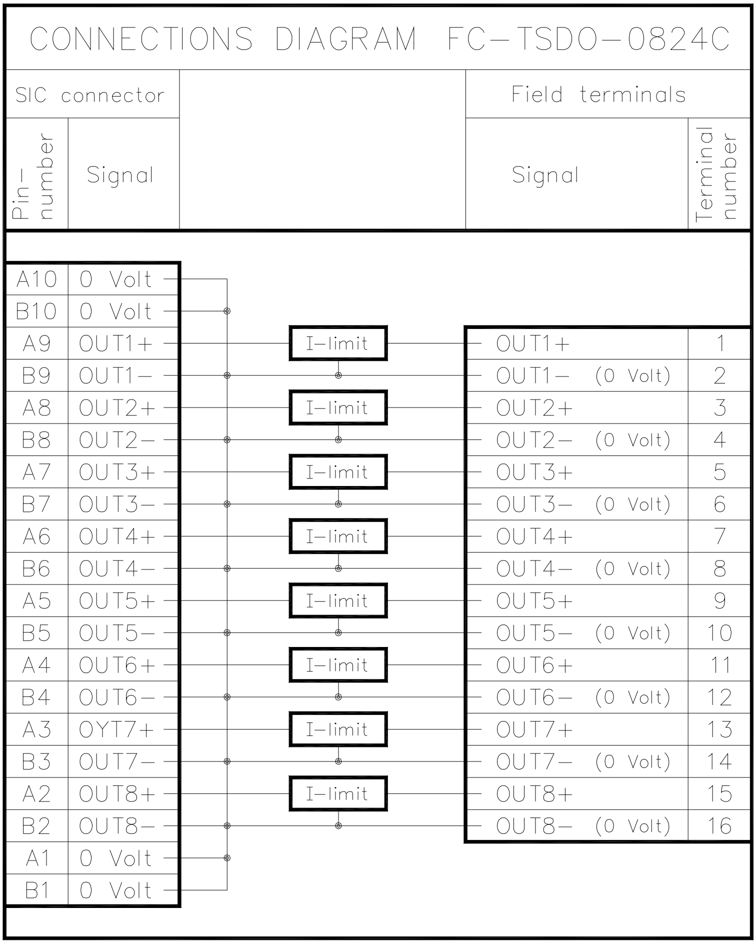
Main function

The TSDO-0824C can energize loads (for example solenoids or LEDs) with voltage-current limitation in compliance with Hazardous Class I, Division 2. The external output-signal (OUT+) is electronically current-limited.

Connections

The connections diagram of the TSDO-0824C:

Figure 349 Connections diagram



Technical data

The TSDO-0824C has the following specifications:

General	Type number[1]:	FC-TSDO-0824C
	Approvals	CE, TUV, UL, CSA, FM
	Environmental shielding	Conformal coating
Power	Number of channels:	8
	Maximum voltage:	36 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Power requirements:	5 mA per channel (plus output load)
Output	Output current limit:	> 110 mA
	Max. output load:	2.5 Watt (at 24 Vdc)
	Voltage drop:	< 1.5 Vdc at 110 mA
	Off current:	< 0.1 mA
Physical	Module dimensions:	110 × 70 × 48 mm (L × W × H) 4.32 × 2.76 × 1.89 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	111 mm (4.36 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)
Field signal specifications	HYDROGEN (Group A & B)	
	• Max. loop inductance	3.0 mH
	• Max. loop capacitance	0.2 µF
	NON-HYDROGEN (Group C & D)	
	• Max. loop inductance	12 mH
	• Max. loop capacitance	5 µF

1 FC-type modules are conformal coated modules.

TDOL-0724

Line-monitored relay contact digital output (7 channels, 24Vdc)

Description

The field termination assembly module TDOL-0724 is an interface to field loads that require 24Vdc line-monitored digital outputs.

The TDOL-0724 has 7 (2A) fused relay contact outputs that may be used for non-safety related resistive or inductive field loads upto 50Watt.

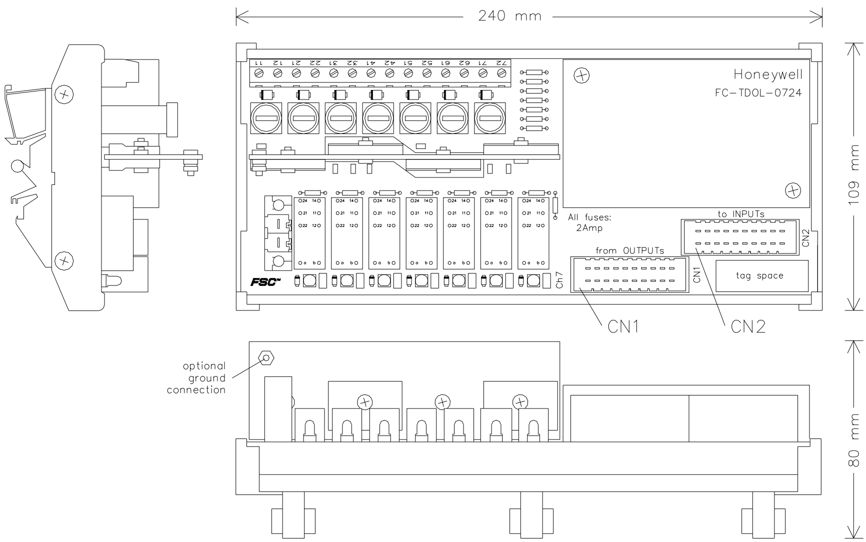
Per channel dedicated line monitoring circuits support both short-circuit and lead-breakage detection while the output is either **energized** or **de-energized**.

For these line-monitoring diagnostics the TDOL-0724 operates in combination with standard DI and DO modules of Safety Manager (configured as either redundant or non-redundant IO).

This overall Safety Manager hardware configuration comes with dedicated application software, loadable from the Safety Manager Function Library.

The TDOL-0724 has universal snap-in provisions for standard DIN EN rails, (7 pairs of) screw terminals for the field wiring and a (2-pole) power connector for the common supply connection.

Figure 350 Mechanical layout



Main functions and usage

The TDOL-0724 is connected to a (non-redundant or redundant) SDO-0824 output module and a (non-redundant or redundant) SDI-1624 input module via system interconnection cables (SICs).

- A fused relay contact connects the common supply voltage (24Vdc) with a field terminal. The 7 output relays are controlled by channel 1 to 7 of the SDO-0824. A LED indicates the state of its output relay.
- Each output channel has line-monitoring circuits. The line-monitoring circuits are controlled by channel 8 of the SDO-0824 and are wired to channel 1 to 15 of the SDI-1624.
- Special application logic drives the outputs and processes the line monitoring results.

Schematic diagram of a channel

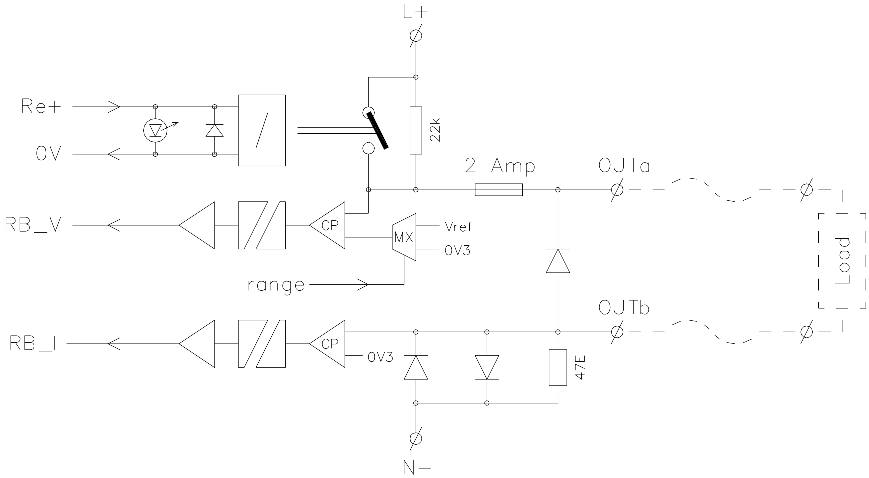
Figure 351 on page 584 shows a schematic diagram of a channel. Each channel consists of:

- one relay with indicator LED
- a fused (2 AT) contact output
- a current injection resistor (22kΩ)
- a voltage readback circuit (with two ranges)
- a current sense connection and a current readback circuit

The common part of the module (see Figure 356 on page 589) consists of:

- a DC/DC converter to supply the voltage- and current- readback circuits.
- a supply voltage monitor (generating the `RB_PWR` signal)
- an opto-coupler to transfer the range switch command from the Controller 24Vdc side to the field 24Vdc side.

Figure 351 Schematic diagram of a channel



Lead breakage detection.

Lead breakage in a channel is detected if:

- The channel is `off` and the 22kΩ channel resistor (see Figure 351 on page 584) is able to pull the output voltage readback over the V_{ref} threshold.
- The channel is `on` and the current readback (RB_I) threshold (approx. `0.3V`) is *not* met.

Note:

A blown channel fuse will be indicated as lead breakage of that channel.

To prevent lead breakage indication on a spare channel, the `USED` input of that channel (an input of the channel application function block) must be `low`. For details see "Special application logic" on page 585.

Short circuit detection

Short circuit in a channel is detected if:

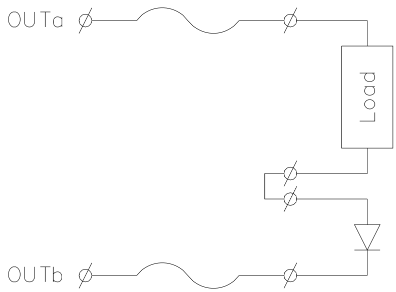
- The channel is `off` and the 22kΩ channel resistor (see Figure 351 on page 584) is not able to create a field voltage drop higher than the `low` threshold value (approx. `0.3V`).
- The channel is `on`. This will blow the channel fuse and will be indicated as lead breakage.

Field loads with a resistance below 400Ω

Field loads with a resistance below 400Ω may activate the short circuit detection.

To avoid this, an additional diode can be wired in series with the load as shown in Figure 352 on page 585. Behind this diode the short circuit detection is “blind”, so this diode should be placed as close to the load as possible.

Figure 352 Additional diode for loads < 400Ω



Note:

The additional diode for loads < 400Ω must be of type 1N4004 (or equivalent) at load currents up to 0.7Amp, or of type 1N5404 (or equivalent) for loads up to 2 Amp.

Special application logic

Special application logic is required to drive the outputs and monitor the on-board line monitoring electronics.

“Common function blocks” on page 585 and “Channel function blocks” on page 587 explain the function of this special application logic.

Note:

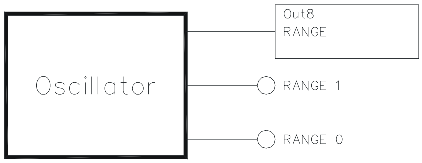
Special function blocks can be provided for in Safety Manager which can be modified to better suit the customers whishes.

Common function blocks

Figure 353 on page 586 and Figure 354 on page 586 show the schematics of the common function blocks required for the TDOL-0724.

Oscillator function block

Figure 353 Example of the oscillator function block



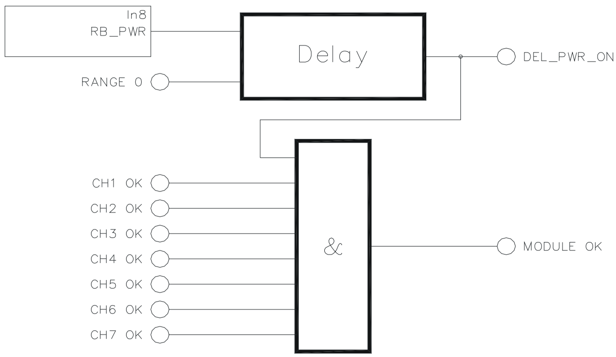
The oscillator function block may be global (one per series of TDOL-0724 FTAs in a Safety Manager).

The oscillator toggles the `RANGE` input of the voltage readback circuits on each TDOL-0724 and controls the latches in each channel function block.

This allows each channel function block to monitor the line for both energized *and* de-energized channels.

Delay and OK function block

Figure 354 Example of the delay and OK function block



The delay and OK function block is common per TDOL-0724.

- The Delay logic monitors the presence of 24V on the field power terminals and provides (power-up) time to stabilize the line monitoring circuits.
- The AND-gate collects the `CHx OK` signals of the seven channels function blocks of the TDOL-0724, as indicated in Figure 355 on page 587.

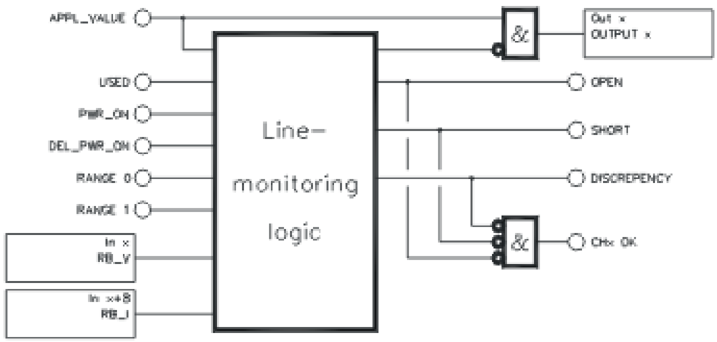
  If all channels are OK, the `MODULE OK` output is `high`.

Channel function blocks

Figure 355 on page 587 shows the schematics of the channel function blocks.

One channel function block is needed per channel of the TDOL-0724 FTA.

Figure 355 Example of a channel function block



A standard channel function block as shown in Figure 355 on page 587 has:

- an application value input `APPL_VALUE`
- a `USED` input to prevent lead breakage (`OPEN`) indications on unused channels.
- four inputs that must be linked to the common function blocks (for details see "Common function blocks" on page 585)
- one input for the voltage readback result `RB_V` of each channel (IN `1` thru `7`)
- one input for the current readback result `RB_I` of each channel (IN `9` thru `15`)
- one output for the output relay OUT of each channel (DO channel 1 thru 7)
- a `SHORT` output that indicates a short-circuit on the field wires (a `SHORT` detection also blocks the energization of the output relay)
- an `OPEN` output that indicated lead-breakage on the field wires (or output fuse blown)
- a `DISCREPENCY` output that indicates:
  - Field output is `on` while relay not energized or
  - Field output is `low`, while relay energized.
- a `CHx OK` output if no (line monitoring) errors are detected

Channel assignment:

When connected to the TDOL-0724 the IO channels of the SDO-0824 and the SDI-1624 are assigned as follows:

Field channel TDOL-0724	Controlling outputs SDO-0824[1]	line monitoring inputs SDI-1624[2]	
		RB_V	RB_I
Channel 1	Output 1	Input 1	Input 9
Channel 2	Output 2	Input 2	Input 10
Channel 3	Output 3	Input 3	Input 11
Channel 4	Output 4	Input 4	Input 12
Channel 5	Output 5	Input 5	Input 13
Channel 6	Output 6	Input 6	Input 14
Channel 7	Output 7	Input 7	Input 15

1 Channel 8 is assigned to the voltage range switcher (`RANGE`) in the common function block

2 Channel 8 is assigned to the 24V power monitor (`RB_PWR`)
Channel 16 is unused.

Applications

For correct operation the TDOL-0724 must be combined with:

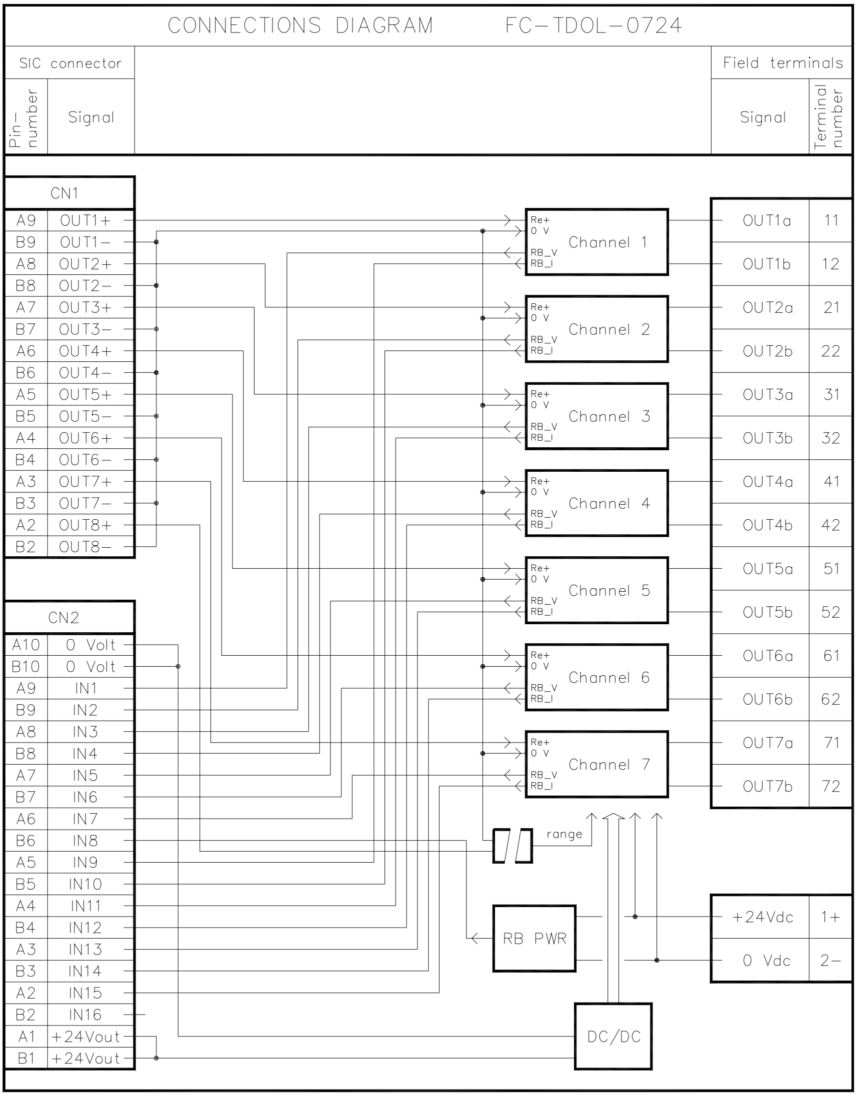
- a (redundant pair of) SDO-0824 module(s),
- a (redundant pair of) SDI-1624 module(s) and
- dedicated function blocks in the application.

For details on applications and connection options for the TDOL-0724 module, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TDOL-0724 module is as follows:

Figure 356 Connections diagram



SIC-connector CN1 (see Figure 350 on page 582 and Figure 356 on page 589) must be connected with the (redundant pair of) SDO-0824 module(s).

SIC-connector CN2 (see Figure 350 on page 582 and Figure 356 on page 589) must be connected with the (redundant) SDI-1624.

The TDOL-0724 has 7 pairs of terminals to connect the load.

External power

A 24 Vdc power distribution cable (see datasheet "PDC-MB24-x" on page 812 for details) can be used to connect the main busbar with the power connector on the TDOL-0724 module.

- When using other connection cables, make sure the wire size is adequate and the supplied Weidmuller BVZ 7.62/02F SW connector is used.

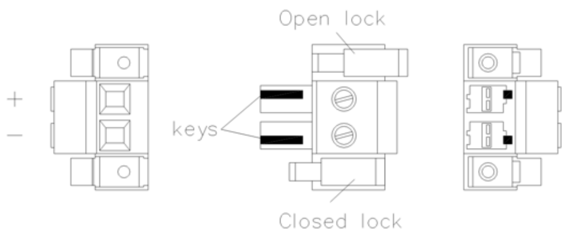
Note:

The 0 V connection of the external power is directly connected to the common 0 V of all output channels.

Figure 357 on page 590 shows the top, side & bottom view and the pin assignment of the power input connector.

- The pin marked **+** is pin 1: connected to +24Vdc busbar.
- The pin marked **-** is pin 2: connected to the 0Vdc busbar.

Figure 357 Power input connector (Weidmuller BVZ 7.62/02F SW) top, side and bottom view



The two (orange) locking slides of the cable-connector in Figure 357 on page 590 keep the cable-connector locked when inserted into the power connector.

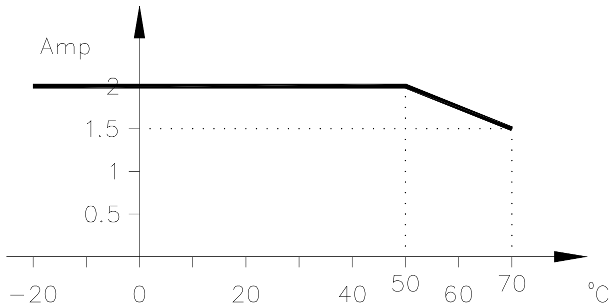
Grounding

Connect a ground wire to the (free) screw on the top left-side of the heatsink (see Figure 350 on page 582 for location) if grounding of metal parts is required.

Maximum output load

Figure 358 on page 591 shows the maximum channel load vs the ambient temperature.

Figure 358 Derating curve (channel load vs ambient temperature) for the TDOL-0724



Technical data

The TDOL-0724 module has the following specifications:

General	Type numbers[1]:	FC-TDOL-0724
	Approvals:	CE; TUV, UL, CSA pending
Outputs	Number of channels:	7
	Max. output current:	2 Amp
	Output load 24Vdc:	resistive or inductive with spark suppression diode
	Channel fuses:	5 x 20 mm (0.20 x 0.79 in) 2 Amp (slow-acting)
	Output supply voltage:	24Vdc +/- 20%
	Maximum load resistance:	2200Ω
	Leakage current to load:	approx. 1.1mA at 24V
	No load output voltage: • output OFF • output ON	 90% of output supply voltage 100% of output supply voltage
	Short-circuit detection load threshold:	$200\Omega < R_{Th} < 400\Omega$

Relay contact	Max switched power:	150 Watts
	Expected life: • electrical • mechanical	 100,000 switch operations 30,000,000 switch operations
Power consumption	Field power	
	24Vdc:	< 9mA (all channels off)
	24 Vdc (consumed via SDO-0824 and SDI-1624 IO)	
	Relais + channel 8:	approx. 200mA (out of TSDO-0824) max. 250mA at V_{max}
	Read back circuit:	< 110mA (single SDI-1624) or < 210mA (redundant SDI-1624) max. 275mA at V_{max}
Physical	Module dimensions:	240 x 109 x 80 mm (L x W x H) 9.45 x 4.29 x 3.15 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	241mm (9.49 inch)
Termination	Channel screw terminals: • max wire diameter • strip length • tightening torque	 2.5 mm^2 (AWG 14) 7 mm (0.28 in) 0.5 Nm (0.37 ft-lb)
	Power connector • make and type: • strip length: • Connectable conductors:	2 pole header with keying Weidmuller: BVZ 7.62/02F SW (conn.) Weidmuller: KO BV/SV7.62 (keys) 8 mm (0.28 in) 0.5-6mm^2 (AWG 20-AWG 10)

1 FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TDOL-0724P

Line-monitored relay contact digital output (7 channels, 24Vdc)

Description

The field termination assembly module TDOL-0724P is an interface to field loads that require 24Vdc line-monitored digital outputs.

The TDOL-0724P has 7 (2A) fused relay contact outputs that may be used for non-safety related resistive or inductive field loads upto 50Watt.

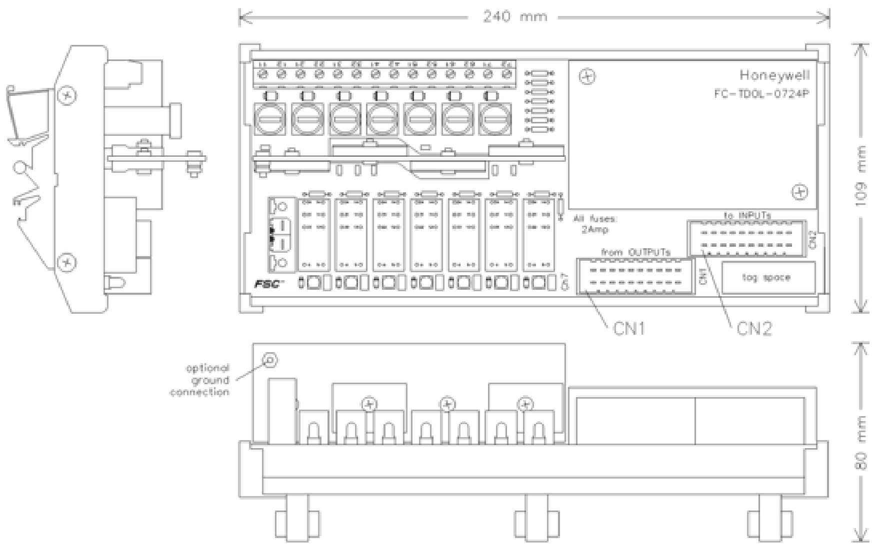
Per channel dedicated line monitoring circuits support both short-circuit and lead-breakage detection while the output is either **energized** or **de-energized**.

For these line-monitoring diagnostics the TDOL-0724P operates in combination with standard DI and DO modules of Safety Manager (configured as either redundant or non-redundant IO).

This overall Safety Manager hardware configuration comes with dedicated application software, loadable from the Safety Manager Function Library.

The TDOL-0724P has universal snap-in provisions for standard DIN EN rails, (7 pairs of) screw terminals for the field wiring and a (2-pole) power connector for the common supply connection.

Figure 359 Mechanical layout



Main functions and usage

The TDOL-0724P is connected to a (non-redundant or redundant) SDO-0824 output module and a (non-redundant or redundant) SDI-1624 input module via system interconnection cables (SICs).

- A fused relay contact connects the common supply voltage (24Vdc) with a field terminal. The 7 output relays are controlled by channel 1 to 7 of the SDO-0824. A LED indicates the state of its output relay.
- Each output channel has line-monitoring circuits. The line-monitoring circuits are controlled by channel 8 of the SDO-0824 and are wired to channel 1 to 15 of the SDI-1624.
- Special application logic drives the outputs and processes the line monitoring results.

Schematic diagram of a channel

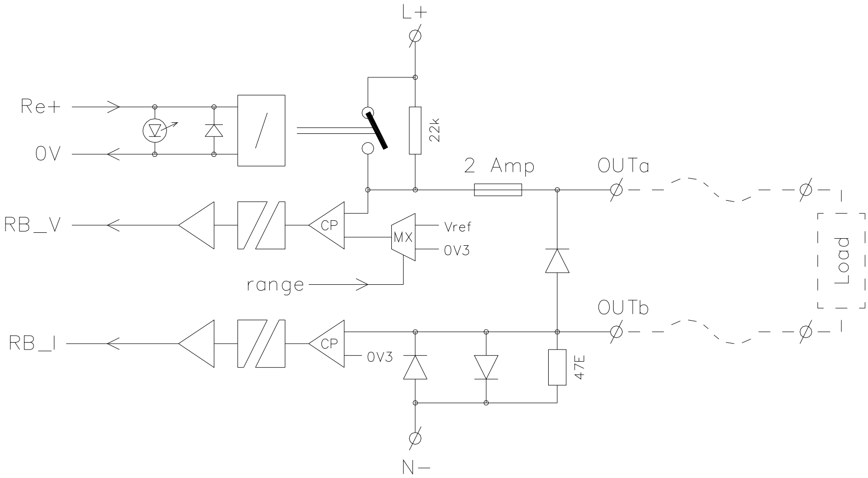
Figure 360 on page 595 shows a schematic diagram of a channel. Each channel consists of:

- one relay with indicator LED
- a fused (2 AT) contact output
- a current injection resistor (22kΩ)
- a voltage readback circuit (with two ranges)
- a current sense connection and a current readback circuit

The common part of the module (see Figure 365 on page 600) consists of:

- a DC/DC converter to supply the voltage- and current- readback circuits.
- a supply voltage monitor (generating the `RB_PWR` signal)
- an opto-coupler to transfer the range switch command from the Controller 24Vdc side to the field 24Vdc side.

Figure 360 Schematic diagram of a channel



Lead breakage detection.

Lead breakage in a channel is detected if:

- The channel is `off` and the 22kΩ channel resistor (see Figure 360 on page 595) is able to pull the output voltage readback over the V_{ref} threshold.
- The channel is `on` and the current readback (RB_I) threshold (approx. `0.3V`) is *not* met.

Note:

A blown channel fuse will be indicated as lead breakage of that channel.

To prevent lead breakage indication on a spare channel, the `USED` input of that channel (an input of the channel application function block) must be `low`. For details see “Special application logic” on page 596.

Short circuit detection

Short circuit in a channel is detected if:

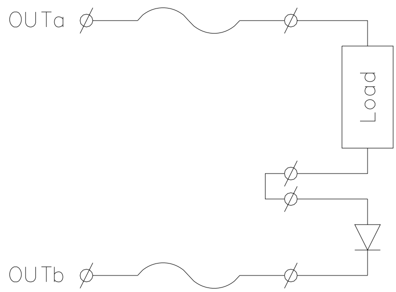
- The channel is `off` and the 22kΩ channel resistor (see Figure 360 on page 595) is not able to create a field voltage drop higher than the `low` threshold value (approx. `0.3V`).
- The channel is `on`. This will blow the channel fuse and will be indicated as lead breakage.

Field loads with a resistance below 400Ω

Field loads with a resistance below 400Ω may activate the short circuit detection.

To avoid this, an additional diode can be wired in series with the load as shown in Figure 361 on page 596. Behind this diode the short circuit detection is “blind”, so this diode should be placed as close to the load as possible.

Figure 361 Additional diode for loads < 400Ω



Note:

The additional diode for loads < 400Ω must be of type 1N4004 (or equivalent) at load currents up to 0.7Amp, or of type 1N5404 (or equivalent) for loads up to 2 Amp.

Special application logic

Special application logic is required to drive the outputs and monitor the on-board line monitoring electronics.

“Common function blocks” on page 596 and “Channel function blocks” on page 598 explain the function of this special application logic.

Note:

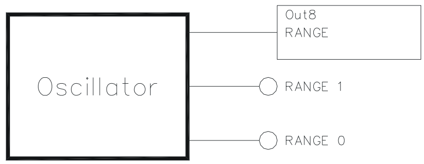
Special function blocks can be provided for in Safety Manager which can be modified to better suit the customers whishes.

Common function blocks

Figure 362 on page 597 and Figure 363 on page 597 show the schematics of the common function blocks required for the TDOL-0724P.

Oscillator function block

Figure 362 Example of the oscillator function block



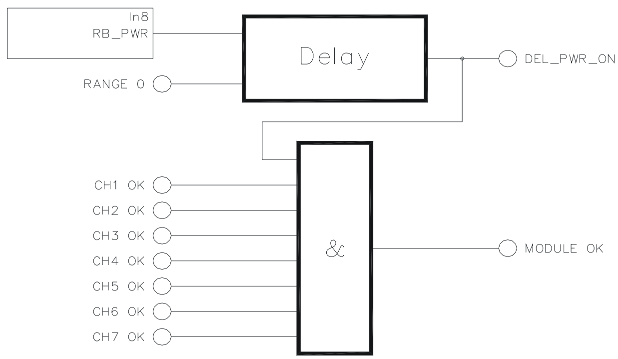
The oscillator function block may be global (one per series of TDOL-0724P FTAs in a Safety Manager).

The oscillator toggles the `RANGE` input of the voltage readback circuits on each TDOL-0724P and controls the latches in each channel function block.

This allows each channel function block to monitor the line for both energized *and* de-energized channels.

Delay and OK function block

Figure 363 Example of the delay and OK function block



The delay and OK function block is common per TDOL-0724P.

- The Delay logic monitors the presence of 24V on the field power terminals and provides (power-up) time to stabilize the line monitoring circuits.
- The AND-gate collects the `CHx OK` signals of the seven channels function blocks of the TDOL-0724P, as indicated in Figure 364 on page 598.

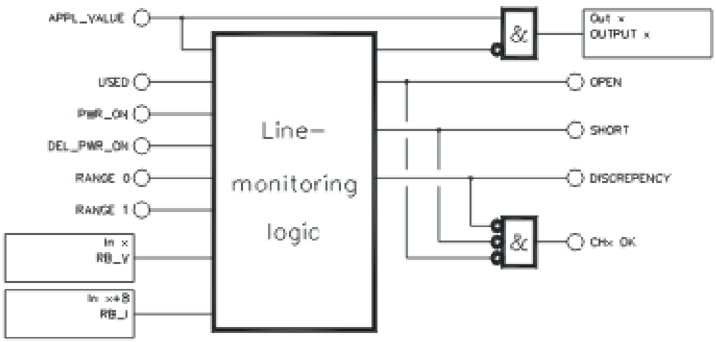
  If all channels are OK, the `MODULE OK` output is `high`.

Channel function blocks

Figure 364 on page 598 shows the schematics of the channel function blocks.

One channel function block is needed per channel of the TDOL-0724P FTA.

Figure 364 Example of a channel function block



A standard channel function block as shown in Figure 364 on page 598 has:

- an application value input `APPL_VALUE`
- a `USED` input to prevent lead breakage (`OPEN`) indications on unused channels.
- four inputs that must be linked to the common function blocks (for details see “Common function blocks” on page 596)
- one input for the voltage readback result `RB_V` of each channel (IN `1` thru `7`)
- one input for the current readback result `RB_I` of each channel (IN `9` thru `15`)
- one output for the output relay OUT of each channel (DO channel 1 thru 7)
- a `SHORT` output that indicates a short-circuit on the field wires
  (a `SHORT` detection also blocks the energization of the output relay)
- an `OPEN` output that indicated lead-breakage on the field wires (or output fuse blown)
- a `DISCREPENCY` output that indicates:
  - Field output is `on` while relay not energized or
  - Field output is `low`, while relay energized.
- a `CHx OK` output if no (line monitoring) errors are detected

Channel assignment:

When connected to the TDOL-0724P the IO channels of the SDO-0824 and the SDI-1624 are assigned as follows:

Field channel TDOL-0724P	Controlling outputs SDO-0824[1]	line monitoring inputs SDI-1624[2] RB_V	RB_I
Channel 1	Output 1	Input 1	Input 9
Channel 2	Output 2	Input 2	Input 10
Channel 3	Output 3	Input 3	Input 11
Channel 4	Output 4	Input 4	Input 12
Channel 5	Output 5	Input 5	Input 13
Channel 6	Output 6	Input 6	Input 14
Channel 7	Output 7	Input 7	Input 15

1 Channel 8 is assigned to the voltage range switcher (`RANGE`) in the common function block

2 Channel 8 is assigned to the 24V power monitor (`RB_PWR`)
Channel 16 is unused.

Applications

For correct operation the TDOL-0724P must be combined with:

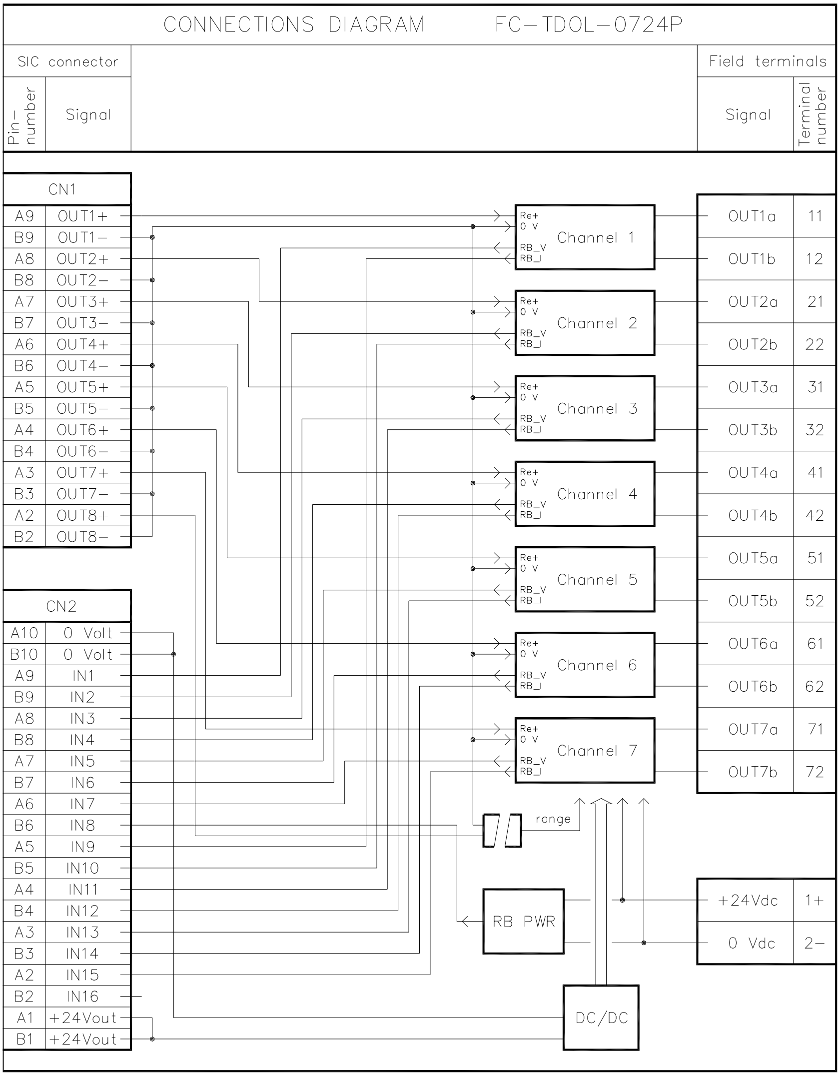
- a (redundant pair of) SDO-0824 module(s),
- a (redundant pair of) SDI-1624 module(s) and
- dedicated function blocks in the application.

For details on applications and connection options for the TDOL-0724P module, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TDOL-0724P module is as follows:

Figure 365 Connections diagram



SIC-connector CN1 (see Figure 359 on page 593 and Figure 365 on page 600) must be connected with the (redundant pair of) SDO-0824 module(s).

SIC-connector CN2 (see Figure 359 on page 593 and Figure 365 on page 600) must be connected with the (redundant) SDI-1624.

The TDOL-0724P has 7 pairs of terminals to connect the load.

External power

A 24 Vdc power distribution cable (see datasheet “PDC-MB24-y” on page 814 for details) can be used to connect the main busbar with the power connector on the TDOL-0724P module.

- When using other connection cables, make sure the wire size is adequate and the supplied Weidmuller BVZ 7.62HP/02/180F SN connector is used.

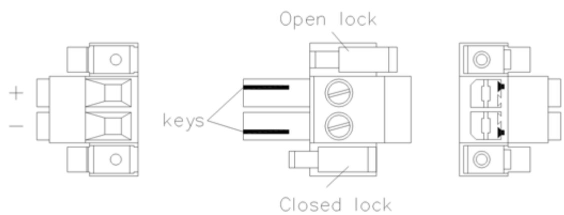
Note:

The 0 V connection of the external power is directly connected to the common 0 V of all output channels.

Figure 366 on page 601 shows the top, side & bottom view and the pin assignment of the power input connector.

- The pin marked **+** is pin 1: connected to +24Vdc busbar.
- The pin marked **-** is pin 2: connected to the 0Vdc busbar.

Figure 366 Power input connector (Weidmuller BVZ 7.62HP/02/180F SN) top, side and bottom view



The two (red) locking slides of the cable-connector in Figure 366 on page 601 keep the cable-connector locked when inserted into the power connector.

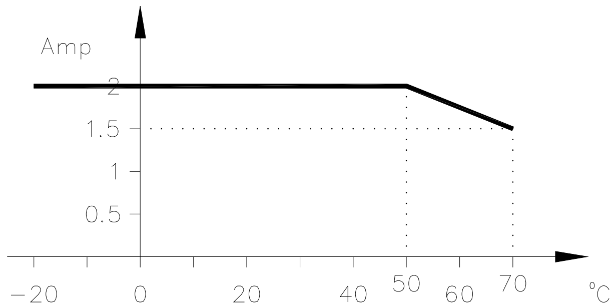
Grounding

Connect a ground wire to the (free) screw on the top left-side of the heatsink (see Figure 359 on page 593 for location) if grounding of metal parts is required.

Maximum output load

Figure 367 on page 602 shows the maximum channel load vs the ambient temperature.

Figure 367 Derating curve (channel load vs ambient temperature) for the TDOL-0724P



Technical data

The TDOL-0724P module has the following specifications:

General	Type numbers[1]:	FC-TDOL-0724P
	Approvals:	CE; TUV, UL, CSA pending
Outputs	Number of channels:	7
	Max. output current:	2 Amp
	Output load 24Vdc:	resistive or inductive with spark suppression diode
	Channel fuses:	5 x 20 mm (0.20 x 0.79 in) 2 Amp (slow-acting)
	Output supply voltage:	24Vdc +/- 20%
	Maximum load resistance:	2200Ω
	Leakage current to load:	approx. 1.1mA at 24V
	No load output voltage: • output OFF • output ON	 90% of output supply voltage 100% of output supply voltage
	Short-circuit detection load threshold:	$200\Omega < R_{Th} < 400\Omega$

Relay contact	Max switched power:	150 Watts
	Expected life: • electrical • mechanical	 100,000 switch operations 30,000,000 switch operations
Power consumption	Field power	
	24Vdc:	< 9mA (all channels off)
	24 Vdc (consumed via SDO-0824 and SDI-1624 IO)	
	Relais + channel 8:	approx. 200mA (out of TSDO-0824) max. 250mA at V_{max}
	Read back circuit:	< 110mA (single SDI-1624) or < 210mA (redundant SDI-1624) max. 275mA at V_{max}
Physical	Module dimensions:	240 x 109 x 80 mm (L x W x H) 9.45 x 4.29 x 3.15 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	241mm (9.49 inch)
Termination	Channel screw terminals: • max wire diameter • strip length • tightening torque	 2.5 mm^2 (AWG 14) 7 mm (0.28 in) 0.5 Nm (0.37 ft-lb)
	Power connector • make and type: • strip length: • Connectable conductors:	2 pole header with keying Weidmuller: BVZ 7.62HP/02/180F SN (conn.) Weidmuller: BV/SV7.62HP KO (keys) 8 mm (0.28 in) 0.5-6mm^2 (AWG 20-AWG 10)

1 FC-type modules are conformal coated modules.

TDOL-0724U

Line-monitored relay contact digital output (7 channels, 24Vdc, RUSIO)

Description

The field termination assembly module TDOL-0724U is an interface to field loads that require 24Vdc line-monitored digital outputs.

The TDOL-0724U has 7 (2A) fused relay contact outputs that may be used for non-safety related resistive or inductive field loads upto 50Watt.

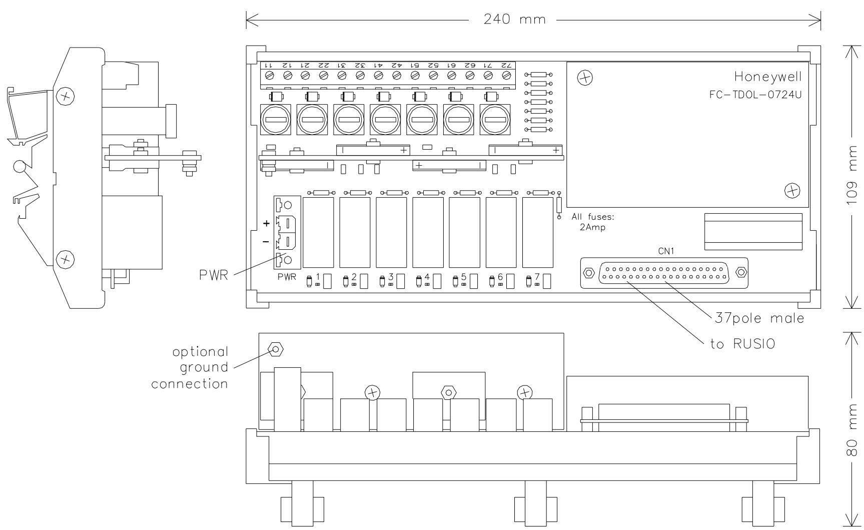
Per channel dedicated line monitoring circuits support both short-circuit and lead-breakage detection while the output is either **energized** or **de-energized**.

For these line-monitoring diagnostics the TDOL-0724U operates in combination with 16 RUSIO channels (configured as either redundant or non-redundant IO).

This overall Safety Manager hardware configuration comes with dedicated application software, loadable from the Safety Manager Function Library.

The TDOL-0724U has universal snap-in provisions for standard DIN EN rails, (7 pairs of) screw terminals for the field wiring and a (2-pole) power connector (PWR) for the common supply connection.

Figure 368 Mechanical layout



Main functions and usage

The TDOL-0724U is connected to a (non-redundant or redundant) IOTA via a CA-HWC300-AIO-DIO-xxM cable.

- A fused relay contact connects the common field supply voltage (24Vdc) with the field terminals. The 7 output relays are controlled by DO1-7 or DO17-23 of the RUSIO-3224. A led indicates the state of its output relay.
- Each output channel has a line-monitoring circuit. The line-monitoring circuit is powered by RUSIO channel 8 or 24. The (4-20mA) line-monitoring outputs are connected with analog inputs AI9-15 or AI25-31 of the RUSIO-3224.
- Presence of a proper common field supply voltage is monitored by a PWR_ON monitor that is connected with Line-Monitored Digital Input 16 or 32 of the RUSIO-3224.
- Special application logic drives the outputs and processes the line monitoring result.

Line-monitoring circuit output

The line-monitoring output has 5 states:

- 5 mA indicating a lead-breakage in the field wires
- 7 mA indicating an open contact output situation on the field wires
- 9 mA indicating a closed contact output situation on the field wires
- 11 mA indicating a short-circuit situation on the field wires
- other; indicating an error (e.g. loss of power)

Schematic diagram of a channel

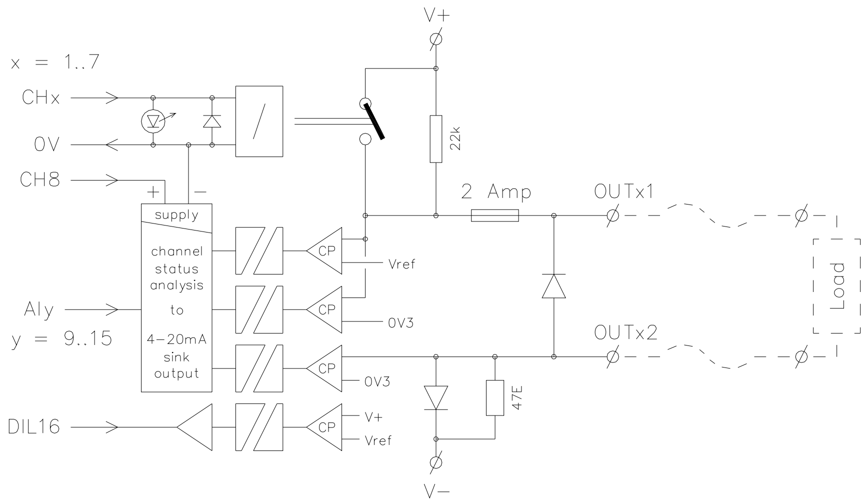
Figure 369 on page 606 shows a schematic diagram of a channel. Each channel consists of:

- one relay with indicator LED
- a fused (2 AT) contact output
- a current injection resistor (22kΩ)
- a voltage readback circuit
- a current sense connection and a current readback circuit

The common part of the module (see Figure 373 on page 611) consists of:

- a DC/DC converter to supply the voltage- and current- readback circuits
- a supply voltage monitor (generating the `RB_PWR` signal)

Figure 369 Schematic diagram of a channel



Lead breakage detection

Lead breakage in a channel is detected if:

- The channel is `off` and the 22kΩ channel resistor (see Figure 369 on page 606) is able to pull the output voltage readback over the V_{ref} threshold.
- The channel is `on` and the current readback (RB_I) threshold (approx. `0.3V`) is *not* met.

Note:

A blown channel fuse will be indicated as lead breakage of that channel.

Short circuit detection

Short circuit in a channel is detected if:

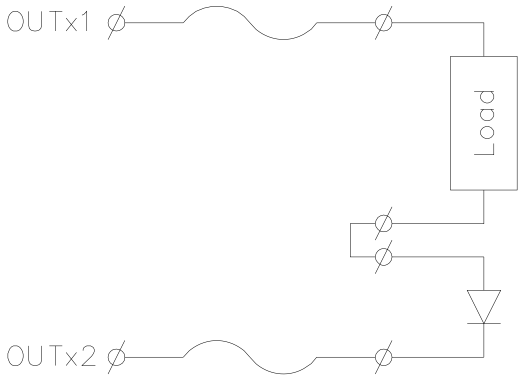
- The channel is `off` and the 22kΩ channel resistor (see Figure 369 on page 606) is not able to create a field voltage drop higher than the `low` threshold value (approx. `0.3V`).
- The channel is `on`. This will blow the channel fuse and will be indicated as lead breakage.

Field loads with a resistance below 400Ω

Field loads with a resistance below 400Ω may activate the short circuit detection.

To avoid this, an additional diode can be wired in series with the load as shown in Figure 370 on page 607. Behind this diode the short circuit detection is “blind”, so this diode should be placed as close to the load as possible.

Figure 370 Additional diode for loads < 400Ω



Note:

The additional diode for loads < 400Ω must be of type 1N4004 (or equivalent) at load currents up to 0.7Amp, or of type 1N5404 (or equivalent) for loads up to 2 Amp.

Special application logic

Special application logic is required to drive the outputs and monitor the on-board line monitoring electronics.

“Common function blocks” on page 608 and “Channel function blocks” on page 609 explain the function of this special application logic.

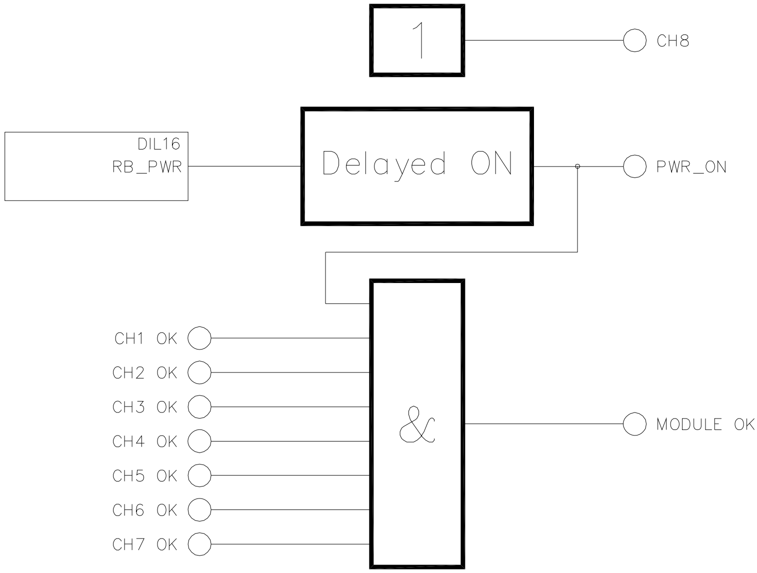
Note:

Special function blocks can be provided for in Safety Manager which can be modified to better suit the customers whishes.

Common function blocks

Figure 371 on page 608 shows the schematic of the common function block required for the TDOL-0724U.

Figure 371 Example of the delay and OK function block



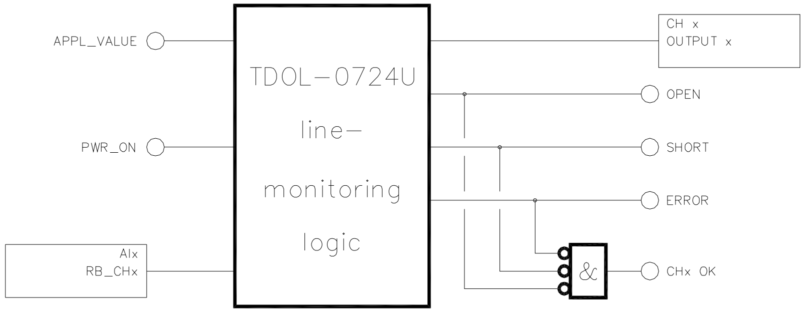
The delay and OK function block is common per TDOL-0724U.

- The Delay logic monitors the presence of 24V on the field power terminals and provides (power-up) time to stabilize the line monitoring circuits.
- The AND-gate collects the `CHx OK` signals of the seven channels function blocks of the TDOL-0724U, as indicated in Figure 372 on page 609.
  If all channels are OK, the `MODULE OK` output is `high`.
- Connect a “1” with SPARE or unused channels of the AND-gate.

Channel function blocks

Figure 372 on page 609 shows the schematics of the channel function blocks. One channel function block is needed per channel of the TDOL-0724U FTA.

Figure 372 Example of a channel function block



A standard channel function block as shown in Figure 372 on page 609 has:

- an application value input APPL_VALUE
- a PWR_ON input that must be linked to the common function block (for details see "Common function blocks" on page 608)
- one input for the voltage readback result RB_CHx of each channel (AI 9 thru 15)
- one output for the output relay OUT of each channel (DO 1 thru 7)
- a SHORT output that indicates a short-circuit on the field wires (a SHORT detection also blocks the energization of the output relay)
- an OPEN output that indicated lead-breakage on the field wires (or output fuse blown)
- an ERROR output that indicates:
  - Field output is on while relay not energized or
  - Field output is low, while relay energized.
- a CHx OK output if no (line monitoring) errors are detected

Channel assignment:

When connected to the TDOL-0724U the IO channels of the RUSIO-3224 are assigned as follows:

Field channel	RUSIO-3224	
TDOL-0724U	channel	type
CH 1	DO1 or DO17	DO
CH 2	DO2 or DO18	DO
CH 3	DO3 or DO19	DO
CH 4	DO4 or DO20	DO
CH 5	DO5 or DO21	DO
CH 6	DO6 or DO22	DO
CH 7	DO7 or DO23	DO
CH 8	DO8 or DO24	DO
RB_CH 1	AI9 or AI25	4-20mA
RB_CH 2	AI10 or AI26	4-20mA
RB_CH 3	AI11 or AI27	4-20mA
RB_CH 4	AI12 or AI28	4-20mA
RB_CH 5	AI13 or AI29	4-20mA
RB_CH 6	AI14 or AI30	4-20mA
RB_CH 7	AI15 or AI31	4-20mA
RB_PWR	DIL16 or DIL32	DIL

Applications

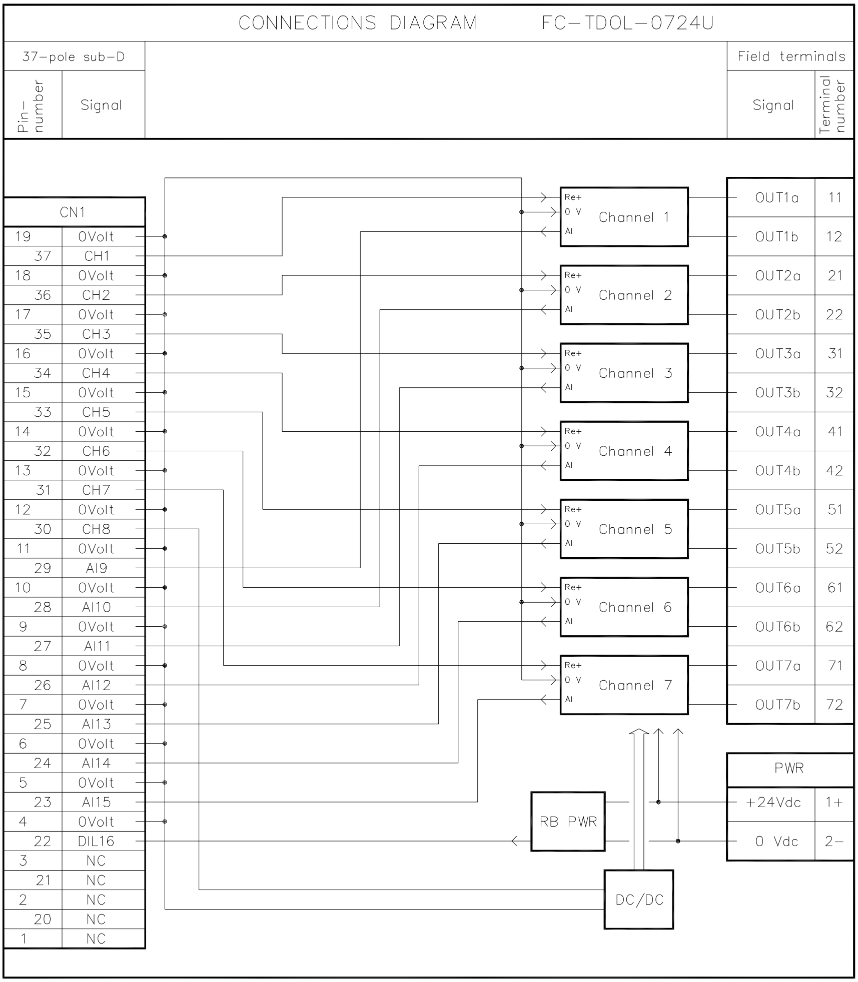
For correct operation, the TDOL-0724U must be combined with 16 channels of a (redundant set of) universal IO module(s).
A cable[1] of suitable lenght is used to connect the TDOL-0724U with an (redundant or non-redundant) IOTA.

1. Honeywell type numbers that are available: 4213509 up to and including 4212516.
These type numbers correspond with part number
CA-HWC300-AIO-DIO-xxM (Pepperl & Fuchs), where ‘xx’
stands for the length in meters.
For details see the manufacturer’s data sheet (Pepperl & Fuchs).

Connections

The connections diagram of the TDOL-0724U module is as follows:

Figure 373 Connections diagram



The following connections apply:

- connector CN1 (37 pole Dsub male) must be connected with the IOTA
- 24Vdc (field-)power must be connected on connector PWR

The TDOL-0724U has 7 pairs of terminals to connect the load.

External power

A 24 Vdc power distribution cable (see datasheet “PDC-MB24-y” on page 814 for details) can be used to connect the main busbar with the power connector on the TDOL-0724U module.

- When using other connection cables, make sure the wire size is adequate and the supplied Weidmuller BVZ 7.62HP/02/180F SN connector is used.

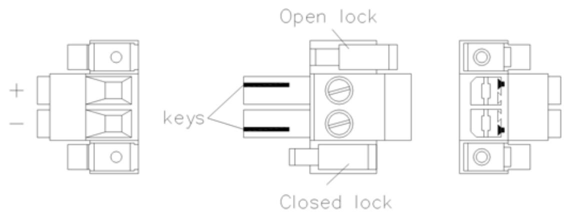
Note:

The 0 V connection of the external power is directly connected to the common 0 V of all output channels.

Figure 374 on page 612 shows the top, side & bottom view and the pin assignment of the power input connector.

- The pin marked **+** is pin 1: connected to +24Vdc busbar.
- The pin marked **-** is pin 2: connected to the 0Vdc busbar.

Figure 374 Power input connector (Weidmuller BVZ 7.62HP/02/180F SN) top, side and bottom view



The two (red) locking slides of the cable-connector in Figure 374 on page 612 keep the cable-connector locked when inserted into the power connector.

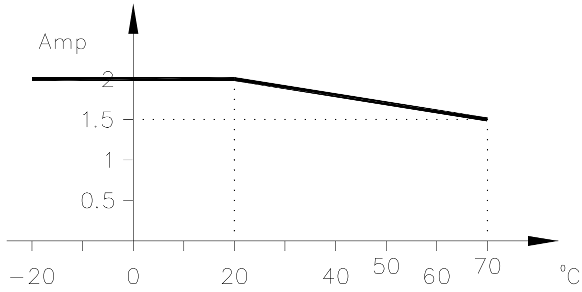
Grounding

Connect a ground wire to the (free) screw on the top left-side of the heatsink (see Figure 368 on page 604 for location) if grounding of metal parts is required.

Maximum output load

Figure 375 on page 613 shows the maximum channel load vs the ambient temperature.

Figure 375 Derating curve (channel load vs ambient temperature) for the TDOL-0724U



Technical data

The TDOL-0724U module has the following specifications:

General	Type numbers[1]:	FC-TDOL-0724U
	Approvals:	CE; TUV, UL, CSA pending
Outputs	Number of channels:	7
	Max. output current:	2 Amp
	Output load 24Vdc:	resistive or inductive with spark suppression diode
	Channel fuses:	5 x 20 mm (0.20 x 0.79 in) 2 Amp (slow-acting)
	Output supply voltage:	24Vdc +/- 20%
	Module voltage drop:	max. 1 Volt (at 2 Amp)
	Minimum required load:	2200Ω
	Leakage current to load:	max. 1.1mA at 24V
	No load output voltage: • output OFF • output ON	 95% of output supply voltage 100% of output supply voltage
	Short-circuit detection threshold on field wires:	$200\Omega < R_{Th} < 400\Omega$

Return signals	4-20mA channels: • lead breakage • open contact • closed contact • short circuit	 5 mA +/- 1 mA 7 mA +/- 1 mA 9 mA +/- 1 mA 11 mA +/- 1 mA
	DIL channel: • Field voltage low • Field voltage OK	 15 kΩ +/- 2% 5 kΩ +/- 2%
Relay contact	Max switched power:	150 Watts
	Expected life: • electrical • mechanical	 100,000 switch operations 30,000,000 switch operations
Power consumption	PWR connector:	<10 mA (internal) + Field load
	CN1 connector:	max. 350 mA at 24Vdc
Physical	Module dimensions:	240 x 109 x 80 mm (L x W x H) 9.45 x 4.29 x 3.15 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	241mm (9.49 inch)
Termination	Screw terminals: • max wire diameter • strip length • tightening torque	 2.5 mm^2 (AWG 14) 7 mm (0.28 in) 0.5 Nm (0.37 ft-lb)
	Power connector: • make and type: • strip length: • Connectable conductors:	2 pole header with keying Weidmuller: BVZ 7.62HP/02/180F SN BK (conn.) Weidmuller: BV/SV7.62HP KO (keys) 8 mm (0.28 in) 0.5-6mm^2 (AWG 20-AWG 10)
	CN1 connector:	37 pole Dsub female (cable side)

1 FC-type modules are conformal coated modules.

TDOL-07120

Line-monitored relay contact digital output (7 channels, 120Vac/120Vdc)

Description

The field termination assembly module TDOL-07120 is an interface to field loads that require 120Vac or 120Vdc line-monitored digital outputs.

The TDOL-07120 has 7 (2A) fused relay contact outputs that may be used for non-safety related resistive or inductive field loads up to 240VA or 150Watt.

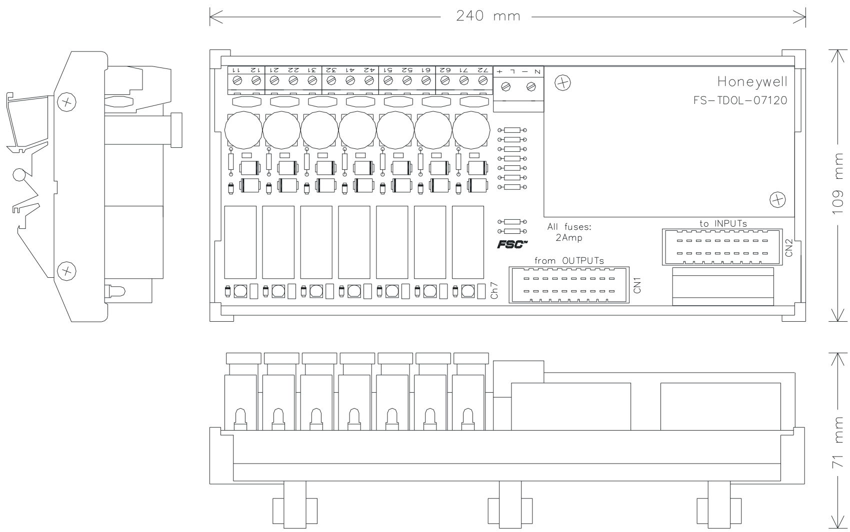
Per channel dedicated line monitoring circuits support both short-circuit and lead-breakage detection while the output is either **energized** or **de-energized**.

For these line-monitoring diagnostics the TDOL-07120 operates in combination with standard DI and DO modules of Safety Manager (configured as either redundant or non-redundant IO).

This overall Safety Manager hardware configuration comes with dedicated application software, loadable from the Safety Manager Function Library.

The TDOL-07120 has universal snap-in provisions for standard DIN EN rails, (7 pairs of) screw terminals for the field wiring and (a pair of) screw terminals for the common supply connection.

Figure 376 Mechanical layout



Main functions and usage

The TDOL-07120 is connected to a (non-redundant or redundant) SDO-0824 output module and a (non-redundant or redundant) SDI-1624 input module via system interconnection cables (SICs).

- A fused relay contact connects the common supply voltage (120Vac or 120Vdc) with a field terminal. The 7 output relays are controlled by channel 1 to 7 of the SDO-0824. A LED indicates the state of its output relay.
- Each output channel has line-monitoring circuits. The line-monitoring circuits are controlled by channel 8 of the SDO-0824 and are wired to channel 1 to 15 of the SDI-1624.
- Special application logic drives the outputs and processes the line monitoring results.

Schematic diagram of a channel

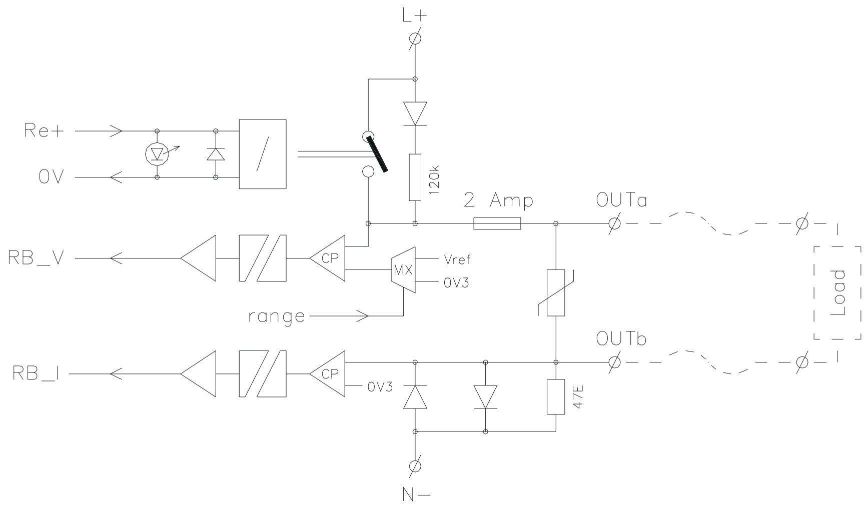
Figure 377 on page 617 shows a schematic diagram of a channel. Each channel consists of:

- one relay with indicator LED
- a fused (2 AT) contact output
- a current injection resistor (120kΩ)
- a voltage readback circuit (with two ranges)
- a current sense connection and a current readback circuit

The common part of the module (see Figure 383 on page 623) consists of:

- a DC/DC converter to supply the voltage- and current- readback circuits.
- a supply voltage monitor (generating the `RB_PWR` signal)
- an opto-coupler to transfer the range switch command from the 24V side to the 120V side.

Figure 377 Schematic diagram of a channel



Lead breakage detection.

Lead breakage in a channel is detected if:

- The channel is `off` and the 120kΩ channel resistor (see Figure 377 on page 617) is able to pull the output voltage readback over the V_{ref} threshold.
- The channel is `on` and the current readback (RB_I) threshold (approx. `0.3V`) is *not* met.

Note:

A blown channel fuse will be indicated as lead breakage of that channel.

To prevent lead breakage indication on a spare channel, the `USED` input of that channel (an input of the channel application function block) must be `low`. For details see “Special application logic” on page 619.

Short circuit detection

Short circuit in a channel is detected if:

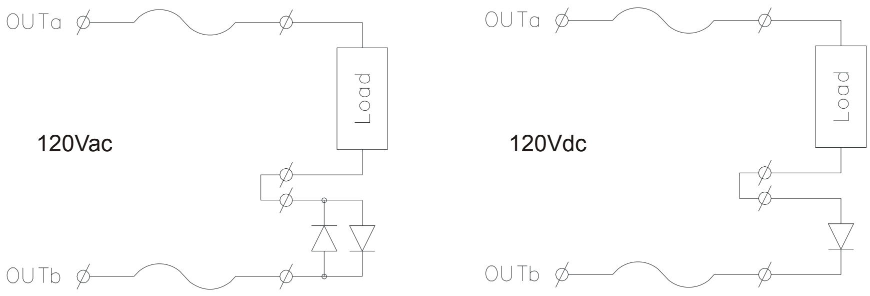
- The channel is `off` and the 120kΩ channel resistor (see Figure 377 on page 617) is not able to create a field voltage drop higher than the `low` threshold value (approx. `0.3V`).
- The channel is `on`. This will blow the channel fuse and will be indicated as lead breakage.

Field loads with a (DC-)resistance below 400Ω

Field loads with a (DC-)resistance below 400Ω may activate the short circuit detection.

To avoid this, an additional (pair of) diode(s) can be wired in series with the load as shown in Figure 378 on page 618. As these diodes prevent loads <400Ω to activate the short circuit detection they should be placed as close as possible to the load.

Figure 378 Additional diodes for loads < 400Ω



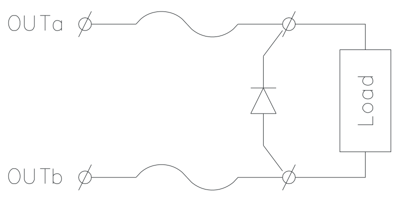
Note:

The additional diode(s) for loads < 400Ω must be of type 1N4004 (or equivalent) at load currents up to 0.7Amp, or of type 1N5404 (or equivalent) for loads up to 2 Amp.

Inductive loads on 120Vdc

Inductive loads on 120Vdc require a spark suppression diode of type 1N4004 (or equivalent) as shown in Figure 379 on page 618.

Figure 379 Spark suppression diode for inductive loads on 120Vdc



Special application logic

Special application logic is required to drive the outputs and monitor the on-board line monitoring electronics.

"Common function blocks" on page 619 and "Channel function blocks" on page 620 explain the function of this special application logic.

Note:

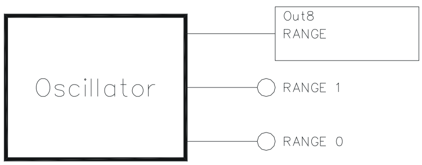
Special function blocks can be provided for in Safety Manager which can be modified to better suit the customers whishes.

Common function blocks

Figure 380 on page 619 and Figure 381 on page 620 show the schematics of the common function blocks required for the TDOL-07120.

Oscillator function block

Figure 380 Example of the oscillator function block



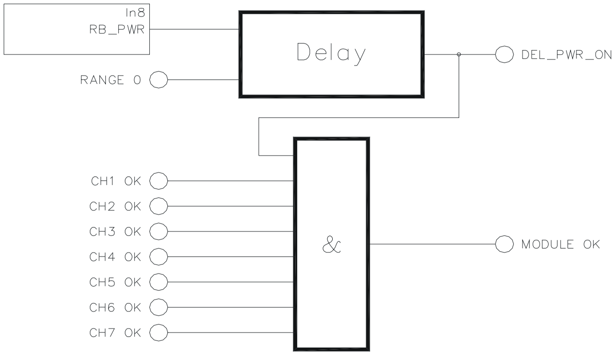
The oscillator function block may be global (one per series of TDOL-07120 FTAs in a Safety Manager).

The oscillator toggles the `RANGE` input of the voltage readback circuits on each TDOL-07120 and controls the latches in each channel function block.

This allows each channel function block to monitor the line for both energized *and* de-energized channels.

Delay and OK function block

Figure 381 Example of the delay and OK function block



The delay and OK function block is common per TDOL-07120.

- The Delay logic monitors the presence of 120V on the field power terminals and provides (power-up) time to stabilize the line monitoring circuits.
- The AND-gate collects the `CHx OK` signals of the seven channels function blocks of the TDOL-07120, as indicated in Figure 382 on page 620.

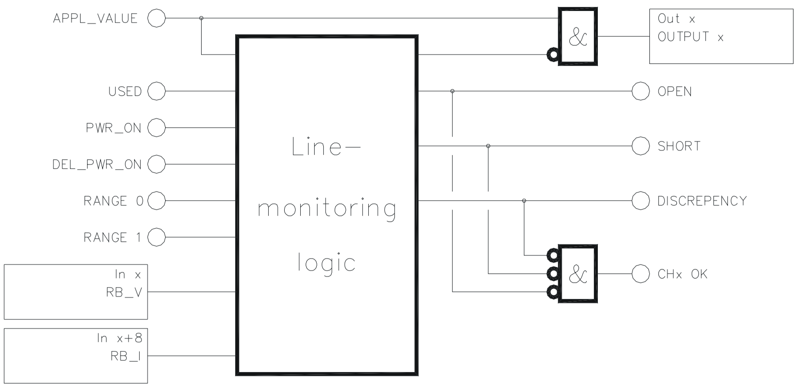
  If all channels are OK, the `MODULE OK` output is `high`.

Channel function blocks

Figure 382 on page 620 shows the schematics of the channel function blocks.

One channel function block is needed per channel of the TDOL-07120 FTA.

Figure 382 Example of a channel function block



A standard channel function block as shown in Figure 382 on page 620 has:

- an application value input APPL_VALUE
- a USED input to prevent lead breakage (OPEN) indications on unused channels.
- four inputs that must be linked to the common function blocks (for details see "Common function blocks" on page 619)
- one input for the voltage readback result RB_V of each channel (IN 1 thru 7)
- one input for the current readback result RB_I of each channel (IN 9 thru 15)
- one output for the output relay OUT of each channel (DO channel 1 thru 7)
- a SHORT output that indicates a short-circuit on the field wires
  (a SHORT detection also blocks the energization of the output relay)
- an OPEN output that indicated lead-breakage on the field wires (or output fuse blown)
- a DISCREPENCY output that indicates:
  - Field output is on while relay not energized or
  - Field output is low, while relay energized.
- a CHx OK output if no (line monitoring) errors are detected

Channel assignment:

When connected to the TDOL-07120 the IO channels of the SDO-0824 and the SDI-1624 are assigned as follows:

Field channel TDOL-07120	Controlling outputs SDO-0824[1]	line monitoring inputs SDI-1624[2]	
		RB_V	RB_I
Channel 1	Output 1	Input 1	Input 9
Channel 2	Output 2	Input 2	Input 10
Channel 3	Output 3	Input 3	Input 11
Channel 4	Output 4	Input 4	Input 12
Channel 5	Output 5	Input 5	Input 13
Channel 6	Output 6	Input 6	Input 14
Channel 7	Output 7	Input 7	Input 15

1 Channel 8 is assigned to the voltage range switcher (`RANGE`) in the common function block

2 Channel 8 is assigned to the 120V power monitor (`RB_PWR)`
Channel 16 is unused.

Applications

For correct operation the TDOL-07120 must be combined with:

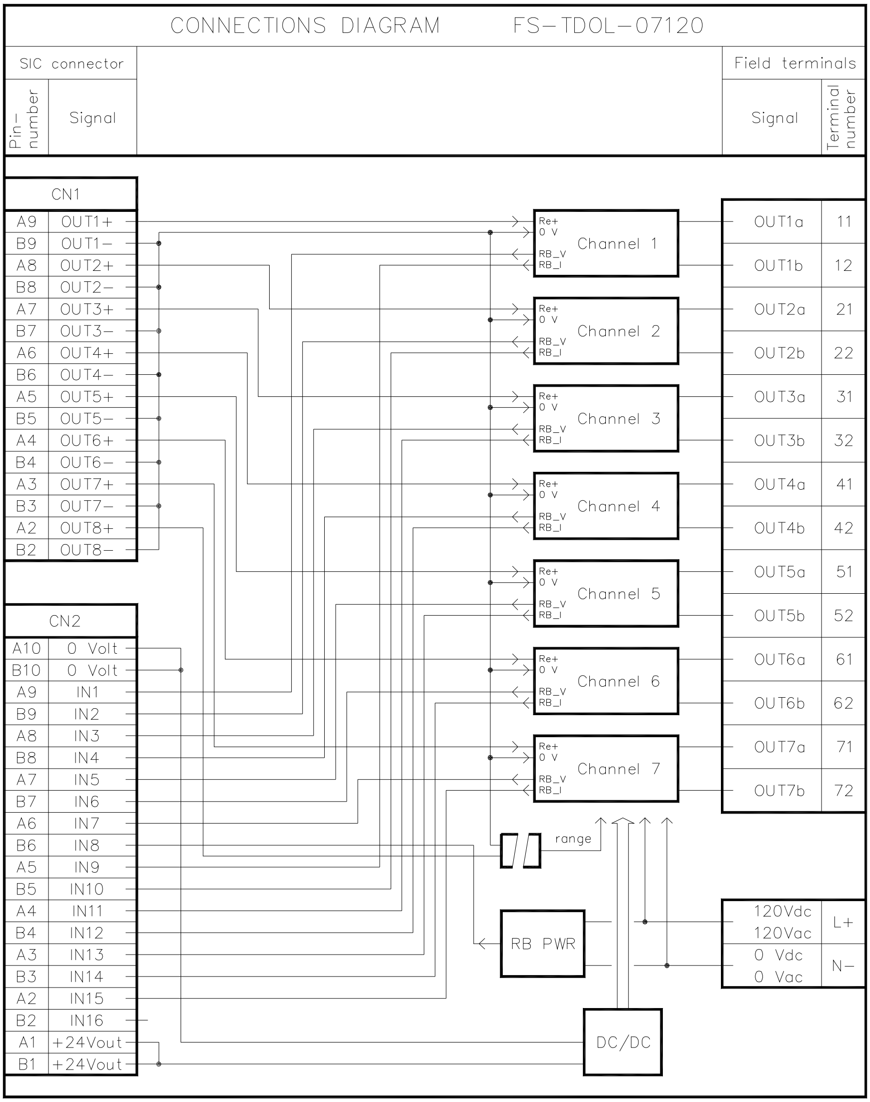
- a (redundant pair of) SDO-0824 module(s),
- a (redundant pair of) SDI-1624 module(s) and
- dedicated function blocks in the application.

For details on applications and connection options for the TDOL-07120 module, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TDOL-07120 module is as follows:

Figure 383 Connections diagram



SIC-connector CN1 (see Figure 376 on page 615 and Figure 383 on page 623) must be connected with the (redundant pair of) SDO-0824 module(s).

SIC-connector CN2 (see Figure 376 on page 615 and Figure 383 on page 623) must be connected with the (redundant) SDI-1624.

The TDOL-7120 has 7 pairs of terminals to connect the load.

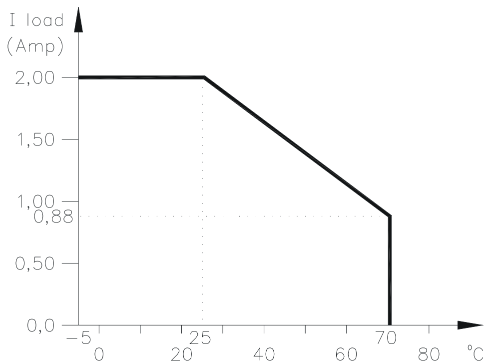
External power must be connected to the TDOL-07120 via the power screw terminal pair marked `L+` and `N-`.

- 120Vac(line) or +120Vdc must be connected with `L+`.
- 0Vac (neutral) or 0Vdc (-) must be connected with `N-`.

Maximum AC output load

Figure 384 on page 624 shows the maximum AC channel load vs. the ambient temperature.

Figure 384 Derating curve (AC channel load vs. ambient temperature) for the TDOL-07120



Technical data

The TDOL-07120 module has the following specifications:

General	Type numbers[1 2]:	FS-TDOL-07120 V1.1
		FC-TDOL-07120 CCV1.1
	Approvals:	CE, UL, CSA; TUV pending
Outputs	Number of channels:	7
	Max. output current:	2 Amp (at 120Vac)[3] 0.28 Amp at 120Vdc (UL limit) 0.5 Amp at 120Vdc (relay limit)
	Output load 120Vdc:	resistive or inductive with spark suppression diode
	Channel fuses:	5 x 20 mm (0.20 x 0.79 in) 2 Amp (slow-acting)
	Output supply voltage:	120VAc or 120Vdc +/- 20%
	Minimum required field load:	1 Watt
	Leakage current to load:	max. 1mA at 120V
	No load output voltage: • output OFF • output ON	 35..130 Vdc with AC output supply or 90% of DC output supply voltage 100% of output supply voltage (AC or DC)
	Short-circuit detection load threshold:	$200\Omega < R_{Th} < 400\Omega$
	Max. load capacitance:	1uF
Relay contact	Max switched power:	1250 VA / 60 Watts
	Expected life: • electrical • mechanical	 100,000 switch operations 30,000,000 switch operations
Power consumption	Field power	
	120Vac/Vdc:	< 8mA (all channels off)
	24 Vdc (consumed via SDO-0824 and SDI-1624 IO)	
	Relays + channel 8:	approx. 200mA (out of TSDO-0824) max. 250mA at V_{max}
	Read back circuit:	< 110mA (single SDI-1624) or < 210mA (redundant SDI-1624) max. 275mA at V_{max}

Physical	Module dimensions:	240 x 109 x 71 mm (L x W x H) 9.45 x 4.29 x 2.80 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	241mm (9.49 inch)
Termination	Channel screw terminals: • max wire diameter • strip length • tightening torque	 2.5 mm2 (AWG 14) 7 mm (0.28 in) 0.5 Nm (0.37 ft-lb)
	Power screw terminals: • max wire diameter • strip length • tightening torque	 16 mm2 (AWG 8) 7 mm (0.28 in) 1.2 Nm (0.88 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

2 Modules with suffix code V1.1 or CCV1.1 and higher have an improved design. There are no functional changes.

3 The AC load current is limited to 0.88 Amp at 70°C, for details see Figure 384 on page 624.

TSDO-0424

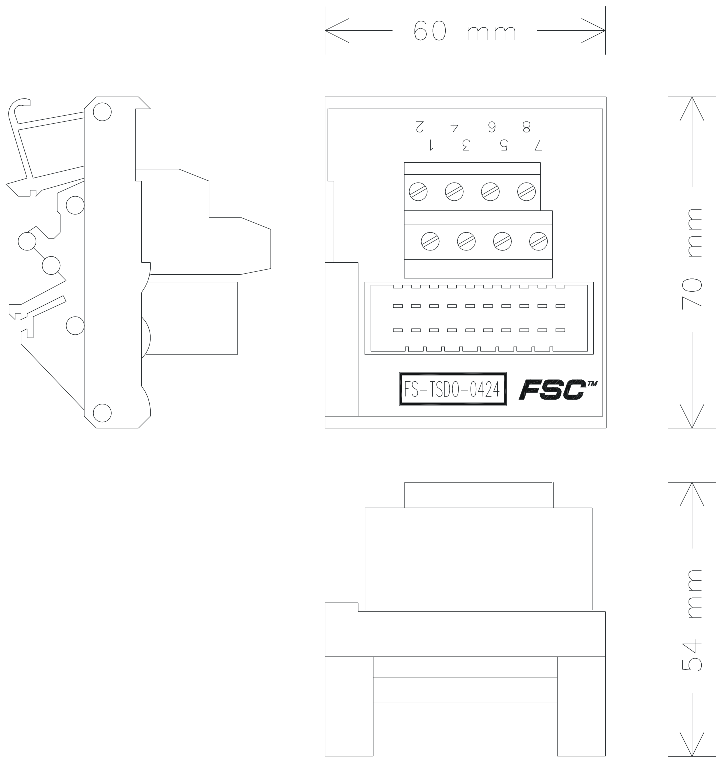
Safe digital output FTA (24 Vdc, 4 channels)

Description

The field termination assembly module TSDO-0424 is the interface between the system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). The four channels of a (redundant pair of) SDO-0424 module(s) can be connected to the TSDO-0424 module via the system interconnection cable SICC-0001/Lx.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 385 Mechanical layout



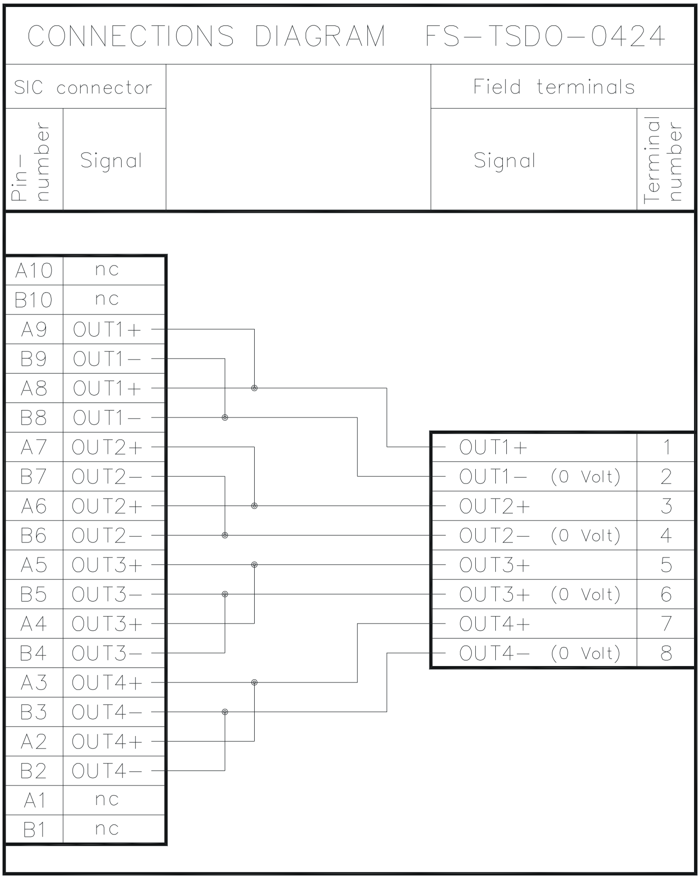
Applications

For details on applications and connection options for the TSDO-0424 module, see section “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSDO-0424 module:

Figure 386 Connections diagram



Technical data

The TSDO-0424 module has the following specifications:

General	Type numbers[1] :	FS-TSDO-0424
		FC-TSDO-0424
	Approvals:	CE, UL, TUV, CSA
Power	Number of channels:	4
	Maximum voltage:	36 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum continuous current per channel:	4 A
	Actual maximum current defined by connected output module	
Physical	Module dimensions:	60 × 70 × 54 mm (L × W × H) 2.36 × 2.76 × 2.13 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	61 mm (2.40 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TSDO-04UNI

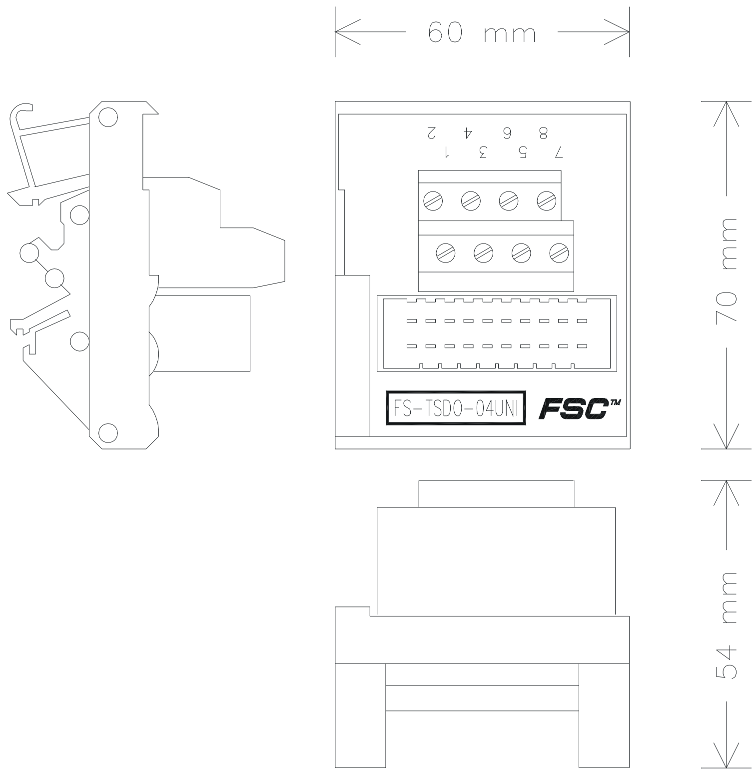
Safe digital output FTA (24/48/110 Vdc, 4 channels)

Description

Field termination assembly module TSDO-04UNI is the interface between system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). The four channels of a (redundant pair of) SDO-04x module(s) or SDOL-04x module(s) can be connected to the TSDO-04UNI module via system interconnection cable SICC-0001/Lx.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 387 Mechanical layout



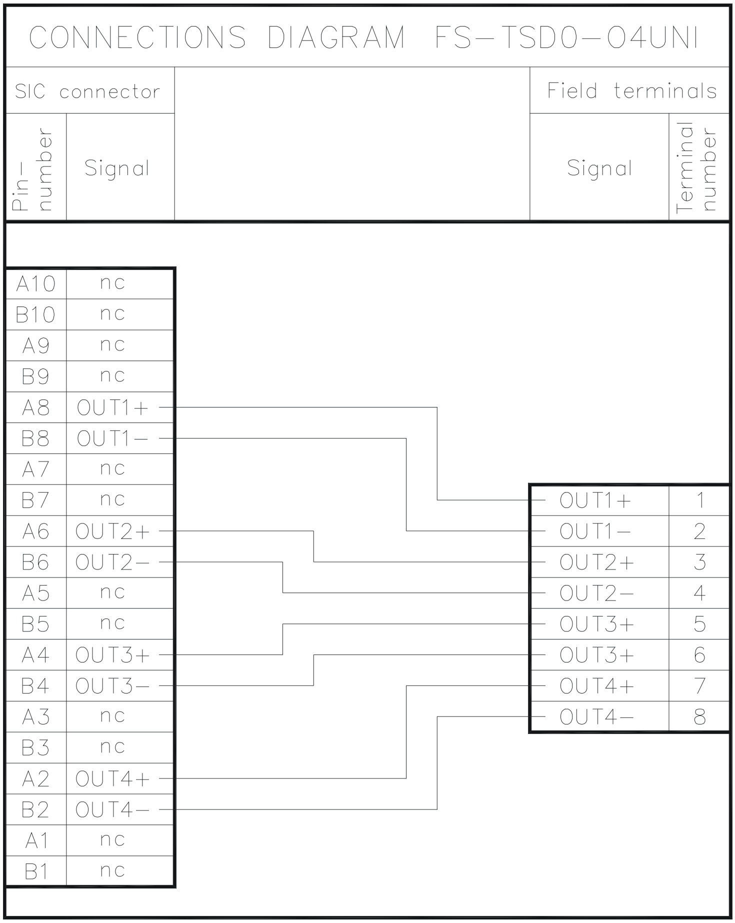
Applications

For details on applications and connection options for the TSDO-04UNI module, see section “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSDO-04UNI module is as follows:

Figure 388 Connections diagram



Technical data

The TSDO-04UNI module has the following specifications:

General	Type numbers[1] :	FS-TSDO-04UNI
		FC-TSDO-04UNI
	Approvals:	CE, TUV, UL, CSA, FM
Power	Number of channels:	4
	Maximum voltage:	50 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12) 150 Vdc – IEC 1010 (1990), overvoltage category 2 (Table D.10)
	Maximum continuous current per channel:	2 A
	Actual maximum current defined by connected output module	
Physical	Module dimensions:	60 × 70 × 54 mm (L × W × H)
		2.36 × 2.76 × 2.13 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	61 mm (2.40 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

TSDOL-0424C

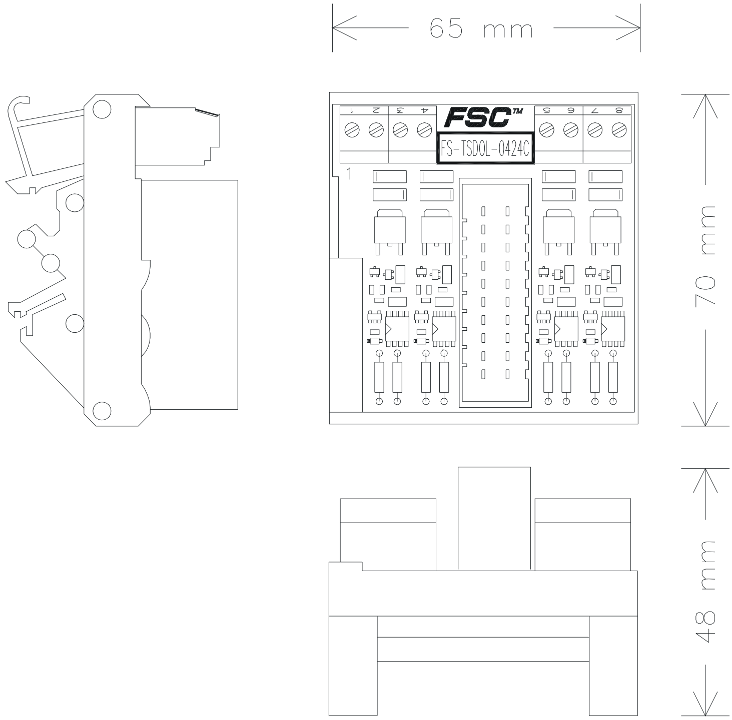
Conformal-coated safe digital output FTA, current limited, loop monitored (24 Vdc, 4 channels)

Description

Field termination assembly module TSDOL-0424C is the interface for safe loop monitored digital output module SDOL-0424 with the system inter- connection cable SICC-0001/Lx and external field wiring (screw terminals). It can be used for interfacing to Class I, Division 2 Hazardous locations. TSDOL-0424C provides four loop-monitored current limited digital outputs to the field. Each output is capable of supplying 110 mA (= 2.5 Watt at 24 Vdc).

The FTA module is coated conform the requirements for type A coatings given in IEC 60664-3 (the values for POLLUTION DEGREE 1 apply), has a universal snap-in provision for standard DIN EN rails, and screw terminals for the field wiring.

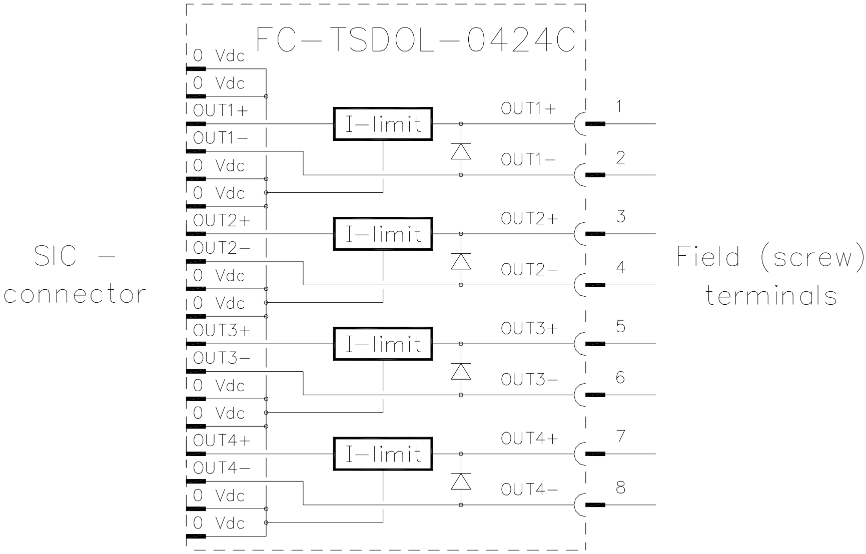
Figure 389 Mechanical layout



Applications

For details on applications and connection options for the TSDOL-0424C module, see section “SICC-0001/Lx” on page 715.

Figure 390 Schematic diagram



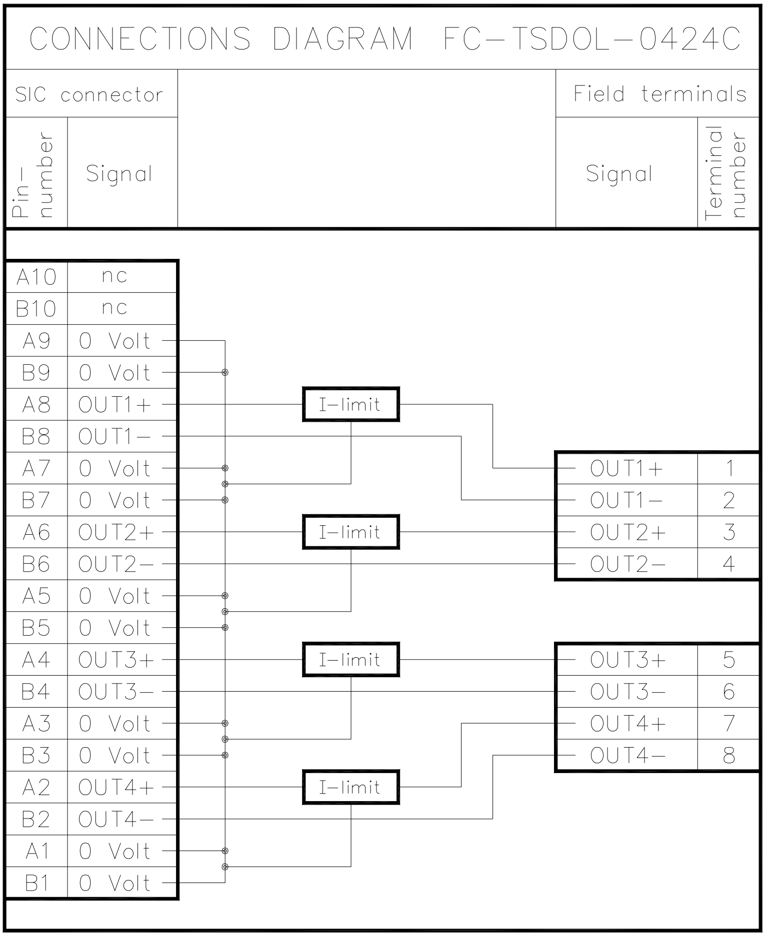
Main function

The TSDOL-0424C can energize loads (for example solenoids or leds) with voltage-current limitation in compliance with Hazardous Class I, Division 2. The external output-signal (OUT+) is electronically current-limited.

Connections

The connections diagram of the TSDOL-0424C:

Figure 391 Connections diagram



Technical data

TSDOL-0424C has the following specifications:

General	Type number[1]:	FC-TSDOL-0424C
	Approvals	CE, TUV, UL, CSA, FM
	Environmental shielding	Conformal coating
Power	Number of channels:	4
	Maximum voltage:	36 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Power requirements:	5 mA per channel (plus output load)
Output	Output current limit:	> 110 mA
	Max. output load:	2.5 Watt (at 24 Vdc)
	Voltage drop:	< 1.5 Vdc at 110 mA
	Off current:	< 0.1 mA
Physical	Module dimensions:	65 × 70 × 48 mm (L × W × H) 2.55 × 2.76 × 1.89 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	66 mm (2.59 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)
Field signal specifications	HYDROGEN (Group A & B)	
	• Max. loop inductance	3.0 mH
	• Max. loop capacitance	0.2 µF
	NON-HYDROGEN (Group C & D)	
	• Max. loop inductance	12 mH
	• Max. loop capacitance	5 µF

1 FC-type modules are conformal coated modules.

TDO-1624

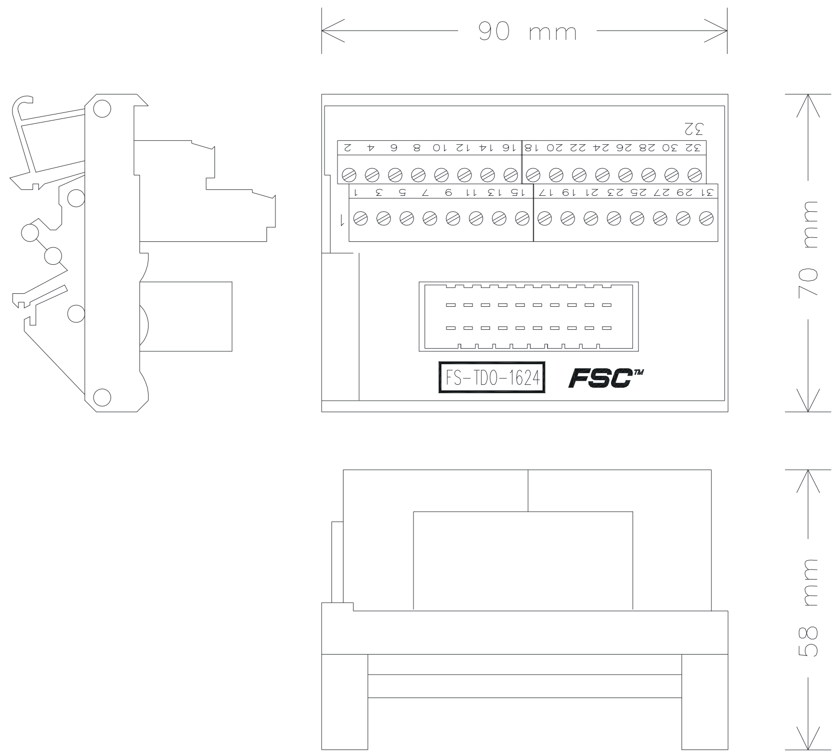
Non-safe digital output FTA (24 Vdc, 16 channels)

Description

Field termination assembly module TDO-1624 is the interface between system interconnection cable SICC-0001/Lx and external field wiring (screw terminals). The non-safe channels of a (redundant pair of) DO-1624 module(s) or DO-1224 module(s) can be connected to TDO-1624 via system interconnection cable SICC-0001/Lx.

The FTA module has a universal snap-in provision for standard DIN EN rails and screw terminals for connecting field wiring.

Figure 392 Mechanical layout



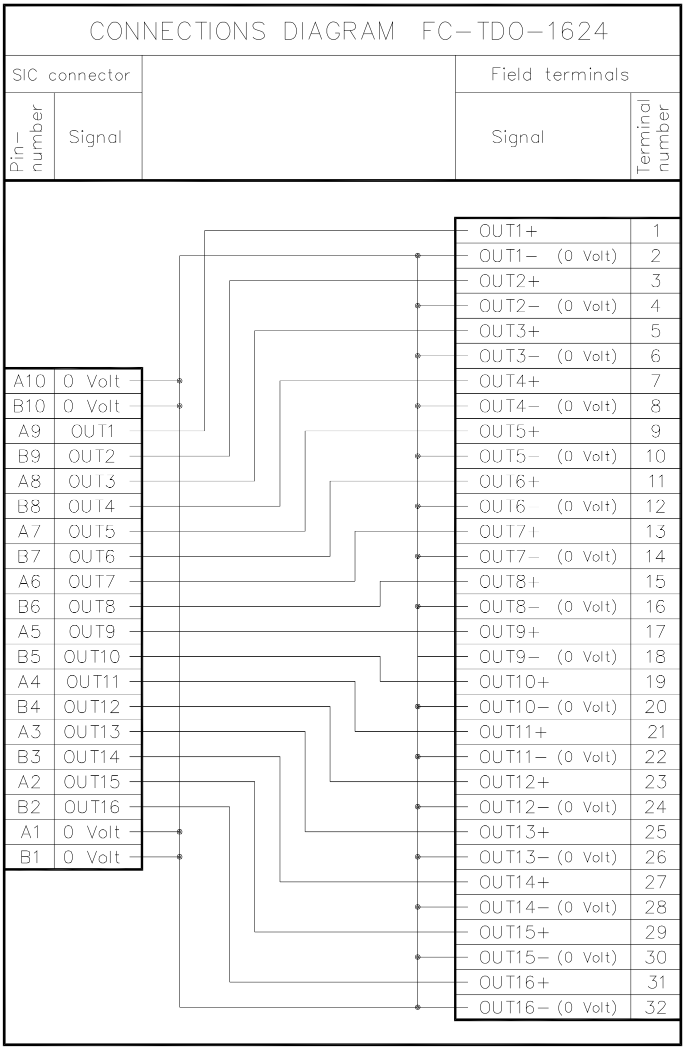
Applications

For details on applications and connection options for TDO-1624, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TDO-1624 module:

Figure 393 Connections diagram



Technical data

The TDO-1624 module has the following specifications:

General	Type numbers[1] :	FS-TDO-1624
		FC-TDO-1624
	Approvals:	CE, UL, TUV, CSA
Power	Number of channels:	16
	Maximum voltage:	36 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum continuous current per channel:	1.5 A
	Actual maximum current defined by connected output module	
Physical	Module dimensions:	90 × 70 × 58 mm (L × W × H) 3.54 × 2.76 × 2.28 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	91 mm (3.58 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TSRO-0824

Safe dry digital output FTA for SIL3 applications (8 channels)

Description

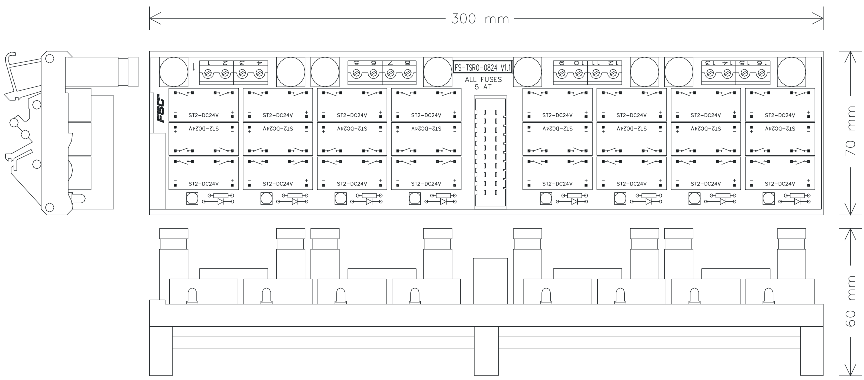
Field termination assembly module TSRO-0824 is the interface between system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). It has eight relay-based potential-free safe output channels suitable for applications up to and including SIL3 without the use of fault exclusions. TSRO-0824 complies with safety requirements for general use in safety requirement classes SIL3 as defined in IEC 61508.

The TSRO-0824 has floating, non commoned, output contacts that can be wired independently. Each output channel consists of:

- Three relays
- A fused NO field contact (5 AT, slow-acting)
- A status indication LED

The relays are capable of driving a wide variety of loads, including 115/230 Vac, which gives Safety Manager a 115/230 Vac output capability for SIL3 applications. The energized relay state is indicated by a LED on the module.

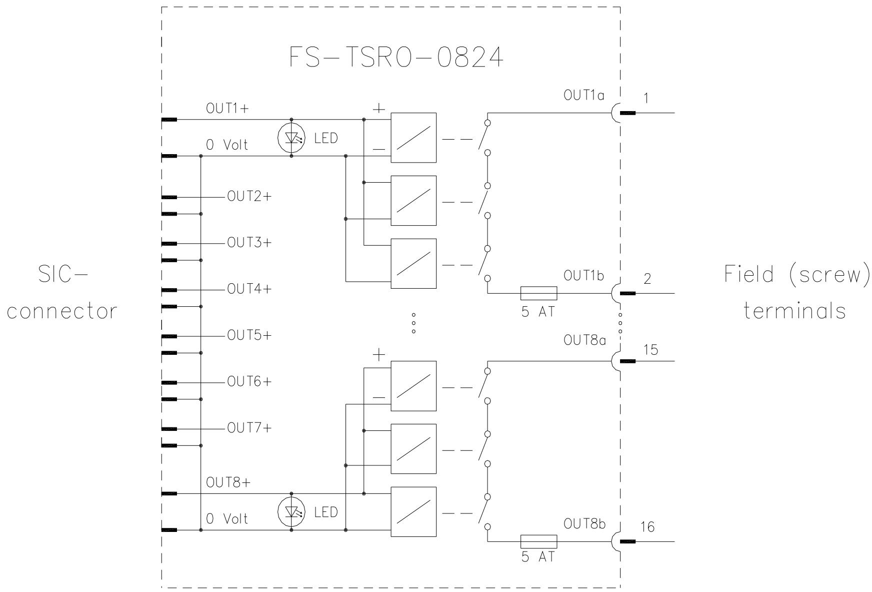
Figure 394 Mechanical layout



Eight channels can be connected to the TSRO-0824 module via system interconnection cable SICC-0001/Lx. This cable is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SDO-0824 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

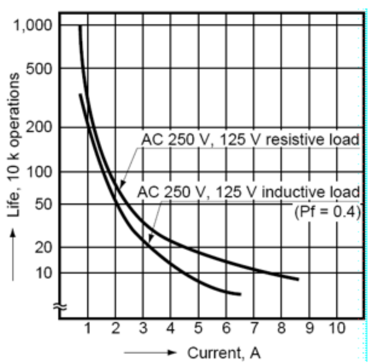
Figure 395 Schematic diagram



Relay life

The electrical life of the relays heavily depends on the contact rating the relay is exposed to. Figure 396 on page 642 shows the expected relay life versus contact current.

Figure 396 Life curve of the applied relays



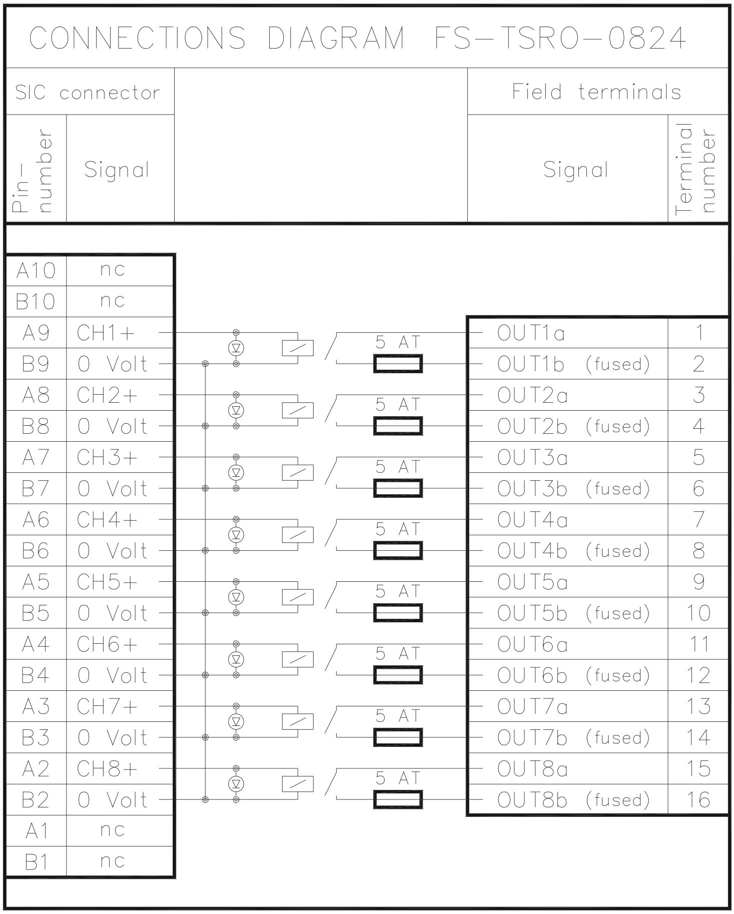
Applications

For details on applications and connection options for TSRO-0824, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSRO-0824 module:

Figure 397 Connections diagram



Technical data

The TSRO-0824 module has the following specifications:

General	Type numbers[1 2]:	FS-TSRO-0824 V1.1
		FC-TSRO-0824 V1.1
	Approvals:	CE, UL, TUV, CSA
	Safety class:	up to and including SIL3
Input	Nominal input voltage:	24 Vdc
	Max. input voltage:	36 Vdc
	Relay pick-up voltage:	19.2 Vdc
	Input current:	Typically 40 mA at 24 Vdc
Output	Number of output channels:	8
	Max. output current:	5 A (fused)
	Min. output current:	1 mA at 5 V
	Max. output voltage:	250 Vac / 250 Vdc
	Max. switched load:	1250 VA / 150 W (see Figure 398 on page 645)
Fuses	Rating:	5 AT (slow-acting)
	Dimensions:	5 × 20 mm (0.2 × 0.78 in)
Physical	Module dimensions:	300 × 70 × 60 mm (L × W × H) 11.81 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	301 mm (11.85 in)
Termination	Screw terminals:	
	• Max. wire diameter:	2.5 mm² (AWG 14)
	• Strip length:	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)
Environment	Ambient temperature:	–5°C—+60°C (23°F—140°F)

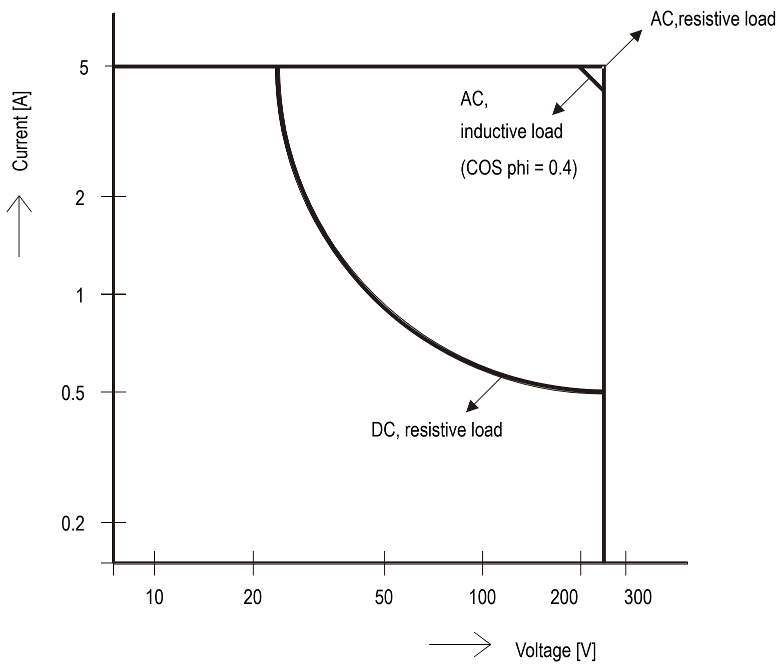
Isolation	Isolation:	
	• Coil to contact	4000 Vac
	• Contact to contact	1200 Vac
Relay contact	Max. switching load:[3]	250 Vac, 5A 24 Vdc, 5A 48 Vdc, 1A 110 Vdc, 500 mA
	Max. switching frequency:	20 Hz
	Expected life:	See Figure 396 on page 642
	Contact material:	gold flash over silver alloy

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

2 Modules with suffix code V1.1 or CCV1.1 and higher have improved insulation. There are no functional changes.

3 When switching DC loads, only use resistive loads or inductive loads with spark suppression diodes

Figure 398 Maximum switched power



TSRO-08UNI

Safe common external power relay output FTA for SIL3 applications (8 channels)

Description

Field termination assembly module TSRO-08UNI is the interface between system interconnection cable SICC-0001/Lx and the external field wiring (screw terminals). It has eight relay-based safe output channels suitable for applications up to SIL3 without the use of fault exclusions. TSRO-08UNI complies with safety requirements for general use in safety requirement classes SIL3 as defined in IEC 61508.

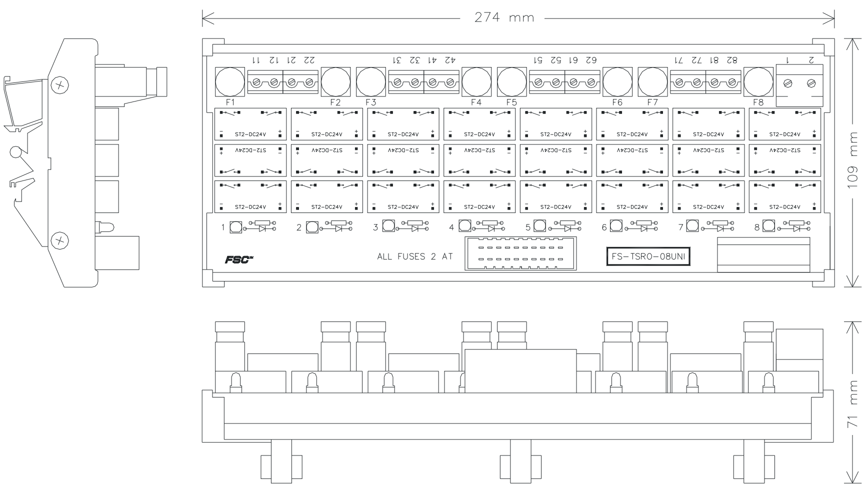
The TSRO-08UNI has one (common) external power connection (screw terminals).

Each channel consists of:

- Three relays
- A fused NO field contact (2 AT, slow-acting)
- A status indication LED

The relays are capable of switching a wide variety of loads, including 115/230 Vac, which gives Safety Manager a 115/230 Vac output for SIL3 applications. The energized relay state is indicated by a LED on the module.

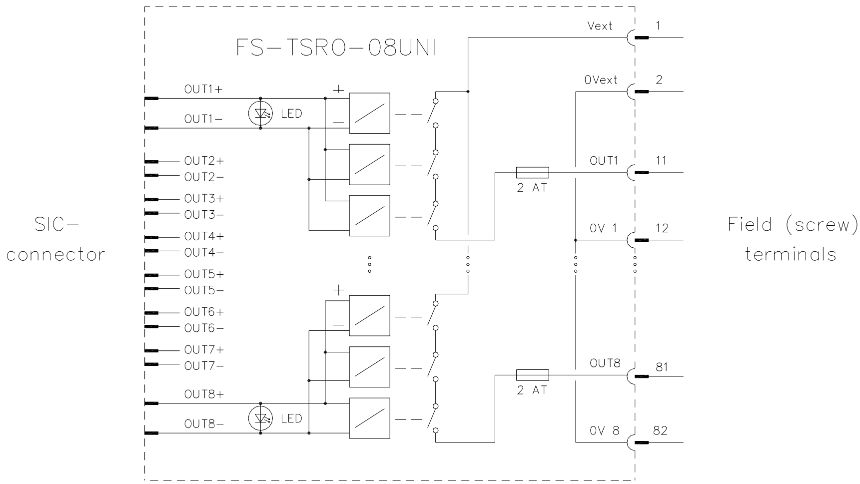
Figure 399 Mechanical layout



Eight channels can be connected to the TSRO-08UNI module via system interconnection cable SICC-0001/Lx. This cable is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SDO-0824 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

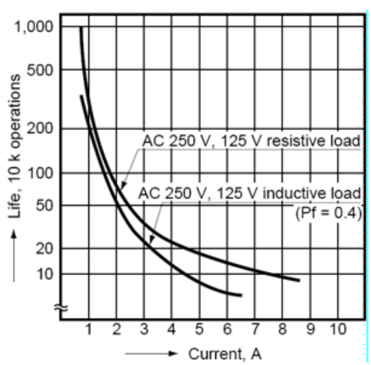
Figure 400 Schematic diagram



Relay life

The electrical life of the relays heavily depends on the contact rating the relay is exposed to. Figure 401 on page 647 shows the expected relay life versus contact current.

Figure 401 Life curve of the applied relays



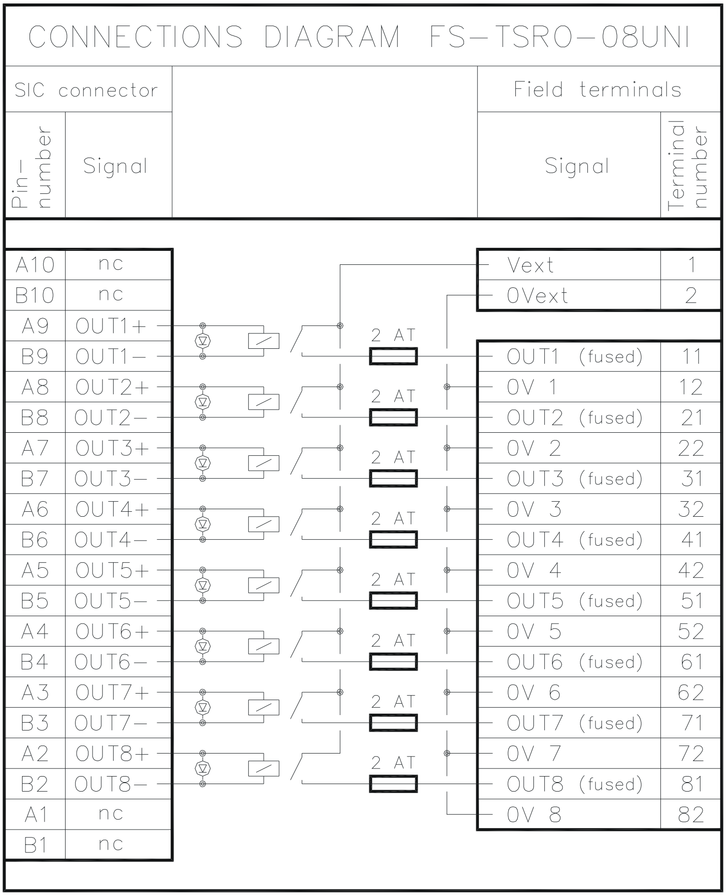
Applications

For details on applications and connection options for TSRO-08UNI, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSRO-08UNI module:

Figure 402 Connections diagram



Technical data

The TSRO-08UNI module has the following specifications:

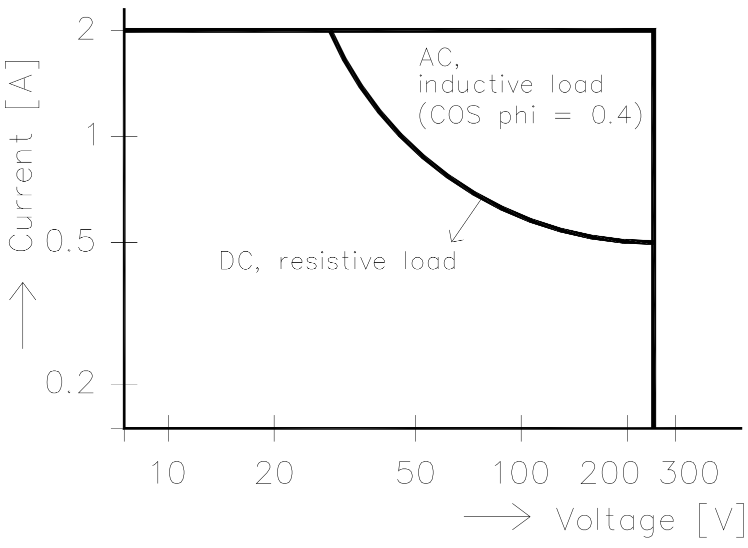
General	Type number[1]:	FS-TSRO-08UNI
		FC-TSRO-08UNI
	Approvals:	CE; UL, CSA; TUV pending
	Safety class:	up to SIL3
Input	Nominal input voltage:	24 Vdc
	Max. input voltage:	36 Vdc
	Relay pick-up voltage:	19.2 Vdc
	Input current:	Typically 40 mA at 24 Vdc
Output	Number of output channels:	8
	Max. output current:	2 A (fused)
	Min. output current:	1 mA at 5 V
	Max. output voltage:	250 Vac / 250 Vdc
	Max. switched load:	500 VA / 150 W (see Figure 403 on page 650)
Fuses	Rating:	2 AT (slow-acting)
	Dimensions:	5 × 20 mm (0.2 × 0.78 in)
Physical	Module dimensions:	274 × 109 × 71mm (L × W × H) 10.8 × 4.3 × 2.8 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	275 mm (10.8 in)
Termination	Channel screw terminals:	
	• Max. wire diameter:	2.5 mm² (AWG 14)
	• Strip length:	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)
	External power screw terminals:	
	• Max. wire diameter:	16 mm² (AWG 8)
	• Strip length:	7 mm (0.28 in)
	• Tightening torque	1.2 Nm (0.88 ft.-lb.)
Environment	Ambient temperature:	–5°C—+60°C (23°F—140°F)

Isolation	Isolation:	
	• Coil to contact	3750 Vac
	• Contact to contact	1200 Vac
Relay contact	Max. switching load[2]:	250 Vac, 2A 24 Vdc, 2A 48 Vdc, 1A 110 Vdc, 500 mA
	Max. switching frequency:	20 Hz
	Expected life:	See Figure 401 on page 647.
	Contact material:	gold flash over silver alloy

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

2 When switching DC loads, only use resistive loads or inductive loads with spark suppression diodes

Figure 403 Maximum switched power



TRO-0824

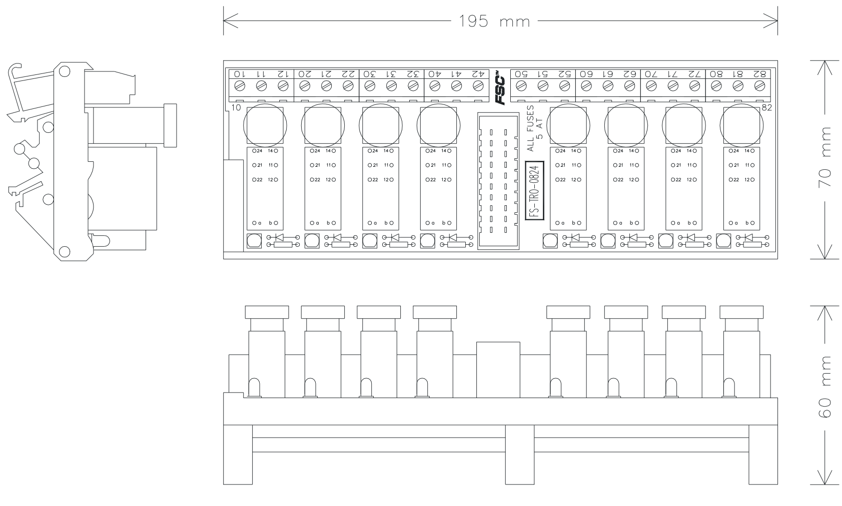
Non-safe dry digital output FTA (8 channels, NO/NC)

Description

Field termination assembly module TRO-0824 is the interface between system interconnection cable SICC-0001/Lx and external field wiring (screw terminals). It has eight non-safe potential-free relay changeover contacts (NO/NC). The energized relay state is indicated by a LED on the module. You can connect up to eight channels to TRO-0824 via the system interconnection cable SICC-0001/Lx. This cable is plugged into the SIC connector on the FTA module, and connects to a (redundant pair of) SDO-0824 module(s).

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

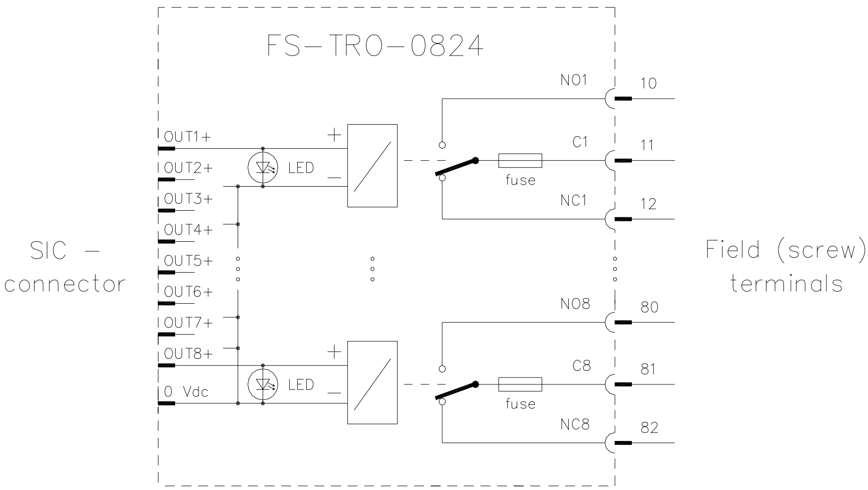
Figure 404 Mechanical layout



Each channel consists of:

- One relay
- A changeover contact with a fused (5 AT) common
- A status indicator LED

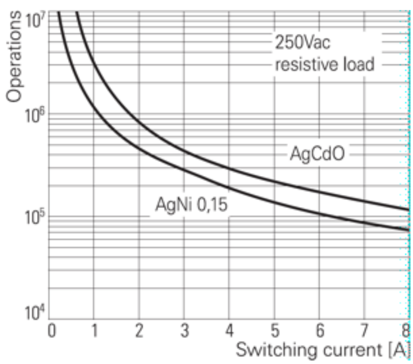
Figure 405 Schematic diagram



Relay life

The electrical life of the relays heavily depends on the contact rating the relay is exposed to. Figure 406 on page 652 shows the expected relay life versus contact current.

Figure 406 Life curve of the applied relays



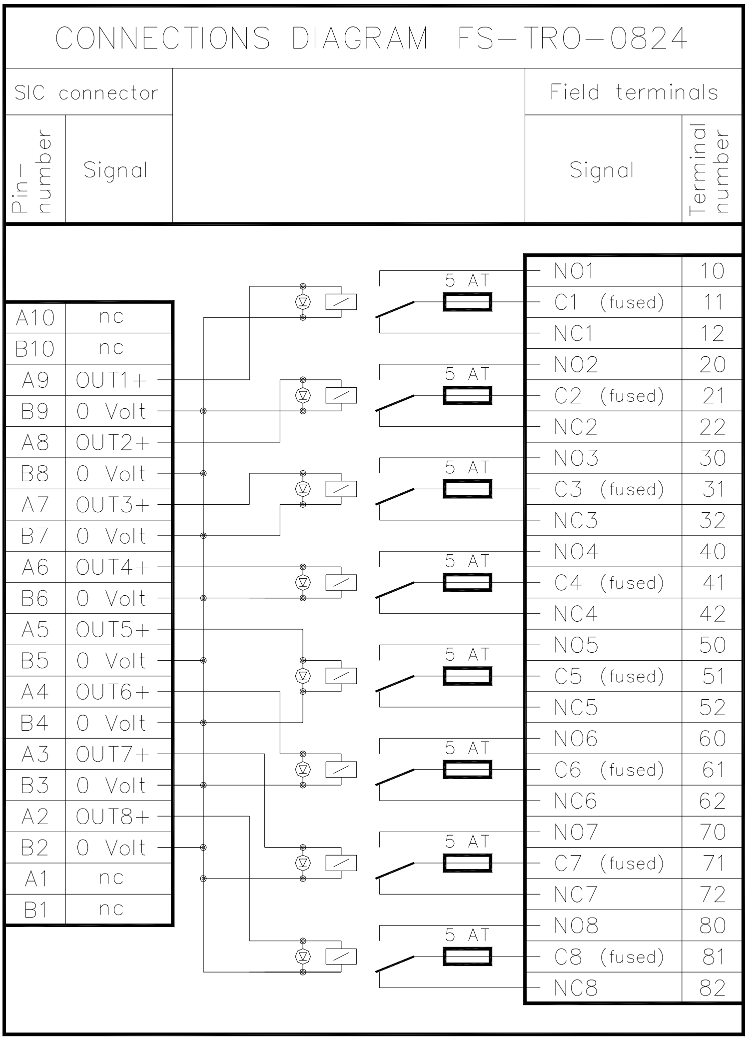
Applications

For details on applications and connection options for TRO-0824, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TRO-0824 module:

Figure 407 Connections diagram



Technical data

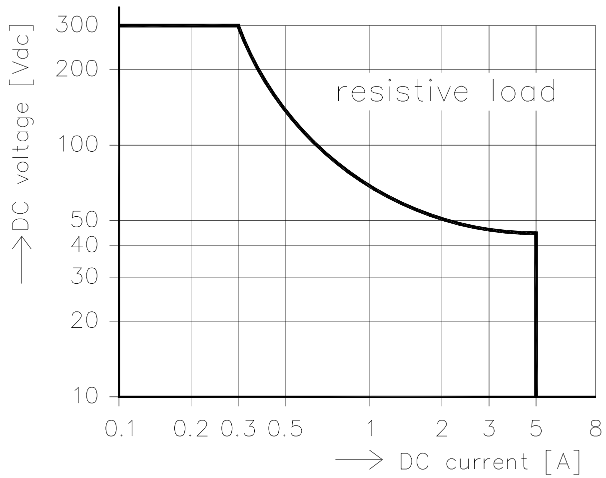
The TRO-0824 module has the following specifications:

General	Type numbers[1] :	FS-TRO-0824
		FC-TRO-0824
	Approvals:	CE, UL, TUV, CSA
Input	Nominal input voltage:	24 Vdc
	Max. input voltage:	31 Vdc
	Relay cut-in voltage:	19 Vdc
	Input current:	typically 27 mA at 24 Vdc
Output	Number of output channels:	8
	Max. output current:	5 A
	Max. output voltage:	250 Vac / 300 Vdc
	Max. switched load:	1250 VA / 150 W at 30 Vdc (see Figure 408 on page 655)
Fuses	Rating:	5 AT (slow-acting)
	Dimensions	5 × 20 mm (0.20 × 0.79 in)
Physical	Module dimensions:	195 × 70 × 60 mm (L × W × H) 7.68 × 2.76 × 2.36 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	196 mm (7.72 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

Relay contacts	Max. current:	8 A
	Max. switched voltage:	250 Vac / 300 Vdc
	Max. switched load:	2000 VA / 192 W at 24 Vdc (see Figure 408 on page 655)
	Max. switching frequency:	20 Hz
	Expected life:	See Figure 406 on page 652
	Isolation:	
	• Coil to contact	4000 Vac
	• Contact to contact	1000 Vac
	Ambient temperature:	–40°C—+70°C (–40°F—+158°F)
	Contact material:	Silver-cadmium oxide (AgCdO)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

Figure 408 Maximum DC switched power curve for TRO-0824 module



TRO-1024

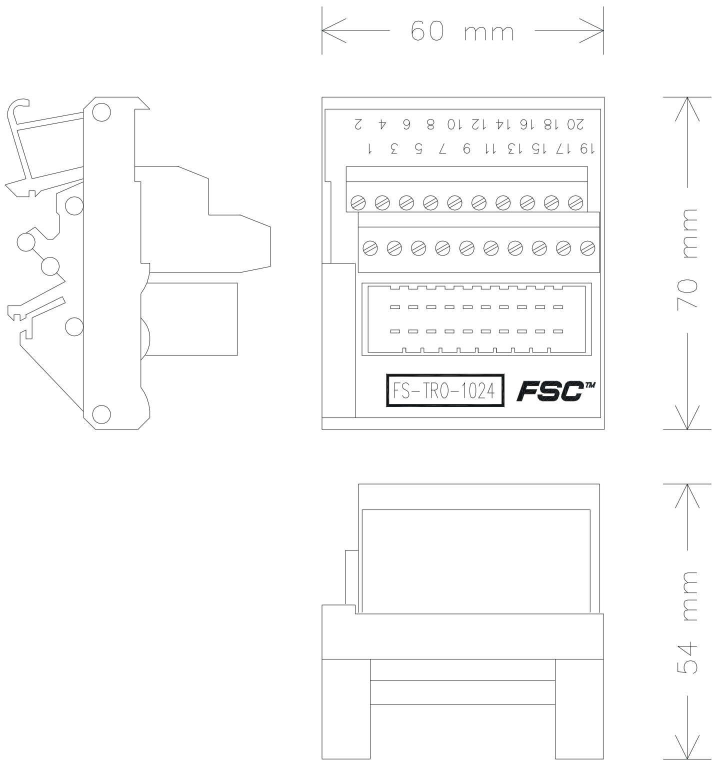
Non-safe dry digital output (relay contact) FTA (10 channels)

Description

Field termination assembly module TRO-1024 is the interface between system interconnection cable SICC-0001/Lx and external field wiring (screw terminals). The non-safe channels of a (redundant pair of) RO-1024 module(s) can be connected to the TRO-1024 module via the system interconnection cable SICC-0001/Lx.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 409 Mechanical layout



Applications

For details on applications and connection options for TRO-1024, see "SICC-0001/Lx" on page 715.

Connections

The connections diagram of the TRO-1024 module:

Figure 410 Connections diagram

CONNECTIONS DIAGRAM FS–TRO–1024

SIC connector		Field terminals	
Pin–number	Signal	Signal	Terminal number
A10	C1	C1	1
B10	NO1	NO1	2
A9	C2	C2	3
B9	NO2	NO2	4
A8	C3	C3	5
B8	NO3	NO3	6
A7	C4	C4	7
B7	NO4	NO4	8
A6	C5	C5	9
B6	NO5	NO5	10
A5	C6	C6	11
B5	NO6	NO6	12
A4	C7	C7	13
B4	NO7	NO7	14
A3	C8	C8	15
B3	NO8	NO8	16
A2	C9	C9	17
B2	NO9	NO9	18
A1	C10	C10	19
B1	NO10	NO10	20

Technical data

The TRO-1024 module has the following specifications:

General	Type numbers[1] :	FS-TRO-1024
		FC-TRO-1024
	Approvals:	CE, UL, TUV, CSA
Power	Number of channels:	10
	Maximum voltage:	48 Vac / 48Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum switched power:	100 W / 1000 VA
	Maximum continuous current per channel:	2 A
	Contact material on RO-1024:	Gold flush silver-cadmium oxide
Physical	Module dimensions:	60 × 70 × 54 mm (L × W × H) 2.36 × 2.76 × 2.13 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	61 mm (2.40 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

TSAO-0220m

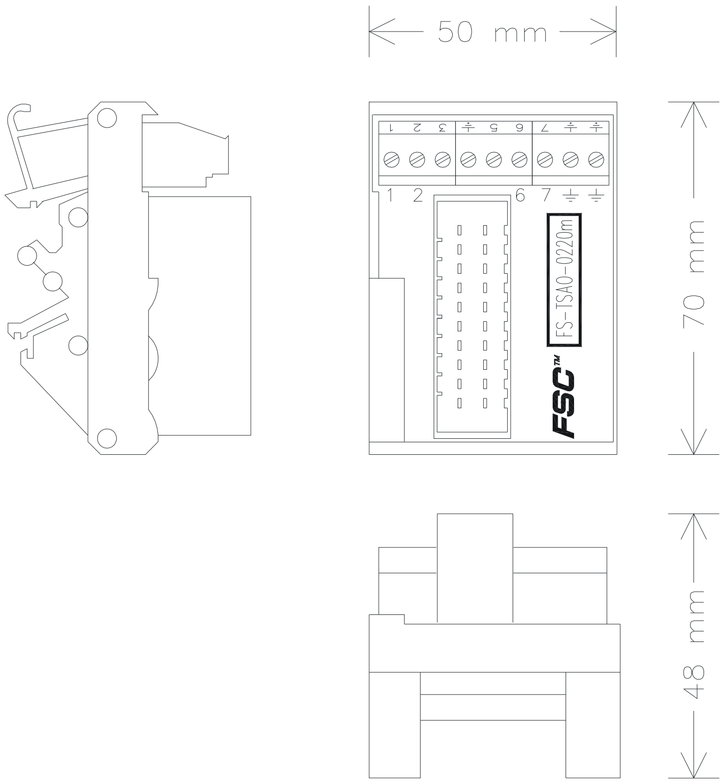
Safe analog output FTA (0(4)-20 mA, 2 channels)

Description

Field termination assembly module TSAO-0220m is the interface between system interconnection cable SICC-0001/Lx and external field wiring (screw terminals). The two channels of an TSAO-0220m module can be connected to a (redundant pair of) SAO-0220m module(s) with the system interconnection cable SICC-0001/Lx.

The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for connecting field wiring.

Figure 411 Mechanical layout



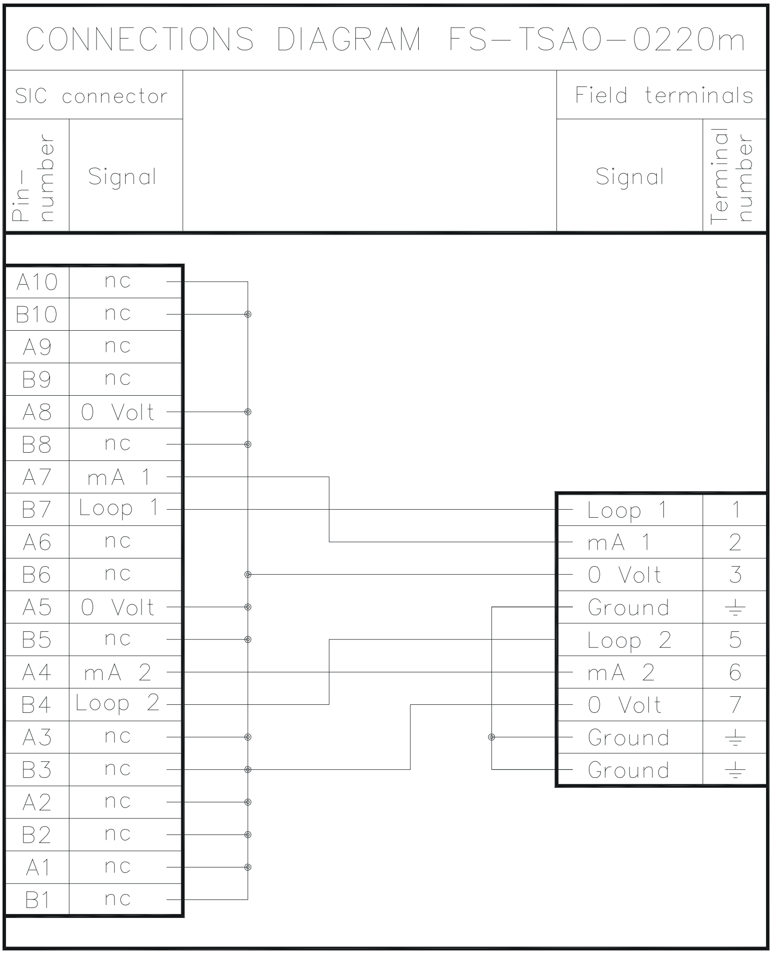
Applications

For details on applications and connection options for TSAO-0220m, see “SICC-0001/Lx” on page 715.

Connections

The connections diagram of the TSAO-0220m module is as follows:

Figure 412 Connections diagram



Technical data

The TSAO-0220m module has the following specifications:

General	Type numbers[1] :	FS-TSAO-0220m
		FC-TSAO-0220m
	Approvals:	CE, TUV, UL, CSA, FM
Power	Number of channels:	2
	Maximum voltage:	40 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum continuous current per channel:	25 mA
Physical	Module dimensions:	50 × 70 × 48 mm (LxWxH) 1.97 × 2.76 × 1.89 in (LxWxH)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	51 mm (2.01 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

TSAOH-0220m

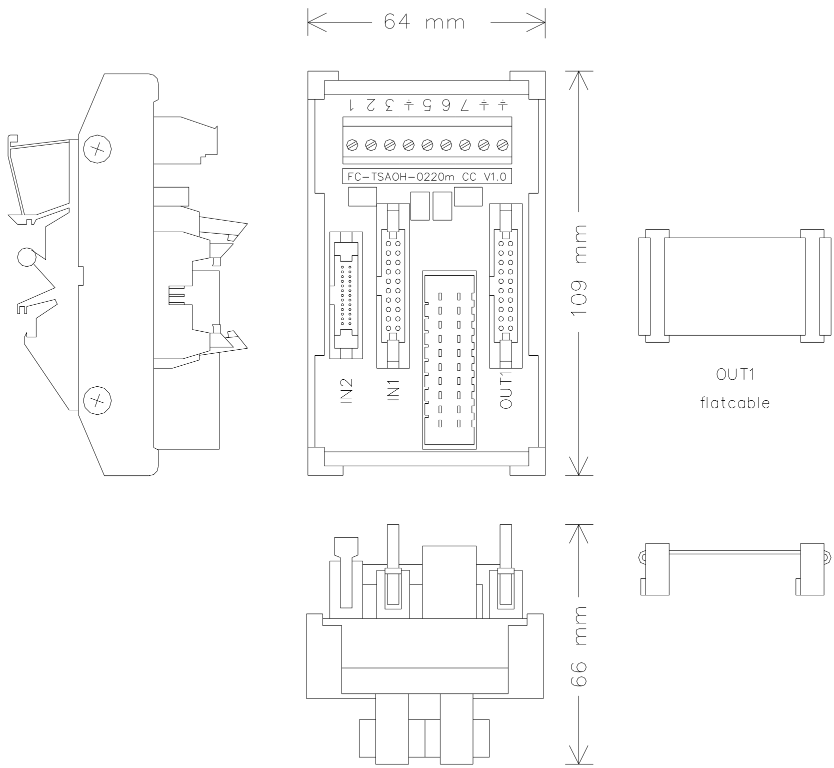
Safe analog output FTA with HART interface (0-20mA, 2 channels)

Description

The field termination assembly module TSAOH-0220m is the interface between system interconnection cable SICC-0001/Lx and external field wiring (screw terminals). The two analog output channels of a (redundant pair of) SAO-0220m module(s) can be connected to the TSAOH-0220m with the system interconnection cable SICC-0001/Lx.

The TSAOH-0220m module provides a HART interface on each channel *and* enables connection of -up to eight- TSAOH-0220m modules in series, enabling the use of all 16 HART channels of the HART-multiplexer.

Figure 413 Mechanical layout



The FTA module has a universal snap-in provision for standard DIN EN rails, and screw terminals for the connection of field wiring.

HART interface

Warning:

Suggested HART multiplexers have *no* galvanic isolation between (24 Vdc) supply and the HART signals (common 0 Vdc).

The TSAOH-0220m module provides an interface to HART multiplexer units from MTL and Pepperl+Fuchs (P+F). Dedicated connectors are installed on the FTA to enable the use of the standard cables from these suppliers.

The following equipment can be connected:

	MTL Solution	**P+F solution**
Multiplexer unit	MTL4842	KFD0-HMS-16 or KFD2-HMM-16
Cable	MTL FLAT20-2.2	K-MH26
Connector on FTA[1]	IN1	IN2

1 See Figure 413 on page 662

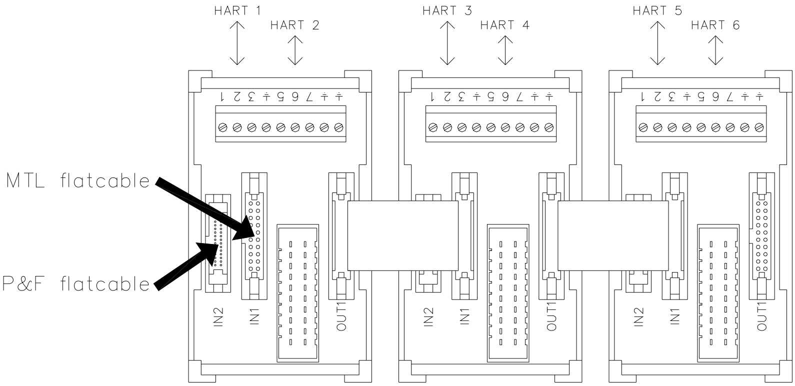
HART-flatcable linking

The flatcable connector OUT1 in Figure 413 on page 662 allows linking of up to eight TSAOH-0220m modules in series.

Figure 414 on page 664 shows how the flatcable, supplied with each TSAOH-0220m, can be used to link OUT1 with IN1 of the next module:

This way the outputs of the first TSAOH-0220m module will be connected to channel 1 and 2 of the HART-multiplexer on connector IN1 or IN2, the second module to channel 3 and 4, the third module to channel 5 and 6, and so on.

Figure 414 Linking up to 16 HART channels to one multiplexer unit



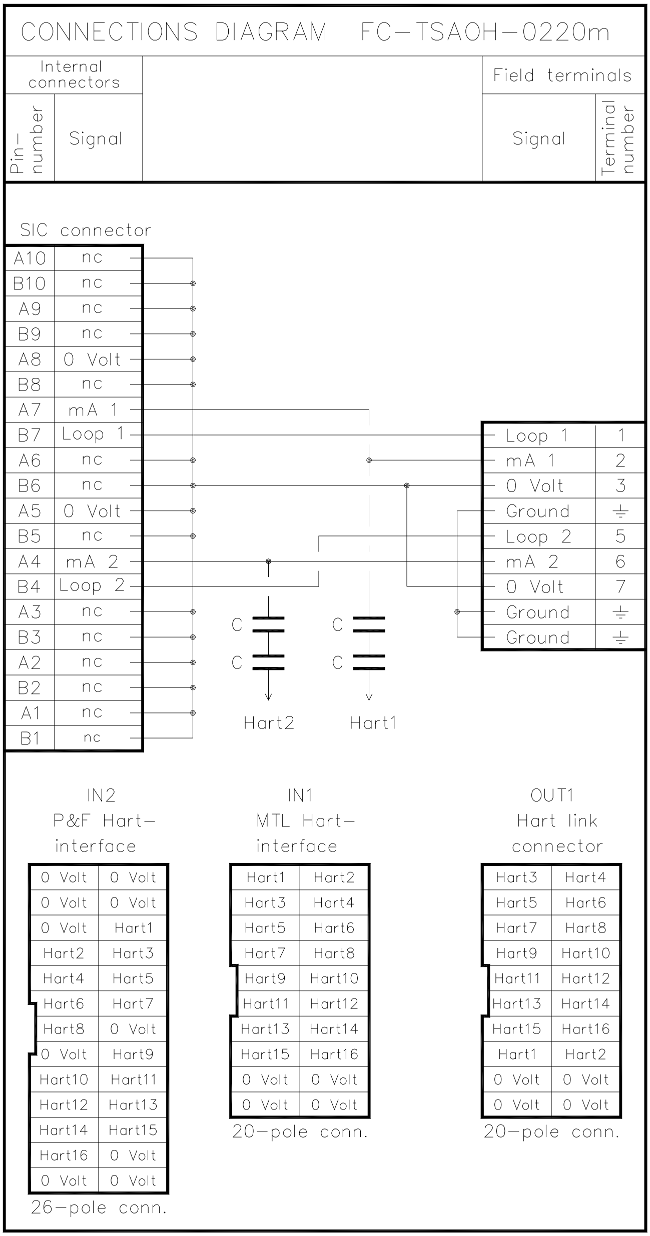
Applications

For details on applications and connection options for the TSAOH-0220m, see “SICC-0001/Lx” on page 715.

Connections

Figure 415 on page 665 shows the connections diagram of the TSAOH-0220m.

Figure 415 Connections diagram



Technical data

The TSAOH-0220m module has the following specifications:

General	Type numbers[1] :	FC-TSAOH-0220m CC V1.0
	Approvals:	CE; TUV, UL and CSA pending
Power	Number of channels:	2 (with common 0V)
	Maximum voltage:	40 Vdc – IEC 1010 (1990), overvoltage category 3 (Table D.12)
	Maximum continuous current per channel:	25 mA
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft.-lb.)
Physical	Module dimensions:	64 × 109× 66 mm (LxWxH) 2.52 x 4.29 x 2.60 in (LxWxH)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	65 mm (2.56 in)

1 FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

TPSU-2430

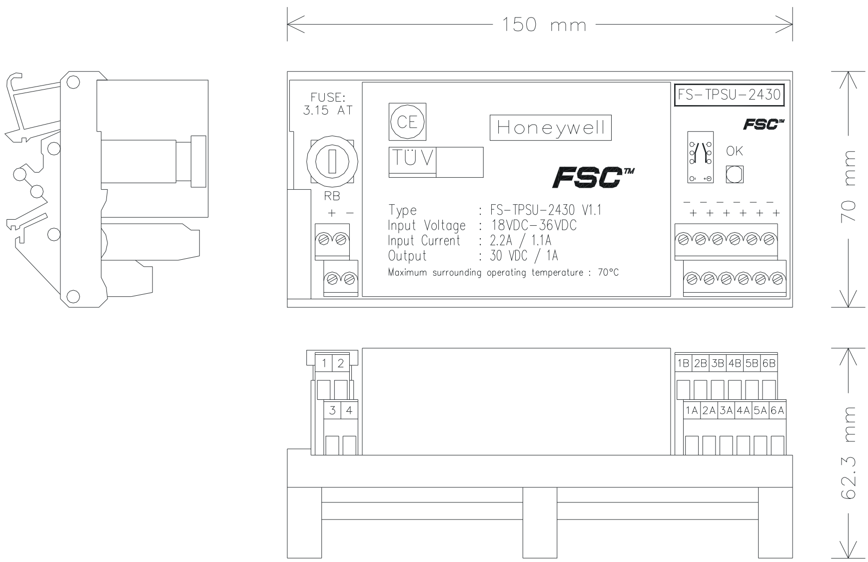
24 Vdc to 30 Vdc / 1 A converter

Description

The TPSU-2430 module is a DC/DC converter, which provides an isolated 30 Vdc / 1 A to other field termination assemblies (FTAs), such as the analog input FTA modules TSAI-1620m and TSHART-1620m. It has voltage monitoring capabilities with local LED indication and also provides alarm functions (read back relay contact). If the local DC/DC output voltage is OK, the LED is on and the read back relay contact is closed.

The FTA module has a universal snap-in provision for standard DIN-EN rails.

Figure 416 Mechanical layout



Connections

The TPSU-2430 module has four screw terminals for connecting incoming power wires and the read back wiring. The screw terminals are numbered 1 to 4. The function of each terminal is listed below:

Screw terminal	Function
1	Read back contact
2	Read back contact
3	24 Vdc IN +
4	24 Vdc IN –

Caution

Removal or connection of the 24 Vdc IN+ and/or 24 Vdc IN– wire(s) is only allowed when the 24 Vdc power supply to the TPSU-2430 module has been switched off.

The TPSU-2430 module has twelve screw terminals for connection of outgoing power wires. The screw terminals are numbered ‘1A’, ‘1B’, ‘2A’, and so on, up to ‘6B’. The function of each terminal is listed below:

Screw terminal	Function
1A	30 Vdc OUT
1B	0 Vdc OUT
2A	30 Vdc OUT
2B	0 Vdc OUT
3A	30 Vdc OUT
3B	0 Vdc OUT
4A	30 Vdc OUT
4B	0 Vdc OUT
5A	30 Vdc OUT
5B	0 Vdc OUT
6A	30 Vdc OUT
6B	0 Vdc OUT or ground [1]

1 O Vdc must be grounded to provide a predictable system response in case of a short to earth in the field.

Technical data

The TPSU-2430 module has the following specifications:

General	Type numbers[1 2]:	FS-TPSU-2430 V1.1
		FC-TPSU-2430 CCV1.1
	Approvals:	CE, TUV, UL, CSA, FM
	Safety class:	up to and including SIL3
	MTBF:	approx. 400,000 hours
Input	Nominal input voltage:	24 Vdc
	Input voltage range:	18—36 Vdc
	Inrush current:	≤ 4 A *(see note below)*
Output	Output voltage:	30 Vdc, ± 0.25 V
	Output current:	1 A (short-circuit proof)
	Short-circuit current:	< 3.3 A
	Ripple (0—30 MHz):	< 0.1 Vrms
	Regulation:	< 1% (load + line)
	Transient response:	class C according to NFC42801C
	Power-on overshoot:	output < 31 V
	Overvoltage protection:	31 V
	Long-term stability (after 30 min. operation):	< 0.3%
	Efficiency:	> 75%
	Switching frequency:	> 25 kHz
Physical	Module dimensions:	150 × 70 × 62.3 mm (L × W × H) 5.91 × 2.76 × 2.45 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	151 mm (5.94 in)
Fuse	Rating:	3.15 AT (slow-acting)
	Dimensions:	5 × 20 mm (0.2 × 0.79 in)
Termination	Screw terminals:	
	• Max. wire diameter	2.5 mm² (AWG 14)
	• Strip length	7 mm (0.28 in)
	• Tightening torque	0.5 Nm (0.37 ft-lb)

Isolation	Isolation voltage:	
	• Input to output	2000 Vac (1 min.)
	• Input to relay contact	2000 Vac (1 min.)
	• Output to relay contact	2000 Vac (1 min.)
Environment	Operating temperature:	–5°C—+70°C (23°F—158°F)
	Storage temperature:	–40°C—+85°C (–40°F—+185°F)
	Cooling:	natural convection
Alarm functions	Overvoltage protection:	dual, two-fault-tolerant
	Restart overvoltage protection:	only after removal of 24 Vdc power
	Undervoltage detector:	LED on if voltage OK, read-back relay contact closed if voltage OK
	Undervoltage level:	typically 27.5 Vdc
Readback	Relay contact rating:	36 Vdc / 40 mA, 30 Vac / 40 mA

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

2 Modules with suffix code V1.1 or CCV1.1 have reduced power dissipation. There are no functional changes.

Caution

The inrush current limiter is only active at power-on.

To regain the inrush current limiting function, the TPSU-2430 module must be switched off for at least 30 seconds. Switching on the module within 30 seconds may blow a fuse or activate a circuit breaker.

TSPKUNI-1624

Sub-D to Powered Knife terminals FTA (Universal,16ch)

Description

The field termination assembly module TSPKUNI-1624 provides sixteen sets of three knife terminals for RUSIO signals.

The TSPKUNI-1624 has:

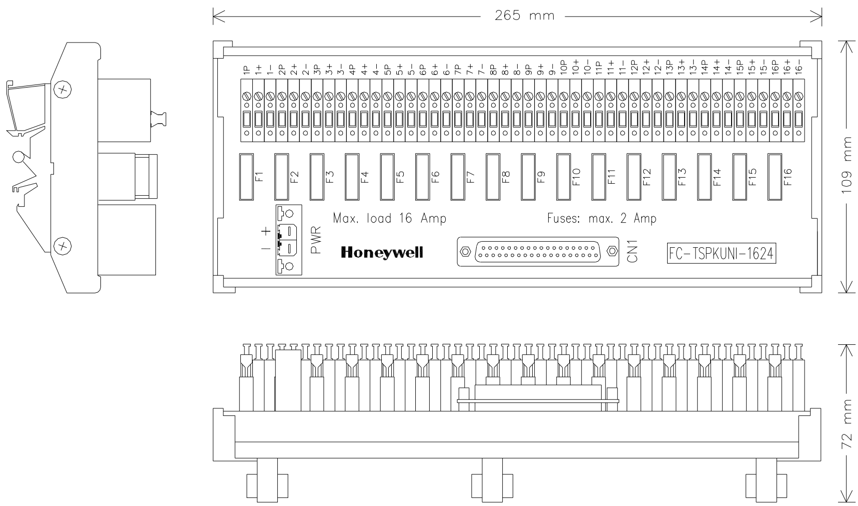
- a Power input connector (PWR) that supplies the (+24Vdc) field power
- 37-pole sub-D male connector (CN1) that must be connected with (16) RUSIO channels
- 16 sets of three knife terminals for the sixteen channels

Each channel has a the following knife terminal connections:

- a P terminal that has a (2 Amp) fused +24Vdc connection.
- a + terminal that is the (RUSIO) signal connection.
- a - terminal that is the common 0 Volt connection.

The TSPKUNI-1624 has universal snap-in provisions for standard DIN EN rails.

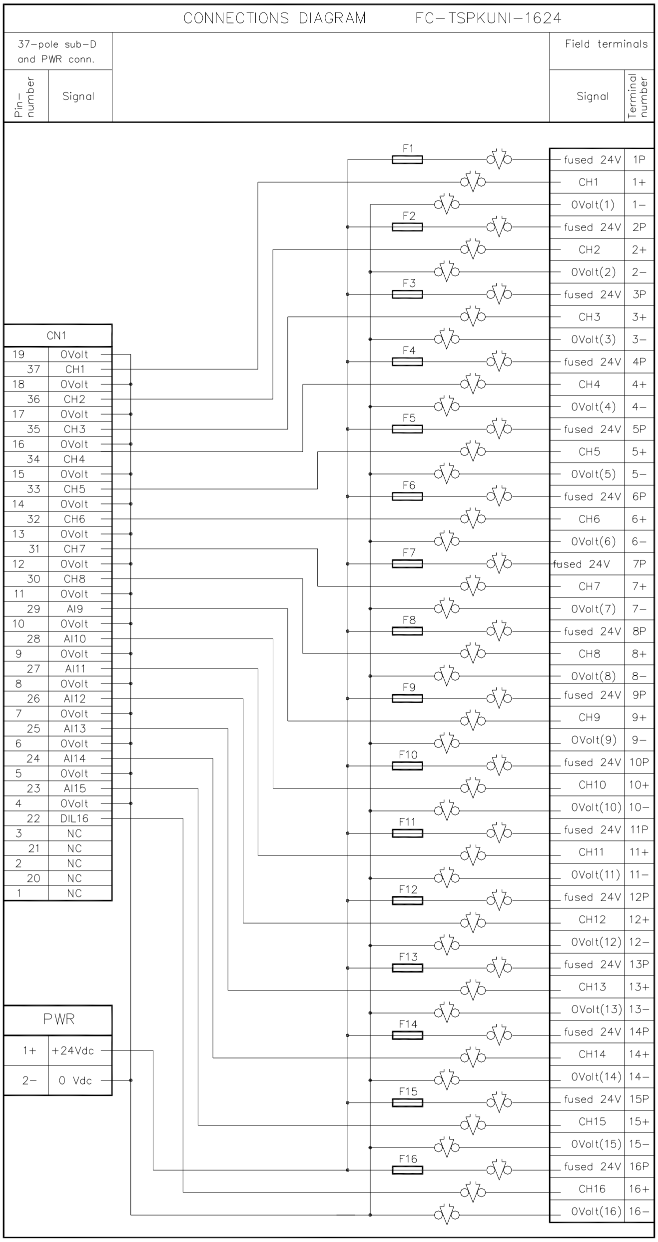
Figure 417 Mechanical layout



Connections

The connection diagram of the TSPKUNI-1624 module is as follows:

Figure 418 Connections diagram



The TSPKUNI-1624 must be combined with 16 channels of a (redundant set of) universal IO module(s).
A cable[2] of suitable lenght is used to connect the TSPKUNI-1624 with an (redundant or non-redundant) IOTA.

External power

A 24 Vdc power distribution cable (see datasheet "PDC-MB24-y" on page 814 for details) can be used to connect the main busbar with the power connector (PWR).

- When using other connection cables, make sure the wire size is adequate and the supplied Weidmuller BVZ 7.62HP/02/180F SN connector is used.

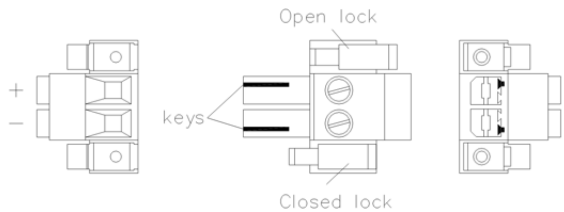
Note:

The 0 V connection of the external power is directly connected to the common 0 V of all output channels.

Figure 419 on page 673 shows the top, side & bottom view and the pin assignment of the power input connector.

- The pin marked **+** is pin 1: connected to +24Vdc busbar.
- The pin marked **-** is pin 2: connected to the 0Vdc busbar.

Figure 419 Power input connector (Weidmuller BVZ 7.62HP/02/180F SN) top, side and bottom view



The two (red) locking slides of the cable-connector in Figure 419 on page 673 keep the cable-connector locked when inserted into the power connector (PWR).

2. Honeywell type numbers that are available: 4213509 up to and including 4212516.
These type numbers correspond with part number CA-HWC300-AIO-DIO-xxM (Pepperl & Fuchs), where 'xx' stands for the length in meters.
For details see the manufacturer's data sheet (Pepperl & Fuchs).

Technical data

The TSPKUNI-1624 module has the following specifications:

General	Type numbers[1]:	FC-TSPKUNI-1624
	Approvals:	CE; TUV, UL, CSA pending
Power	Field power:	24 Vdc
	Total field load:	max 16 Amp
	Fuse:	
	• rating:	2 Amp, 58V
	• type:	TAC ATO Style Blade Fuse
	• manufacturer:	Littelfuse
	• ordernumber:	142.6185.420_
Physical	Module dimensions:	265 x 109 x 72 mm (L x W x H) 10.44 x 4.29 x 2.84 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	266 mm (10.47 in)
Termination	Channel screw terminals: • wire diameter • strip length • tightening torque	 0.2 - 4 mm^2 (AWG 28 - AWG 12) 8 mm (0.31 in) max. 0.6 Nm (0.44 ft-lb)
	Power connector: • make and type: • strip length: • Connectable conductors:	 Weidmuller: BVZ 7.62HP/02/180F SN (conn.) Weidmuller: BV/SV7.62HP KO (keys) 8 mm (0.28 in) 0.5-6mm^2 (AWG 20-AWG 10)

1 FC-type modules are conformal coated modules.

DCOM-232/485

RS232/485 communication FTA

Description

The communication FTA DCOM-232/485 is the combined RS232/485 communication interface of Safety Manager. It is used to provide Safety Manager with a RS485/422 or a RS232 connection.

The communication FTA may be driven by one (or a pair of redundant) Control Processor(s). The communication FTA does not require separate supply wiring. It is supplied by the connected Control Processor(s). The communication FTA must be connected with earth (use the supplied terminal). This will connect the shield of the internal cable(s) and the housing of the field connector(s) with (cabinet-) earth. For information on required communication cables, see section "Communication cables" on page 735.

The module has a universal snap-in provision for standard DIN EN rails.

Figure 420 Top view of the DCOM-232/485 communication FTA

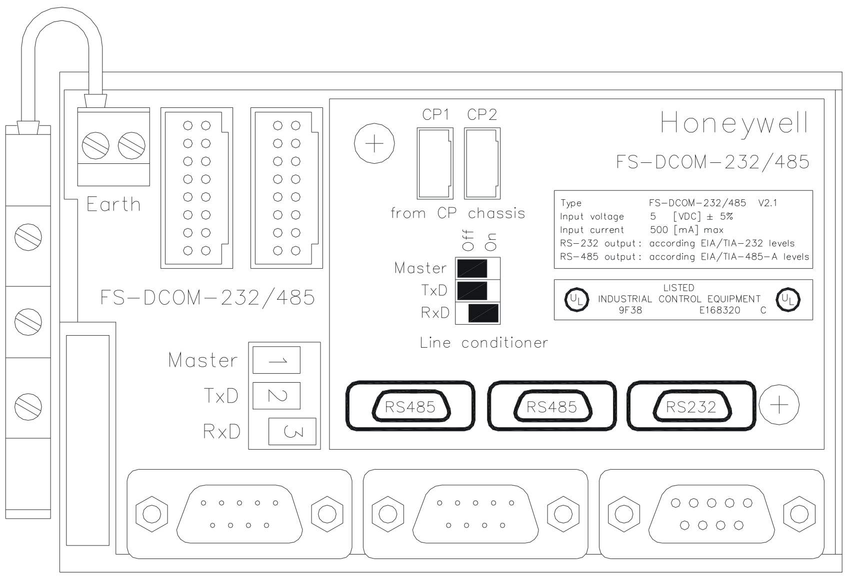
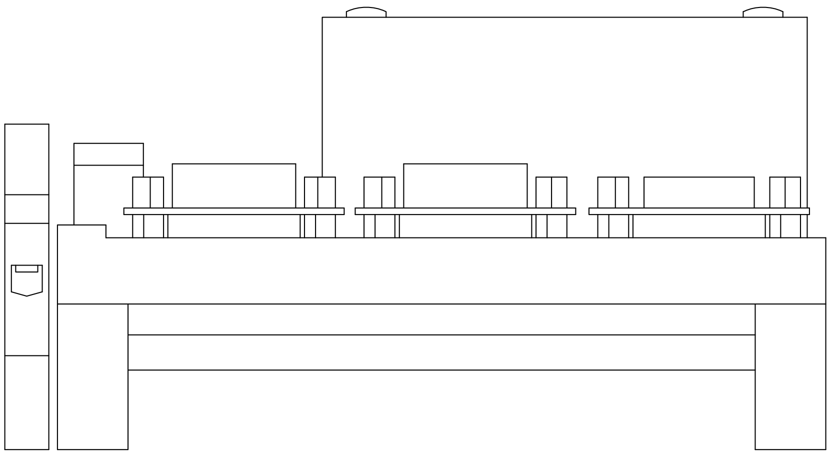


Figure 421 Front view of the DCOM-232/485 communication FTA



Connectors

Table 75 on page 676 describes the connectors present on the DCOM-232/485.

Table 75 connections for the DCOM-232/485

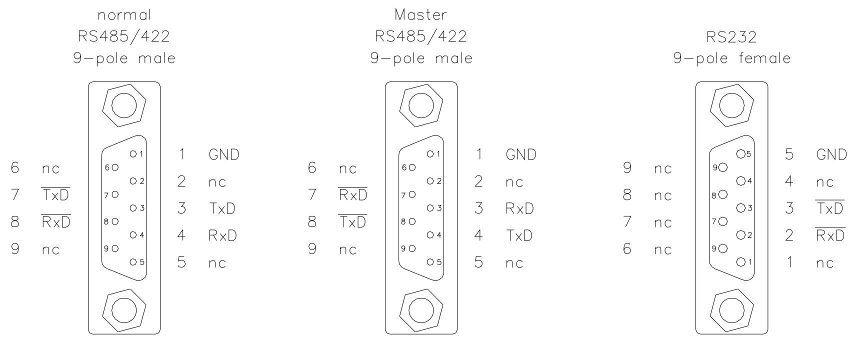
Connector	Quantity	Description	Use with cable
2-pin earth connector	1	FTA connection to cabinet earth (see Figure 420 on page 675).	-
2-pin earth terminal		1 FTA connection to cabinet earth	Supplied
9pole sub-D male	2	Used for RS422 or RS485 communication. The two connectors are identical: if only one is used, then the other needs an end of line terminator.	CCE-485-01/Lx CCE-485-02/Lx EOL-485-01
9pole sub-D female	1	Used for RS232 communication.	CCE-232-01/Lx CCE-232-02/Lx
16-pins male	2	Communication and supply connection to the Control Processor(s).	CCI-UNI-01

Pin allocation

Figure 422 on page 677 shows the pin allocation of the RS232 and RS485 connectors on the DCOM-232/485 communication FTA.

- The RS485/422 connectors are male type connectors.
- The RS232 connector is a female type connector.
- The pin assignment for the RS485/422 connectors depends on the position of the “Master” switch (dip switch 1).

Figure 422 Pin allocation of the connectors on the DCOM-232/485[1]



1 Figure 420 on page 675 shows the physical location of these connectors.

Dip switches

The DCOM-232/485 contains three color-coded dip switches for configuration of the external RS485/422 communication lines.

Line conditioner

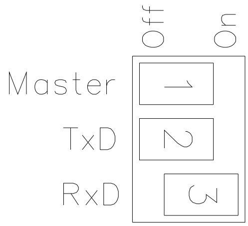
A line conditioner consists of a pull-up and a pull-down resistor of 680 Ω each.

Line conditioners are connected to the RxD lines if switch 2 and/or 3 are `ON`. With these resistors connected, the receivers will get less noise during the periods in which no transmitter is active on the line.

Dip switch settings

Figure 423 on page 678 and Table 76 on page 678 show the possible settings when configuring the DCOM-232/485.

Figure 423 Detail of the DCOM-232/485 dip switches



- Dip switch 1 (Master) selects the RS485/422 pin configuration.
  - The `Off` position is "normal".
  - The `On` position changes the pin allocation of the RS485/422 connectors from "normal" to "master" (see figure 220).

  This switch makes it possible to use one-on-one cables only (see e.g. "CCE-485-01/Lx" on page 753). In case of a communication-master re configuration, no new cabling is required (provided only one-on-one cables are used).
- Dip switch 2 (TxD) is the line conditioner for the transmitter lines (on pins 3 and 7).
- Dip switch 3 (RxD) is the line conditioner for the receiver lines (on pins 4 and 8).

Table 76 dip switch settings for the DCOM-232/485[1]

DCOM-232/485 Configuration	Dip switch 1	Dip switch 2	Dip switch 3
RS422 Point-to-point	`On/Off`[2]	`On`	`On`
RS485 Slave	`Off`	`Off`	`Off`
RS485 Master	`On`	`On`	`On`
RS485 Master half duplex	`On`	`On`	`Off`
RS232 Point-to-point	`Off`	`Off`	`On`

1 `On` and `Off` positions are marked on the actual module (see Figure 420 on page 675).

2 When using standard one-on-one cables (e.g. cable "CCE-485-01/Lx" on page 753), dip switch 1 of the DCOM-232/485 on one side must be `On` and dip switch 1 of the other DCOM-232/485 must be `Off`.
When using a cross-cable, dip switch 1 of both DCOM-232/485s must be `Off`.

Note:

For proper RS232 operation, it is important that dip switch 3 is `On`!

Cable lengths

The maximum (total) cable length for RS232, RS422 and RS485 communication depends on the baud rate and the communication method (full-duplex or half-duplex).

Table 77 on page 679 gives the maximum cable length provided a proper cable type is used.

Table 77 Maximum cable length versus baud rate

communication method	baud rate	maximum cable length
RS232 full-duplex	≤ 100 kBd	10 m
RS422 full-duplex RS485 full-duplex	≤ 100 kBd	1.2 km
	≤ 125 kBd	1 km
	≤ 1 MBd	120 m
	≤ 2 MBd	60 m
RS485 half-duplex	≤ 100 kBd	600 m
	≤ 125 kBd	500 m
	≤ 1 MBd	60 m
	≤ 2 MBd	30 m

Fan-in / fan-out

- RS232 connections are point to point only
- RS422 connections are point to point only
- RS485 full duplex connections allow maximum 32 connected devices
- RS485 half duplex connections allow maximum 16 connected devices

Technical data

General	Type number[1 2]:	FS-DCOM-232/485 V2.1
		FC-DCOM-232/485 V2.1
	Approvals:	CE, TUV, UL, FM
Physical	Module dimensions:	110 × 70 × 61 mm (L × W × H) 4.33 × 2.76 × 2.40 in (L × W × H)
	Terminal dimensions:	6 × 57 × 47 mm (L × W × H) 0.24 × 2.24 × 1.85 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	117 mm (4.6 in)
Power	Input voltage:	5 Vdc ±5%
	Input current:	Max 500 mA, supplied by the Control Processor(s)
Output	RS232 output:	According EIA/TIA-232 levels
	RS232 baudrate:	0—250 kBaud
	RS485/422 output:	According EIA/TIA-485-A levels
	RS485/422 baudrate:	0—2 MBaud (transparent, FM0, FM1 or Manchester coded)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

2 Model numbers prior to V2.0 do not have a `MASTER` switch as indicated in Figure 423 on page 678
Model number V2.1 has modified circuits. They solve the issue with model number V2.0 to cause line faults in unusual (rare) RS232 configurations when DIP switch 2 (TxD) is set `On`.
Please note that V2.0 does not support multidrop SafeNet.

SDW-550 EC

5 port HSE communication FTA or "switch"

Tip:

This data sheet contains an extract of the SDW-550 EC manufacturer specifications. For further information see the SDW-500 product documentation issued by Westermo.

Description

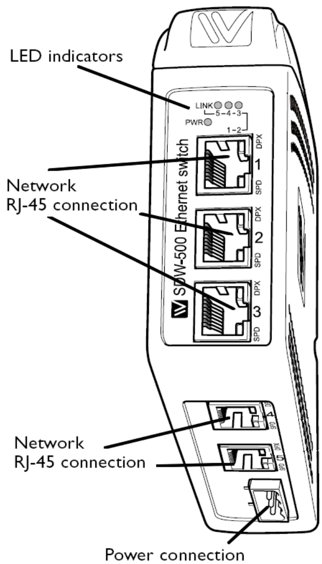
The SDW-550 EC, make Westermo, is a five port 10/100Base Ethernet switch used as interface between USI-0001 or USI-0002 communication modules in the Control Processor and the field.

Figure 424 on page 681 shows that the SDW-550 EC has one (24Vdc) power connector and five isolated RJ-45 TX port connectors, divided into two sections.

The raised isolation level between the two port sections makes the SDW-550-EC compliant to the IEC 61010.

For IEC 61010 compliance use one section (e.g. ports 1, 2 and 3) must be connected to the field while the other section (ports 4 and 5) must connect to the CP backplane, thus optimizing power surge protection from the field.

Figure 424 SDW-550 EC connections



It is recommended to keep port 1 available for a (portable) Safety Station. (See Figure 428 on page 686 for details.)

Mounting

The SDW550 EC is to be mounted on a horizontally placed TS-35 rail.

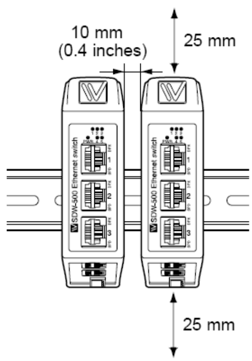
Warning:

Westermo SDW-500 series modules have to be clamped on a *horizontally mounted* TS-35 rail, with free airflow around the module:

- at least 25mm (1.0 inch) above and below the module and
- at least 10mm (0.4 inch) left and right of the module.

Figure 425 on page 682 shows the mounting instructions of the SDW 500 series switches.

Figure 425 Mounting instructions SDW-500 series switches



DIP switch settings

Warnings:

1. Do not open connected equipment.
2. Prevent damage to internal electronics by first discharging your body to ground (e.g. use an ESD wrist strap) before removing the lid on top of the unit.
3. Prevent access to hazardous voltage by disconnecting the unit from 24V supply and removing *at least* the RJ45 field connections (port 1 thru 3).

The DIP switches of the SDW-550 EC are located under the lid on top of the unit. Figure 426 on page 683 shows how to access the DIP switches.

Figure 426 Lid removal to access DIP switches

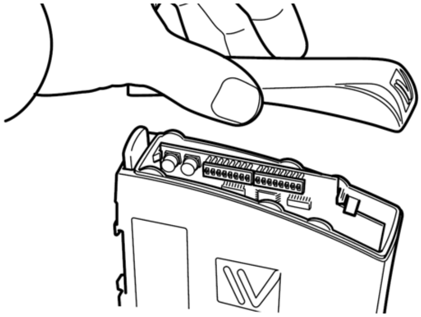


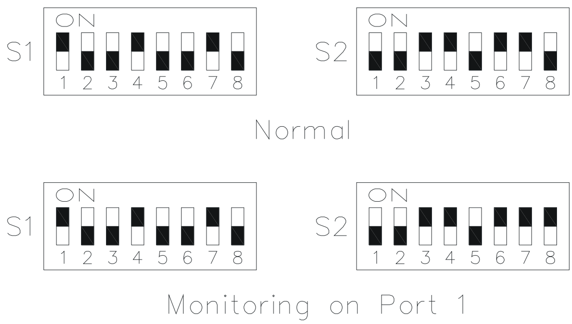
Figure 427 on page 683 shows the advised switch settings:

- The top half of the figure shows the normal settings for operation with Safety Manager.
- The bottom half of the figure shows the switch settings when port 1 is to be configured as monitor. When configured as monitor all packets throught the switch are mirrored to port 1 (e.g. to connect a Safety Station).

Notes:

1. Neither setting in Figure 427 on page 683 is the factory default setting!
2. The DIP switch configuration settings are only read during power-up.

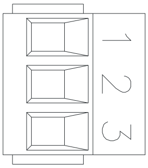
Figure 427 Advised DIP switch settings



Power

Each SDW-550 EC needs 24 Vdc power and an Earth connection.

The Earth connection wire must be 1 mm^2 (AWG 17) copper or more. The power wires must be $0.5mm^2$ (AWG 20) copper or more.

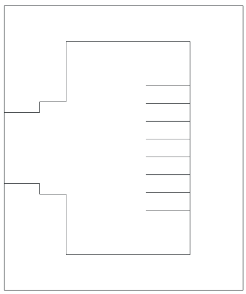


Pin	Description
1	0 Volt
2	24 Volt
3	Earth

RJ-45 TX port connector

The RJ-45 TX port connectors of the SDW-550 EC module are shielded and equipped with status LEDs. For LED details see “Status LEDs” on page 684.

Below table shows the pin assignment of the RJ-45 TX connectors.



Contact	Signal	Direction	Description
1	TD+	Out/In	Transmitted/Received data
2	TD-	Out/In	Transmitted/Received data
3	RD+	In/Out	Received/Transmitted data
4	-		
5	-		
6	RD-	In/Out	Received/Transmitted data
7	-		
8	-		
Case	Shield		HF-connection to earth

Status LEDs

The SDW-550 EC has the following LEDs on the module front:

- a PWR (power) LED
- five LINK LEDs

The SDW-550 EC has the following LEDs on each RJ-45 TX port connector:

- a SPD (speed) LED
- a DPX (duplex) LED

Table 78 on page 685 describes the indications of the status LEDs.

Table 78 Status LEDS of the SDW-550 EC rail mounted switch

Module front status LEDs		
LED	**status**	**description**
PWR	ON	Internal power, initialization OK
	Slow flashing	Initialization progressing
	Fast flashing	Initialization error
LINK	OFF	No ethernet link
	ON	Good ethernet link
	Flashing	Ethernet traffic indication
Port connector status LEDs		
LED	**status**	**description**
SPD	OFF	10 Mbit/s (TX only)
	ON	100 Mbit/s (TX only)
DPX	OFF	Half duplex (TX only)
	ON	Full duplex (TX only)

Applications

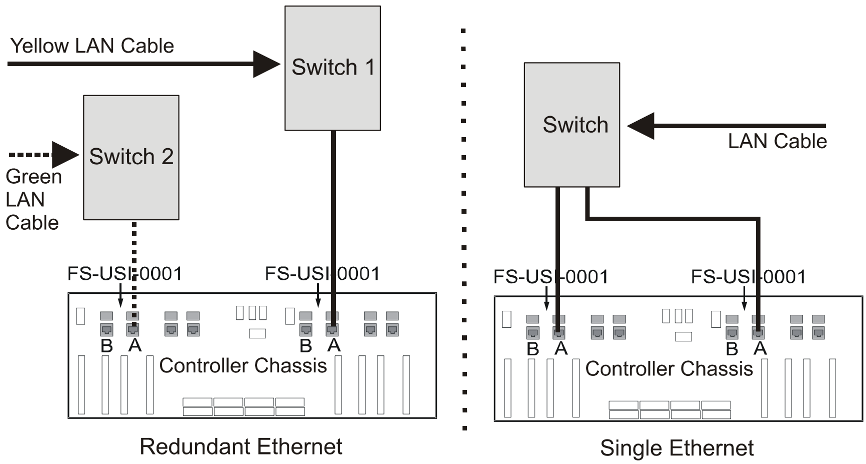
Ethernet switches are used in combination with the USI-0001 or USI-0002 communication modules to:

- provide galvanic isolation between Safety Manager and the network
- connect to other segments of the network.

Safety Manager with a redundant Controller contains up to four USI-0001 or USI-0002 communication modules, so up to eight ethernet channels may be present on the RJ-45 connectors of the Controller backplane (each USI-0001 or USI-0002 uses channel A and B for Ethernet communication).

Figure 428 on page 686 shows the basic configurations for connecting Ethernet switches to these channels.

Figure 428 Connecting the Ethernet switch to the USI-0001 communication modules and the LAN



Technical data

The SDW-550 EC has the following specifications:

General	Type number:	SDW-550 EC
	Manufacturer	Westermo
	Number of channels:	5
	Operating temperature:	–25°C— +70°C (–13°F— +158°F)
	Storage temperature:	–25°C— +70°C (–13°F— +158°F)
	Relative humidity:	5% to 95% (non-condensing)
	Approval:	CE, TUV, UL, FM
Power	Operating voltage:	DC 12 V—48V
	Rated current:	max. 320mA
	Power connector fuse:	Internal
Physical	Dimensions:	121 x 35 x 119 mm (D × W × H) 4.76 × 1.38 × 4.69 in (D × W × H)
	Weight:	0.2 kg
	Used rail length:	55 mm (35 + 2 x 10 free space) 2.18 in (1.38 + 2 x 0.4 free space)

MTL 24571

Single channel ethernet surge protector

Tip:

This data sheet contains an extract of a customized ZoneBarrier product issued by MTL Surge Technologies. For more information see the documentation provided by MTL Surge Technologies.

Description

The MTL 24571 (made by MTL Surge Technologies) is a single channel ethernet surge protector (100BaseT and 10BaseT).

When wired between an USI-0001 or USI-0002 communication module and the field, it gives the USI-0001 or USI-0002 and the Control Processor a IEC 61010 compliant protection against harmful voltages on the ethernet lines.

The MTL 24571 can be used for shielded twisted pair (STP) cables and in IEEE 802.3af compliant networks which apply 48V power on pins 1, 2, 3 and 6.

The MTL24571 has universal snap-in provisions for standard DIN EN rails.

Figure 429 Top-view and side-view of an MTL 24571

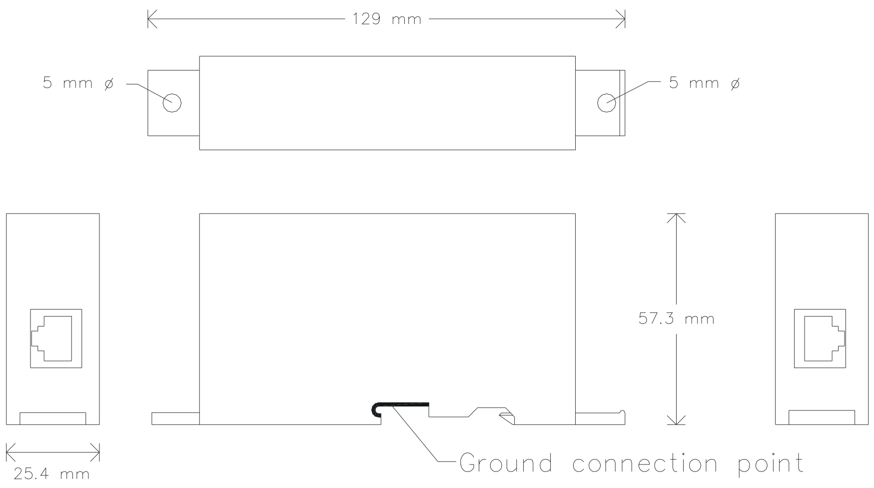
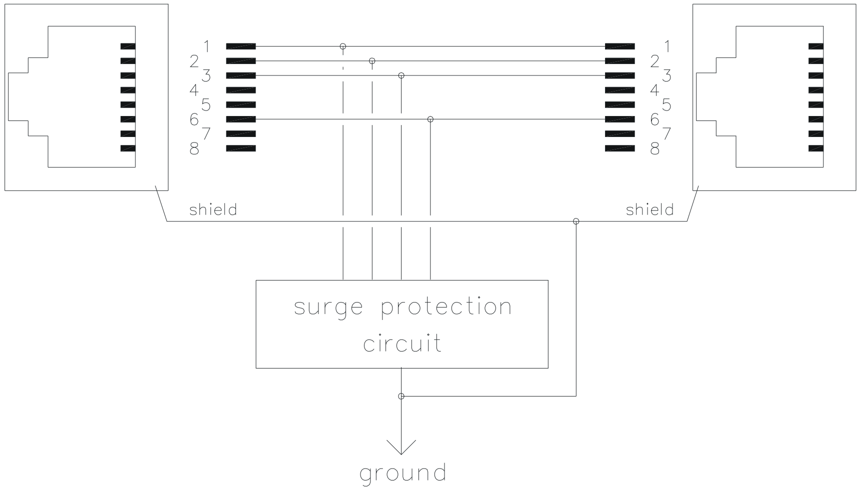


Figure 430 on page 688 provides a block diagram which shows the protected pins and that the shields of the RJ45 connectors are bonded to the protector ground.

Figure 430 Block diagram of the MTL 24571



Grounding

The MTL 24571 needs a proper connection to ground.

This can be achieved by grounding the DIN EN rail it is mounted on.

The MTL 24571 can also be mounted as a stand alone unit on a flat surface, (using the two 5 mm holes). In that case grounding must be done with a wire of (minimum) AWG 10 to the metal plate on the bottom of the MTL 24571 (using the self tapping screw provided).

Technical data

The MTL 24571 has the following specifications:

General	Type number:	MTL 24571
	Manufacturer:	MTL Surge Technologies
Approvals		CE, UL[1]
Power		none
Signals	Ethernet:	max. 155 MHz
	Attenuation:	max. -0.3 dB at 100 MHz
	PoE:	nominal 48 Vdc
	common mode:	230 Vac
Termination	RJ45:	shielded 4 wire (pins 1, 2, 3 and 6)
	Grounding:	DIN EN rail or minimum AWG 10
Protection	Surge Capacity:	1 kA per wire
	Residual Voltage:	75 V @ 0.5 kA, 8/20 µs
	Clamp voltage:	62 Vdc
Physical	Dimensions:	129 x 25.4 x 57.3 mm (D x W x H) 5.08 x 1.0 x 2.26 in (D x W x H)
	Weight:	0.09 kg
	Used rail length:	26 mm (1.02 in)

1 UL 497B, for indoor use

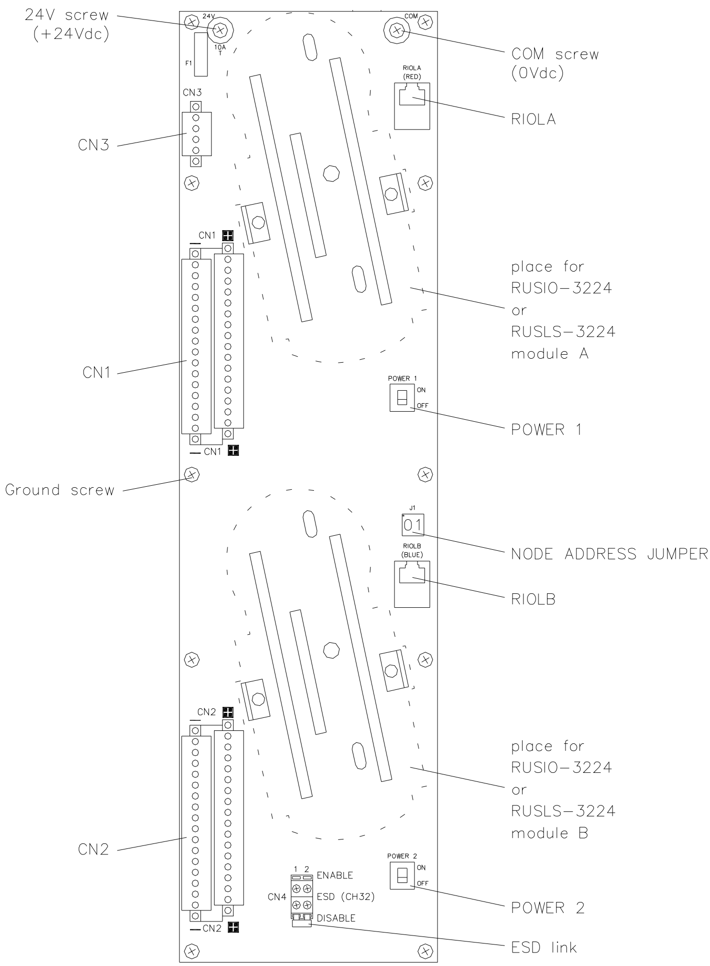
IOTA-R24

Redundant IO Termination Assembly

Description

The IOTA-R24 assembly enables the use of a redundant set of RUSIO-3224 or RUSLS-3224 modules. For physical and schematic representations of the IOTA-R24 see Figure 431 on page 690 and Figure 432 on page 692.

Figure 431 Mechanical layout



The IOTA-R24 can be used in applications up to SIL 3, in compliance with IEC 61508/61511.

The IOTA-R24 provides for:

- connectors for two (redundant) RUSIO-3224 or RUSLS-3224 modules
- 32 (universal) IO channel connections (**CN1** and **CN2**)
- 4 (identical) V+ connections (**CN3**), for active AI devices
- two RJ45 connectors for 100MB Ethernet communication (RIOLA and RIOLB)
- 24V power connection (24V screw and COM screw to the carrier power rails)

The RUSIO-3224 or RUSLS-3224 modules are placed on the indicated positions of the IOTA-R24. See Figure 431 on page 690 for details.

The RUSIO-3224 or RUSLS-3224 module in the top position is addressed as module 'A', the bottom one as module 'B'.

The IOTA-R24 module has two switches:

- use **POWER 1** to switch Module 'A' on and off
- use **POWER 2** to switch Module 'B' on and off

The node number of the IOTA-R24 is set by placing the proper node addres jumper on the IOTA-R24 assembly.

The Emergency ShutDown (ESD) function can be enabled or disabled with the **ESD (CH32)** link.

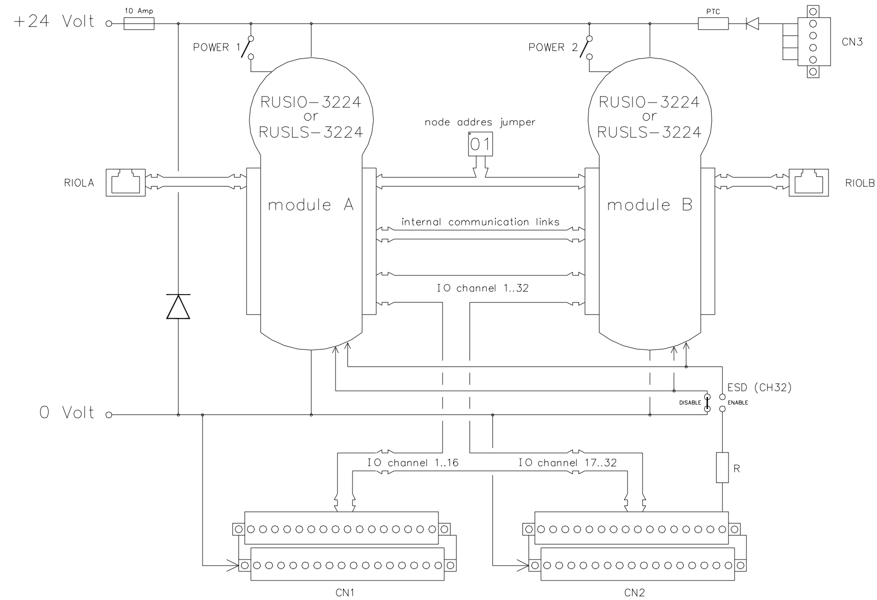
The IO field signals are connected on **CN1** and **CN2**; see Figure 431 on page 690.
The minus-row of **CN1** and **CN2** (left side) are all connected with 0V.
The plus-row of **CN1** and **CN2** (right side) are the 'real' channels.
Any type of IO field signal has only to be connected to the two connections of the applicable universal channel.

CN3 is used to connect active AI devices.

The IOTA-R24 module has two connectors to link the RUSIO-3224 or RUSLS-3224 modules with the SM Controller:

- the **RIOLA** connector is used for module ‘A’
- the **RIOLB** connector is used for module ‘B’

Figure 432 Block diagram



Mounting

The IOTA-R24 is mounted on a (metal) carrier (18 inch or 36 inch long). For details see:

- “MCAR-01” on page 75.
- “MCAR-02” on page 80.

The carrier provides the ground rail and the (+24V and 0V) power rails.

Connections

Channel 1 thru 16 on CN1

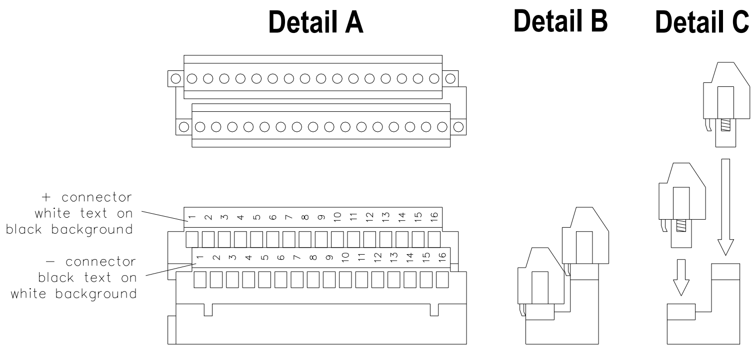
IO-channel 1 thru 16 are terminated on CN1.

Detail A shows the top and side view (field-connectors placed).

Detail B shows the second side-view with the field-connectors placed.

Detail C shows the second side-view with the field-connectors removed.

Figure 433 Channel 1 thru 16 on CN1



Channel 17 thru 32 on CN2

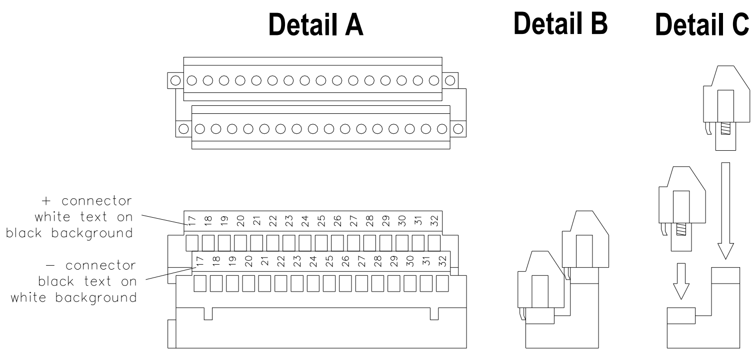
IO-channel 17 thru 32 are terminated on CN2.

Detail A shows the top and side view (field-connectors placed).

Detail B shows the second side-view with the field-connectors placed.

Detail C shows the second side-view with the field-connectors removed.

Figure 434 Channel 17 thru 32 on CN2



V+ connections on CN3

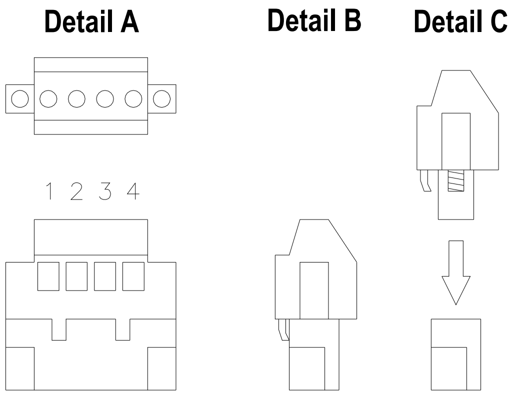
CN3 has four (uni-directional) V+ connections for field signals that require a passive analog input. For details about this type of channel configuration see “RUSIO-3224” on page 416 or “RUSLS-3224” on page 439.

Detail A shows the top and side view (field-connectors placed).

Detail B shows the second side-view with the field-connector placed.

Detail C shows the second side-view with the field-connector removed.

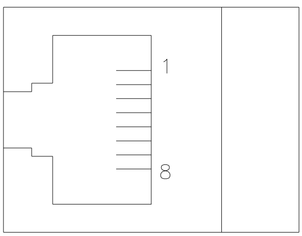
Figure 435 V+ connections on CN3



Ethernet connectors

The ethernet connectors (**RIOLA** ans **RIOLB**) are shielded RJ-45 connectors.

The pin assignment of the RJ-45 connectors is shown below.



Contact	Signal	Direction	Description
1	TD+	Out	Transmitted data
2	TD-	Out	Transmitted data
3	RD+	In	Received data
4	-		
5	-		
6	RD-	In	Received data
7	-		
8	-		
Case	Shield		HF-connection to earth

ESD enable / disable link

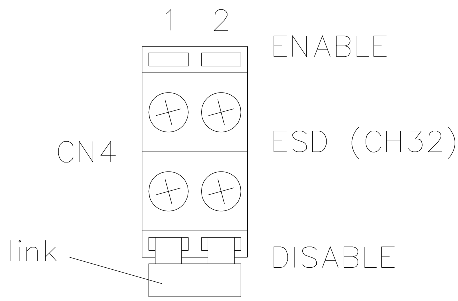
The ESD function (on channel 32) can be enabled (or disabled) with a link on the IOTA.

In case the link is placed in the drawn position (See Figure 436 on page 695), channel 32 can be used as universal channel (analog or digital; input or output).

In case the link is in the ENABLE position, channel 32 must be used as ESD input.

A (normally closed) ESD switch (with 1 kOhm series resistor) must be connected between CH32+ and CH32- of the IOTA.

Figure 436 ESD (CH32) link



Node address jumpers

The node address jumper is used to give the processors in the RUSIO-3224 or RUSLS-3224 module(s) the node address of the IOTA.
The jumper is a 10.2 x 10.2 x 6.1 mm (0.4 x 0.4 x 0.24 in) gray plastic jumper set; it has a (two digit) number that is clearly visible.
For an example of a node address jumper see Figure 437 on page 696.

The jumpers are available in kits of ten numbers:

- 51153818-201 is a kit with the numbers 01 thru 10.
- 51153818-202 is a kit with the numbers 11 thru 20.
- 51153818-203 is a kit with the numbers 21 thru 30.
- 51153818-204 is a kit with the numbers 31 thru 40.

Figure 437 Node address jumper - front and side view

RUSIO / RUSLS connections

The IOTA-R24 assembly supports all IO types that can be configured in the RUSIO-3224 or RUSLS-3224 module.

The supported IO types are:

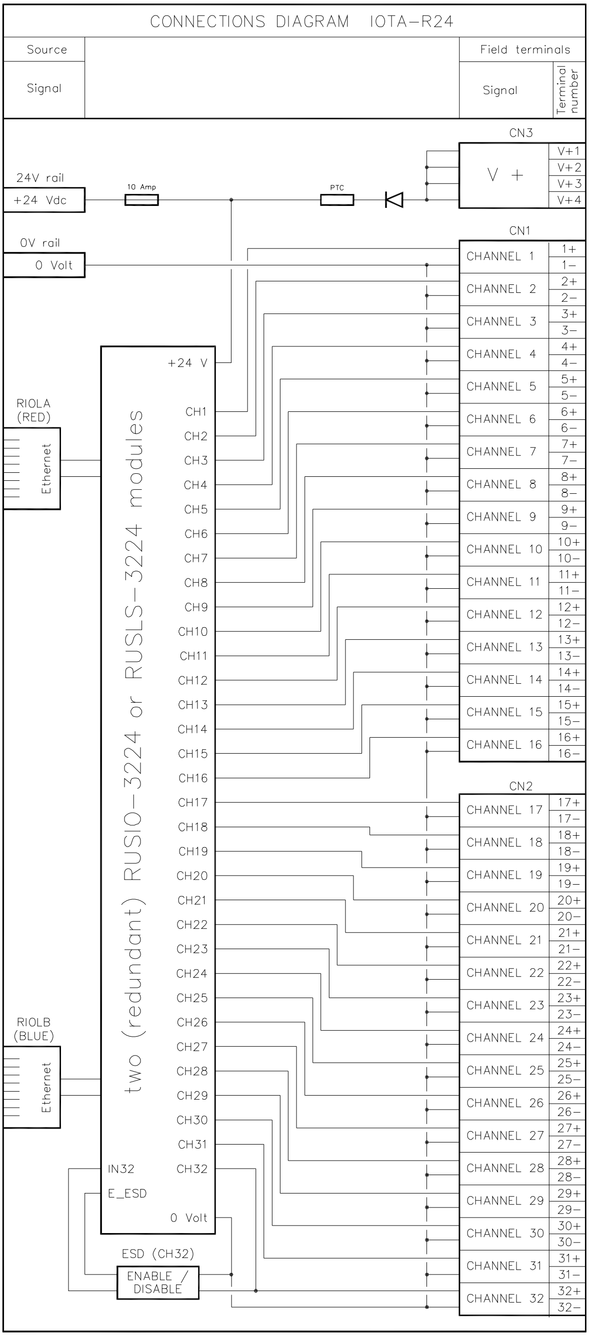
- Line monitored digital input
- Non line monitored digital input
- Line monitored ESD input (on Channel 32)
- Analog input 0-20mA or 4-20mA
- Digital output (0.5 Amp), with or without configurable line monitoring
- Multiple digital output (1 Amp or 2 Amp), with or without line monitoring
- Analog output 0-20mA or 4-20mA

Further details on the connection and specifications of these IO types is described elsewhere. See “RUSIO-3224” on page 416 or “RUSLS-3224” on page 439.

Figure 438 on page 698 shows the IO connection diagram of the IOTA-R24 .

The two RUSIO-3224 or RUSLS-3224 modules are connected in parallel. Each one is capable of controlling the IO.

Figure 438 Connection diagram



Technical data

The IOTA-R24 assembly has the following specifications:

General	Type number:	FC-IOTA-R24
	Operating temperature:	-40 .. +70 degC (-40 .. +158 degF)
	Storage temperature:	-40 .. +85 degC (-40 .. +185 degF)
	Relative humidity:	10..95% (non condensing)
	Pollution:	Pollution degree 2 or better
	Approvals:	CE; UL, TUV pending
Power	Supply voltage:	24 Vdc -15%..+30%
	Supply load:	max. 10 A
	Reverse polarity protection:	parallel diode (blows the fuse)
	Fuse:	
	• rating:	10 Amp, 58V
	• type:	TAC ATO Style Blade Fuse
	• manufacturer:	Littelfuse
	• ordernumber:	142.6185.510_
	V+ pins:	
	• max. current:	1 Amp (total of four CN3 pins)
	• max. voltage drop:	<1.5V (at 0.7A)
	• max. reverse voltage:	36V
Connections	24V supply:	2 x M4 (to power rail of the carrier)
	Ground:	10 x M3.5 (to metal of the carrier)
	Ethernet:	RJ-45
	IO (CN1 and CN2):	Weidmuller: BLZ 5.08/16/90F SN SW
	V+ (CN3):	Weidmuller: BLZ 5.08/4/90F SN SW
	Screw terminals (CN1,CN2,CN3):	
	• max. wire diameter:	0.50 .. 2.50 mm2
	• strip length:	7 mm
Physical Data	Dimensions (H x W x D):	64 x 120.7 x 443.2 mm 2.52 x 4.75 x 17.45 in
	Weight:	0.57 kg 1.26 lbs

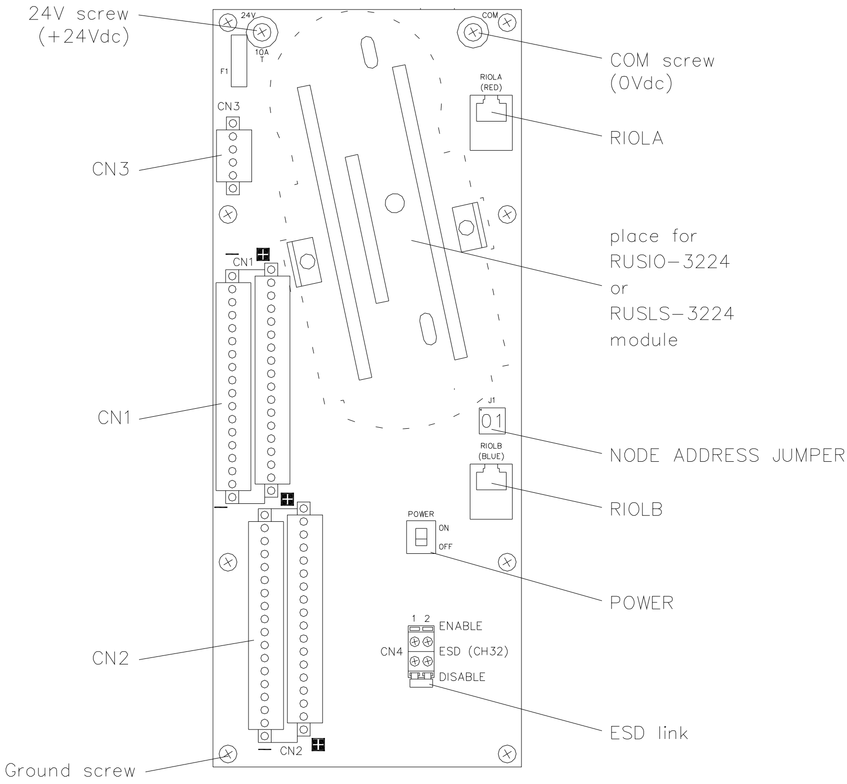
IOTA-NR24

Non-redundant IO Termination Assembly

Description

The IOTA-NR24 assembly enables the use of one RUSIO-3224 or RUSLS-3224 module. For physical and schematic representations of the IOTA-NR24 see Figure 439 on page 700 and Figure 440 on page 702.

Figure 439 Mechanical layout



The IOTA-NR24 can be used in applications up to SIL 3, in compliance with IEC 61508/61511.

The IOTA-NR24 provides for:

- connectors for one RUSIO-3224 or RUSLS-3224 module
- 32 (universal) IO channel connections (**CN1** and **CN2**)
- 4 (identical) V+ connections (**CN3**), for active AI devices
- two RJ45 connectors for 100MB Ethernet communication (RIOLA and RIOLB)
- 24V power connection (24V screw and COM screw to the carrier power rails)

The RUSIO-3224 or RUSLS-3224 module is placed on the indicated position of the IOTA-NR24. See Figure 439 on page 700 for details.

The IOTA-NR24 module has a switch:

- use **POWER** to switch the Module on and off

The node number of the IOTA-NR24 is set by placing the proper node addres jumper on the IOTA-NR24 assembly.

The Emergency ShutDown (ESD) function can be enabled or disabled with the **ESD (CH32)** link.

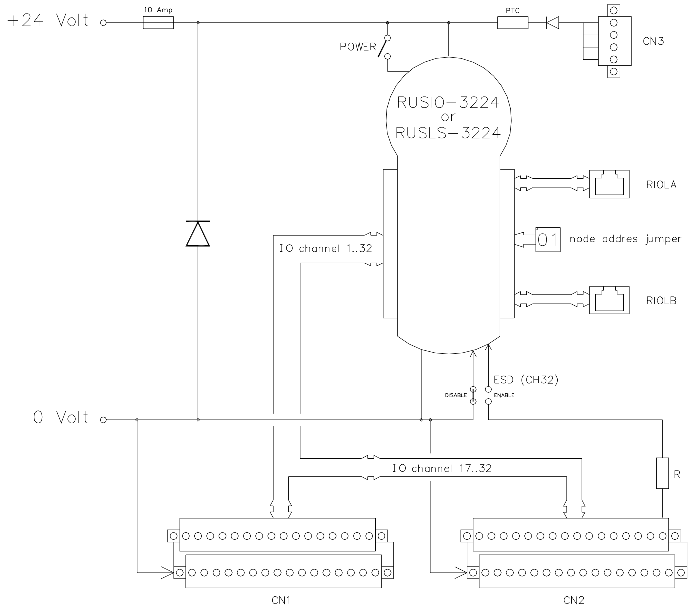
The IO field signals are connected on **CN1** and **CN2**; see Figure 439 on page 700.
The minus-row of **CN1** and **CN2** (left side) are all connected with 0V.
The plus-row of **CN1** and **CN2** (right side) are the 'real' channels.
Any type of IO field signal has only to be connected to the two connections of the applicable universal channel.

CN3 is used to connect active AI devices.

The IOTA-NR24 module has two connectors to link the RUSIO-3224 or RUSLS-3224 module with the SM Controller:

- the **RIOLA** connector is used for link ‘A’
- the **RIOLB** connector is used for link ‘B’

Figure 440 Block diagram



Mounting

The IOTA-NR24 is mounted on a (metal) carrier (18 inch or 36 inch long). For details see:

- “MCAR-01” on page 75.
- “MCAR-02” on page 80.

The carrier provides the ground rail and the (+24V and 0V) power rails.

Connections

Channel 1 thru 16 on CN1

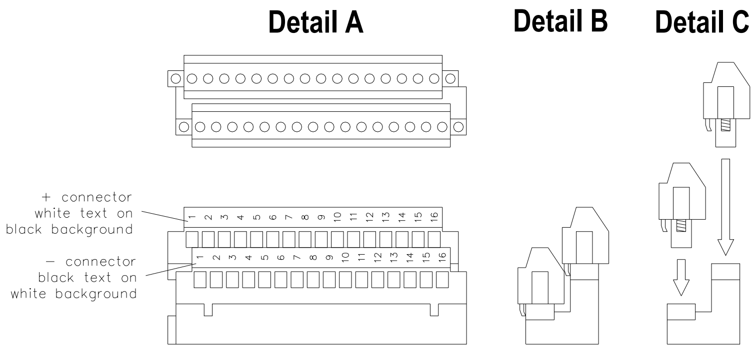
IO-channel 1 thru 16 are terminated on CN1.

Detail A shows the top and side view (field-connectors placed).

Detail B shows the second side-view with the field-connectors placed.

Detail C shows the second side-view with the field-connectors removed.

Figure 441 Channel 1 thru 16 on CN1



Channel 17 thru 32 on CN2

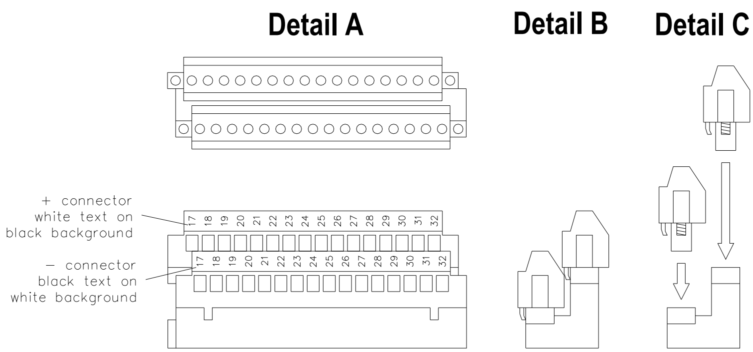
IO-channel 17 thru 32 are terminated on CN2.

Detail A shows the top and side view (field-connectors placed).

Detail B shows the second side-view with the field-connectors placed.

Detail C shows the second side-view with the field-connectors removed.

Figure 442 Channel 17 thru 32 on CN2



V+ connections on CN3

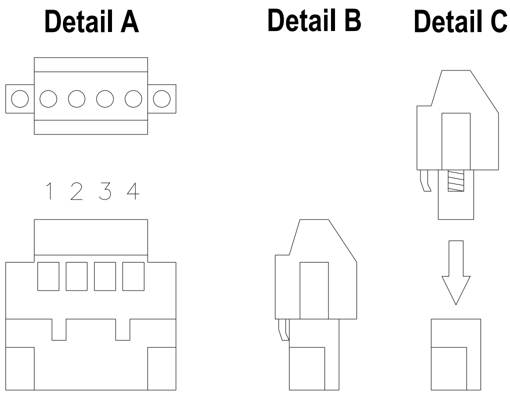
CN3 has four (uni-directional) V+ connections for field signals that require a passive analog input. For details about this type of channel configuration see “RUSIO-3224” on page 416 or “RUSLS-3224” on page 439.

Detail A shows the top and side view (field-connectors placed).

Detail B shows the second side-view with the field-connector placed.

Detail C shows the second side-view with the field-connector removed.

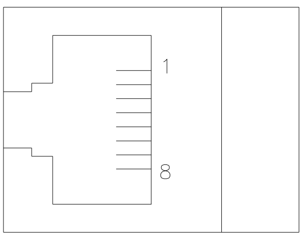
Figure 443 V+ connections on CN3



Ethernet connectors

The ethernet connectors (**RIOLA** ans **RIOLB**) are shielded RJ-45 connectors.

The pin assignment of the RJ-45 connectors is shown below.



Contact	Signal	Direction	Description
1	TD+	Out	Transmitted data
2	TD-	Out	Transmitted data
3	RD+	In	Received data
4	-		
5	-		
6	RD-	In	Received data
7	-		
8	-		
Case	Shield		HF-connection to earth

ESD enable / disable link

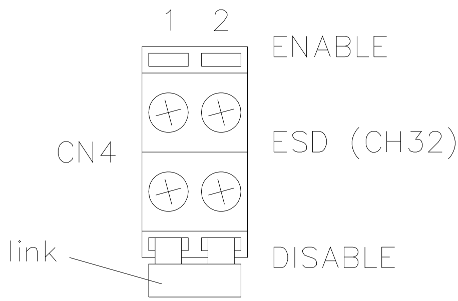
The ESD function (on channel 32) can be enabled (or disabled) with a link on the IOTA.

In case the link is placed in the drawn position (See Figure 444 on page 705), channel 32 can be used as universal channel (analog or digital; input or output).

In case the link is in the ENABLE position, channel 32 must be used as ESD input.

A (normally closed) ESD switch (with 1 kOhm series resistor) must be connected between CH32+ and CH32- of the IOTA.

Figure 444 ESD (CH32) link



Node address jumpers

The node address jumper is used to give the processors in the RUSIO-3224 or RUSLS-3224 module(s) the node address of the IOTA.
The jumper is a 10.2 x 10.2 x 6.1 mm (0.4 x 0.4 x 0.24 in) gray plastic jumper set; it has a (two digit) number that is clearly visible.
For an example of a node address jumper see Figure 445 on page 706.

The jumpers are available in kits of ten numbers:

- 51153818-201 is a kit with the numbers 01 thru 10.
- 51153818-202 is a kit with the numbers 11 thru 20.
- 51153818-203 is a kit with the numbers 21 thru 30.
- 51153818-204 is a kit with the numbers 31 thru 40.

Figure 445 Node address jumper - front and side view

RUSIO / RUSLS connections

The IOTA-NR24 assembly supports all IO types that can be configured in the RUSIO-3224 or RUSLS-3224 module.

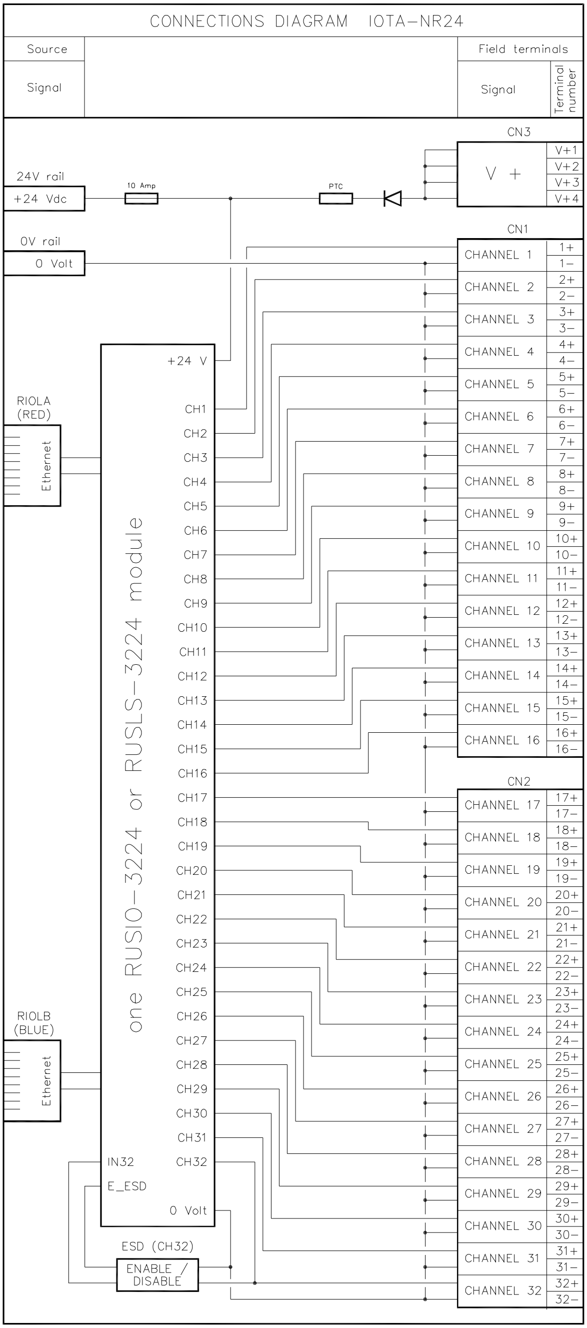
The supported IO types are:

- Line monitored digital input
- Non line monitored digital input
- Line monitored ESD input (on Channel 32)
- Analog input 0-20mA or 4-20mA
- Digital output (0.5 Amp), with or without configurable line monitoring
- Multiple digital output (1 Amp or 2 Amp), with or without line monitoring
- Analog output 0-20mA or 4-20mA

Further details on the connection and specifications of these IO types is described elsewhere. See “RUSIO-3224” on page 416 or “RUSLS-3224” on page 439.

Figure 446 on page 708 shows the IO connection diagram of the IOTA-NR24 .

Figure 446 Connection diagram



Technical data

The IOTA-NR24 assembly has the following specifications:

General	Type number:	FC-IOTA-NR24
	Operating temperature:	-40 .. +70 degC (-40 .. +158 degF)
	Storage temperature:	-40 .. +85 degC (-40 .. +185 degF)
	Relative humidity:	10..95% (non condensing)
	Pollution:	Pollution degree 2 or better
	Approvals:	CE; UL, TUV pending
Power	Supply voltage:	24 Vdc -15%..+30%
	Supply load:	max. 10 A
	Reverse polarity protection:	parallel diode (blows the fuse)
	Fuse:	
	• rating:	10 Amp, 58V
	• type:	TAC ATO Style Blade Fuse
	• manufacturer:	Littelfuse
	• ordernumber:	142.6185.510_
	V+ pins:	
	• max. current:	1 Amp (total of four CN3 pins)
	• max. voltage drop:	<1.5V (at 0.7A)
	• max. reverse voltage:	36V
Connections	24V supply:	2 x M4 (to power rail of the carrier)
	Ground:	8 x M3.5 (to metal of the carrier)
	Ethernet:	RJ-45
	IO (CN1 and CN2):	Weidmuller: BLZ 5.08/16/90F SN SW
	V+ (CN3):	Weidmuller: BLZ 5.08/4/90F SN SW
	Screw terminals (CN1,CN2,CN3):	
	• max. wire diameter:	0.50 .. 2.50 mm2
	• strip length:	7 mm
Physical Data	Dimensions (H x W x D):	64 x 120.7 x 293.4 mm 2.52 x 4.75 x 11.55 in
	Weight:	0.46 kg 1.01 lbs

System interconnection cables 16

This chapter describes the following items:

Item		See
General info about System Interconnection Cables (SIC)		page 712
SM chassis IO to FTA		
SICC-0001/Lx	System Interconnection Cable for chassis IO terminating on FTAs (SICC)	page 715
SICP-0001/Lx	System Interconnection Cable for chassis IO terminating on crimp pins (SICP)	page 718
CP backplane to external sources		
SICP-0002/L3	Digital input cable for Control Processor backplane	page 722
SM universal IO		
SICC-1002/Lx	System Interconnection Cable for universal IO terminating on FTAs (SICC)	page 725
SICC-2001/Lx	System Interconnection Cable for universal IO terminating on FTAs (SICC)	page 728
CA-HWC300-AIO-DIO-xM	System Interconnection Cable for universal IO terminating on IOTAs (SICC)	page 731

General info about System Interconnection Cables (SIC)

System Interconnection Cables (SIC) are divided in these main groups:

- SIC to connect SM chassis IO to FTAs.
  See “SIC for SM chassis IO” on page 712.
- SIC to connect CP backplane to external contact.
  See “SIC for CP backplane” on page 714.
- SIC to connect SM universal IO to FTAs.
  See “SIC for SM universal IO” on page 714.

SIC for SM chassis IO

This type of System Interconnection Cable (SIC) transports field signals to SM chassis IO modules. Depending on whether or not an FTA is used in the configuration, you either use a SICC cable, or a SICP cable. Refer to Table 79 on page 712 for input signals and Table 80 on page 712 for output signals.

Table 79 possible ways to connect input field signals to input modules (read table from left to right to see possible interface/wiring options)

Input Signals				
Field signal		SICP cable		Input module
Field signal		SICP cable	Input converter module	Input module
Field signal	FTA	SICC cable		Input module
Field signal	FTA	SICC cable	Input converter module	Input module

Table 80 possible ways to connect output field signals to output modules (read table from left to right to see possible interface/wiring options)

Output Signals				
Output module		SICP cable		Field signal
Output module	Output converter module	SICP cable		Field signal
Output module		SICC cable	FTA	Field signal
Output module	Output converter module	SICC cable	FTA	Field signal

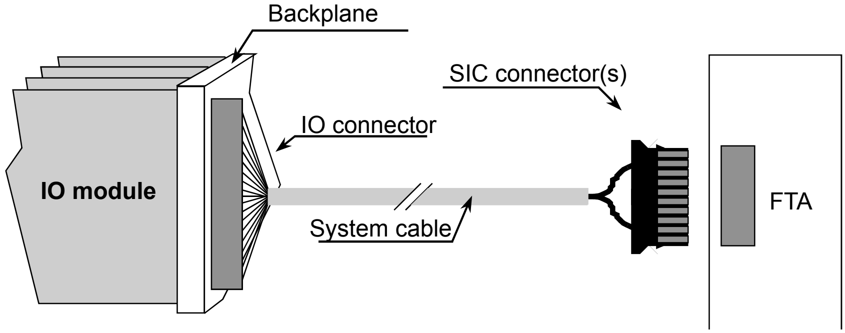
At the back plane side each of the above mentioned connection methods uses an IO-connector.

At the field signal side:

- SICC cables connect to an FTA with a special (20-pins) FTA-connector; the connection principle for this method is shown in Figure 447 on page 713,
- SICP cables connect directly to field signals with 20 wires (crimp pins); the connection principle for this method is shown in Figure 448 on page 713.

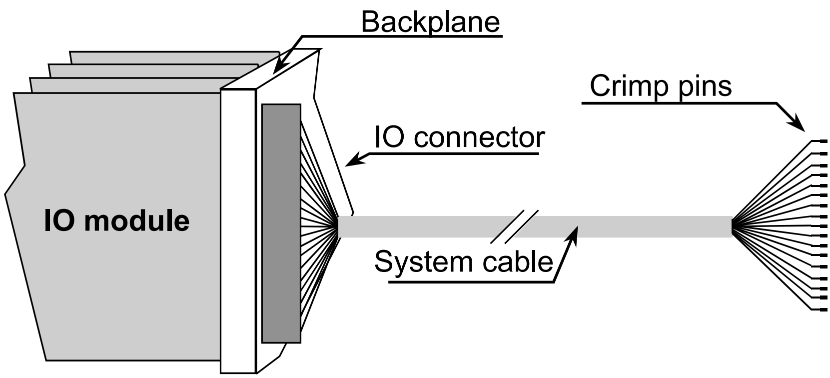
Connection principles

Figure 447 Principle of SICC connection method



The wiring method that uses SIC cables terminating on crimp pins (SICP) is shown in Figure 448 on page 713.

Figure 448 Principle of SICP connection method



Related topic(s): "SICC-0001/Lx" on page 715
"SICP-0001/Lx" on page 718

SIC for CP backplane

This type of System Interconnection Cable (SIC) is used to connect one or more inputs on the CP backplane with external (potential free) contacts.

Related topic(s): "SICP-0002/L3" on page 722

SIC for SM universal IO

This type of System Interconnection Cable (SIC) transports field signals to SM universersal IO modules.

Related topic(s): "SICC-1002/Lx" on page 725
"SICC-2001/Lx" on page 728
"CA-HWC300-AIO-DIO-xM" on page 731

SICC-0001/Lx

System Interconnection Cable for chassis IO terminating on FTAs (SICC)

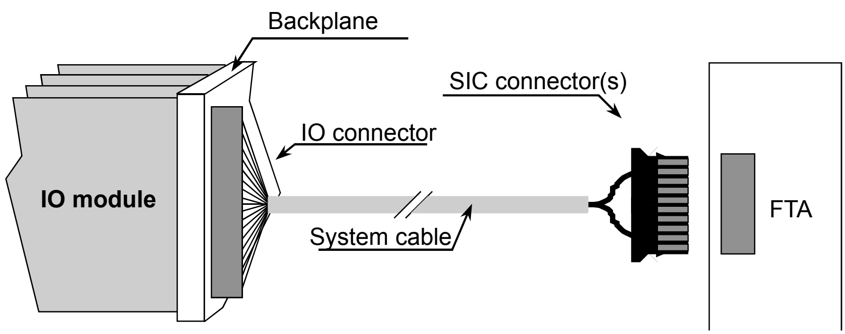
Description

System interconnection cables - for SM chassis IO - with termination to Field Termination Assemblies (FTA) can connect Safety Manager IO modules to FTAs (via an IO backplane). Figure 449 on page 715 illustrates this process. These cables are called SICC cables and have one IO connector on one end and one 20-pin FTA connector on the other end.

Connection principles

The wiring method for SIC cables terminating on FTAs (SICC) is shown in Figure 449 on page 715.

Figure 449 Principle of SICC connection method



Technical data

System interconnection cables terminating on FTAs have the following specifications:

General	Type number:	FS-SICC-0001/Lx (where × = length)
	Cable type:	20 × AWG 22 (= 0.34 mm²) double shielded
	Outer diameter (nominal):	9.93 mm / 0.39 in
	Available lengths:	× = 3.25 m, 5 m, 6 m, 8 m, 10 m, 15 m, 20 m, 25 m and 30 m.

SICC Cable connections

This tables gives an overview of all possible connections of FTAs to input and output modules.

Table 81 Connections for standard SICC-0001/Lx cable to input modules

Signal				**Connector pin**	
SDI-1624 **SDI-1648**	**SAI-0410**	**SAI-1620m**	**SDIL-1608**	**IO module**	**FTA**
		Shield		41	–
0 Vdc	IN1-	0 Volt	0 Volt	40	A10
0 Vdc	IN1+	0 Volt	0 Volt	37	B10
IN1		IN1	IN1	36	A9
IN2		IN2	IN2	33	B9
IN3		IN3	IN3	32	A8
IN4		IN4	IN4	29	B8
IN5		IN5	IN5	28	A7
IN6		IN6	IN6	25	B7
IN7	IN2+	IN7	IN7	24	A6
IN8	IN2-	IN8	IN8	21	B6
IN9	IN3-	IN9	IN9	20	A5
IN10	IN3+	IN10	IN10	17	B5
IN11		IN11	IN11	16	A4
IN12		IN12	IN12	13	B4
IN13		IN13	IN13	12	A3
IN14		IN14	IN14	9	B3
IN15		IN15	IN15	8	A2
IN16		IN16	IN16	5	B2
+ Vext	IN4+	0 Volt	+ Vext (8 Vdc)	4	A1
+ Vext	IN4-	+ Vext/8	Earth	1	B1

Table 82 Connections for standard SICC-0001/Lx cable to output modules

Signal								**Connector pin**	
SDO-0824	**SAO-0220m**	**DO-1224**	**RO-1024**	**DO-1624**	**SDO-04110 SDO-0448**	**SDO-0424**	**SDOL-0424**	**IO module**	**FTA**
–	Shield	–	–	–	–	–	–	41	–
(0 Vdc)	–	–	OUT1 c	–	–	–	–	40	A10
(0 Vdc)	–	–	OUT1 no	–	–	–	–	37	B10
OUT1+	–	OUT1	OUT2 c	OUT1	(0 Vdc)	OUT1+	(0 Vdc)	36	A9
OUT1–	–	OUT2	OUT2 no	OUT2	(0 Vdc)	OUT1–	(0 Vdc)	33	B9
OUT2+	0V (1)	OUT3	OUT3 c	OUT3	OUT1+	OUT1+	OUT1+	32	A8
OUT 2–	–	OUT4	OUT3 no	OUT4	OUT1–	OUT1–	OUT1-	29	B8
OUT3+	mA1	OUT5	OUT4 c	OUT5	0 Vdc	OUT2+	(0 Vdc)	28	A7
OUT3–	Loop1	OUT6	OUT4 no	OUT6	(0 Vdc)	OUT2–	(0 Vdc)	25	B7
OUT4+	–	OUT7	OUT5 c	OUT7	OUT2+	OUT2+	OUT2+	24	A6
OUT4–	–	OUT8	OUT5 no	OUT8	OUT2–	OUT2–	OUT2-	21	B6
OUT5+	0V (2)	OUT9	OUT6 c	OUT9	(0 Vdc)	OUT3+	(0 Vdc)	20	A5
OUT5–	–	OUT10	OUT6 no	OUT10	(0 Vdc)	OUT3–	(0 Vdc)	17	B5
OUT6+	mA2	OUT11	OUT7 c	OUT11	OUT3+	OUT3+	OUT3+	16	A4
OUT6–	Loop2	OUT12	OUT7 no	OUT12	OUT3–	OUT3–	OUT3-	13	B4
OUT7+	–	0 Vdc	OUT8 c	OUT13	(0 Vdc)	OUT4+	(0 Vdc)	12	A3
OUT7–	–	0 Vdc	OUT8 no	OUT14	(0 Vdc)	OUT4–	(0 Vdc)	9	B3
OUT8+	–	0 Vdc	OUT9 c	OUT15	OUT4+	OUT4+	OUT4+	8	A2
OUT8–	–	0 Vdc	OUT9 no	OUT16	OUT4–	OUT4–	OUT4-	5	B2
(0 Vdc)	–	0 Vdc	OUT10 c	0 Vdc	(0 Vdc)	(0 Vdc)	(0 Vdc)	4	A1
(0 Vdc)	–	0 Vdc	OUT10 no	0 Vdc	(0 Vdc)	(0 Vdc)	(0 Vdc)	1	B1

SICP-0001/Lx

System Interconnection Cable for chassis IO terminating on crimp pins (SICP)

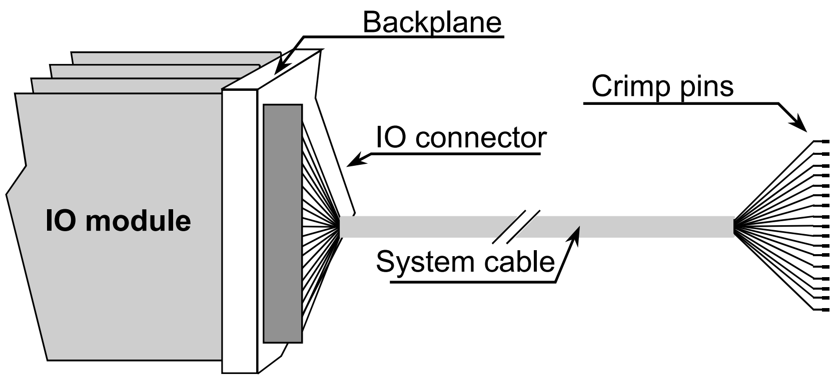
Description

System interconnection cables - for SM chassis IO - terminating on crimp pins are suitable for the connection to screw terminals (see Figure 450 on page 718). These cables are called SICP cables and are fitted with one IO connector on one end and crimp pins on the other.

Connection principle

The wiring method that uses SIC cables terminating on crimp pins (SICP) is shown in Figure 450 on page 718.

Figure 450 Principle of SICP connection method



Technical data

The SICP cable has the following specifications:

General	Type number:	FS-SICP-0001/Lx (where x = length)
	Cable type:	20 × AWG 22 (= 0.34 mm²) double shielded
	Outer diameter (nominal):	9.93 mm / 0.39 in
	Available lengths:	x = 3.25 m, 5 m, 6 m, 8 m, 10 m, 15 m, 20 m, 25 m and 30 m.

SICP Cable connections

The tables below describe possible connections of SIC cables to input and output modules.

Table 83 connections for standard SICP-0001/Lx cable to input modules

Signal				Pins	
SDI-1624 SDI-1648	SAI-0410	SAI-1620m	SDIL-1608	IO module connector pin	Color code crimp pin
		Shield		41	Yellow / Green
0 Vdc	IN1–	0 Volt	0 Volt	40	White
0 Vdc	IN1+	0 Volt	0 Volt	37	Brown
IN1		IN1	IN1	36	Green
IN2		IN2	IN2	33	Yellow
IN3		IN3	IN3	32	Gray
IN4		IN4	IN4	29	Pink
IN5		IN5	IN5	28	Blue
IN6		IN6	IN6	25	Red
IN7	IN2+	IN7	IN7	24	Black
IN8	IN2–	IN8	IN8	21	Violet
IN9	IN3–	IN9	IN9	20	Gray / Pink
IN10	IN3+	IN10	IN10	17	Red / Blue
IN11		IN11	IN11	16	White / Green
IN12		IN12	IN12	13	Brown / Green
IN13		IN13	IN13	12	White / Yellow
IN14		IN14	IN14	9	Yellow / Brown
IN15		IN15	IN15	8	White / Gray
IN16		IN16	IN16	5	Gray / Brown
+ Vext	IN4+	0 Volt	+Vext (8 Vdc)	4	White / Pink
+ Vext	IN4–	+ Vext/8	Earth	1	Pink / Brown

Table 84 connections for standard SICP-0001/Lx cable to output modules

Signal								Pins	
SDO-0824	SAO-0220m	DO-1224	RO-1024	DO-1624	SDO-04110 SDO-0448	SDO-0424	SDOL-0424	IO module connector pin	Color code crimp pin
					Shield		Shield	41	Yellow / Green
			OUT1 c					40	White
			OUT1 no					37	Brown
OUT1+		OUT1	OUT2 c	OUT1		OUT1+		36	Green
OUT1-		OUT2	OUT2 no	OUT2		OUT1-		33	Yellow
OUT2+	0V (1)	OUT3	OUT3 c	OUT3	OUT1+	OUT1+	OUT1+	32	Gray
OUT2–		OUT4	OUT3 no	OUT4	OUT1–	OUT1–	OUT1–	29	Pink
OUT3+	mA1	OUT5	OUT4 c	OUT5		OUT2+		28	Blue
OUT3-	Loop 1	OUT6	OUT4 no	OUT6		OUT2-		25	Red
OUT4+		OUT7	OUT5 c	OUT7	OUT2+	OUT2+	OUT2+	24	Black
OUT4–		OUT8	OUT5 no	OUT8	OUT2–	OUT2-	OUT2–	21	Violet
OUT5+	0V (2)	OUT9	OUT6 c	OUT9		OUT3+		20	Gray / Pink
OUT5-		OUT10	OUT6 no	OUT10		OUT3–		17	Red / Blue
OUT6+	mA2	OUT11	OUT7 c	OUT11	OUT3+	OUT3+	OUT3+	16	White / Green
OUT6–	Loop 2	OUT12	OUT7 no	OUT12	OUT3–	OUT3–	OUT3–	13	Brown / Green
OUT7+		0 Vdc	OUT8 c	OUT13		OUT4+		12	White / Yellow
OUT7-		0 Vdc	OUT8 no	OUT14		OUT4–		9	Yellow / Brown
OUT8+		0 Vdc	OUT9 c	OUT15	OUT4+	OUT4+	OUT4+	8	White / Gray
OUT8–		0 Vdc	OUT9 no	OUT16	OUT4–	OUT4–	OUT4–	5	Gray / Brown
		0 Vdc	OUT10 c	0 Vdc				4	White / Pink

Table 84 connections for standard SICP-0001/Lx cable to output modules *(continued)*

Signal								Pins	
SDO-0824	SAO-0220m	DO-1224	RO-1024	DO-1624	SDO-04110 SDO-0448	SDO-0424	SDOL-0424	IO module connector pin	Color code crimp pin
		0 Vdc	OUT10 no	0 Vdc				1	Pink / Brown

c = common

no = normally open

SICP-0002/L3

Digital input cable for Control Processor backplane

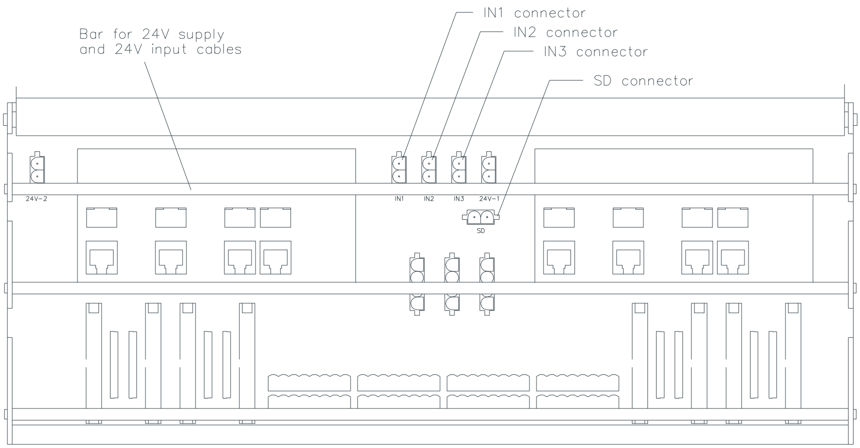
Description

The SICP-0002/L3 digital input cable for the Control Processor backplane is used to connect the SD and INx input(s) on the CP backplane with external (potential free) contacts.

Safety Manager

The cables can be placed on the connectors SD, IN1, IN2 resp. IN3, as indicated in Figure 451 on page 722.

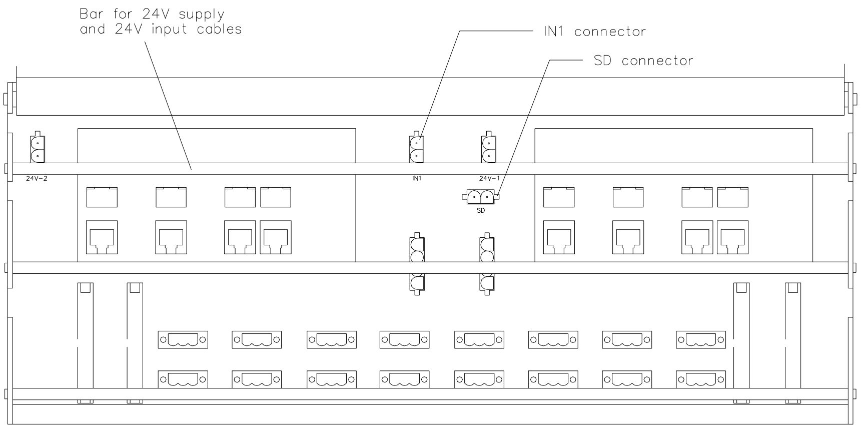
Figure 451 Safety Manager - Position of the SD, IN1, IN2 and IN3 connectors on the CP-backplane.



Safety Manager A.R.T.

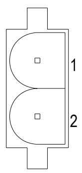
The cables can be placed on the connectors SD and IN1 as indicated in Figure 452 on page 723.

Figure 452 Safety Manager A.R.T. - Position of the SD and IN1 connectors on the CP-backplane.

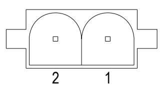


Pin allocation

The back view and pin allocation of the IN1, IN2 and IN3 connectors are:

		IN1	**IN2**	**IN3**
	1	+24V_red	+24V_red	+24V_red
	2	input1	input2	input3

The back view and pin allocation of the SD connector is:

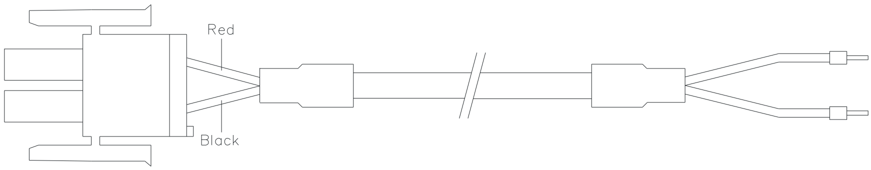
		SD
	1	+24V_sd
	2	input

Layout

Figure 453 on page 724 shows the layout of the FS-SICP-0002/L3 input cable.

The red wire connects to +24V. The black wire connects to the input.

Figure 453 Layout of the FS-SICP-0002/L3 input cable



Technical data

General	Type number:	FS-SICP-0002/L3
	Approvals:	CE, UL, CSA, FM
Cable	Type:	Alphawire 1899AWG/2C (2×1.3 mm^2)
	Length:	3 m
Connectors	CP side:	2 pole mate-n-lock
	Field side:	(crimp-on) pin

SICC-1002/Lx

System Interconnection Cable for universal IO terminating on FTAs (SICC)

Description

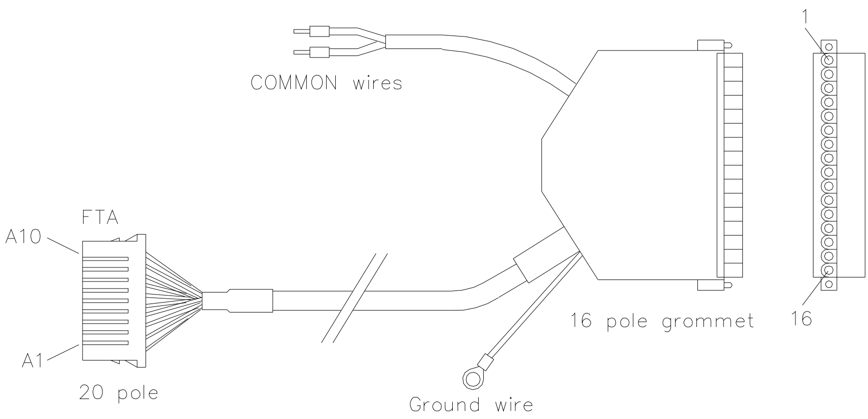
System interconnection cables - for SM universal IO - with termination to Field Termination Assemblies (FTA) connect Safety Manager universal IO modules to FTAs (via an IOTA).

Figure 454 on page 725 shows the SICC-1002/Lx[3].
The 16-pole grommet connects to channel 1 thru 16 (high row of CN1 position) or channel 17 thru 32 (high row of CN2 position) of the IOTA.
The two COMMON wires are connected to:

- CN3 of the IOTA (pins 1 and 2 for channel 1 thru 16 or pins 3 and 4 for channel 17 thru 32), if the field devices supply the channel energy,
- two pins of the low row connector of CN1 for channel 1 thru 16 or to the low-row of connector 2 for channel 17 thru 32, if the IOTA needs to supply the channel energy.

The 20-pole connector is placed on the FTA.
The grommet has a (8 inch long) wire to ground the cable shield.

Figure 454 SICC-1002/Lx - Mechanical layout

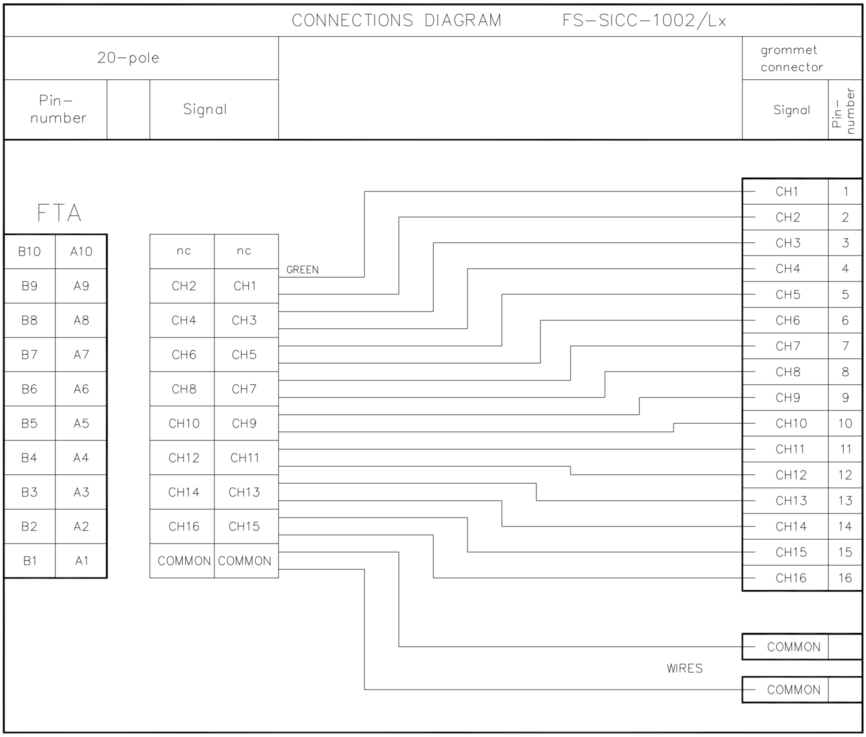


3. The ‘x’ in the model number represents the cable lenght in meters.

Connections

Figure 455 on page 726 shows the connection diagram of the SICC-1002/Lx.

Figure 455 Connection diagram



Technical data

General	Type number: • available length (m):	FS-SICC-1002/Lx [1] 3, 5, 6 and 10
	Approvals:	UL; CSA pending
Cable	Type:	20 x AWG22 shielded cable AWG style 2464
	COMMON wires:	AWG20
Connectors	20-pole: • make:	2x10 pins Dynamic Housing no. 178289-8 TYCO
	Grommet: • make:	SP-BLZ5.08 16P CLAMSHELL Weidmuller
	COMMON wires:	crimp-on cable tube
	Ground wire	Ring terminal (5 mm hole)

1 Where ‘x’ = length.

SICC-2001/Lx

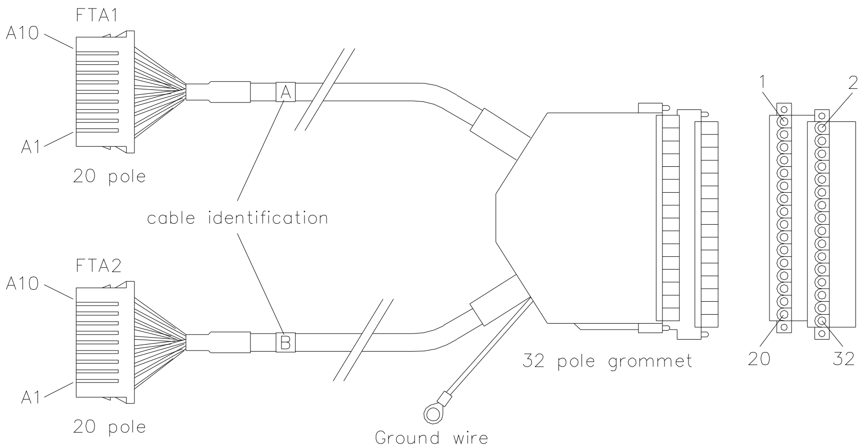
System Interconnection Cable for universal IO terminating on FTAs (SICC)

Description

System interconnection cables - for SM universal IO - with termination to Field Termination Assemblies (FTA) connect Safety Manager universal IO modules to FTAs (via an IOTA).

Figure 456 on page 728 shows the SICC-2001/Lx[4].
The 32-pole grommet connects to channel 1 thru 16 (CN1 position) or channel 17 thru 32 (CN2 position) of the IOTA.
The 20-pole connectors are placed on the FTAs.
The grommet has a (8 inch long) wire to ground the cable shields.

Figure 456 SICC-2001/Lx - Mechanical layout

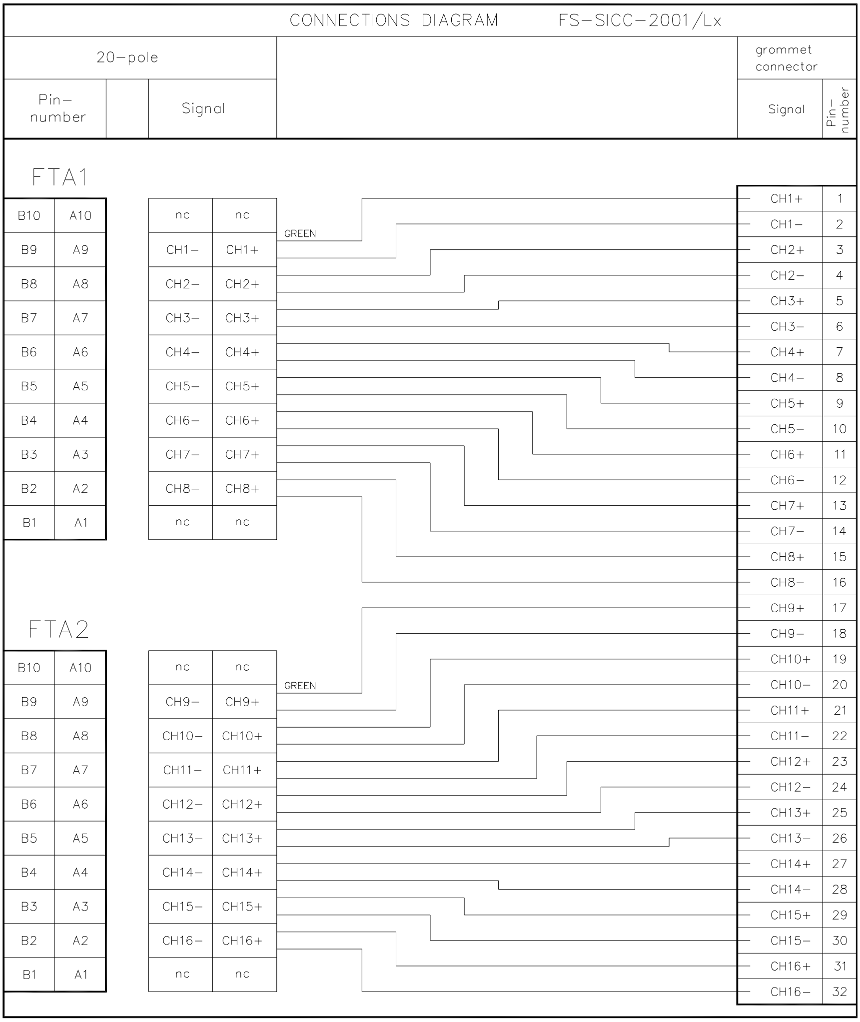


4. The ‘x’ in the model number represents the cable lenght in meters.

Connections

Figure 457 on page 729 shows the connection diagram of the SICC-2001/Lx.

Figure 457 Connection diagram



Technical data

General	Type number:	FS-SICC-2001/Lx [1]
	• available length (m):	3, 5, 6 and 10
	Approvals:	UL; CSA pending
Cable	Type:	20 x AWG22 shielded cable AWG style 2464
Connectors	20-pole:	2x10 pins Dynamic Housing no. 178289-8
	• make:	TYCO
	Grommet:	SP-BLZ5.08 32P CLAMSHELL
	• make:	Weidmuller
	Ground wire	Ring terminal (5 mm hole)

1 Where ‘x’ = length.

CA-HWC300-AIO-DIO-xM

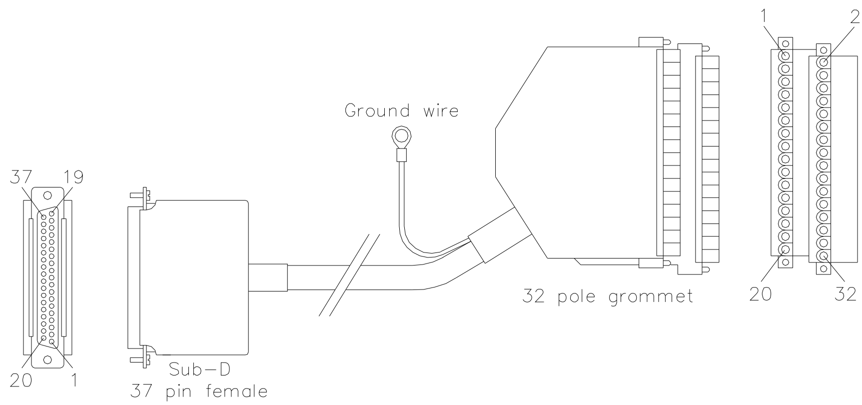
System Interconnection Cable for universal IO terminating on IOTAs (SICC)

Description

System interconnection cables - for SM universal IO - with termination to Field Termination Assemblies (FTA) connect Safety Manager universal IO modules to FTAs (via an IOTA).

Figure 458 on page 731 shows the CA-HWC300-AIO-DIO-xM[5].
The 32-pole grommet connects to channel 1 thru 16 (CN1 position) or channel 17 thru 32 (CN2 position) of the IOTA.
The 37-pin female Sub-D connector is placed on the field termination board.
The grommet has a (8 inch long) wire to ground the cable shield.

Figure 458 CA-HWC300-AIO-DIO-xM - Mechanical layout

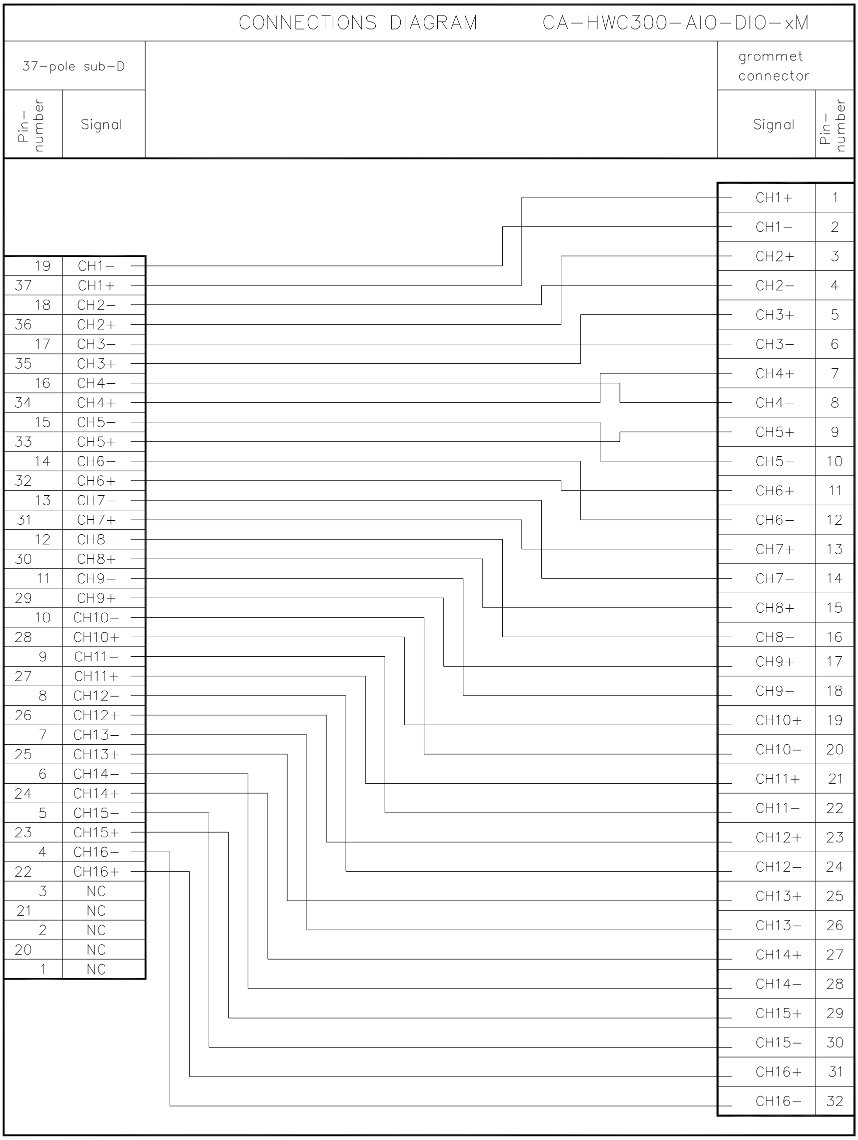


5. The ‘x’ in the model number represents the cable lenght in meters.

Connections

Figure 458 on page 731 shows the connection diagram of the CA-HWC300-AIO-DIO-xM.

Figure 459 Connections diagram



Technical data

System interconnection cables terminating on IOTAs have the following specifications:

General	Type numbers: • available lenghts (m)	CA-HWC300-AIO-DIO-xM (where × = length) 1, 2, 3, 4, 5, 7.5, 10, 12.5, 15, 20, 25, 30
	Approvals:	UL, CSA pending
Cable	Construction type:	22 AWG 7/0096 tinned copper 18 individually twisted pairs overall foil
	Shielding:	aluminium/poly foil 100% coverage 24 AWG 7/32 T.C.DW.
Connectors	Sub-D:	37-pin Sub-D socket female
	Grommet • make	SP-BLZ5.08 32P CLAMSHELL Weidmuller
	Ground wire:	Ring terminal (5 mm hole)

Communication cables

17

This chapter describes the following communication-related items:

Item	See
Internal communication cables	
CCI-UNI-0x	page 745
CCI-HSE-0x	page 747
External communication cables	
CCE-232-01/L10	page 749
CCE-232-02/L10	page 751
CCE-485-01/Lx	page 753
CCE-485-02/Lx	page 755
CCE-485-04/Lx	page 757
CCE-485-05/Lx	page 759
CCE-485-FO-01/Lx	page 761
CCE-485-FO-02/Lx	page 763
CCE-485-FO-04/Lx	page 767
TAPS / switches / terminators	
EOL-485-01	page 769

General info on communication cables

Safety Manager communication

A Safety Manager communication architecture is created with a specific set of assembly guidelines and materials.

The options are:

- High-speed ethernet (10/100 Mbaud, twisted pair, full duplex) using STP-wiring and RJ45 connectors to an ethernet switch (UCOM-HSE) and offering four RJ45 connector positions as field connection.
- RS485/422 communication (full duplex or half duplex) using a SIC-cable to the FTA (DCOM-232/485) and offering two 9-pole male connectors as field connections.
- RS232 communication (full duplex, no handshake) using a SIC-cable to the FTA (DCOM-232/485) and offering a 9-pole female connector as field connection.

Internal and external cabling

Internal cables connect the Control Processor(s) to the high-speed Ethernet FTA (“UCOM-HSE” on page 28) or to the communication FTA (“DCOM-232/485” on page 675).

External cables connect external devices such as stations, other Safety Managers, network servers, other control systems, and so on to communication FTAs (DCOM-232/485).

Table 85 on page 736 shows all available cables, the items they connect and the type of connection they are used for.

Table 85 Internal and external communication cables

Cable	Connects			Connection type
Internal				
CCI-UNI-01 and CCI-UNI-02	USI-0001 or USI-0002	to	DCOM-232/485	Point-to-point duplex or (RS485) full-duplex
CCI-HSE-01 and CCI-HSE-02	USI-0001 or USI-0002	to	SDW-550 EC MTL 24571	High Speed Ethernet
External				
CCE-232-01/Lx	DCOM-232/485	to	DCOM-232/485	Point-to-point

Table 85 Internal and external communication cables *(continued)*

Cable	Connects			Connection type
CCE-232-02/Lx	Development system	to	DCOM-232/485	Point-to-point
CCE-485-01/Lx	DCOM-232/485	to	DCOM-232/485	Between slaves
CCE-485-02/Lx	PC RS485 BB113	to	DCOM-232/485	Point-to-point duplex or master-slave duplex
CCE-485-04/Lx	PC RS485 BB114	to	DCOM-232/485	Point-to-point duplex or master-slave duplex
CCE-485-05/Lx	PC RS485 QT	to	DCOM-232/485	Point-to-point duplex or master-slave duplex

Internal communication wiring examples

The DCOM-232/485 module (see “DCOM-232/485” on page 675) is connected to the SM Controller chassis.

Figure 460 on page 738 shows the non-redundant connection to either Control Processor 1 or Control Processor 2.

Figure 460 Non-redundant internal communication wiring to a DCOM-232/485 module

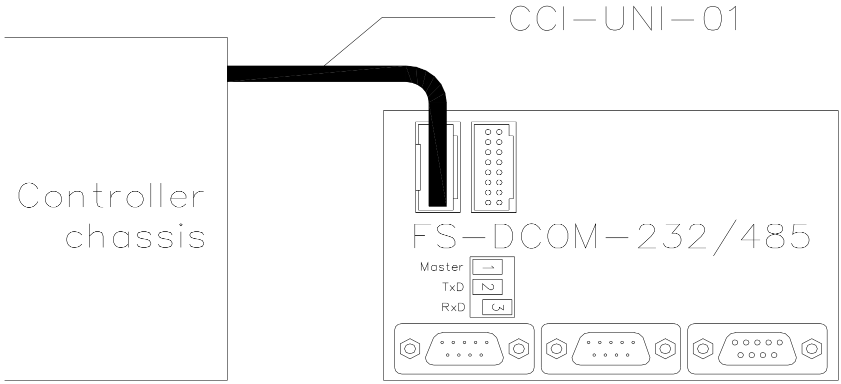
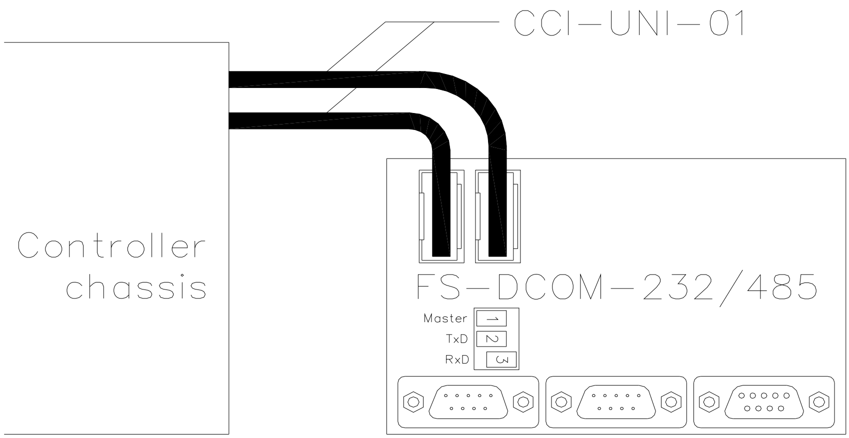


Figure 461 on page 738 shows the redundant connection to Control Processor 1 and Control Processor 2.

Figure 461 Redundant internal communication wiring to a DCOM-232/485 module



A connection is made by connecting one or two CCI-UNI-01 cables (see “CCI-UNI-0x” on page 745). The other ends are connected to 10-pin male connectors on the SM Controller backplane (see Table 7 on page 94).

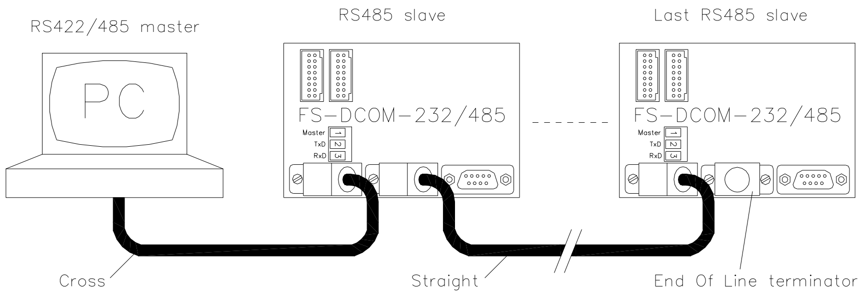
- The RS232 or RS485 connections of a non-redundant Control Processor require one internal cable (see Figure 460 on page 738).
- The RS232 connections of a redundant Control Processor require redundant internal cabling (see Figure 461 on page 738).
- The RS485 connections of a redundant Control Processor can consist of redundant internal cabling (which only requires one DCOM-232/485 module) or redundant external cabling (which requires two DCOM-232/485 modules).

Full duplex RS485 wiring examples

RS485 connection between Safety Station and Safety Manager(s)

Figure 462 on page 740 shows a wiring example for a full duplex RS485 link between a Safety Station (PC) and one or more (DCOM-232/485 modules of) Safety Manager(s).

Figure 462 RS485 link between a PC master and multiple Safety Manager slaves



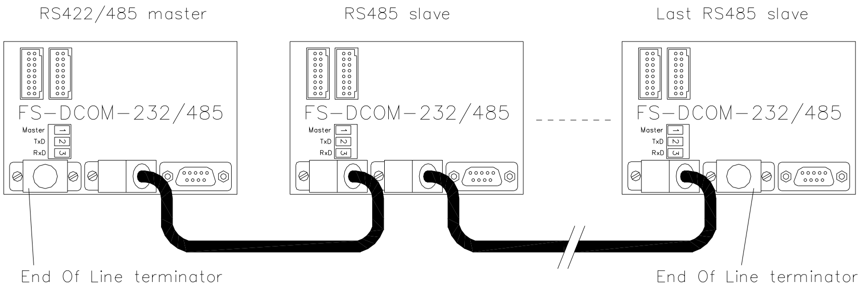
In Figure 462 on page 740:

- The used cable marked ‘cross’ is the CCE-485-02/Lx (see “CCE-485-02/Lx” on page 755).
- All other cables (between slaves) are the CCE-485-01/Lx (see “CCE-485-01/Lx” on page 753).
- The end of line terminator on the last DCOM-232/485 is the EOL-485-01 (see “EOL-485-01” on page 769).
- The two (used) connectors on the DCOM-232/485 are functionally identical, so the connectors (cables or EOL) may be interchanged.
- All three dip switches on all DCOM-232/485 modules must be `Off`.

RS485 connection between master and slave Safety Managers

Figure 463 on page 741 shows a wiring example for a full duplex RS485 link between (the DCOM-232/485 modules of) an Safety Manager master and one or more (DCOM-232/485 modules of) slave Safety Manager(s).

Figure 463 RS485 link between a master Safety Manager and multiple Safety Manager slaves



In Figure 463 on page 741:

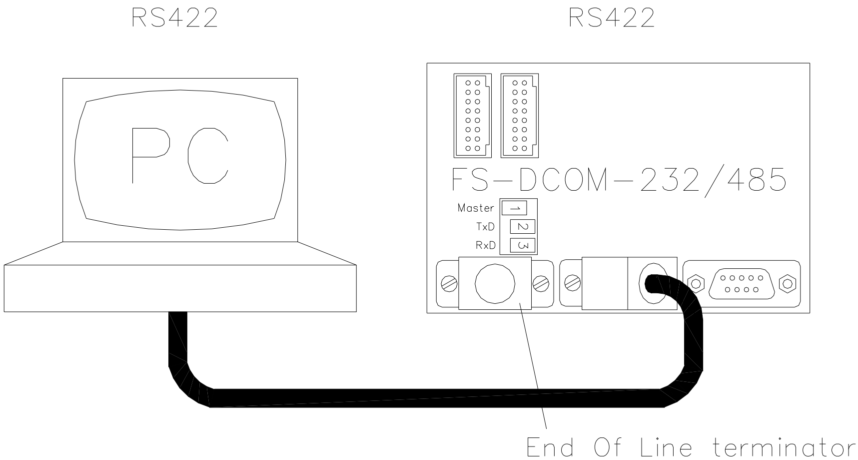
- The used cables are the CCE-485-01/Lx (see “CCE-485-01/Lx” on page 753).
- The end of line terminators on the DCOM-232/485 modules of the master and the last slave are the EOL-485-01 (see “EOL-485-01” on page 769).
- The two (used) connectors on the DCOM-232/485 are functionally identical, so the connectors (cables or EOL) may be interchanged.
- All dip switches on the master DCOM-232/485 must be `On`.
- All dip switches on the slave DCOM-232/485 module(s) must be `Off`.

RS422 wiring examples

RS422 connection between Safety Station and Safety Manager

Figure 464 on page 742 shows a wiring example for an RS422 link between a Safety Station (PC) and the DCOM-232/485 module of Safety Manager.

Figure 464 RS422 link from PC to Safety Manager



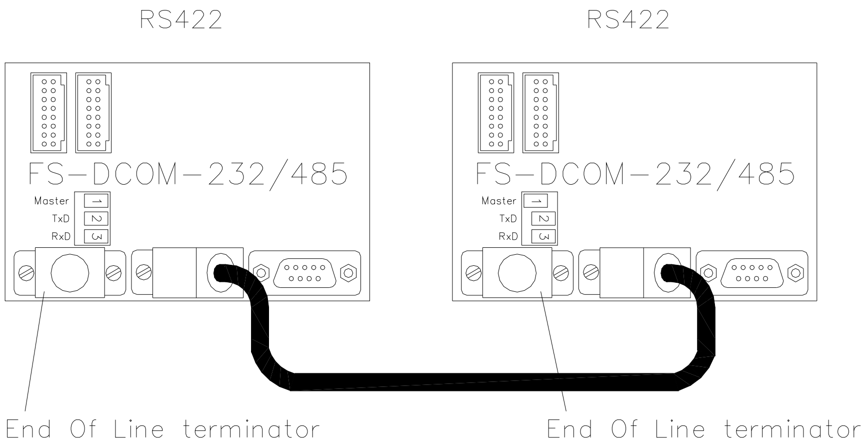
In Figure 464 on page 742:

- The used cable is the CCE-485-02/Lx (see “CCE-485-02/Lx” on page 755).
- The end of line terminator on the DCOM-232/485 is the EOL-485-01 (see “EOL-485-01” on page 769).
- The two (used) connectors on the DCOM-232/485 are functionally identical, so the connectors (cable and EOL) may be interchanged.
- Dip switch 1 (Master) on the DCOM-232/485 must be `Off`.
- The dip switches 2 (TxD) and 3 (RxD) on the DCOM-232/485 must be `On`.

RS422 connection between master and slave Safety Manager

Figure 465 on page 743 shows a wiring example for an RS422 link between (the two DCOM-232/485 modules of) two Safety Managers.

Figure 465 RS422 link between two Safety Manager systems



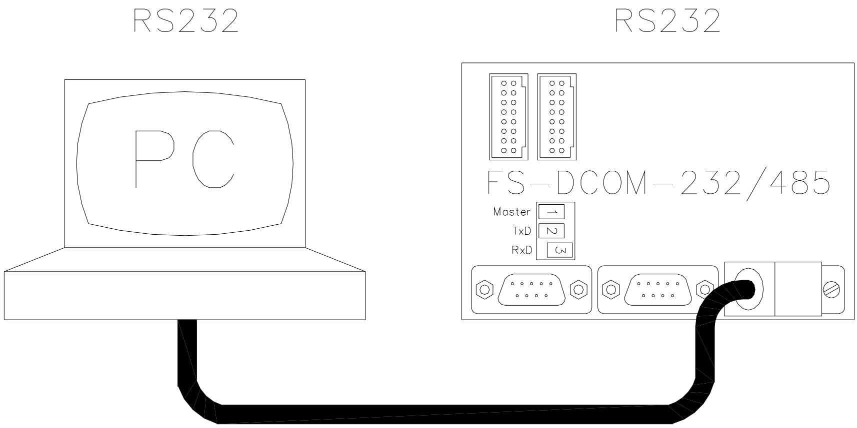
In Figure 465 on page 743:

- The used cable is the CCE-485-01/Lx (see "CCE-485-01/Lx" on page 753).
- The end of line terminators are EOL-485-01 (see "EOL-485-01" on page 769).
- The two (used) connectors on the DCOM-232/485 are functionally identical, so the connectors (cable and EOL) may be interchanged.
- Dip switch 1 (Master) must be:
  - `On` on the first DCOM-232/485
  - `Off` on the second DCOM-232/485.
- The dip switches 2 (TxD) and 3 (RxD) on the DCOM-232/485 must be `On`.

RS232 wiring examples

Figure 466 on page 744 shows a wiring example for an RS232 link between a development station (PC) and the DCOM-232/485 module of Safety Manager.

Figure 466 RS232 link from PC to Safety Manager



In Figure 466 on page 744:

- The used cable is the CCE-232-02/Lx (see “CCE-232-02/L10” on page 751).
- Dip switches 1 (Master) and 2 (TxD) on the DCOM-232/485 must be `Off`.
- Dip switch 3 (RxD) must be `On`.

CCI-UNI-0x

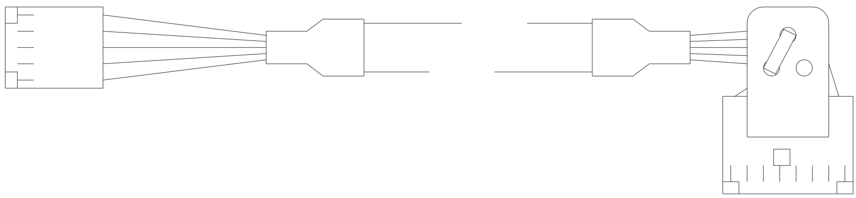
Description

The CCI-UNI-01 and CCI-UNI-02 are internal communication cables that connect a general purpose channel of the Safety Manager Universal Safety Interface (USI-0001 or USI-0002) to the communication FTA (DCOM-232/485).

- .For more information on the Universal Safety Interface, see section “USI-0001” on page 266 or “USI-0002” on page 271.
- For more information on the Communication FTA, see section “DCOM-232/485” on page 675.

Figure 467 on page 745 shows the connectors of a CCI-UNI-01 or CCI-UNI-02 cable.

Figure 467 connectors of a CCI-UNI-0x cable



Connector on Control Processor side Connector on communication FTA side

Technical data CCI-UNI-01

General	Type number:	FS-CCI-UNI-01
	Approval:	UL, CSA, FM
Cable	Type:	BELDEN 8105 5x2 CORE SHIELD
	Length:	3 m
Connectors	Control Processor side: (USI-0001 or USI-0002)	10-pins
	DCOM-232/485 side:	16-pins

Technical data CCI-UNI-02

General	Type number:	FS-CCI-UNI-02
	Approval:	UL, CSA, FM
Cable	Type:	BELDEN 8105 5x2 CORE SHIELD
	Length:	2 m
Connectors	Control Processor side: (USI-0001 or USI-0002)	10-pins
	DCOM-232/485 side:	16-pins

CCI-HSE-0x

Description

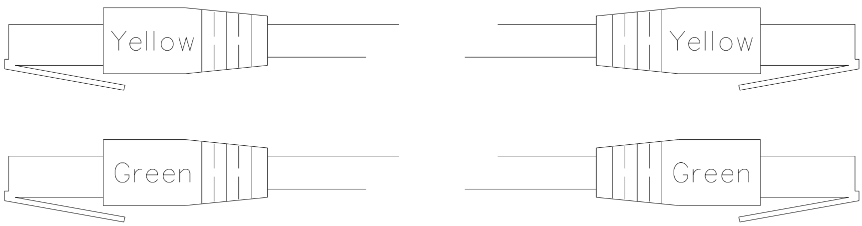
The CCI-HSE-01 and CCI-HSE-02 are cable sets, each consisting of a pair of shielded internal communication cables, used for High Speed Ethernet (HSE) connections.

Each pair consists of a yellow and a green color coded STP cable. Each pair is connects the high-speed ethernet channels of the Universal Safety Interface (USI-0001 or USI-0002) to a galvanically isolated Ethernet interface (an approved switch or alike).

- For more information on the Universal Safety Interface, see section “USI-0001” on page 266 or “USI-0002” on page 271.
- For more information on approved galvanically isolated HSE interfaces see Table 73 on page 503.

The CCI-HSE-01 and CCI-HSE-02 STP cable sets are Experion™ FTE compatible.

Figure 468 The CCI-HSE-0x shielded cable set



Technical data CCI-HSE-01

General	Type number:	FS-CCI-HSE-01
	Approvals:	UL, CSA, FM
Cables	Type:	CAT5PLUS STP (shielded twisted pair)
	Length (each cable):	3 m
Connectors	Both sides:	RJ45

Technical data CCI-HSE-02

General	Type number:	FS-CCI-HSE-02
	Approvals:	UL, CSA, FM
Cables	Type:	CAT5PLUS STP (shielded twisted pair)
	Length (each cable):	2 m
Connectors	Both sides:	RJ45

CCE-232-01/L10

Description

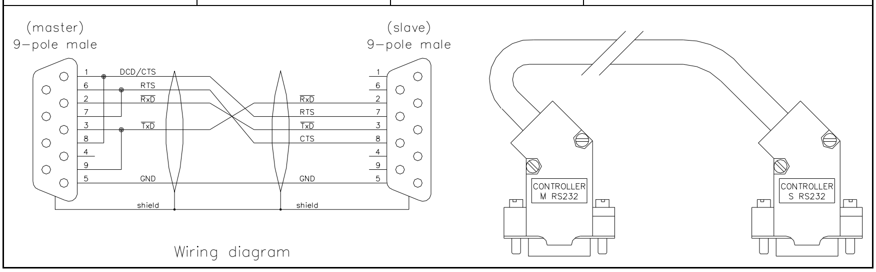
The CCE-232-01/L10 external communication cable is used for a full-duplex RS232 (no handshake) ‘point-to-point’ connection from a communication FTA (DCOM-232/485) to another communication FTA.

For more information on the Communication FTA, see section “DCOM-232/485” on page 675.

Signals

Figure 469 Pin assignment and layout of the CCE-232-01/L10 communication cable

Signal	9-p male (master)	9-p male (slave)	Color code
DCD/CTS	1, 8	7	white / blue stripe
RTS	6, 7	8	white / green stripe
–RxD	2	3	green / white stripe
–TxD	3, 9	2	blue / white stripe
GND	5	5	orange / white stripe



The Safety Manager communication FTA (DCOM-232/485) only uses pins 2, 3 and 5. This means that the ‘master’ connector as well as the ‘slave’ connector of the CCE-232-01/L10 may be placed on the Safety Manager communication FTA.

The handshake lines (and the master links to pins 6 and 9) are included to keep the cable compatible with the FSC-system RS232 cable.

Technical data

General	Type number:	FS-CCE-232-01/L10
	Approvals:	UL, CSA, FM
Cable	Type:	BELDEN 8103 3x2 CORE SHIELD
	Length:	10 meter
Connectors	Both sides:	9 Pole sub-D male Metal housing: 45 deg.

CCE-232-02/L10

Description

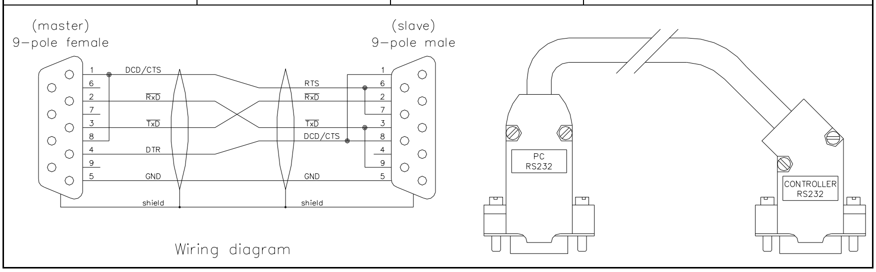
The CCE-232-02/L10 external communication cable is used for a full-duplex RS232 (no handshake) “point-to-point” connection between a “slave” Safety Manager communication FTA (DCOM-232/485) and the “master” Development System (DS) running on a PC.

For more information on the Communication FTA, see section “DCOM-232/485” on page 675.

Signals

Figure 470 Pin assignment and layout of the CCE-232-02/L10 communication cable

Signal	9-p female (PC)	9-p male (slave)	Color code
DCD/CTS	1, 8	6, 7	white / green stripe
–RxD	2	3, 9	blue / white stripe
–TxD	3	2	green / white stripe
DTR	4	1, 8	white / blue stripe
GND	5	5	orange / white stripe



The Safety Manager communication FTA (DCOM-232/485) only uses pins 2, 3 and 5.

The handshake lines (and the slave links to pins 6 and 9) are included to keep the cable compatible with the FSC-system RS232 cable.

Technical data

General	Type number:	FS-CCE-232-02/L10
	Approvals:	UL, CSA, FM
Cable	Type:	BELDEN 8103 3x2 CORE SHIELD
	Length:	10 meter
Connectors	Master side:	9 Pole sub-D female Metal housing: straight
	Slave side:	9 Pole sub-D male Metal housing: 45 deg.

CCE-485-01/Lx

Description

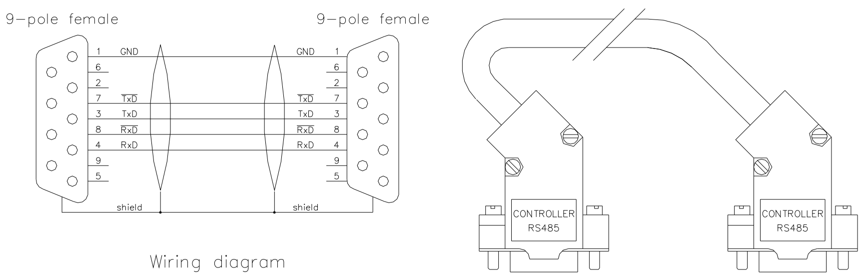
The CCE-485-01/Lx external communication cable is used for

- Full-duplex (RS485) connection between Safety Manager communication FTAs (“DCOM-232/485” on page 675) from “master” to “slave” or between slaves.
- RS422 “point-to-point” connection between two communication FTAs (“DCOM-232/485” on page 675).

Signals

Figure 471 Pin assignment and layout of the CCE-485-01/Lx communication cable

Signal	9-p Female	9-p Female	Color code
GND	1	1	orange / white stripe
+TxD	3	3	white / blue stripe
+RxD	4	4	white / green stripe
–TxD	7	7	blue / white stripe
–RxD	8	8	green / white stripe



Technical data

General	Type number:	FS-CCE-485-01/L10 (10 meter) FS-CCE-485-01/L25 (25 meter) FS-CCE-485-01/L50 (50 meter) FS-CCE-485-01/L100 (100 meter)
	Approvals:	UL, CSA, FM
Cable	Type:	BELDEN 8103 3x2 CORE SHIELD
	Length:	10, 25, 50, 100 meter
	Impedance:	100 Ω
Connectors	Both sides:	9 Pole sub-D female Metal housing: 45 deg.

CCE-485-02/Lx

Description

The CCE-485-02/Lx external communication cable is used for:

- Full-duplex connection between a PC (Blackbox IC113C/133C)(RS485/422 ‘master’) and the first Safety Manager communication FTA (DCOM-232/485)(RS485 ‘slave’).
- RS422 ‘point to point’ connection between a PC (Blackbox IC113C/133C) and a Safety Manager communication FTA (DCOM-232/485).

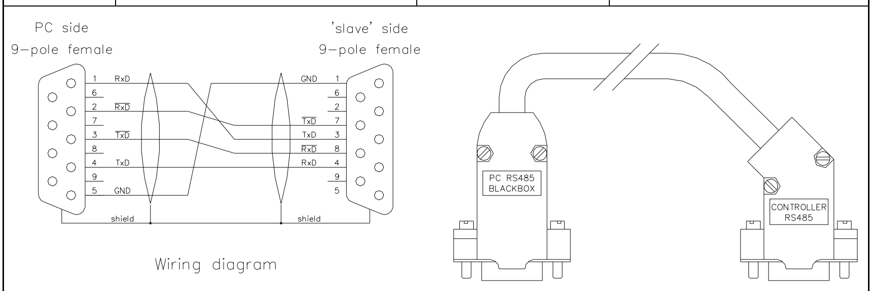
If only one Safety Manager is used, then this connection is a ‘point-to-point’ connection. If multiple Safety Managers are used, then the PC takes the role of master and the communication FTA the role of slave (this communication FTA is then connected to the other communication FTAs in a “in-between-slaves” connection using a CCE-485-01/Lx cable).

For more information on the Communication FTA, see section “DCOM-232/485” on page 675.

Signals

Figure 472 Pin assignment and layout of the CCE-485-02/Lx communication cable

Signal	9-p Female (PC)	9-p Female (slave)	Color code
+RxD	1	3	white / blue stripe
–RxD	2	7	blue / white stripe
–TxD	3	8	green / white stripe
+TxD	4	4	white / green stripe
GND	5	5	orange / white stripe



Technical data

General:	Type number:	FS-CCE-485-02/L10 (10 meter) FS-CCE-485-02/L25 (25 meter) FS-CCE-485-02/L50 (50 meter) FS-CCE-485-02/L100 (100 meter)
	Approvals:	UL, CSA, FM
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	10, 25, 50, 100 meter
	Impedance:	100 Ω
Connectors	Master side:	9 Pole sub-D female Metal housing: straight
	Slave side:	9 Pole sub-D female Metal housing: 45 deg.

CCE-485-04/Lx

Description

The CCE-485-04/Lx external communication cable is used for:

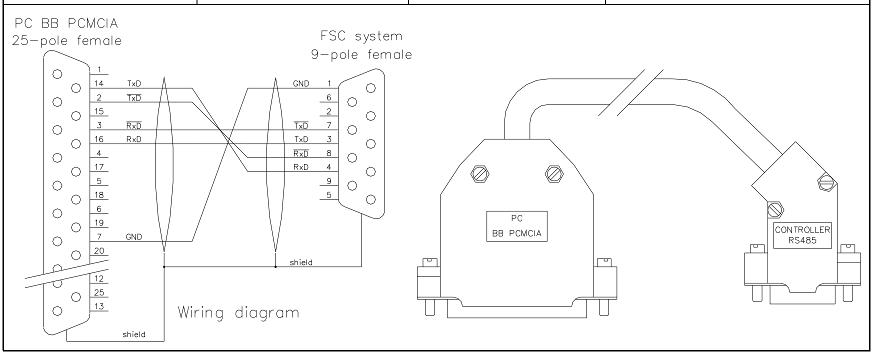
- Full-duplex connection between a PC (Blackbox IC114A) (RS485/422 ‘master’) and the first Safety Manager communication FTA (DCOM-232/485) (RS485 ‘slave’).
- RS422 ‘point-to-point’ connection between a PC (Blackbox IC114A) and a Safety Manager communication FTA (DCOM-232/485).

For more information on the Communication FTA, see “DCOM-232/485” on page 675.

Signals

Figure 473 Pin assignment and layout of the CCE-485-04/Lx communication cable

Signal	25-p Female (master)	9-p Female (slave)	Color code
+TxD	14	4	white / green stripe
–TxD	2	8	green / white stripe
–RxD	3	7	blue / white stripe
+RxD	16	3	white / blue stripe
GND	7	1	orange / white stripe



Technical data

General	Type number:	FS-CCE-485-04/L10 (10 meter) FS-CCE-485-04/L25 (25 meter) FS-CCE-485-04/L50 (50 meter) FS-CCE-485-04/L100 (100 meter)
	Approvals:	UL, CSA, FM
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	10, 25, 50, 100 meter
	Impedance:	100 Ω
Connectors	PC side:	25 Pole sub-D female Metal housing: straight
	Slave side:	9 Pole sub-D female Metal housing: 45 deg.

CCE-485-05/Lx

Description

The CCE-485-05/Lx external communication cable is used for:

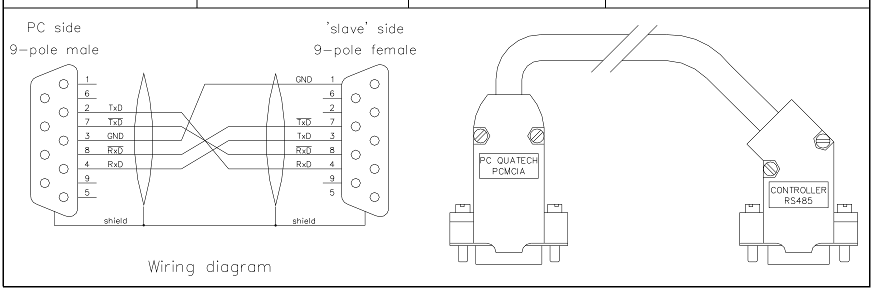
- Full-duplex connection between a PC (Quatech SSP/200/300) (RS485/422 ‘master’) and the first Safety Manager communication FTA (DCOM-232/485) (RS485 ‘slave’).
- RS422 ‘point-to-point’ connection between a PC (Quatech SSP/200/300) and a Safety Manager communication FTA (DCOM-232/485).

For more information on the Communication FTA, see “DCOM-232/485” on page 675.

Signals

Figure 474 Pin assignment and layout of the CCE-485-05/Lx communication cable

Signal	9-p Male (master)	9-p Female (slave)	Color code
+TxD	2	4	white / green stripe
–TxD	7	8	green / white stripe
GND	3	1	orange / white stripe
–RxD	8	7	blue / white stripe
+RxD	4	3	white / blue stripe



Technical data

General	Type number:	FS-CCE-485-05/L10 (10 meter) FS-CCE-485-05/L25 (25 meter) FS-CCE-485-05/L50 (50 meter) FS-CCE-485-05/L100 (100 meter)
	Approvals:	UL, CSA, FM
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	10, 25, 50, 100 meter
	Impedance:	100 Ω
Connectors	PC side:	9 Pole sub-D male Metal housing: straight
	Slave side:	9 Pole sub-D female Metal housing: 45 deg.

CCE-485-FO-01/Lx

Description

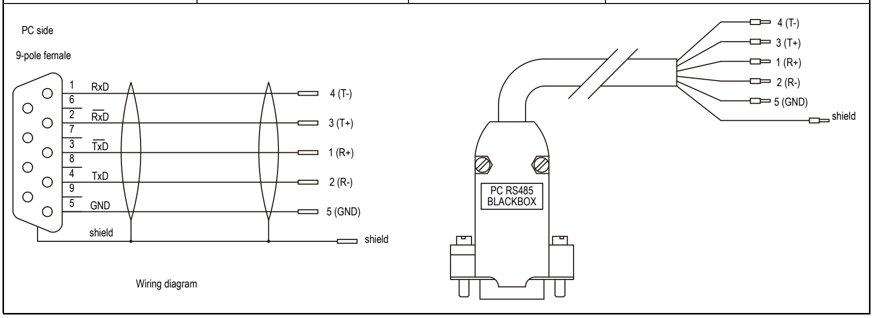
The CCE-485-FO-01/Lx external communication cable is used for:

- Full-duplex RS485/422 connection of a PC (Blackbox IC113C/133C) with a field-cable.
- RS422 ‘point-to-point’ connection between a PC (Blackbox IC113C/133C) with a field-cable.

Signals

Figure 475 Pin assignment and layout of the CCE-485-FO-01/Lx communication cable

Signal	9-p Female (PC)	Sleeve text	Color code
+RxD	1	4 (T–)	white / blue stripe
–RxD	2	3 (T+)	blue / white stripe
–TxD	3	1 (R+)	green / white stripe
+TxD	4	2 (R–)	white / green stripe
GND	5	5 (GND)	orange / white stripe
shield	housing	shield	-



Technical data

General	Type number:	FS-CCE-485-FO-01/Lx
	Approvals:	UL, CSA
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	× meter (user defined)
	Impedance:	100 Ω
Connectors		9 Pole sub-D female Metal housing: straight
Wire ends	Pins:	8 mm < 1 mm^2
	Strip length:	approx. 24 cm (shield) approx. 9 cm (others)

CCE-485-FO-02/Lx

Description

The CCE-485-FO-02/Lx external communication cable is used for:

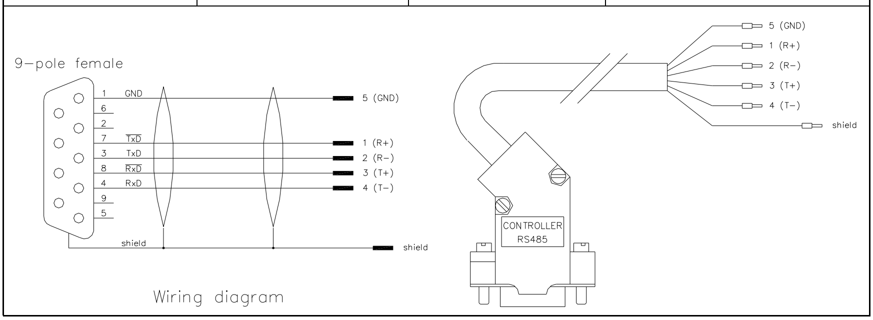
- Full-duplex RS485/422 connection of a Safety Manager communication FTA (DCOM-232/485) with a field-cable.
- RS422 ‘point-to-point’ connection of a Safety Manager communication FTA (DCOM-232/485) with a field-cable.

For more information on the Communication FTA, see “DCOM-232/485” on page 675.

Signals

Figure 476 Pin assignment and layout of the CCE-485-FO-02/Lx communication cable

Signal	9-p Female	Sleeve text	Color code
GND	1	5 (GND)	orange / white stripe
–TxD	7	1 (R+)	blue / white stripe
+TxD	3	2 (R–)	white / blue stripe
–RxD	8	3 (T+)	green / white stripe
+RxD	4	4 (T–)	white / green stripe
shield	housing	shield	-



Technical data

General	Type number:	FS-CCE-485-FO-02/Lx
	Approvals:	UL, CSA
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	× meter (user defined)
	Impedance:	100 Ω
Connectors		9 Pole sub-D female Metal housing: 45 deg.
Wire ends	Pins:	8 mm < 1 mm^2
	Strip length:	approx. 24 cm (shield) approx. 9 cm (others)

CCE-485-FO-03/Lx

Description

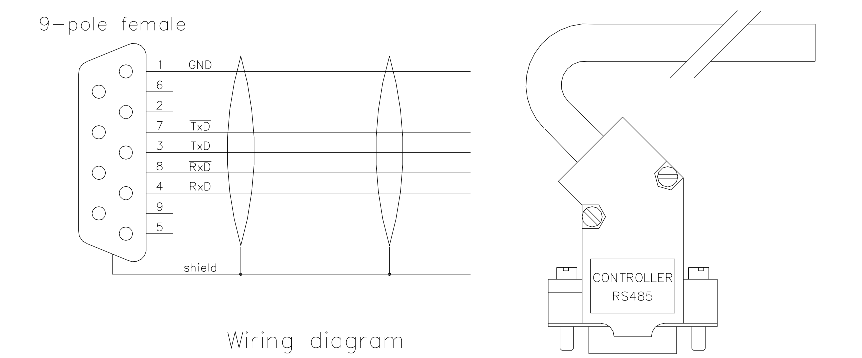
The CCE-485-FO-03/Lx external communication cable is used for:

- Full-duplex RS485/422 connection of a PC (Westermo MD63).
- RS422 ‘point-to-point’ connection of a PC (Westermo MD63).

Signals

Figure 477 Pin assignment and layout of the CCE-485-FO-03/Lx communication cable

Signal	9-p Female	Color code
GND	1	orange / white stripe
–TxD	7	blue / white stripe
+TxD	3	white / blue stripe
–RxD	8	green / white stripe
+RxD	4	white / green stripe
shield	housing	-



Technical data

General	Type number:	FS-CCE-485-FO-03/Lx
	Approvals:	UL, CSA
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	× meter (user defined)
	Impedance:	100 Ω
Connectors		9 Pole sub-D female Metal housing: 45 deg.

CCE-485-FO-04/Lx

Description

The CCE-485-FO-04/Lx external communication cable is used for:

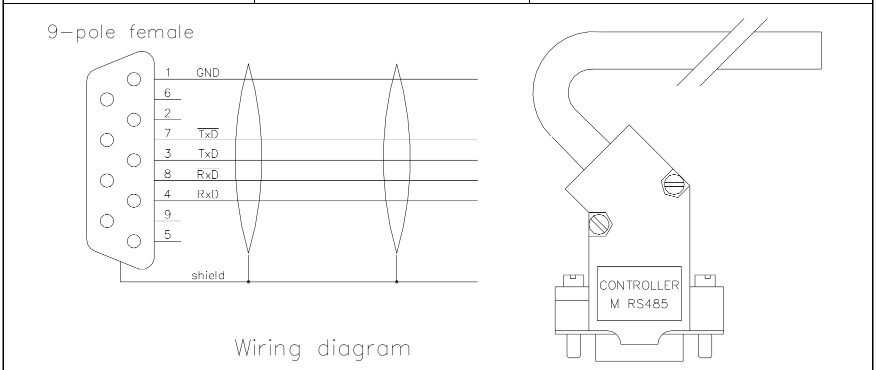
- Full-duplex RS485/422 connection of a Safety Manager communication FTA (DCOM-232/485).
- RS422 ‘point-to-point’ connection of a Safety Manager communication FTA (DCOM-232/485).

For more information on the Communication FTA, see “DCOM-232/485” on page 675.

Signals

Figure 478 Pin assignment and layout of the CCE-485-FO-04/Lx communication cable

Signal	9-p Female	Color code
GND	1	orange / white stripe
–TxD	7	blue / white stripe
+TxD	3	white / blue stripe
–RxD	8	green / white stripe
+RxD	4	white / green stripe
shield	housing	-



Technical data

General	Type number:	FS-CCE-485-FO-04/Lx
	Approvals:	UL, CSA
Cable	Type:	BELDEN 8103 3x2 core shield
	Length:	× meter (user defined)
	Impedance:	100 Ω
Connectors		9 Pole sub-D female Metal housing: 45 deg.

EOL-485-01

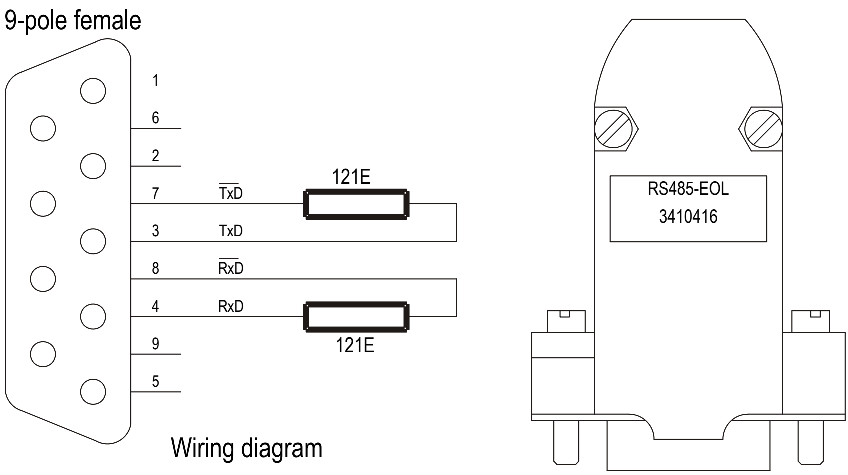
Dual 120 Ω end of line terminator

Description

The dual 120 Ω End Of Line terminator (EOL-485-01) is used as line terminator for RS422 or RS485 connections that end on the Safety Manager communication FTA (DCOM-232/485).

They are placed on the vacant RS485 connector position of a communication FTA (see section "DCOM-232/485" on page 675).

Figure 479 Side view of the EOL-485-01



Technical data

General	Type number:	FS-EOL-485-01
	Approvals:	n/a
Physical	Module dimensions:	31 × 16.5 × 46.5 mm (L × W × H) 1.22 × 0.65 × 1.83 in (L × W × H)
Electrical	Resistors:	121 Ω, 1%, 0.5 W
	Connector:	9-pole sub-D female

Power distribution

18

This chapter describes various types of power distribution modules and cables which can be used for the power distribution in Safety Manager.

The following power distribution modules are described:

Power distribution modules	See
SIF-X; Supply Input Filters (SIF)	page 776
MB-0001; Mains power rail (24Vdc—110Vdc) with 10 sections	page 783
PDB-0824; Power Distribution Board (24Vdc, 2 Amp, 8 channel)	page 792
PDB-0824P; Power Distribution Board (24Vdc, 2 Amp, 8 channel)	page 796
PSU-FLTR2450; Common mode filter for the PSU-UNI2450	page 780

Power distribution cables	See
PDC-MBMB-1; Mains power distribution cable (24Vdc, 48Vdc)	page 800
PDC-CPSET; Power distribution cable set Control Processor (24Vdc)	page 802
PDC-IOSET; Power distribution cable set IO chassis (24Vdc, 48Vdc or 110Vdc)	page 804
PDC-CP24	page 807
PDC-IOxPx	page 809
PDC-MB24-x; Power Distribution Cable (24Vdc), -1, -2 and -3 cables	page 812
PDC-MB24-y; Power Distribution Cable (24Vdc), -1P, -2P and -3P cables	page 814
PDC-FTA24; Power Distribution Cable (24Vdc)	page 816

General info about the power distribution concept

Safety Manager main power wiring concepts are built around the MB-0001 mains power rail, power distribution cables (PDC cables) and power distribution boards (PDB boards).

- Mains power rails distribute the power from (multiple) redundant power supplies to the users.
- PDB power distribution boards enable easy distribution of 24Vdc from the mains power rail to individual devices inside the cabinet enclosure, such as fan units and FTAs.
- Standard PDC cables are used to connect the modules together.

Connecting power supplies to the mains power rail

Figure 480 Redundant PSU concept on an MB-0001 mains power rail

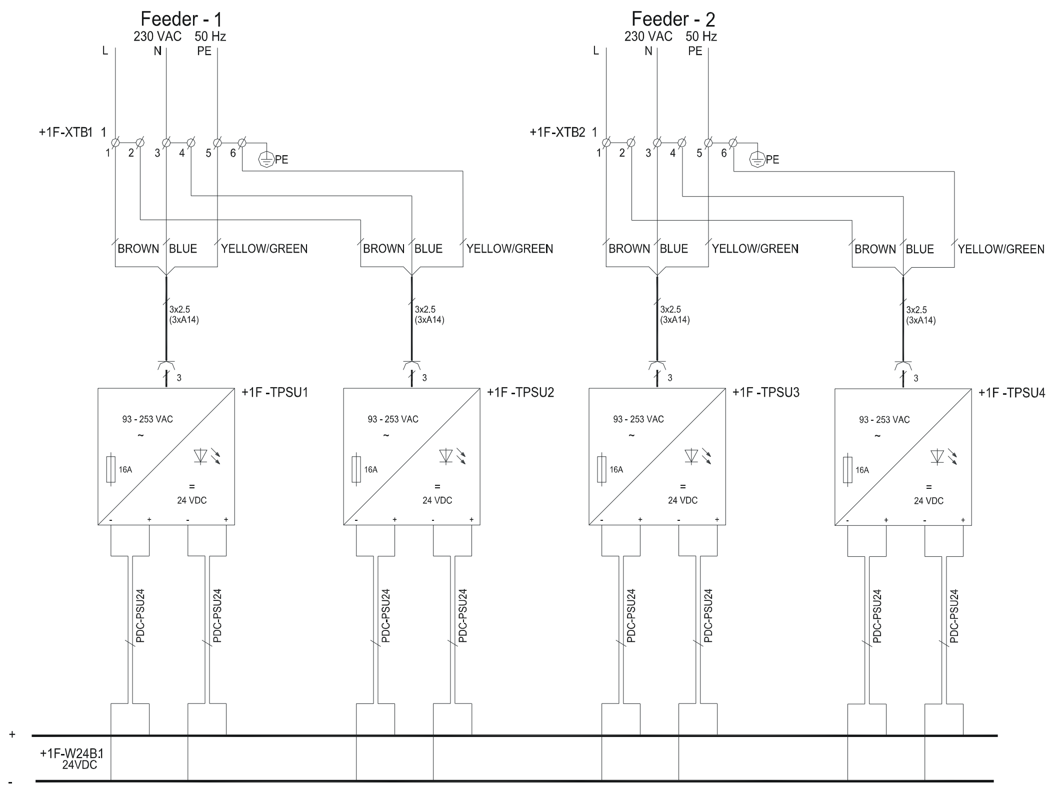


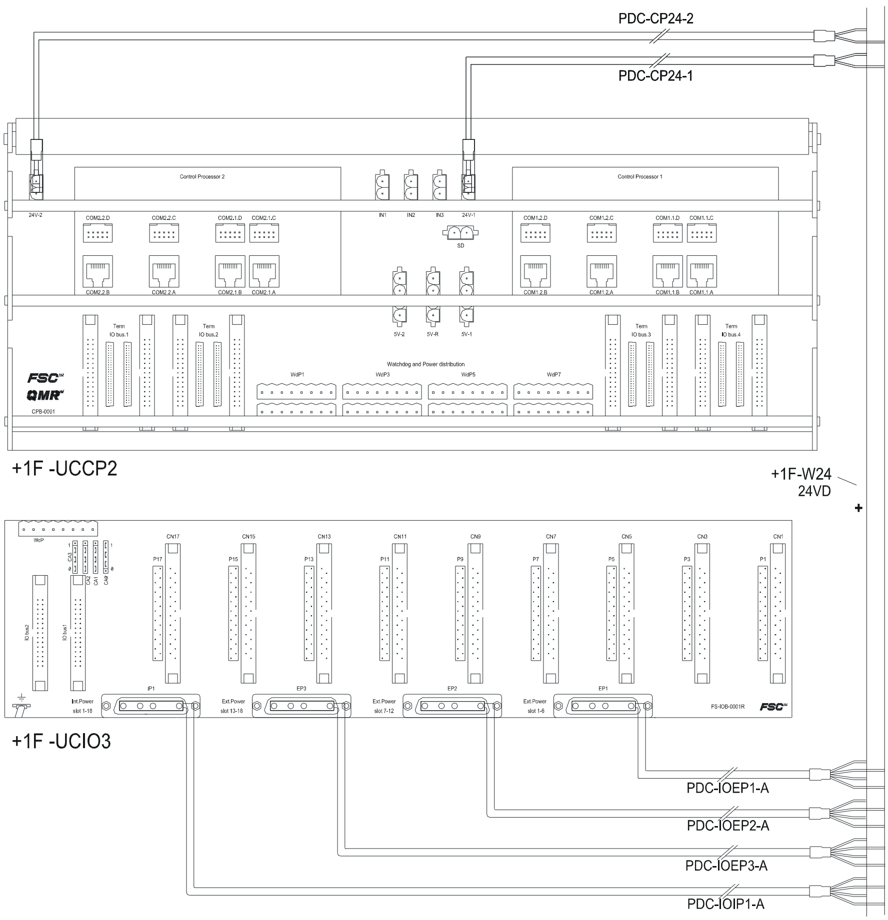
Figure 480 on page 772 shows an example of a redundant power supply concept feeding an MB-0001 mains power rail.

The concept is based on redundant feeders, PSU-UNI2450 PSU's, an MB-0001 mains power rail and PDC-MB24-x power distribution cables.

Connecting Controller and IO chassis to the mains power rail

Figure 481 on page 773 shows how a Controller chassis and a IO chassis are powered by an MB-0001 mains power rail; via dedicated PDC cables.

Figure 481 Controller chassis and IO chassis wired to an MB-0001 mains power rail



The Controller chassis receives its power via an PDC-CPSET power distribution cable-set (see "PDC-CPSET" on page 802). These cables connect the backplane of the chassis (connector 24V-1 supplies Control Processor 1 and connector 24V-2 supplies Control Processor 2) to the mains power rail.

The IO chassis receive their internal and external supply voltages (24 Vdc, 48 Vdc, or 110 Vdc) from the mains power rail via a set of PDC-IOSET power distribution cables (see "PDC-IOSET" on page 804 for details).

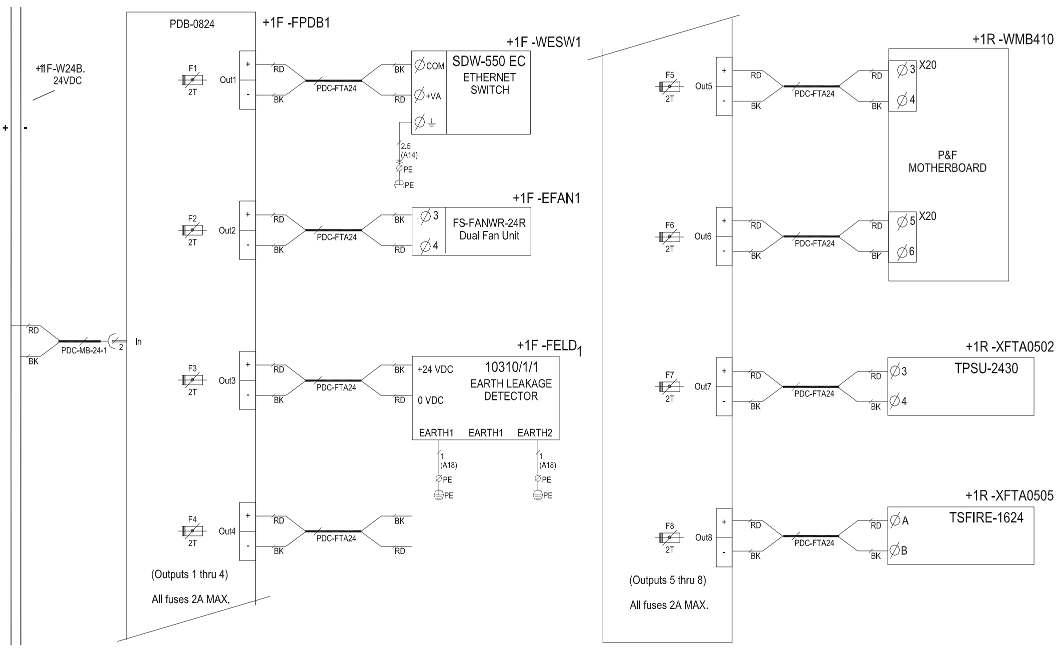
IO module slots	Power supply voltage	Cable
1-6	External	FS-PDC-IOEP1A
7-12	External	FS-PDC-IOEP2A
13-18	External	FS-PDC-IOEP3A
All	Internal	FS-PDC-IOIP1A

The 5 Vdc power distribution is not part of the main power distribution and is described in "5 Volt and watchdog distribution" on page 819.

Connecting to the mains power rail via the power distribution board

Figure 482 on page 774 shows an example of how 24 Vdc devices, requiring less than 2A (fan units, ELD's, FTA's, etc.), are powered by the MB-0001 mains power rail; via a PDB-0824 power distribution board and dedicated PDC cables.

Figure 482 Low power consumers wired to an MB-0001 mains power rail



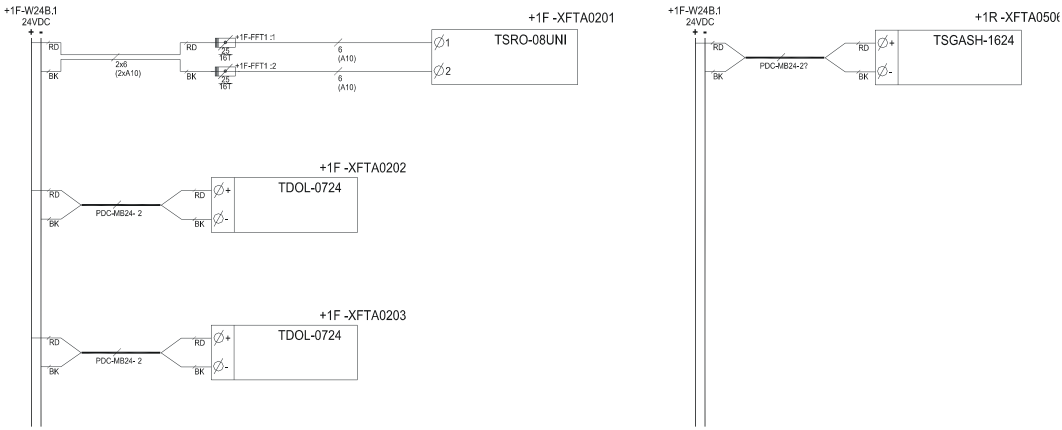
Connecting directly to the mains power rail

Note:

A dedicated mains power rail must be installed for each voltage used. For power options see “MB-0001” on page 783.

Figure 483 on page 775 shows how the remaining devices (24 Vdc devices requiring more than 2A or devices powered by voltages other than 24 Vdc) are powered by the MB-0001 mains power rail.

Figure 483 High power consumers wired to an MB-0001 mains power rail



SIF-X

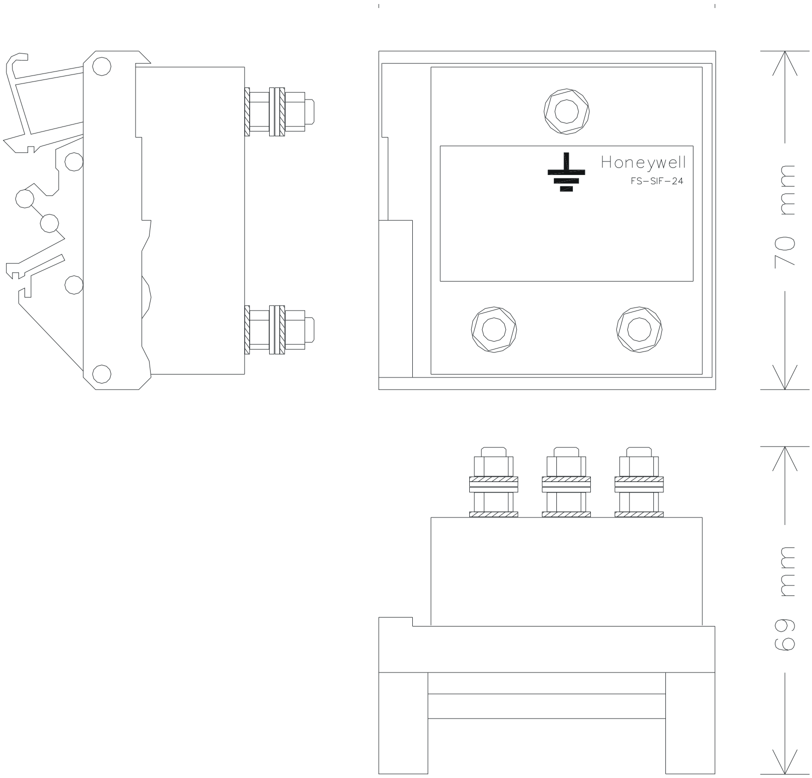
Supply Input Filters (SIF)

Description

The SIF-X modules are used as power supply input filters. The type of SIF-X module to be used depends on the voltage level:

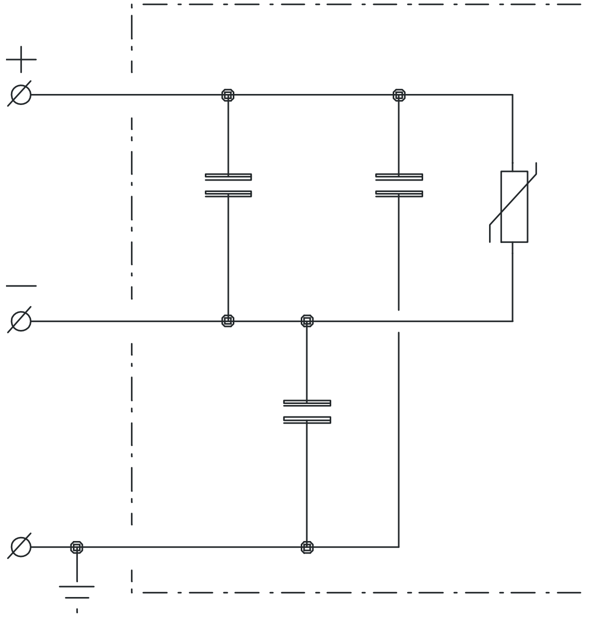
- 24 Vdc: FS-SIF-24
- 48 Vdc: FS-SIF-48
- 60 Vdc: FS-SIF-60
- 110 Vdc: FS-SIF-110

Figure 484 SIF-X mechanical layout



The SIF-X modules have a universal snap-in provision for standard DIN EN rails.

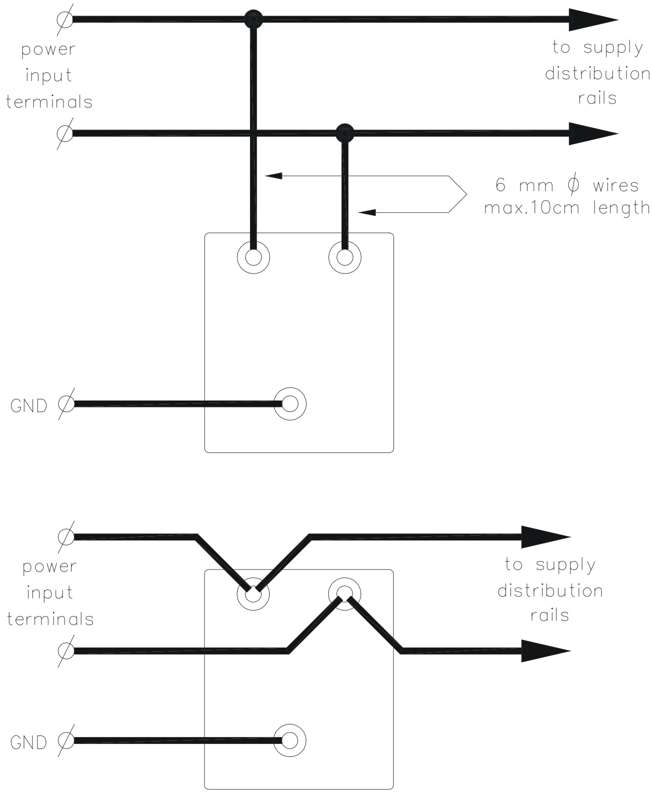
Figure 485 SIF-X circuit



If the DC power is supplied externally, the input filter must be placed close to the input terminals of the power supply. The plus (+) and minus (–) connections are arbitrary. The ground connection is indicated.

The supply wires must be routed via filter terminals, or they must be connected to the input filter using wires with a diameter of at least 6 mm² (AWG 10) and a maximum length of 10 cm (4 in).

Figure 486 Wiring examples for SIF-X modules



Technical data

The SIF-X modules have the following specifications:

General	Type number[1]:	24 Vdc: FS-SIF-24 48 Vdc: FS-SIF-48 60 Vdc: FS-SIF-60 110 Vdc: FS-SIF-110
	Approvals:	CE, CSA, UL; TUV, FM[2] pending
Physical	Dimensions:	70 × 70× 69 mm (L × W × H) 2.76 × 2.76 × 2.72 in (L × W × H)
	DIN EN rails:	TS32 / TS35 x 7.5
	Used rail length:	71 mm (2.80 in)
	Weight:	Approximately 130 gr. (4.18 oz.)
Power	Power requirements:	None
	Maximum voltage:	FS-SIF-24: 31Vdc FS-SIF-48: 55Vdc FS-SIF-60: 65Vdc FS-SIF-110: 125 Vdc
	Maximum voltage between any input and GND:	500 Vac or 700 Vdc
Terminations	Connection type:	M5

1 The SIF-X input supply filter types replace the10306/1/x input supply filter types which only have an UL approval up to 40°C. There are no functional changes.

2 FM approval applies to the FS-SIF-24 module type only.

PSU-FLTR2450

Common mode filter for the PSU-UNI2450

Description

The PSU-FLTR2450 module is a common mode filter that can be fitted on the PSU-UNI2450 V1.0 power supply, as described in “PSU-UNI2450” on page 8.

Note:

The PSU-FLTR2450 is mandatory for version 1.0 of the PSU-UNI2450.

The PSU-FLTR2450 has:

- two female connectors that slot in the 24V connectors of the PSU-UNI2450.
- two male connectors to connect the mains power rail via a dual cable set. (For more information see “MB-0001” on page 783.)
- a mounting bracket, to secure the filter on top of the mounting bracket located at the output side of the PSU-UNI2450.

Figure 487 on page 780 shows the front view of the PSU-FLTR2450.

Figure 487 PSU-FLTR2450 front view

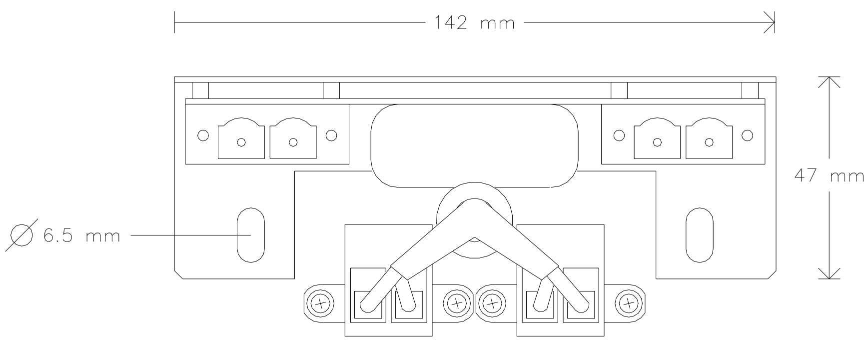
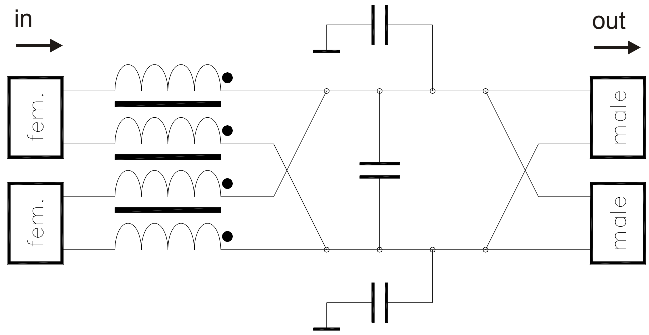


Figure 488 on page 781 contains a schematic diagram of the PSU-FLTR2450 common mode filter.

Figure 488 PSU-FLTR2450 schematic diagram

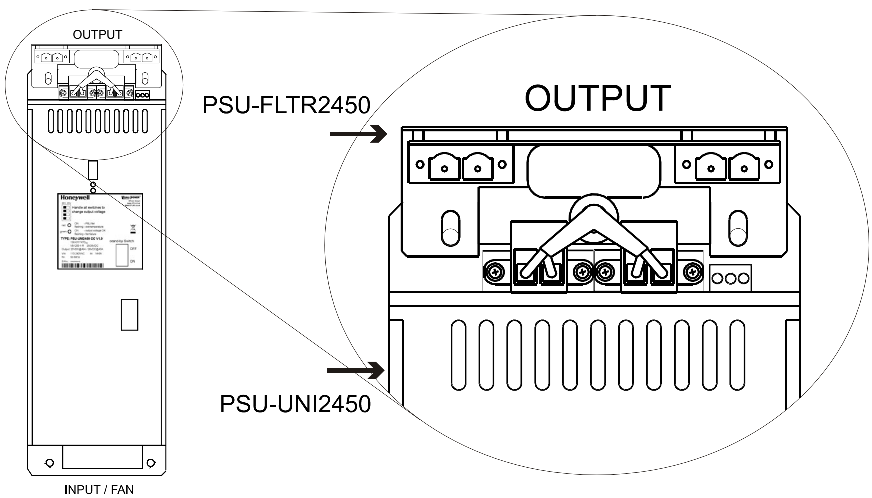


Connection and assembly instructions

Figure 489 on page 781 shows how the PSU-FLTR2450 filter module is installed to the PSU-UNI2450 power supply unit:

- Disconnect the 24 Vdc power cables and remove the two bolts securing the output side of the PSU-UNI2450 to the mounting plate.
- Slot the PSU-FLTR2450 in the 24V connectors of the PSU-UNI2450 and position the filter over the mounting brackets of the PSU-UNI2450.
- Secure the PSU-FLTR2450 to the PSU-UNI2450 and the mounting plate with the two bolts removed earlier, and reconnect the 24 Vdc power cables.

Figure 489 PSU-FLTR2450 connected to a PSU-UNI24520 V1.0



Technical data

The FC-PSU-FLTR2450 module has the following specifications:

General	Type number:	FC-PSU-FLTR2450
	Approvals[1]:	CE, TUV
Physical	Dimensions:	60 x 142 x 100 mm (L × W × H) 2.36 x 5.6 x 3.94 in (L × W × H)
	Mounting:	on PSU-UNI2450 mounting bracket with M6 bolts
	Weight:	Approximately 360 gr. (12.7oz.)
Power	Power requirements:	None
	Output power:	Complies with PSU-UNI-2450
	Maximum voltage between any input and GND:	500 Vac or 700 Vdc
Terminations	Output connector type:	2 x Phoenix PCV6-16 2G1F-10,16 male with locking screws

1 TUV approval pending. For updates contact Honeywell SMS.

MB-0001

Mains power rail (24Vdc—110Vdc) with 10 sections

Description

The MB-0001 mains power rail distributes a DC voltage in the range of 24Vdc—110Vdc from (multiple) redundant power supplies to its users.

The MB-0001 mains power rail has 120 connection points and can distribute up to 200 Amps. Connection to the rail requires special connectors.

They may be of type Jackscrew (JCK) or of type Squeeze-To-Release (STR), as shown in Figure 490 on page 783.

Figure 490 JCK and STR type connectors for the MB-0001

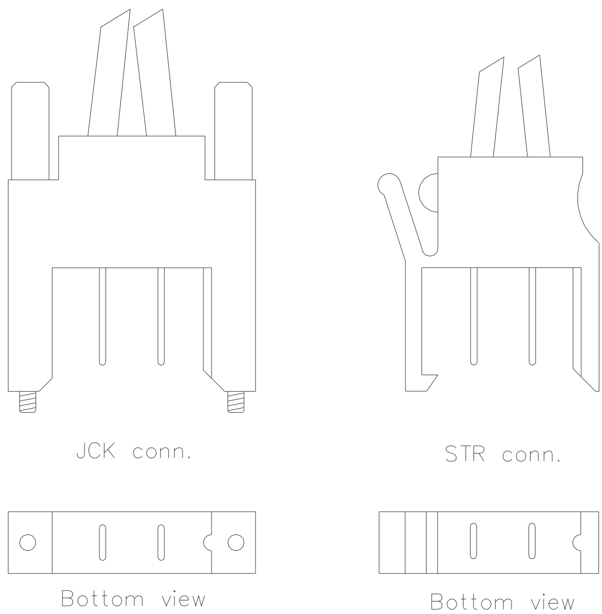


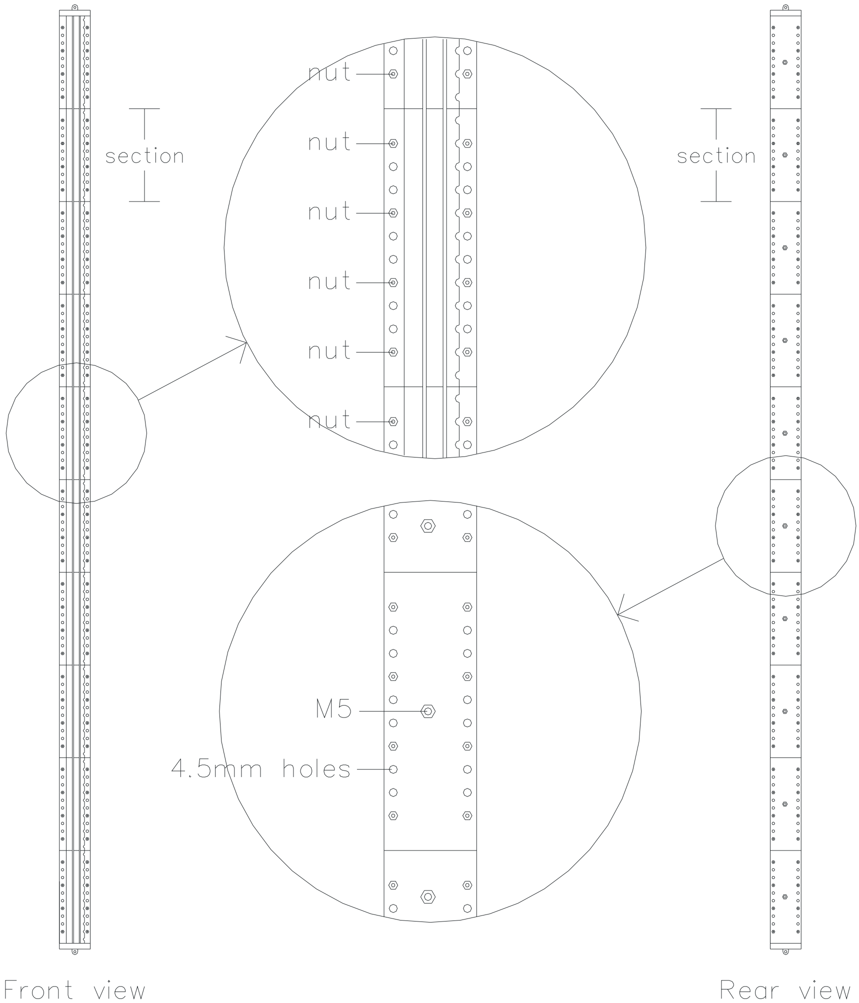
Figure 491 on page 784 shows that the MB-0001 mains power rail consists of:

- two copper rails,
- two end caps and
- ten 6 inch sections.

Each section has twelve connector positions.

- The second, fifth, eighth and the eleventh connector position of each section have nuts in the housing to accommodate for JCK connectors.
- All (twelve) positions (of each section) can be used for STR connectors.

Figure 491 MB-0001 – 10 section power rail, front view and rear view



The rail can be mounted using the M5 thread hole on the rear centre of the rail, as shown in Figure 491 on page 784.

Mounting without rear access is possible using the 4.5mm diameter holes on both sides of the rail and on each end cap.

Technical data

General	Type number:	FS-MB-0001
	Approvals:	UL, CSA, FM pending
Load	Rail current:	max. 200 A
Connectors	D-TAB-200-JCK	max. 55 A (with AWG 8 wire)
	D-TAB-200-STR	max. 25 A (with AWG 12 wire)
	Temperature rail and JCK connector	max. 125 ºC (257 ºF)
	Temperature STR connector	max. 105 ºC (221 ºF)
Sections	quantity per rail	10
	JCK positions per section	max 4
	STR positions per section	max 12
	length per section	152.4 mm (6 inch)
Physical	Rail dimensions	1563 x 5.08 x 34.8 mm (L x W x H) 61.52 x 2.0 x 1.37 in (L x W x H)
	Weight	3.7kg (8.16 lb)
	M5 mounting thread hole	6.5mm (0.256 inch) depth, 152.4mm (6 inch) mounting interval

MB-0002

Mains power rail (24Vdc—110Vdc) with 4 sections

Description

The MB-0002 mains power rail distributes a DC voltage in the range of 24Vdc—110Vdc from (multiple) redundant power supplies to its users.

The MB-0002 mains power rail has 48 connection points and can distribute up to 200 Amps. Connection to the rail requires special connectors.

They may be of type Jackscrew (JCK) or of type Squeeze-To-Release (STR), as shown in Figure 492 on page 786.

Figure 492 JCK and STR type connectors for the MB-0002

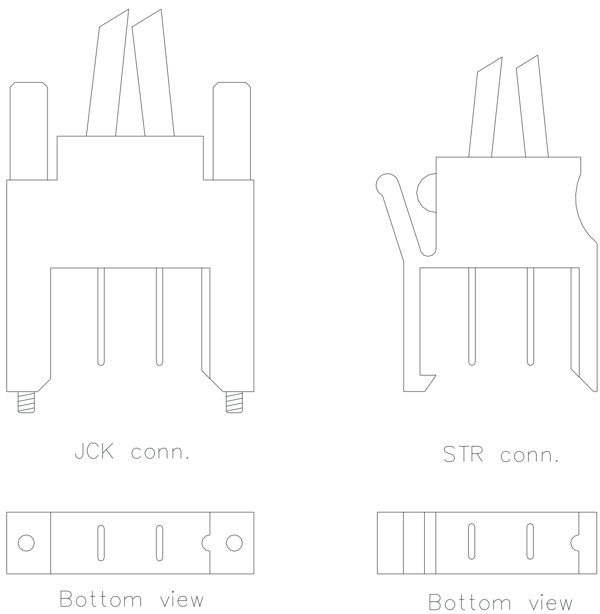


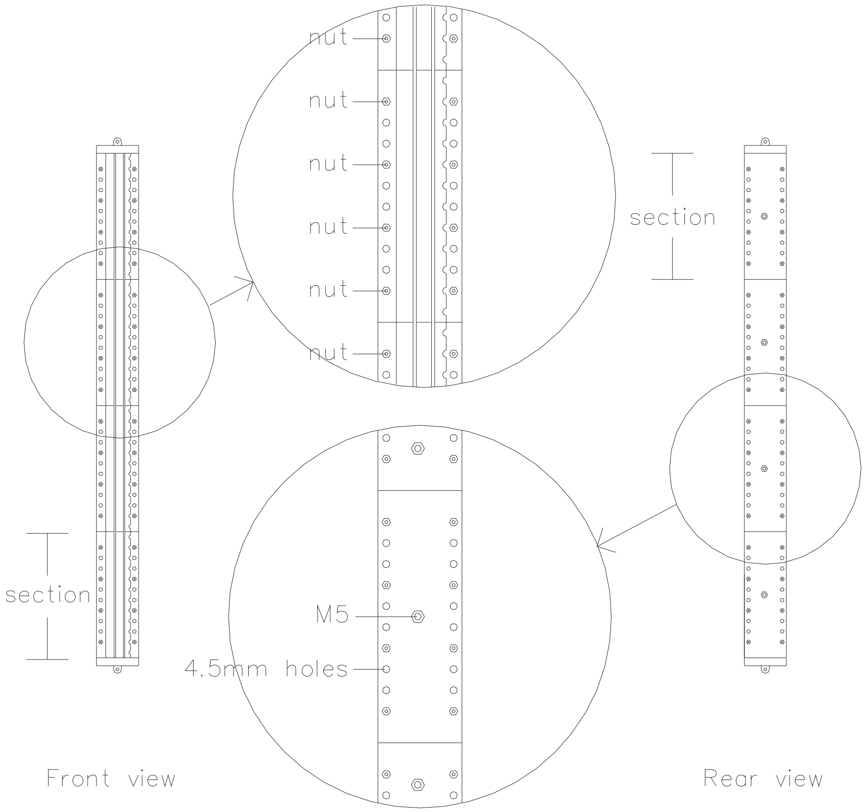
Figure 493 on page 787 shows that the MB-0002 mains power rail consists of:

- two copper rails,
- two end caps and
- four 6 inch sections.

Each section has twelve connector positions.

- The second, fifth, eighth and the eleventh connector position of each section have nuts in the housing to accommodate for JCK connectors.
- All (twelve) positions (of each section) can be used for STR connectors.

Figure 493 MB-0002 – 4 section power rail, front view and rear view



The rail can be mounted using the M5 thread hole on the rear centre of the rail, as shown in Figure 493 on page 787.

Mounting without rear access is possible using the 4.5mm diameter holes on both sides of the rail and on each end cap.

Technical data

General	Type number:	FS-MB-0002
	Approvals:	UL, CSA, FM pending
Load	Rail current:	max. 200 A
Connectors	D-TAB-200-JCK	max. 55 A (with AWG 8 wire)
	D-TAB-200-STR	max. 25 A (with AWG 12 wire)
	Temperature rail and JCK connector	max. 125 ºC (257 ºF)
	Temperature STR connector	max. 105 ºC (221 ºF)
Sections	quantity per rail	4
	JCK positions per section	max 4
	STR positions per section	max 12
	length per section	152.4 mm (6 inch)
Physical	Rail dimensions	649 x 5.08 x 34.8 mm (L x W x H) 25.52 x 2.0 x 1.37 in (L x W x H)
	Weight	1.5kg (3.3 lb)
	M5 mounting thread hole	6.5mm (0.256 inch) depth, 152.4mm (6 inch) mounting interval

MB-0003

Mains power rail (24Vdc—110Vdc)) with 6 sections

Description

The MB-0003 mains power rail distributes a DC voltage in the range of 24Vdc—110Vdc from (multiple) redundant power supplies to its users.

The MB-0003 mains power rail has 72 connection points and can distribute up to 200 Amps. Connection to the rail requires special connectors.

They may be of type Jackscrew (JCK) or of type Squeeze-To-Release (STR), as shown in Figure 494 on page 789.

Figure 494 JCK and STR type connectors for the MB-0003

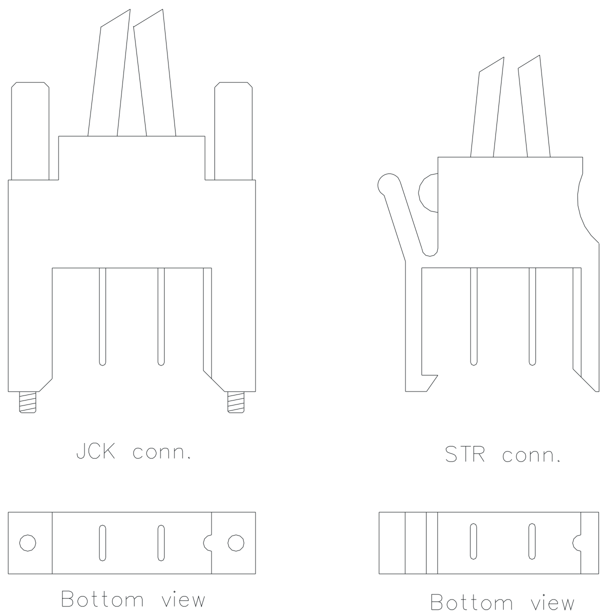


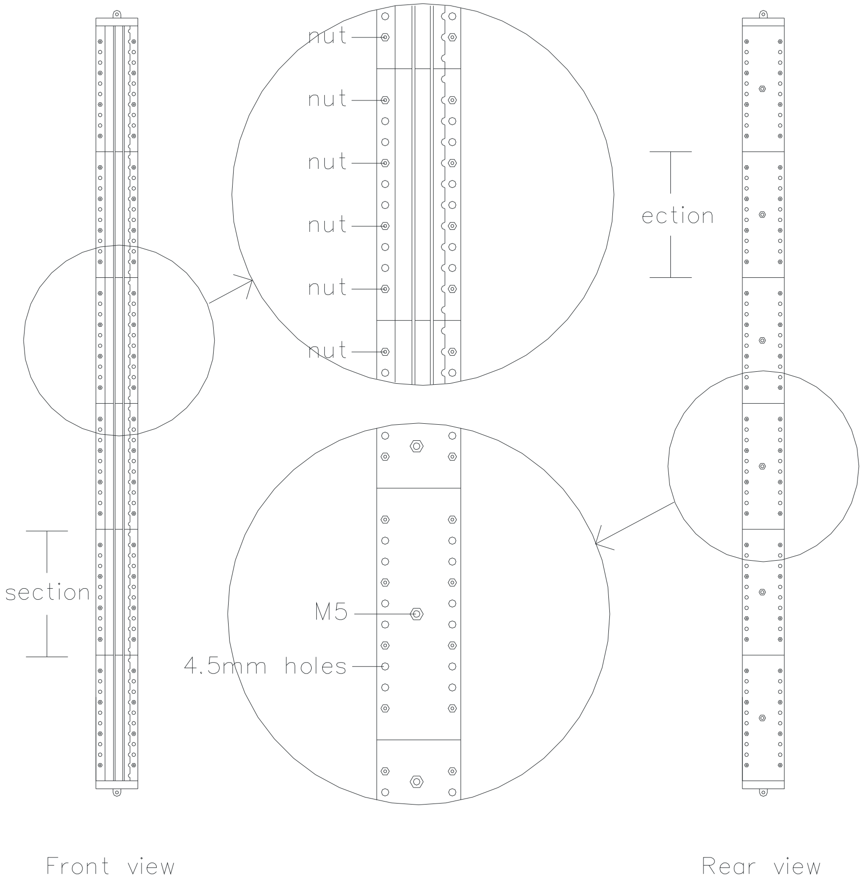
Figure 495 on page 790 shows that the MB-0003 mains power rail consists of:

- two copper rails,
- two end caps and
- ten 6 inch sections.

Each section has twelve connector positions.

- The second, fifth, eighth and the eleventh connector position of each section have nuts in the housing to accommodate for JCK connectors.
- All (twelve) positions (of each section) can be used for STR connectors.

Figure 495 MB-0003 – 6 section power rail, front view and rear view



The rail can be mounted using the M5 thread hole on the rear centre of the rail, as shown in Figure 495 on page 790.

Mounting without rear access is possible using the 4.5mm diameter holes on both sides of the rail and on each end cap.

Technical data

General	Type number:	FS-MB-0003
	Approvals:	UL, CSA, FM pending
Load	Rail current:	max. 200 A
Connectors	D-TAB-200-JCK	max. 55 A (with AWG 8 wire)
	D-TAB-200-STR	max. 25 A (with AWG 12 wire)
	Temperature rail and JCK connector	max. 125 ºC (257 ºF)
	Temperature STR connector	max. 105 ºC (221 ºF)
Sections	quantity per rail	6
	JCK positions per section	max 4
	STR positions per section	max 12
	length per section	152.4 mm (6 inch)
Physical	Rail dimensions	954 x 5.08 x 34.8 mm (L x W x H) 37.52 x 2.0 x 1.37 in (L x W x H)
	Weight	2.22 kg (4.9 lb)
	M5 mounting thread hole	6.5mm (0.256 inch) depth, 152.4mm (6 inch) mounting interval

PDB-0824

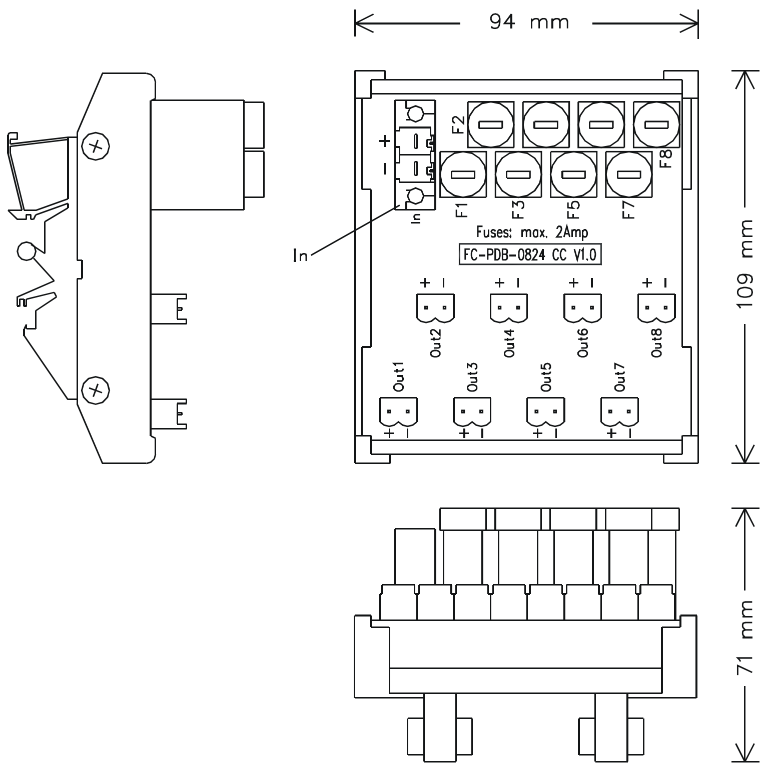
Power Distribution Board (24Vdc, 2 Amp, 8 channel)

Description

The PDB-0824 power distribution board enables easy distribution of 24Vdc from the main power rail to individual 24Vdc devices inside the cabinet enclosure, such as fan units and FTAs.

Figure 496 on page 792 shows the PDB-0824 board with one 24Vdc entry connector (In) for connection to the main bus bar and eight (2 Amp fused) 24Vdc field connectors (Out1 thru Out8) for connection to eight 24Vdc devices.

Figure 496 PDB-0824 board layout



A 24 Vdc power distribution cable (see data sheet “PDC-MB24-x” on page 812 for details) can be used to connect the main power bar to In.

- When using other connection cables make sure the wire size is adequate and a Weidmuller BVZ 7.62/02F SW connector with two keying pins is used to connect to In of the PDB-0824 (see “Pin allocation” on page 793).

24V distribution cables (see “PDC-FTA24” on page 816) connect the PDB-0824 with up to eight 24Vdc devices.

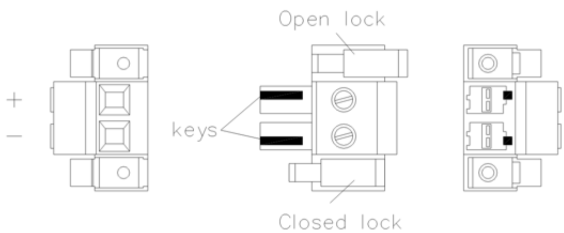
- When using other connection cables make sure the wire size is adequate and a Weidmuller BL 5.08/2 SN OR or equivalent connector is used to connect to one of the Outx connectors of the PDB-0824 (see “Pin allocation” on page 793).

Pin allocation

Figure 497 on page 793 shows the top, side & bottom view and the pin assignment of the Weidmuller BVZ 7.62/02F SW cable-connector on In.

1. The pin marked “+” is pin 1; connect to +24Vdc wire to the main bus bar
2. The pin marked “-” is pin 2; connect to 0Vdc wire to the main bus bar

Figure 497 Power connector on In (Weidmuller BVZ 7.62/02F SW) top, side and bottom view

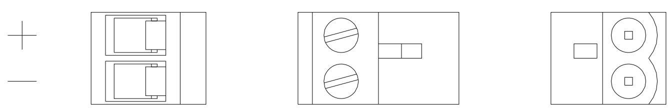


The two (orange) locking slides of the cable-connector in Figure 497 on page 793 keep the cable-connector locked when inserted into In.

Figure 498 on page 793 shows the top, side & bottom view and the pin assignment of the Weidmuller BL 5.08/2 SN OR or equivalent connector to an Outx field connector on the PDB-0824.

1. The pin marked “+” is pin 1; connect to +24Vdc wire to the consumer
2. The pin marked “-” is pin 2; connect to 0Vdc wire to the consumer

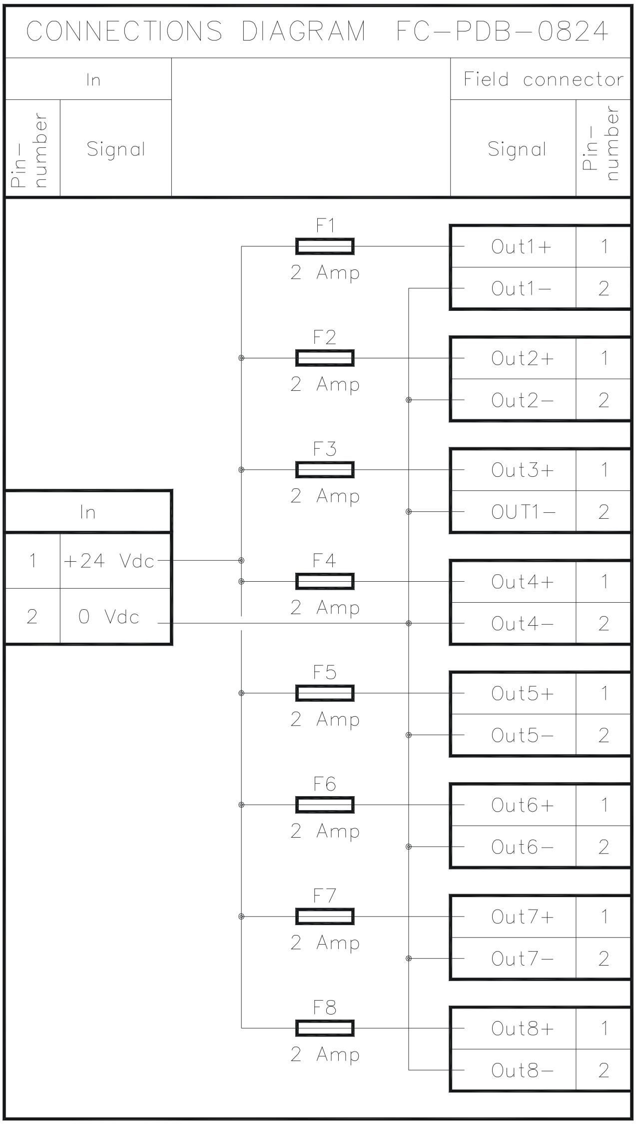
Figure 498 Power connector on Outx (Weidmuller BL 5.08/2 SN OR) top, side and bottom view



Connections

The connection diagram of the PDB-0824 module:

Figure 499 Connection diagram



Technical data

General	Type numbers[1] :	FC-PDB-0824 CC V1.0
	Approvals:	CE; UL, TUV, CSA pending
Fuses	rating	max. 2 AT (slow acting)
	dimensions:	5 x 20 mm (0.20 x 0.79 in)
Connectors	In make and type:	2 pole header with keying • Weidmuller: BVZ 7.62/02F SW (conn.) • Weidmuller: KO BV/SV7.62 (keys)
	Field connector make and type:	2 pole socket block Weidmuller: BL 5.08/2 SN OR
Physical	Module dimensions:	94 x 109 x 71 mm (L x W x H) 3.7 x 4.3 x 2.8 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	95 mm (3.74 in)

1 FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

PDB-0824P

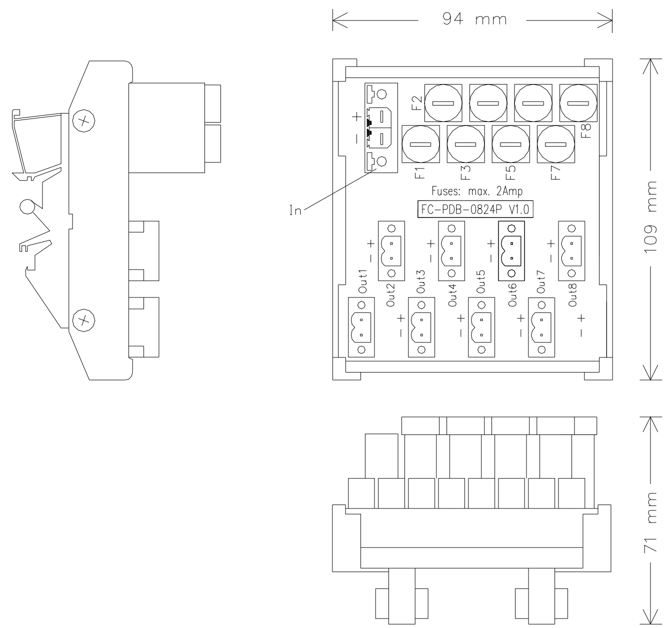
Power Distribution Board (24Vdc, 2 Amp, 8 channel)

Description

The PDB-0824P power distribution board enables easy distribution of 24Vdc from the main power rail to individual 24Vdc devices inside the cabinet enclosure, such as fan units and FTAs.

Figure 500 on page 796 shows the PDB-0824P board with one 24Vdc entry connector (In) for connection to the main bus bar and eight (2 Amp fused) 24Vdc field connectors (Out1 thru Out8) for connection to eight 24Vdc devices.

Figure 500 PDB-0824P board layout



A 24 Vdc power distribution cable (see data sheet “PDC-MB24-y” on page 814 for details) can be used to connect the main power bar to In.

- When using other connection cables make sure the wire size is adequate and a Weidmuller BVZ 7.62HP/02F SN connector with two keying pins is used to connect to In of the PDB-0824P (see “Pin allocation” on page 797).

24V distribution cables (see “PDC-FTA24” on page 816) connect the PDB-0824P with up to eight 24Vdc devices.

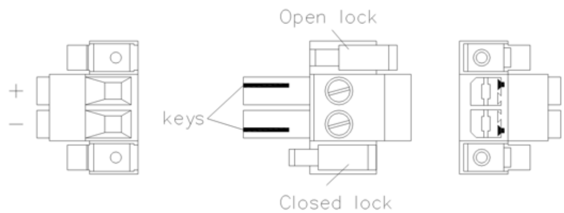
- When using other connection cables make sure the wire size is adequate and a Weidmuller BLZ 5.08/2F SN SW or equivalent connector (e.g. BL 5.08/2 SN OR) is used to connect to one of the Outx connectors of the PDB-0824P (see “Pin allocation” on page 797).

Pin allocation

Figure 501 on page 797 shows the top, side & bottom view and the pin assignment of the Weidmuller BVZ 7.62HP/02F SN cable-connector on In.

1. The pin marked “+” is pin 1; connect to +24Vdc wire to the main bus bar
2. The pin marked “-” is pin 2; connect to 0Vdc wire to the main bus bar

Figure 501 Power connector on In (Weidmuller BVZ 7.62HP/02F SN) top, side and bottom view

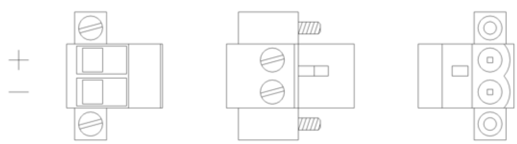


The two (red) locking slides of the cable-connector in Figure 501 on page 797 keep the cable-connector locked when inserted into In.

Figure 502 on page 797 shows the top, side & bottom view and the pin assignment of the Weidmuller BLZ 5.08/2F SN SW.

1. The pin marked “+” is pin 1; connect to +24Vdc wire to the consumer
2. The pin marked “-” is pin 2; connect to 0Vdc wire to the consumer

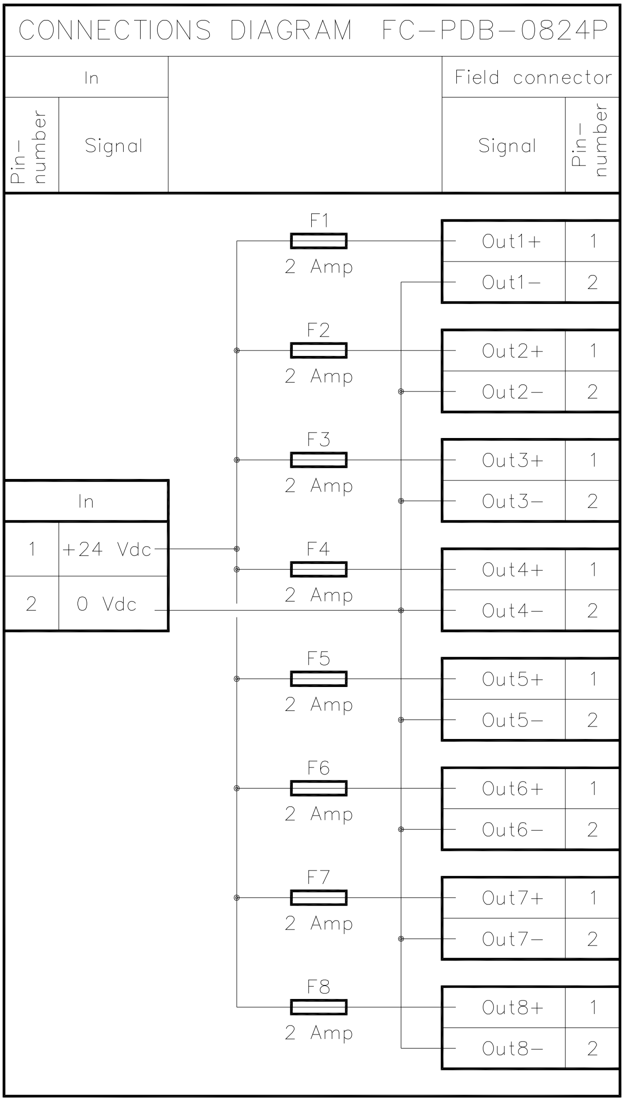
Figure 502 Power connector on Outx (Weidmuller BLZ 5.08/2F SN SW) top, side and bottom view



Connections

The connection diagram of the PDB-0824P module:

Figure 503 Connection diagram



Technical data

General	Type number[1] :	FC-PDB-0824P V1.0
	Approvals:	CE; UL, TUV, CSA pending
Fuses	rating	max. 2 AT (slow acting)
	dimensions:	5 x 20 mm (0.20 x 0.79 in)
Connectors	In make and type:	2 pole header with keying • Weidmuller: BVZ 7.62HP/02F SN (conn.) • Weidmuller: BV/SV7.62HP KO (keys)
	Field connector make and type:	2 pole socket block Weidmuller: BLZ 5.08/2F SN SW
Physical	Module dimensions:	94 x 109 x 71 mm (L x W x H) 3.7 x 4.3 x 2.8 in (L x W x H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	95 mm (3.74 in)

1 FC-type modules are conformal coated modules.

PDC-MBMB-1

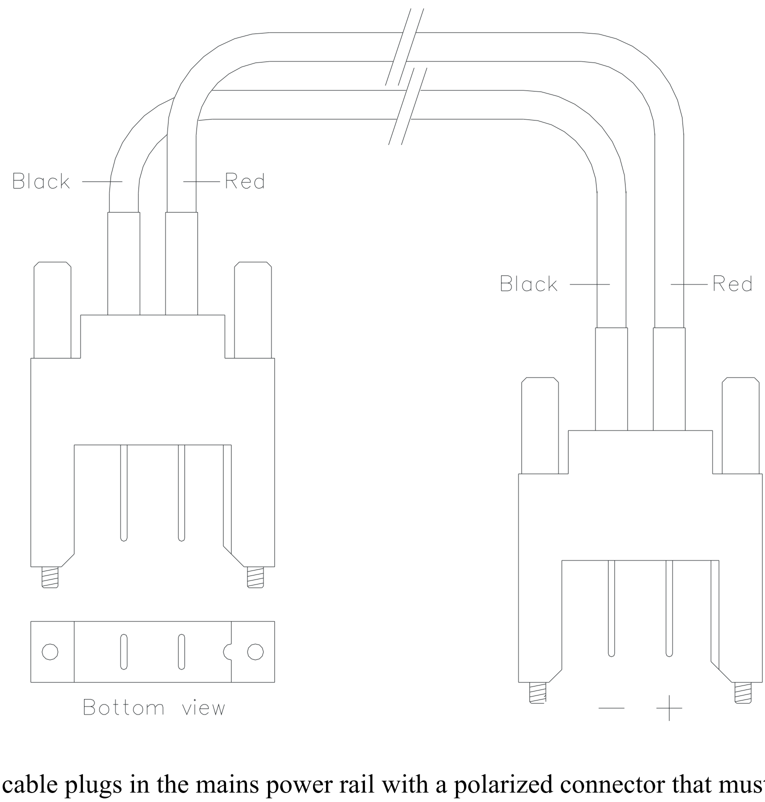
Mains power distribution cable (24Vdc, 48Vdc)

Description

The PDC-MBMB-1 power distribution cable transfers the 24Vdc or 48Vdc from one mains power rail of type FS-MB-0001 to another mains power rail of that type.

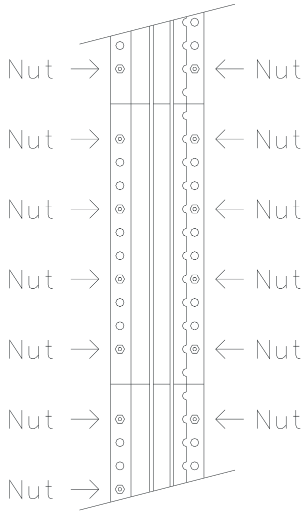
Figure 504 on page 800 shows the layout of the PDC-MBMB-1 power distribution cable.

Figure 504 Layout of PDC-MBMB-1 power distribution cable



The cable plugs in the mains power rail with a polarized connector that must be locked on the rail using its two screws. To enable this, the plug must be placed on one of the rail positions that has nuts in the rail housing (see Figure 505 on page 801).

Figure 505 Section of the MB-0001 mains power rail



High loads

With second rail loads exceeding 30 Amp (up to 100 Amp) it is recommended to use two PDC-MBMB-1 cables to connect the two power rails.

- Connect the first cable close to the top of each power rail.
- Connect the second cable close to the bottom of each power rail.

Technical data

General	Type number:	FS-PDC-MBMB-1
	Approvals:	UL, CSA; FM pending
Cables	Type:	HV8-55-c (AWG 8)
	Length:	3 meter
Connectors	2-pole Jackscrew	
	Type connector:	D-TAB-200-JCK
	Type pin:	D-TAB-200-8-S
	Power rating:	55 A
	Temperature:	max. 125 ºC (257 ºF)

PDC-CPSET

Power distribution cable set Control Processor (24Vdc)

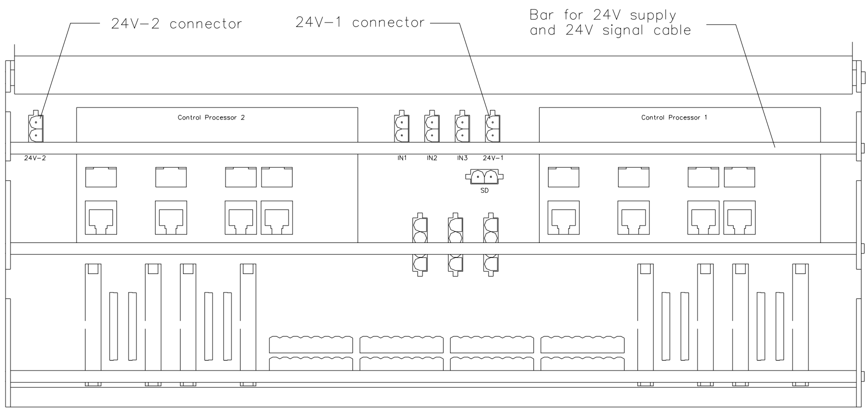
Description

The FS-PDC-CPSET power distribution cable-set transfers power from the 24 Vdc mains bus bar type FS-MB-0001 to the Controller chassis.

The set consists of 2 power cables, one for each Control Processor.

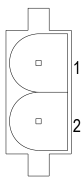
The cables are placed on the appropriate connectors on the backplane (24V-1 and 24V-2 see Figure 506 on page 802).

Figure 506 Position of 24 V connectors on the SM Controller backplane



Pin allocation

The back view and pin allocation of the 24V-1 and 24V-2 connectors are:

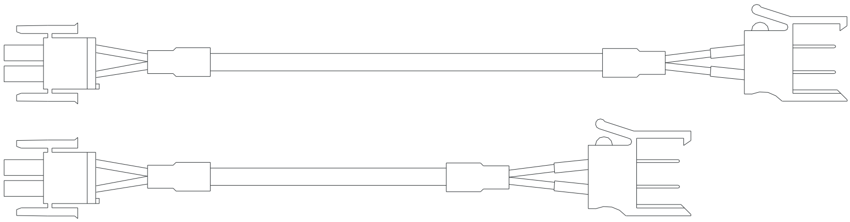
		24V-1	**24V-2**
	1	+24V for CP1	+24V for CP2
	2	0V for CP1	0V for CP2

Layout

Figure 507 on page 803 shows the layout of the FS-PDC-CPSET power distribution cable set.

- The FS-PDC-CP24-1 (the short cable in Figure 507 on page 803) connects CP1 with the 24V supply. This cable is placed between the 24V-1 connector on the SM Controller backplane and the 24 Vdc mains bus bar, type FS-MB-0001.
- The FS-PDC-CP24-2 (the long cable in Figure 507 on page 803) connects CP2 with the 24V supply. This cable is placed between the 24V-2 connector on the SM Controller backplane and the 24 Vdc mains bus bar, type FS-MB-0001.

Figure 507 Layout of the FS-PDC-CPSET power distribution cables



Technical data

General	Type number:	FS-PDC-CPSET
	Approvals:	UL, CSA; FM pending
Cable	Type:	CC600 2 x 2.5 mm^2
	Length FS-PDC-CP24-1:	54 cm (21.26 in)
	Length FS-PDC-CP24-2:	77 cm (30.31 in)
Connectors	Bus bar side:	2 pole Squeeze To Release type: D-TAB-200-STR
	SM Controller side:	2 pole mate-n-lock

PDC-IOSET

Power distribution cable set IO chassis (24Vdc, 48Vdc or 110Vdc)

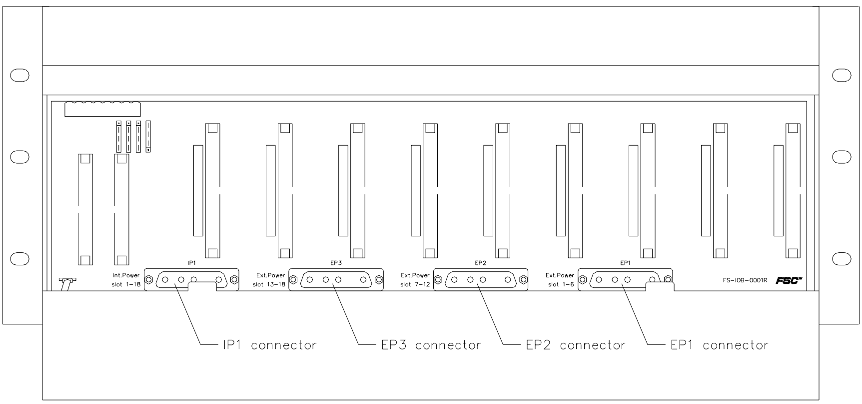
Description

The FS-PDC-IOSET power distribution cables of the IO chassis transfer 24 Vdc, 48 Vdc or 110Vdc from mains power rails of type FS-MB-0001 to the IO chassis. Figure 508 on page 804 shows the position of the IP1, EP1, EP2, and EP3 connector on the back of an IO chassis.

Attention:

To avoid assembly mistakes the use of color coded labels and/or sleeves is recommended on both the cable sets and the connectors when applied for voltages other than 24Vdc.

Figure 508 Position of the power connectors on an IO backplane



The following module slots are powered by the IO chassis power distribution cables:

IO module slots	Power supply voltage	Cable
1-6	External	FS-PDC-IOEP1a
7-12	External	FS-PDC-IOEP2a
13-18	External	FS-PDC-IOEP3a
All	Internal	FS-PDC-IOIP1a

Pin allocation

The pin allocation of the external power connectors EP1, EP2 and EP3 of a redundant IO chassis are:

Pin	Marking	EP3	EP2	EP1
1	Red (1)	EP slot 13, 15, 17	EP slot 7, 9, 11	EP slot 1, 3, 5
3	Black (1)	0 Volt	0 Volt	0 Volt
4	Black (2)	0 Volt	0 Volt	0 Volt
5	Red (2)	EP slot 14, 16, 18	EP slot 8, 10, 12	EP slot 2, 4, 6

The pin allocation of the internal power connector IP1 of a redundant IO chassis is:

Pin	Marking	IP1	To slot
1	Red (1)	IP	1, 3, 5, 7, 9, 11, 13, 15 and 17
3	Black (1)	0 Volt	
4	Black (2)	0 Volt	
5	Red (2)	IP	2, 4, 6, 8, 10, 12, 14, 16 and 18

The pin allocation of the External Power connectors EP1, EP2 and EP3 of a non-redundant IO chassis are:

Pin	marking	EP3	EP2	EP1
1	Red (1)	EP slot 13, 14, 15	EP slot 7, 8, 9	EP slot 1, 2, 3
3	Black (1)	0 Volt	0 Volt	0 Volt
4	Black (2)	0 Volt	0 Volt	0 Volt
5	Red (2)	EP slot 16, 17, 18	EP slot 10, 11, 12	EP slot 4, 5, 6

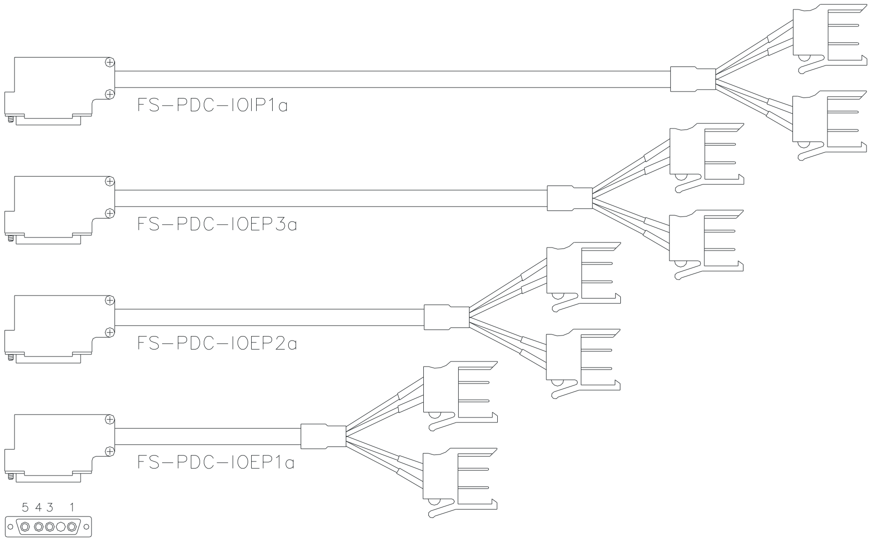
The pin allocation of the Internal Power connector IP1 in a non-redundant IO chassis is:

Pin	Marking	IP1
1	Red (1)	IP slot 1-9
3	Black (1)	0 Volt
4	Black (2)	0 Volt
5	Red (2)	IP slot 10-18

Layout

Figure 509 on page 806 shows the layout of the FS-PDC-IOSET power distribution cables.

Figure 509 Layout of the FS-PDC-IOSET power distribution cables



Technical data

General	Type number:	FS-PDC-IOSET
	Approvals:	UL, CSA; FM pending
Cable	Type:	CC 600 World 4 × 2.5 mm^2
	Length:	33 cm (FS-PDC-IOEP1a) 41 cm (FS-PDC-IOEP2a) 49 cm (FS-PDC-IOEP3a) 57 cm (FS-PDC-IOIP1a)
Connectors	Bus bar side:	2 pole Squeeze To Release type: D-TAB-200-STR
	IO chassis side:	FM5W5 S (female) housing: low profile, 90°

PDC-CP24

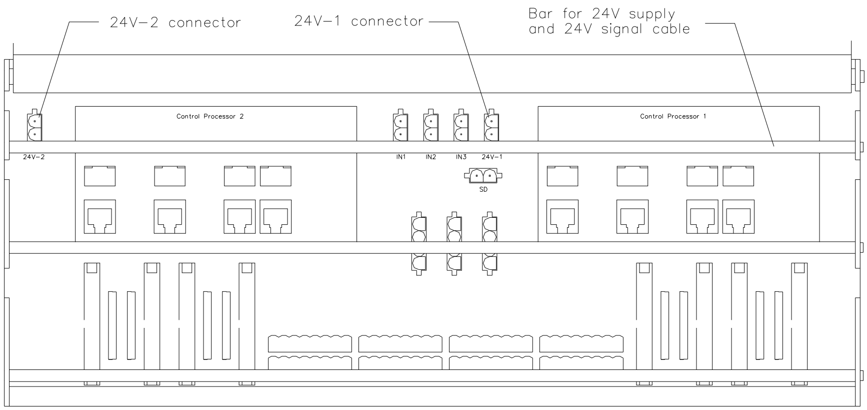
Power distribution cable Control Processor (24Vdc)

Description

The FS-PDC-CP24 power distribution cable of the Control Processor transfers the 24 Vdc from the mains power rails to Controller chassis. Each Control Processor has a separate FS-PDC-CP24 cable.

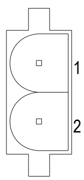
The cables are placed on the appropriate connectors on the backplane (24V-1 and 24V-2 see Figure 510 on page 807).

Figure 510 Position of 24 V connectors on the SM Controller backplane



Pin allocation

The back view and pin allocation of the 24V-1 and 24V-2 connectors are:

		24V-1	**24V-2**
	1	+24V for CP1	+24V for CP2
	2	0V for CP1	0V for CP2

Layout

Figure 511 on page 808 shows the layout of the FS-PDC-CP24 power distribution cable.

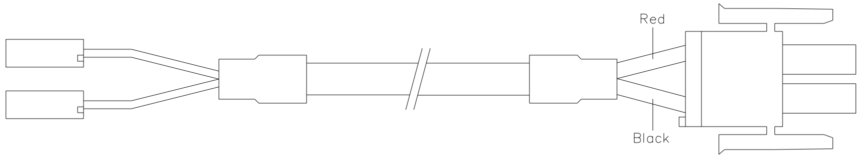


Figure 511 Layout of the FS-PDC-CP24 power distribution cable

Technical data

General	Type number:	FS-PDC-CP24
	Approvals:	UL, CSA, FM
Cable	Type:	Alphawire 1899AWG/2C ($2 \times 1.3\ mm^2$)
	Length:	1 m
Connectors	Bus bar side:	Fast-on
	SM Controller side:	2 pole mate-n-lock

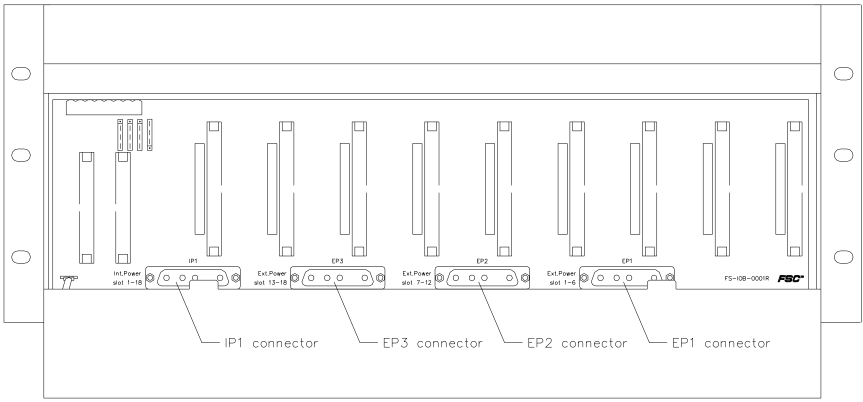
PDC-IOxPx

Power distribution cable IO chassis (24Vdc, 48Vdc or 110Vdc)

Description

The FS-PDC-IOxPx power distribution cables of the IO chassis transfer 24 Vdc, 48 Vdc or 110 Vdc from the mains power rails to the IO chassis. Figure 512 on page 809 shows the position of the IP1, EP1, EP2, and EP3 connector on the back of an IO chassis.

Figure 512 Position of the power connectors on an IO backplane



The following module slots are powered by the IO chassis power distribution cables:

IO module slots	Power supply voltage	Cable
1-6	External	FS-PDC-IOEP1
7-12	External	FS-PDC-IOEP2
13-18	External	FS-PDC-IOEP3
All	Internal	FS-PDC-IOIP1

Pin allocation

The pin allocation of the external power connectors EP1, EP2 and EP3 of a redundant IO chassis are:

Pin	Marking	EP3	EP2	EP1
1	Red (1)	EP slot 13, 15, 17	EP slot 7, 9, 11	EP slot 1, 3, 5
3	Black (1)	0 Volt	0 Volt	0 Volt
4	Black (2)	0 Volt	0 Volt	0 Volt
5	Red (2)	EP slot 14, 16, 18	EP slot 8, 10, 12	EP slot 2, 4, 6

The pin allocation of the internal power connector IP1 of a redundant IO chassis is:

Pin	Marking	IP1	To slot
1	Red (1)	IP	1, 3, 5, 7, 9, 11, 13, 15 and 17
3	Black (1)	0 Volt	
4	Black (2)	0 Volt	
5	Red (2)	IP	2, 4, 6, 8, 10, 12, 14, 16 and 18

The pin allocation of the External Power connectors EP1, EP2 and EP3 of a non-redundant IO chassis are:

Pin	marking	EP3	EP2	EP1
1	Red (1)	EP slot 13, 14, 15	EP slot 7, 8, 9	EP slot 1, 2, 3
3	Black (1)	0 Volt	0 Volt	0 Volt
4	Black (2)	0 Volt	0 Volt	0 Volt
5	Red (2)	EP slot 16, 17, 18	EP slot 10, 11, 12	EP slot 4, 5, 6

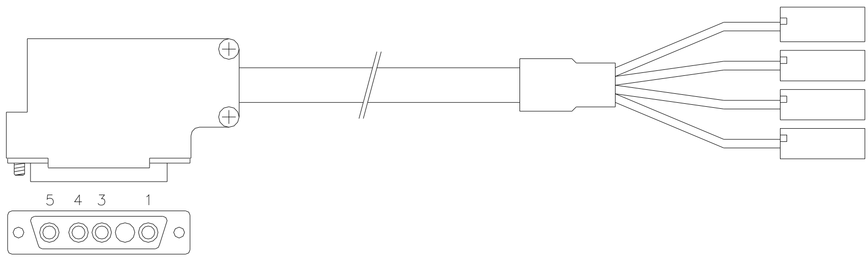
The pin allocation of the Internal Power connector IP1 in a non-redundant IO chassis is:

Pin	Marking	IP1
1	Red (1)	IP slot 1-9
3	Black (1)	0 Volt
4	Black (2)	0 Volt
5	Red (2)	IP slot 10-18

Layout

Figure 513 on page 811 shows the layout of the FS-PDC-IOxPx power distribution cable.

Figure 513 Layout of the FS-PDC-IOxPx power distribution cables



Technical data

General	Type number:	FS-PDC-IOEP1 FS-PDC-IOEP2 FS-PDC-IOEP3 FS-PDC-IOIP1
	Approvals:	UL, CSA, FM
Cable	Type:	CC 600 World 4 × 2.5 mm^2
	Length:	64 cm (IOEP1) 72 cm (IOEP2) 80 cm (IOEP3) 88 cm (IOIP1)
Connectors	Bus bar side:	Fast-on
	IO chassis side:	FM5W5 S (female) housing: low profile, 90°

PDC-MB24-x

Power Distribution Cable (24Vdc)

Description

The FS-PDC-MB24-x power distribution cables transfer the 24Vdc from the main power rail of type FS-MB-0001 to:

- power distribution boards like the FC-PDB-0824 (for details see “PDB-0824” on page 792),
- FTAs equipped with a Weidmuller BVZ 7.62/02F SW power connector, keyed for 24Vdc.

Table 86 on page 812 provides a listing of available cable types and associated lengths.

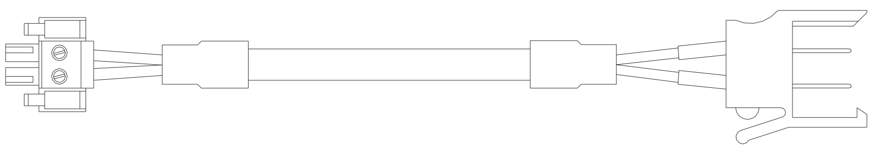
Table 86 Type and length of FS-PDC-MB24-x power distribution cables

Cable type	length
FS-PDC-MB24-1	145 cm (57.1 in)
FS-PDC-MB24-2	245 cm (96.5 in)
FS-PDC-MB24-3	325 cm (128.0 in)

Layout

Figure 514 on page 812 shows the layout of the FS-PDC-MB24-x power distribution cable.

Figure 514 Layout of the FS-PDC-MB24-x power distribution cable



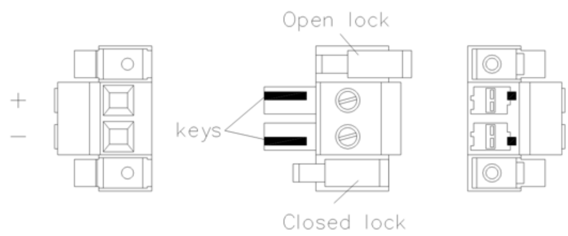
FTA / board connector with 24 Vdc keying

A Weidmuller BVZ 7.62/02F SW cable-connector with 24Vdc keying is used to connect the cable to an FTA or a 24Vdc power distribution board.

Figure 515 on page 813 shows the views, keying and the pin assignment of the Weidmuller BVZ 7.62/02F SW cable-connector.

1. The pin marked “+” is pin 1; connect to +24Vdc wire to the main bus bar
2. The pin marked “-” is pin 2; connect to 0Vdc wire to the main bus bar

Figure 515 FTA/board side connector (Weidmuller BVZ 7.62/02F SW) views and 24 Vdc keying



Two (orange) locking slides of the cable-connector in Figure 515 on page 813 keep the cable-connector locked when inserted into the FTA or the power distribution board.

Technical data

General	Type numbers:	FS-PDC-MB24-1 FS-PDC-MB24-2 FS-PDC-MB24-3
	Approvals:	UL, CSA; FM pending
Cable	Type:	CC600 2 x 6mm^2
	Length FS-PDC-MB24-1:	145 cm (57.1 in)
	Length FS-PDC-MB24-2:	245 cm (96.5 in)
	Length FS-PDC-MB24-3:	325 cm (128.0 in)
Connectors	mains power bar side:	2 pole Squeeze To Release type: D-TAB-200-STR
	FTA / board side:	2 pole header with keying Weidmuller: BVZ 7.62/02F SW
	FTA / board keying	Weidmuller: KO BV/SV7.62

PDC-MB24-y

Power Distribution Cable (24Vdc)

Description

The FS-PDC-MB24-y (where “y” stands for 1P, 2P or 3P) power distribution cables transfer the 24Vdc from the main power rail of type FS-MB-0001 to:

- power distribution boards like the FC-PDB-0824P (for details see “PDB-0824P” on page 796),
- FTAs equipped with a Weidmuller SV 7.62HP/02/180F power connector, keyed for 24Vdc.

Table 87 on page 814 provides a listing of available cable types and associated lengths.

Table 87 Type and length of FS-PDC-MB24-y power distribution cables

Cable type	length
FS-PDC-MB24-1P	145 cm (57.1 in)
FS-PDC-MB24-2P	245 cm (96.5 in)
FS-PDC-MB24-3P	325 cm (128.0 in)

Layout

Figure 516 on page 814 shows the layout of the FS-PDC-MB24-y power distribution cable.

Figure 516 Layout of the FS-PDC-MB24-y power distribution cable

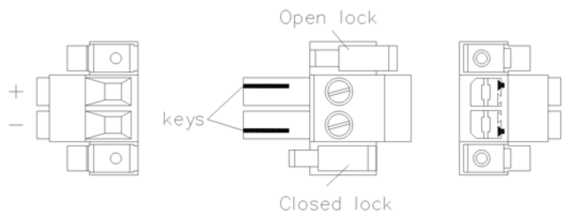
FTA / board connector with 24 Vdc keying

A Weidmuller BVZ 7.62HP/02F SN cable-connector with 24Vdc keying is used to connect the cable to an FTA or a 24Vdc power distribution board.

Figure 517 on page 815 shows the views, keying and the pin assignment of the Weidmuller BVZ 7.62HP/02F SN cable-connector.

1. The pin marked “+” is pin 1; connect to +24Vdc wire to the main bus bar
2. The pin marked “-” is pin 2; connect to 0Vdc wire to the main bus bar

Figure 517 FTA/board side connector (Weidmuller BVZ 7.62HP/02F SN) views and 24 Vdc keying



Two (red) locking slides of the cable-connector in Figure 517 on page 815 keep the cable-connector locked when inserted into the FTA or the power distribution board.

Technical data

General	Type numbers:	FS-PDC-MB24-1P FS-PDC-MB24-2P FS-PDC-MB24-3P
	Approvals:	UL, CSA and FM pending
Cable	Type:	CC600 2 x 6mm^2
	Length FS-PDC-MB24-1P:	145 cm (57.1 in)
	Length FS-PDC-MB24-2P	245 cm (96.5 in)
	Length FS-PDC-MB24-3P:	325 cm (128.0 in)
Connectors	mains power bar side:	2 pole Squeeze To Release type: D-TAB-200-STR
	FTA / board side:	2 pole header with keying Weidmuller: BVZ 7.62HP/02F SN
	FTA / board keying	Weidmuller: BV/SV7.62HP KO

PDC-FTA24

Power Distribution Cable (24Vdc)

Description

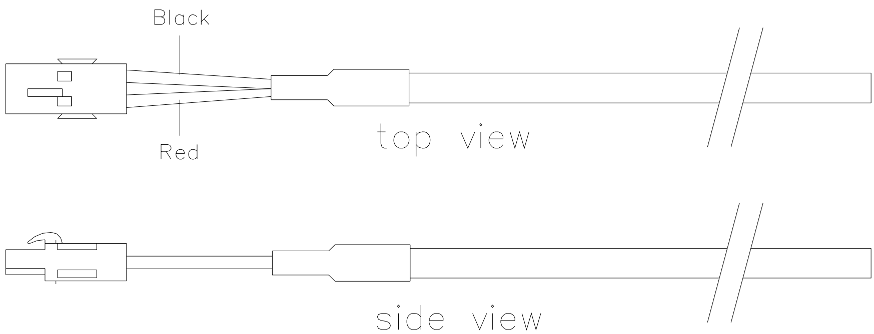
The FS-PDC-FTA24 power distribution cables transfer the 24Vdc from the FC-PDB-0824 power distribution board to individual 24Vdc devices inside the cabinet enclosure, such as fan units and FTAs.

(For details on the FC-PDB-0824 power distribution board see “PDB-0824” on page 792.)

The FS-PDC-FTA24 is equipped with a connector on the FC-PDB-0824 side, and no connector on the device side.

Figure 518 on page 816 shows the layout of the FS-PDC-FTA24 power distribution cable.

Figure 518 Layout of the FS-PDC-FTA24 power distribution cable



Before connecting the FS-PDC-FTA24 to the device, its wires must be cut to the required length and fitted with a suitable connector for the device. In Figure 518 on page 816:

- The red wire represents the +24Vdc.
- The black wire represents the 0Vdc.

Technical data

General	Type numbers:	FS-PDC-FTA24
	Approvals:	UL, CSA; FM pending
Cable	Type:	2 x 1.31 mm^2 (AWG 16) tri-rated
	Length:	2 m (78.74 in)
Connector	housing type:	2 pole socket block Weidmuller BLC 5.08/2BR OR
	crimp pin type:	Weidmuller DFFC 1.5-2.5 SN E

5 Volt and watchdog distribution

19

This chapter describes the 5 Volt and Watchdog distribution boards and cables.

Item		See
5 Volt and Watchdog distribution layout - general information		page 820
modules - Safety Manager and Safety Manager A.R.T.		
PDB-IOX05	Power Distribution Board extension IO cabinet (5 Vdc, Watchdog)	page 830
PDB-CPX05	Power Distribution Board Controller cabinet (5 Vdc, Watchdog)	page 833
modules - Safety Manager A.R.T.		
PDB-ARTF05	Fused Power Distribution Board for IO cabinet - 5 Vdc, Watchdog (Safety Manager A.R.T.)	page 835
cables - Safety Manager and Safety Manager A.R.T.		
PDC-IOX05-x	Power Distribution Cable for IO cabinets (5 Vdc, Watchdog)	page 842
PDC-CPX05	Power Distribution Cable for controller cabinets (5 Vdc, Watchdog)	page 844
cables - Safety Manager		
PDC-IOS05	Power Distribution Cable for a non-redundant IO chassis - 5 Vdc, Watchdog (Safety Manager)	page 838
PDC-IOR05	Power Distribution Cable for a redundant IO chassis - 5 Vdc, Watchdog (Safety Manager)	page 840
cables - Safety Manager A.R.T.		
PDC-ART05	Power Distribution Cable for an IO chassis - 5 Vdc, Watchdog (Safety Manager A.R.T.)	page 846

5 Volt and Watchdog distribution layout

This sub-section contains these topics:

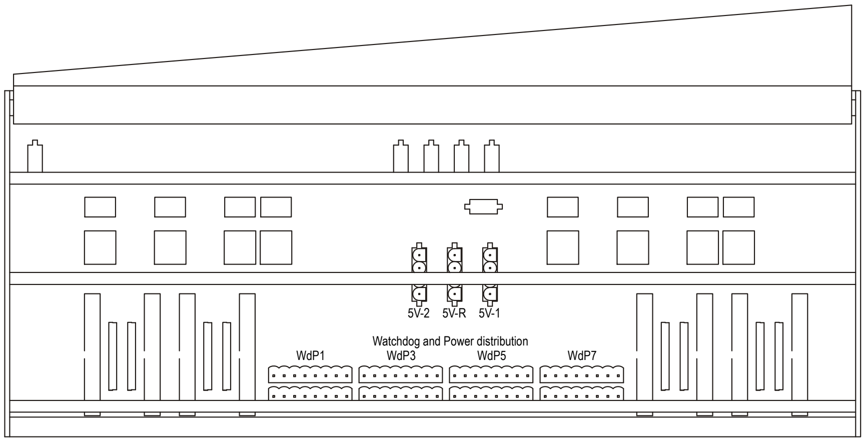
- 5 Volt and Watchdog distribution layout (Safety Manager); see page 821,
- 5 Volt and Watchdog distribution layout (Safety Manager A.R.T.); see page 825.

5 Volt and Watchdog distribution layout (Safety Manager)

The 5V supply voltages and watchdog signals of Safety Manager are generated in the Controller chassis (see “CPCHAS-0001” on page 87). These signals are available on the backplane of the Controller chassis.

Figure 519 on page 821 shows a -simplified- view of the Controller backplane.

Figure 519 Position of the 5V and Wd connectors on a Controller backplane



Attention

The connectors that are used on the cables for Watchdog and 5V distribution can be sensitive to mechanical tension. These cables are connected to WdP1 thru WdP8 on the CP backplane and WdP on IO backplanes. Make sure that the cables are appropriately secured to avoid inadvertant disconnection.

The eight WdPx connectors (two rows of four connectors) at the bottom middle of Figure 519 on page 821 are used to transfer watchdog and power (5V) to the IO-chassis in the controller cabinet.

The three 5V-x connectors (5V-2, 5V-R and 5V-1) in the center of Figure 519 on page 821 are used to transfer watchdog and 5V to the IO chassis in the extension cabinet(s).

Figure 520 on page 822 shows the watchdog and power (5V) connector on a -simplified- non-redundant IO backplane.

Figure 520 Position of the WdP connector on a non-redundant IO chassis

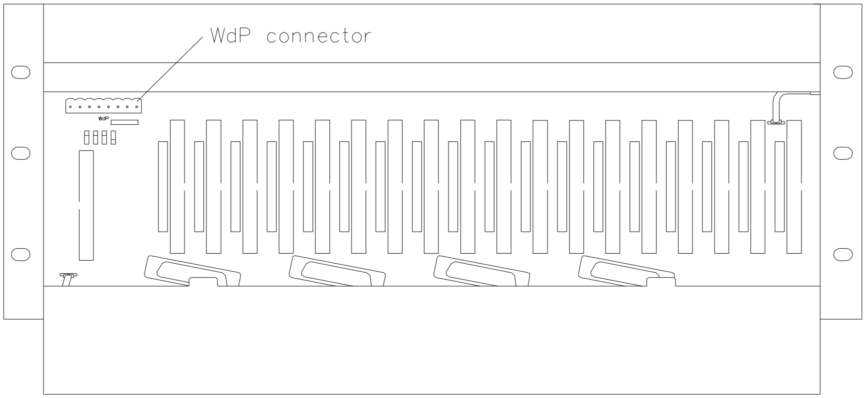


Figure 521 on page 822 shows the watchdog and power (5V) connector on a -simplified- redundant IO backplane.

Figure 521 Position of the WdP connector on a redundant IO chassis

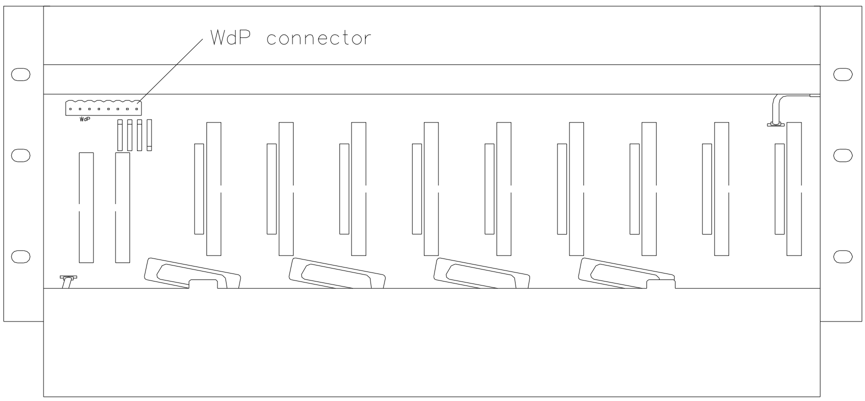


Figure 522 on page 823 shows the watchdog and 5V distribution inside a controller cabinet (left) and inside an IO extension cabinet (right).

In a controller cabinet, all cables come from the CP chassis backplane. In an IO extension cabinet, all cables come from an PDB-IOX05 board (see “PDB-IOX05” on page 830).

The used cable depends on the IO chassis type that is connected:

- Non-redundant IO chassis require the PDC-IOS05 cable (see “PDC-IOS05” on page 838).

- Redundant IO chassis require the PDC-IOR05 cable (see “PDC-IOR05” on page 840).

Figure 522 5V and Wd distribution wiring in a controller cabinet resp. extension cabinet

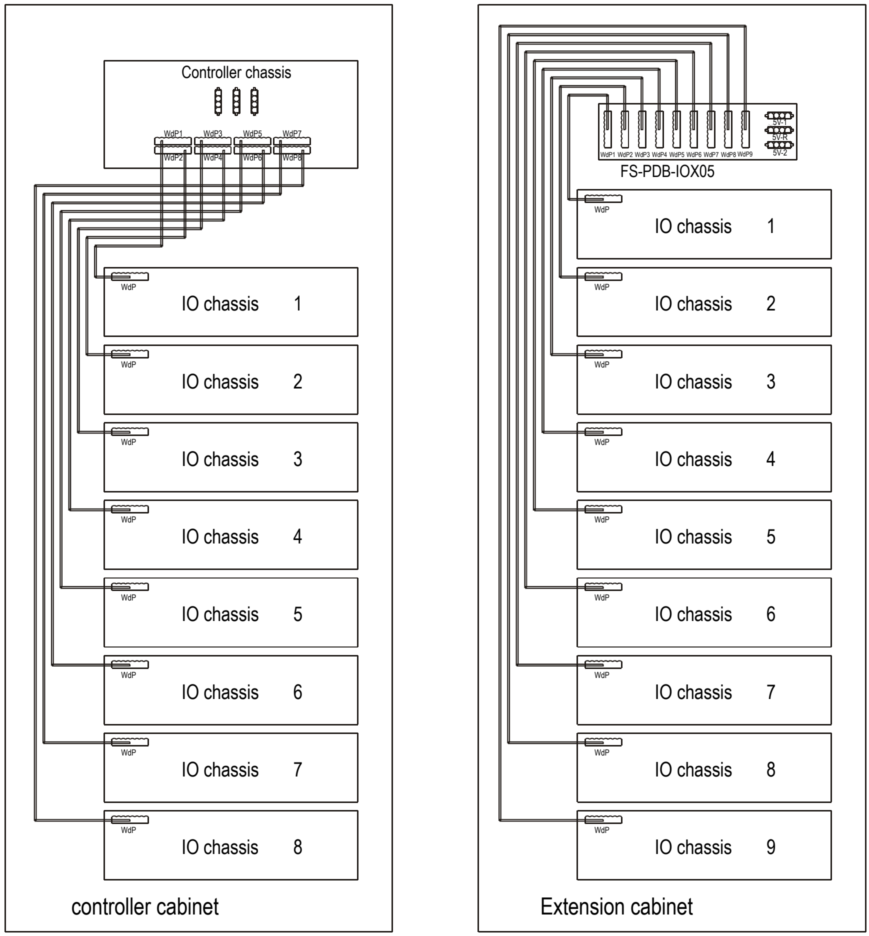


Figure 523 on page 824 shows the 5V and watchdog distribution between the controller cabinet and a single IO extension cabinet.

All (three) cables to the IO extension cabinet are of the type PDC-IOX05-1 (see “PDC-IOX05-x” on page 842).

The cable on connector ‘5V-1’ carries 0V (ground), the watchdog of CP1 and the 5V of CP1.

The cable on connector ‘5V-2’ carries 0V (ground), the watchdog of CP2 and the 5V of CP2.

The cable on connector ‘5V-R’ carries 0V (ground), the ‘second’ watchdog output of CP1 and CP2 (for non-redundant IO see Figure 155 on page 250) and the (redundant) 5V of CP1 and CP2 (see Figure 47 on page 92).

IO extension cabinets containing only redundant IO use the signals on the ‘5V-1’ and ‘5V-2’ cables.

IO extension cabinets containing only non-redundant IO only use the signals on the ‘5V-R’ cable.

Figure 523 5V and Wd distribution between the controller cabinet and a single IO extension cabinet

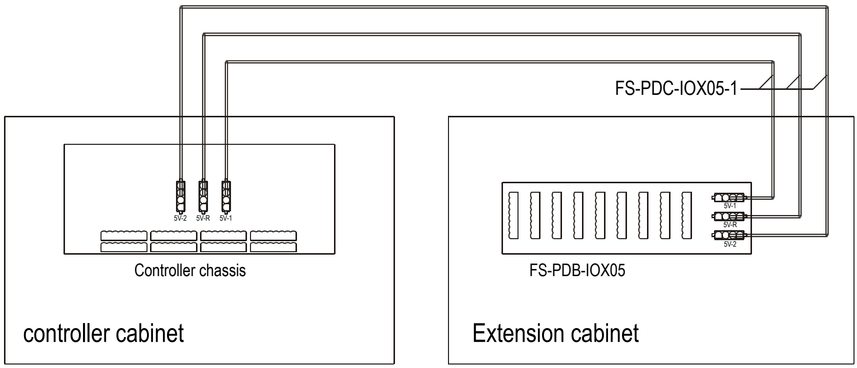
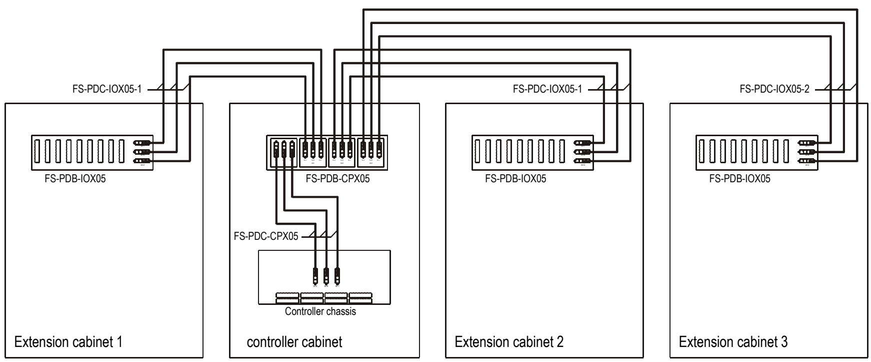


Figure 524 on page 824 shows the 5V and watchdog distribution between the controller cabinet and more than one IO extension cabinet.

All cables to the IO extension cabinet are of type PDC-IOX05-1 (short) or type PDC-IOX05-2 (long) (see “PDC-IOX05-x” on page 842). These cables go to an PDB-CPX05 board (see “PDB-CPX05” on page 833) in the controller cabinet.

The PDB-CPX05 board itself is linked to the CP backplane using three PDC-CPX05 cables (see “PDC-CPX05” on page 844).

Figure 524 5V and Wd distribution between the controller cabinet and three IO extension cabinets

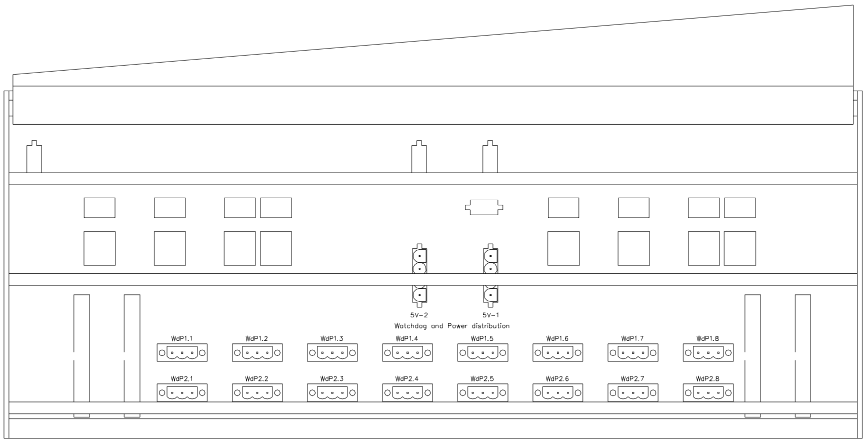


5 Volt and Watchdog distribution layout (Safety Manager A.R.T.)

The 5V supply voltages and watchdog signals of Safety Manager are generated in the Control Processor chassis (see "CPCHAS-0002" on page 116). These signals are available on the rear side of the Control Processor chassis.

Figure 525 on page 825 shows a -simplified- view of the rear side of the Controller chassis.

Figure 525 Position of the 5V and Wd connectors on the rear side of a Controller chassis



The sixteen WdPx.y connectors (two rows of eight) at the bottom middle of Figure 525 on page 825 are used to transfer WatchDog and Power (5 Volt) to the IO-chassis in the controller cabinet of non-UL cabinets.

- The WdP1.y connectors carry the 5V and WD of CP1.
- The WdP2.y connectors carry the 5V and WD of CP2.

The two 5V-x connectors (5V-2 and 5V-1) in the centre of Figure 525 on page 825 are used to transfer WatchDog and 5 Volt to the IO-chassis in an extension cabinet and for all IO-chassis in UL cabinets.

Figure 526 on page 826 shows the WatchDog and Power (5 Volt) connectors on the back of a -simplified- non-redundant IO chassis.

Figure 526 Position of the WdP connector on a non-redundant IO chassis

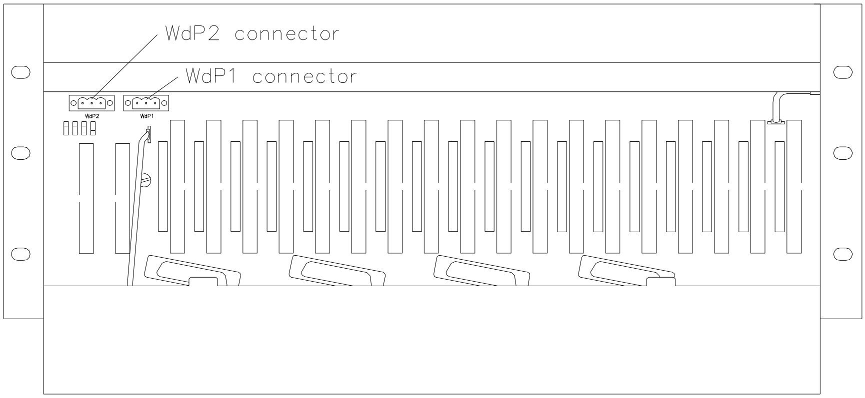


Figure 527 on page 826 shows the WatchDog and Power (5 Volt) connectors on the back of a -simplified- redundant IO chassis.

Figure 527 Position of the WdP connector on a redundant IO chassis

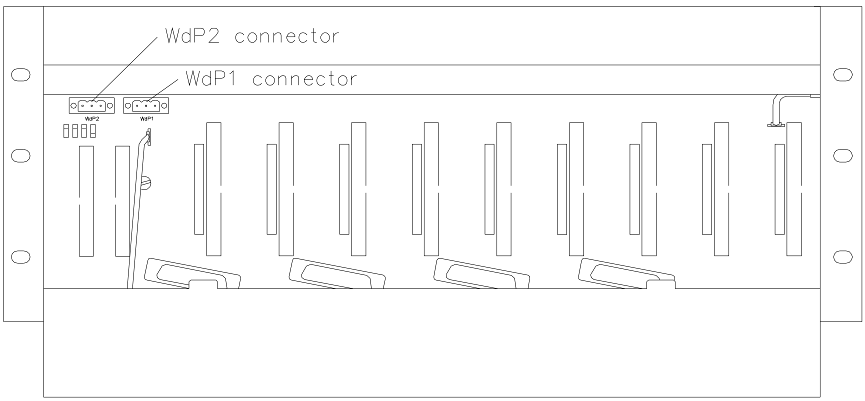


Figure 528 on page 827 shows the WatchDog and 5 Volt distribution inside a controller cabinet (left) and inside an IO extension cabinet (right) for non-UL applications.

Each chassis requires one pair of cables type FS-PDC-ART05 (see "PDC-ART05" on page 846).
In the controller cabinet, all cables come from the CP chassis backplane.
In the IO extension cabinet, all cables come from an FC-PDB-ARTF05 board (see "PDB-ARTF05" on page 835).
The cables between the controller cabinet and the FC-PDB-ART05 are a pair of FS-PDC-IOX05-1 cables.

Figure 528 5V and Wd distribution wiring in a controller cabinet and an extension cabinet - non-UL version

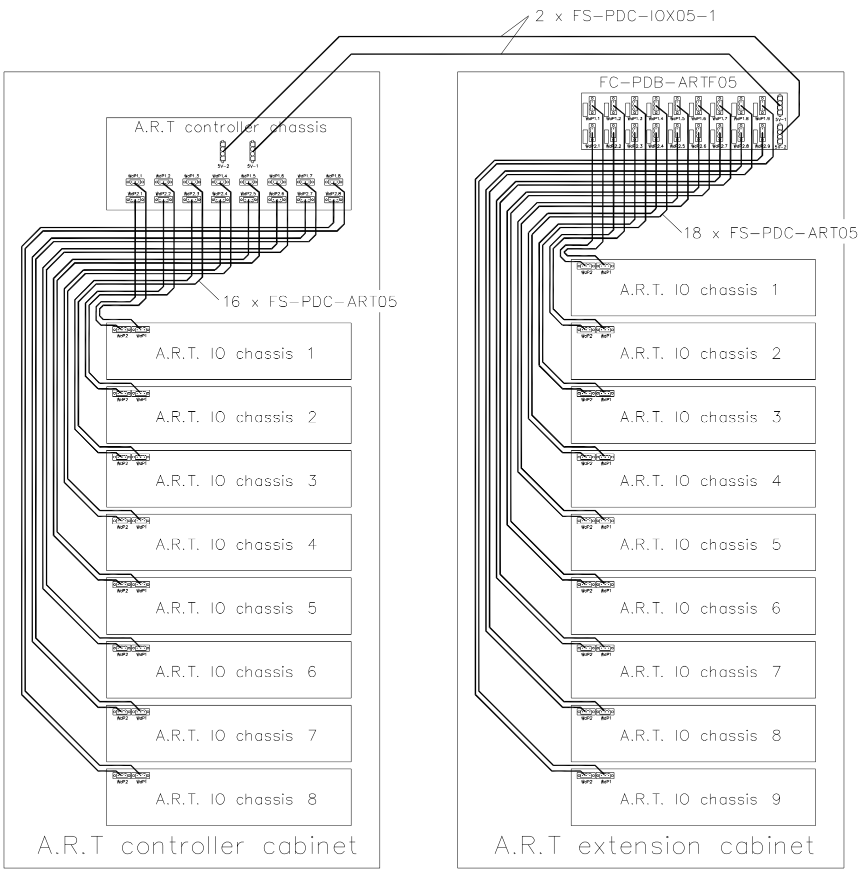


Figure 529 on page 828 shows the 5 Volt and watchdog distribution in the controller cabinet for UL applications.

UL requires the use of fused 5 Volt distribution that is accomplished *on* the FC-PDB-ARTF05 module.
The FC-PDB-ARTF05 gets its power from the Controller chassis with a pair of FS-PDC-CPX05 cables (see “PDC-CPX05” on page 844).
All IO chassis are connected with the FS-PDB-ARTF05.

Each chassis requires one pair of cables type FS-PDC-ART05 (see “PDC-ART05” on page 846).

Figure 529 5V and Wd distribution wiring in a controller cabinet - UL version

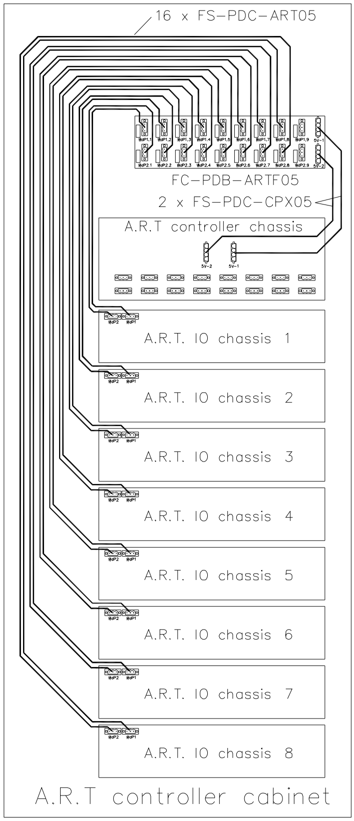
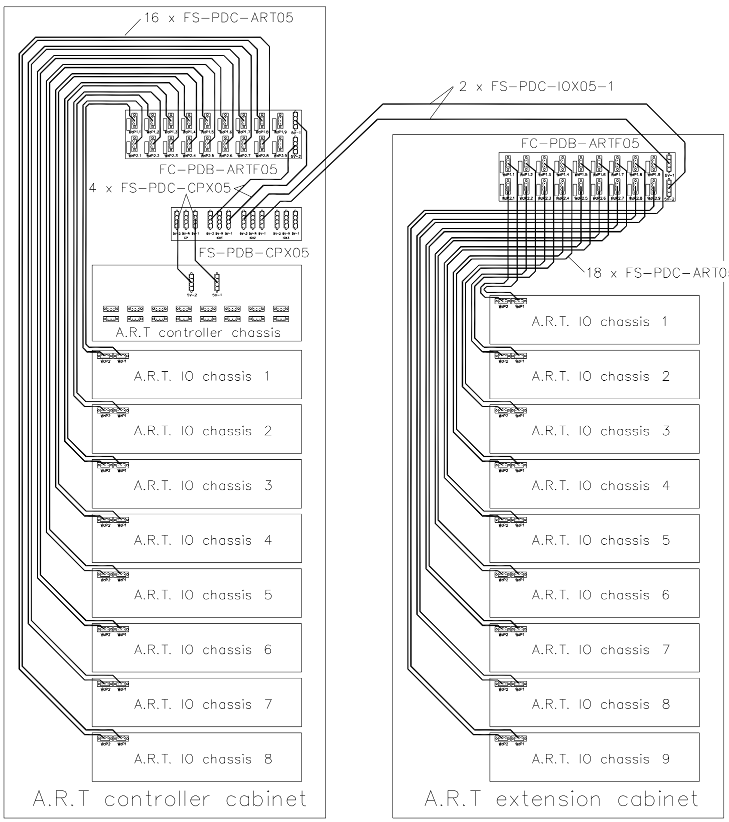


Figure 529 on page 828 shows the 5 Volt and watchdog distribution in a Controller cabinet with Extension cabinet for UL applications.

UL requires the use of fused 5 Volt distribution that is accompleshed *on* the FC-PDB-ARTF05 module.
The 5V and Watchdog signals of the controll chassis are multiplied on the FS-PDB-CPX05 module (see “PDB-CPX05” on page 833).
The local FC-PDB-ARTF05 gets its power from the FS-PDB-CPX05 using a pair of FS-PDC-CPX05 cables (see “PDC-CPX05” on page 844).
The FC-PDB-ARTF05 in the extension cabinet gets its power from the FS-PDB-CPX05 using a pair of FC-PDC-IOX05-1 cables (see “PDC-IOX05-x” on page 842).
All A.R.T. IO chassis are connected with the FS-PDB-ARTF05.

Each chassis requires one pair of cables type FS-PDC-ART05 (see “PDC-ART05” on page 846).

Figure 530 5V and Wd distribution wiring in a controller cabinet and an extension cabinet - UL version



PDB-IOX05

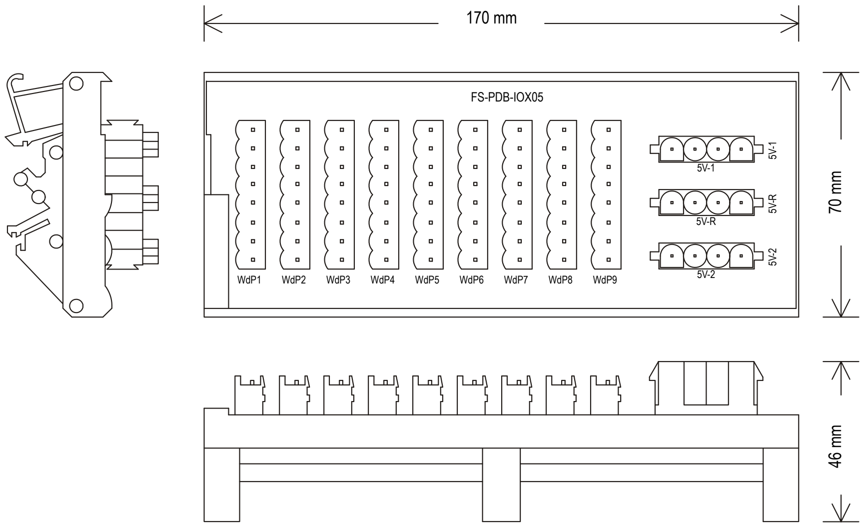
Power Distribution Board extension IO cabinet (5 Vdc, Watchdog)

Description

The PDB-IOX05 power distribution board for extension IO cabinets is a board that enables the distribution of the 5V and watchdog signals of the controller cabinet to the IO chassis in an IO extension cabinet.

Figure 531 on page 830 shows the PDB-IOX05 with its 9+3 connectors.

Figure 531 PDB-IOX05 board layout



Power distribution cables from the controller cabinet (PDC-IOX05-1 and PDC-IOX05-2, see “PDC-IOX05-x” on page 842) are placed on the three (4-pole) connectors.

The cable on connector ‘5V-1’ provides 0V (ground), the watchdog of CP1 and the 5V of CP1.

The cable on connector ‘5V-2’ provides 0V (ground), the watchdog of CP2 and the 5V of CP2.

The cable on connector ‘5V-R’ carries 0V (ground), the ‘second’ watchdog output of CP1 and CP2 (for non-redundant IO see Figure 155 on page 250) and the (redundant) 5V of CP1 and CP2 (see Figure 47 on page 92).

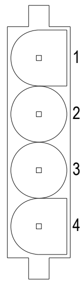
Power Distribution Cables (see “PDC-IOS05” on page 838 or “PDC-IOR05” on page 840) transfer the 5V and watchdog signal(s) to the IO chassis.

The cable on WdP1 should go to the first (highest) IO chassis.

Cables on WdP2 to WdP9 go to the next IO chassis (as far as these are available).

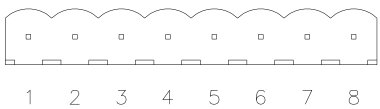
Pin allocation

The top view and pin allocation of the 5V-2, 5V-R and 5V-1 connectors are:



	5V-2	**5V-R**	**5V-1**
1	ground	ground	ground
2	WD of CP2	WDR of CP1 and CP2	WD of CP1
3	ground	ground	ground
4	5V of CP2	5VR of CP1 and CP2	5V of CP1

The top view and pin allocation of the nine WdPx connectors are:



	WdPx
1	5V of CP2
2	WD of CP2
3	ground
4	5VR of CP1 and CP2
5	WDR of CP1 and CP2
6	ground
7	5V of CP1
8	WD of CP1

Technical data

General	Type numbers[1] :	FS-PDB-IOX05 FC-PDB-IOX05
	Approvals:	CE, UL, TUV, CSA
Connectors	5V-x:	4 pos, action pin, header
	WdPx:	8 pole, pin header
Physical	Module dimensions:	170 × 70 × 46 mm (L × W × H) 6.69 × 2.76 × 1.81 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	171 mm (6.73 in)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters "CC" preceding the version number.

PDB-CPX05

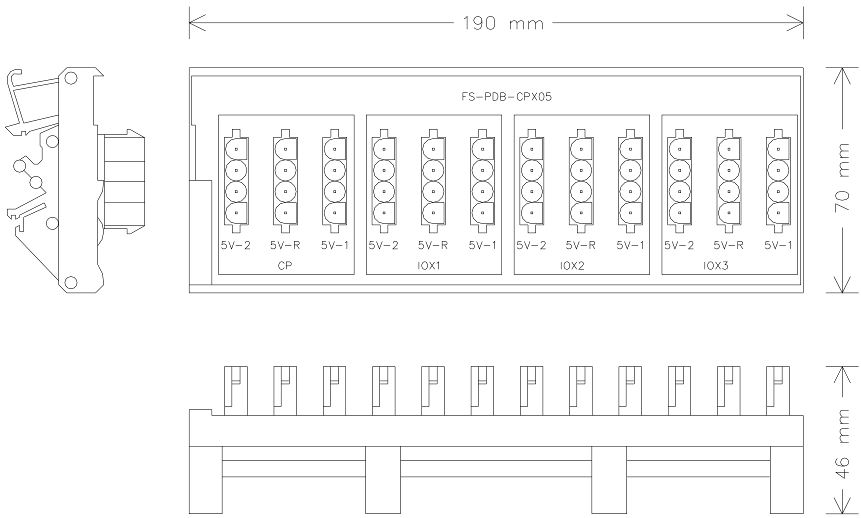
Power Distribution Board Controller cabinet (5 Vdc, Watchdog)

Description

The PDB-CPX05 power distribution board for controller cabinets is a board that enables the distribution of the 5V and watchdog signals of the Controller chassis to more than one IO extension cabinet.

Figure 532 on page 833 shows the PDB-CPX05 with its 4 × 3 connectors.

Figure 532 PDB-CPX05 board layout



Power Distribution Cables from the Controller chassis (see “PDC-CPX05” on page 844) are placed on the three connectors (‘5V-2’, ‘5V-R’ and ‘5V-1’) in section ‘CP’.

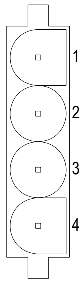
Power Distribution Cables to the first IO extension cabinet (see “PDC-IOX05-x” on page 842) are placed on the three connectors (‘5V-2’, ‘5V-R’ and ‘5V-1’) in section ‘IOX1’.

Power Distribution Cables to the second IO extension cabinet (see “PDC-IOX05-x” on page 842) are placed on the three connectors (‘5V-2’, ‘5V-R’ and ‘5V-1’) in section ‘IOX2’.

Power Distribution Cables to the third IO extension cabinet (see “PDC-IOX05-x” on page 842) are placed on the three connectors (‘5V-2’, ‘5V-R’ and ‘5V-1’) in section ‘IOX3’.

Pin allocation

The top view and pin allocation of the 5V-2, 5V-R and 5V-1 connectors are:



	5V-2	**5V-R**	**5V-1**
1	ground	ground	ground
2	WD of CP2	WDR of CP1 and CP2	WD of CP1
3	ground	ground	ground
4	5V of CP2	5VR of CP1 and CP2	5V of CP1

Technical data

General	Type numbers[1] :	FS-PDB-CPX05 FC-PDB-CPX05
	Approvals:	CE, UL, TUV, CSA
Connectors	Type:	4 pos, action pin, header
Physical	Module dimensions:	190 × 70 × 46 mm (L × W × H) 7.48 × 2.76 × 1.81 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	191 mm (7.52 in)

1 FS-type modules are non conformal coated modules.
FC-type modules are conformal coated modules. Conformal coated modules have the letters “CC” preceding the version number.

PDB-ARTF05

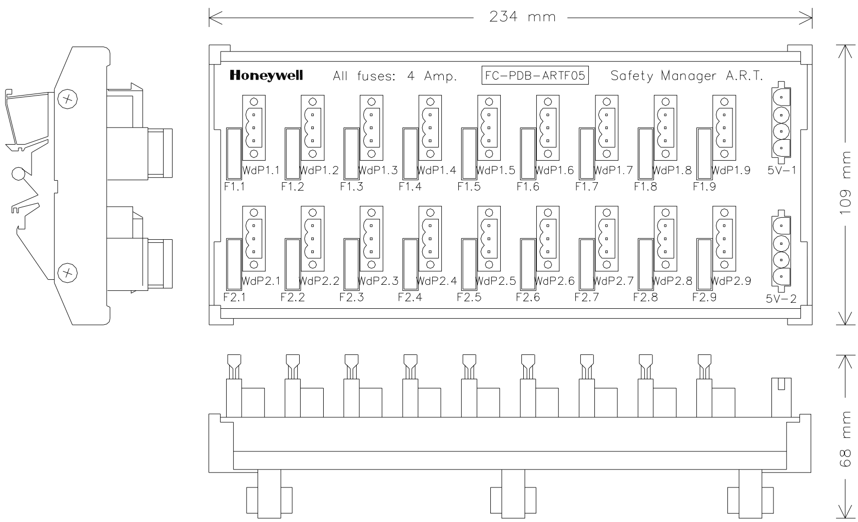
Fused Power Distribution Board for IO cabinet - 5 Vdc, Watchdog (Safety Manager A.R.T.)

Description

The PDB-ARTF05 fused power distribution board for an IO cabinet is a board that enables the distribution of the watchdog signals and fused 5V of the controller cabinet to an IO cabinet.
Fuse Fx.y transfers the incoming 5V of CPx to connector WdPx.y (e.g. fuse F2.9 transfers the incoming 5V of CP2 to connector WdP2.9).

Figure 533 on page 835 shows the PDB-ARTF05 with its 2 x 10 connectors and 2 x 9 fuses.

Figure 533 PDB-ARTF05 board layout



The PDB-ARTF05 for the Controller cabinet IO-racks is placed on top of the controller chassis.
The PDB-ARTF05 for IO-racks in the extension IO cabinet is placed in the extension IO cabinet.

Two Power Distribution Cables (type PDC-CPX05) are used to connect the Controller chassis with the PDB-ARTF05 in the controller cabinet.
Two Power Distribution Cables (type PDC-IOX05-1) are used to connect the Controller chassis with the PDB-ARTF05 in an extension IO-cabinet.

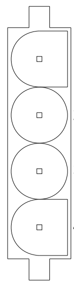
- Connect 5V-1 of the Controller chassis with 5V-1 of the PDB-ARTF05.
- Connect 5V-2 of the Controller chassis with 5V-2 of the PDB-ARTF05.

Each IO-rack uses a pair of PDC-ART05 cables to connect with the PDB-ARTF05:

- Connect WdP1.x of the PDB-ARTF05 with WdP1 of the IO-rack.
- Connect WdP2.x of the PDB-ARTF05 with WdP2 of the IO-rack.

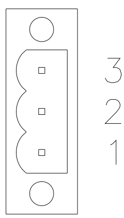
Pin allocation

The top view and pin allocation of the 5V-1 and 5V-2 connectors are:



	5V-1	5V-2
1	ground	ground
2	WD of CP1	WD of CP2
3	ground	ground
4	5V of CP1	5V of CP2

The top view and pin allocation of the WdPx connectors are:



	WdP1.x	WdP2.x
3	WD of CP1	WD of CP2
2	ground	ground
1	5V of CP1	5V of CP2

Technical data

General	Type numbers:	FC-PDB-ARTF05
	Approvals:	CE: UL,TUV,CSA pending
Power	• 5V-1: • 5V-2:	max. 16A max. 16A
Fuses	rating:	4 Amp / 58V
	type:	Littelfuse 142.6185.4406 (pink)
Connectors	5V-x:	4 pos, action pin,header
	WdPx.y:	3 pole, pin header
Physical	Module dimensions:	234 x 109 x 68 mm (L × W × H) 9.21 x 4.29 x 2.68 in (L × W × H)
	DIN EN rails:	TS32 / TS35 × 7.5
	Used rail length:	235 mm (9.25 in)

PDC-IOS05

Power Distribution Cable for a non-redundant IO chassis - 5 Vdc, Watchdog (Safety Manager)

Description

The PDC-IOS05 power distribution cable for a non-redundant IO chassis is used to transfer the (redundant) 5V of CP1 and CP2 (see Figure 47 on page 92) and the ‘second’ watchdog output of CP1 and CP2 (for non-redundant IO see Figure 155 on page 250) to a non-redundant IO chassis.

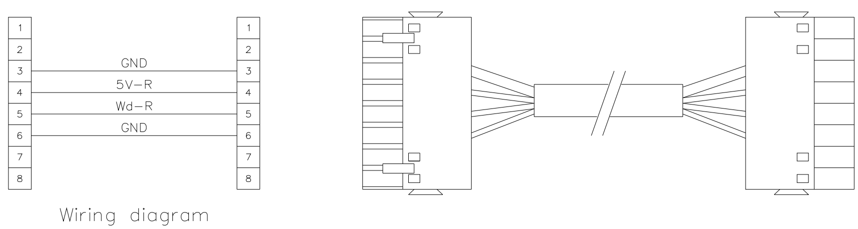
Attention

The connectors that are used on this cable can be sensitive to mechanical tension. Make sure that the cables are appropriately secured to avoid inadvertant disconnection.

Signals

Figure 534 Pin assignment and layout of the PDC-IOS05 cable

Signal	Connector pin	Wire color
GND	3	green/yellow (sleeved)
5V-R	4	brown
WD-R	5	blue
GND	6	black



Technical data

General	Type number:	FS-PDC-IOS05
	Approvals:	UL, CSA
Cable	Type:	SAB 2040415 CC600 4 × 1.5 mm^2
	Length:	2 m
Connectors	Type:	8 pole, pin header Weidmuller: BLC 5.08/8 BR
	Pins:	Weidmuller: DFFC 0.5 - 1.0 SN E

PDC-IOR05

Power Distribution Cable for a redundant IO chassis - 5 Vdc, Watchdog (Safety Manager)

Description

The PDC-IOR05 power distribution cable for a redundant IO chassis is used to transfer the 5V of CP1 and CP2 (see Figure 47 on page 92) and the watchdog outputs of CP1 and CP2 to a redundant IO chassis.

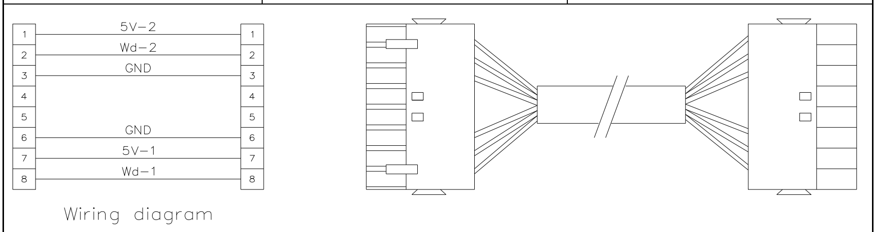
Attention

The connectors that are used on this cable can be sensitive to mechanical tension. Make sure that the cables are appropriately secured to avoid inadvertant disconnection.

Signals

Figure 535 Pin assignment and layout of the PDC-IOR05 cable

Signal	Connector pin	Wire indication
5V-2	1	‘1’ marking
WD-2	2	‘2’ marking
GND	3	‘3’ marking
GND	6	‘4’ marking
5V-1	7	‘5’ marking
WD-1	8	‘6’ marking



Technical data

General	Type number:	FS-PDC-IOR05
	Approvals:	UL, CSA
Cable	Type:	SAB 2040707 CC600 $7 \times 0.75\ mm^2$
	Length:	2 m
Connectors	Type:	8 pole, pin header Weidmuller: BLC 5.08/8 BR
	Pins:	Weidmuller: DFFC 0.5 - 1.0 SN E

PDC-IOX05-x

Power Distribution Cable for IO cabinets (5 Vdc, Watchdog)

Description

The PDC-IOX05-x power distribution cable for IO cabinets is used to transfer the 5V of CP1, CP2 or the redundant 5V (see Figure 47 on page 92) and the watchdog outputs of CP1, CP2 or the redundant watchdog (for non-redundant IO see Figure 155 on page 250) to an IO cabinet.

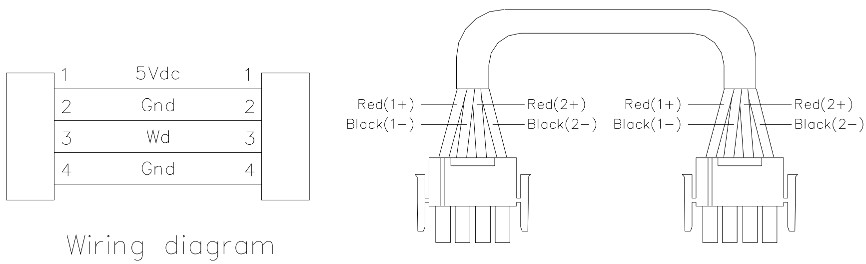
The PDC-IOX05-x cables are generally used in a set of three, to transfer all 5V and watchdog signals to the IO cabinet.

The PDC-IOX05-x cables run from the controller cabinet to the PDB-IOX05 board in the IO cabinet (see Figure 523 on page 824 and Figure 524 on page 824)

Signals

Figure 536 Pin assignment and layout of the PDC-IOX05-x cable

Signal	Connector pin	Wire indication
5V	1	red ‘1+’ marking
GND	2	black ‘1-’ marking
Watchdog	3	red ‘2+’ marking
GND	4	black ‘2-’ marking



Technical data

General	Type number:	FS-PDC-IOX05-1 (3.1 meter) FS-PDC-IOX05-2 (3.9 meter)
	Approvals:	UL, CSA
Cable	Type:	Special CC 600 World 4×2.5 mm^2
	Length:	3.1 / 3.9 m
Connectors	Type:	4 pole, mate-n-lock Tyco: 350779-1
	Pins:	Mate-n-lock crimp-socket Tyco: 350550-1

PDC-CPX05

Power Distribution Cable for controller cabinets (5 Vdc, Watchdog)

Description

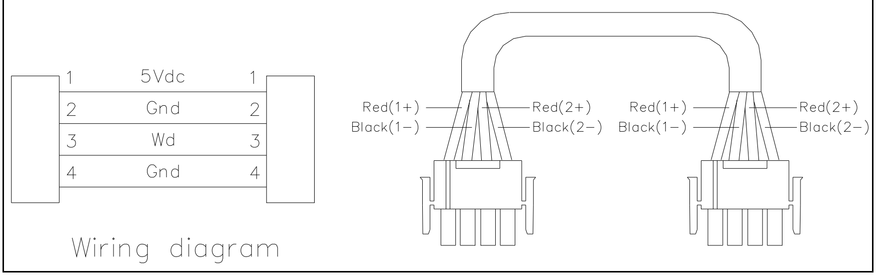
The PDC-CPX05 power distribution cables for controller cabinets are used to transfer the 5V of CP1, CP2 and the redundant 5V from the Controller chassis backplane to an PDB-CPX05 board.

The PDC-CPX05 cables are used in a set of three.

Signals

Figure 537 Pin assignment and layout of the PDC-CPX05 cable

Signal	Connector pin	Wire indication
5V	1	red ‘1+’ marking
GND	2	black ‘1-’ marking
Watchdog	3	red ‘2+’ marking
GND	4	black ‘2-’ marking



Technical data

General	Type number:	FS-PDC-CPX05
	Approvals:	UL, CSA
Cable	Type:	Special CC 600 World 4×2.5 mm^2
	Length:	0.8 m
Connectors	Type:	4 pole, mate-n-lock Tyco: 350779-1
	Pins:	Mate-n-lock crimp-socket Tyco: 350550-1

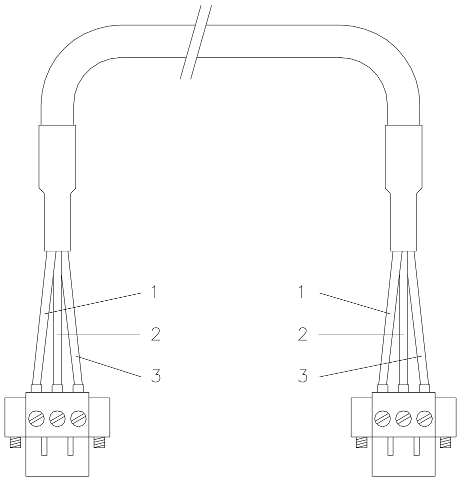
PDC-ART05

Power Distribution Cable for an IO chassis - 5 Vdc, Watchdog (Safety Manager A.R.T.)

Description

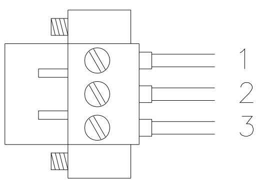
The PDC-ART05 power distribution cable for an IO chassis is used to transfer the 5V of CP1 or CP2 and the watchdog of CP1 or CP2 to the IO chassis (see “5 Volt and Watchdog distribution layout (Safety Manager A.R.T.)” on page 825).

Figure 538 Wire assignment of the PDC-ART05 cable



Signals

The pin assignment of the PDC-ART05 connectors is:

		**WdP1.x**	**WdP2.x**
	1	5V of CP1	5V of CP2
	2	ground	ground
	3	WD of CP1	WD of CP2

Technical data

General	Type number:	FS-PDC-ART05
	Approvals:	UL, CSA pending
Cable	Type:	SAB 02040415 CC600 4 × 1.5 mm^2
	Length:	2 m
Connectors	Type:	3 pole socket connector
	Make:	Weidmuller: BLZ 5.08/03/180F SN BK

List of abbreviations

AI	Analog Input
AO	Analog Output
ASM	Abnormal Situation Management
ATEX	Explosive Atmosphere (in French: "**AT**mospheres **EX**plosibles")
A.R.T.	Advanced Redundancy Technique
BKM	Battery and Key switch Module
BMS	Burner Management System
CDA	Common Data Access
CEE	Control Execution Environment
CP	Control Processor
DCF	Digital Coded Frequency
DCS	Distributed Control System
DI	Digital Input
DO	Digital Output
DTI	Diagnostic Test Interval
E/E/PES	Electrical/Electronic/Programmable Electronic System
EMC	Electromagnetic Compatibility
ESD	• ElectroStatic Discharge • Emergency ShutDown system
EUC	Equipment Under Control
EUT	Equipment Under Test
F&G	Fire and Gas
FB	Function Block
FDM	Field Device Management
FGS	Fire and Gas System
FLD	Functional Logic Diagram
FSC	Fail Safe Communication
FTA	Field Termination Assembly
FTE	Fault Tolerant Ethernet
GPS	Global Positioning System
HIPS	High-Integrity Protection Systems
HMI	Human Machine Interface
HSE	High Speed Ethernet

HSMS	Honeywell Safety Management Systems
IO	Input/Output
IP	• Internet Protocol • Ingress Protection
IS	Intrinsically Safe
LAN	Local Area Network
LED	Light-Emitting Diode
MAC	Media Access Control
MAP	Manufacturing Automation Protocol
MOS	Maintenance Override Switch
MTBF	Mean Time Between Failure
MTTF	Mean Time To Failure
MTTR	Mean Time To Repair
NTP	Network Time Protocol
OLE	Object Linking and Embedding
OLM	On-line Modification
OPC	Object linking and embedding for Process Control
OS	Operating System
P&ID	Piping and Instrumentation Diagram
PCDI	Peer Control Data Interface
PE	Protective Earth
PES	Programmable Electronic System
PFD	Probability of Failure on Demand
PKS	Process Knowledge System
PLC	Programmable Logic Controller
PST	Process Safety Time
PSU	Power Supply Unit
PTP	Precision Time Protocol
PUC	Process Under Control
PV	Process Value
QMR	Quadruple Modular Redundant
QPP	Quad Processor Pack
RFI	Radio Frequency Interference
RO	Relay Output (for descriptions use: potential free output contact)
SCADA	Supervisory Control And Data Acquisition

SCN	Software Change Notification (formerly addressed as *Release Note*)
SIC	System Interconnection Cable
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SMOD	Secondary Means Of De-energization
SOE	Sequence Of Events
SRS	Safety-Related System
SSC	Serial Communication Channel
STP	Shielded Twisted Pair
USI	Universal Safety Interface
UTP	Unshielded Twisted Pair
UTC	Coordinated Universal Time (Universal Time Coordinated)
WAN	Wide Area Network

Safety Manager Glossary

A

Alarm

An automatic signal that serves as a warning of an event or danger.

Application

The definition of the EUC-dependent function for Safety Manager.

Application Compiler

A tool of the Safety Builder used to create a controller file.

Application Editor

A tool of the Safety Builder used to create or edit functional logic diagrams.

Application value

The value of a process point as provided to, or calculated by, the application software.

Application version

A first or subsequent version of the application that is controlled in Safety Manager. An application version can have several states (see Application version state). An application version will be consolidated – or ‘frozen’ – when the application is loaded or published. The next change to the application will increment its version.

Application version state

A defined status of the application version. Safety Manager has a limited and controlled number of application version states to:

- enforce a useful sequence of activating program functions,
- enable control and/or comparison of application versions between connected components (i.e. Safety Builder, SM Controller, Experion).

Safety Manager uses these application version states:

state	meaning
Changed (Compile and Load Application needed)	changes to the application were made that *do* require loading to SM Controller
Changed (Publish Application needed)	changes to the application were made that *do not* require loading to SM Controller
Compiled	the application was successfully compiled

state	meaning
Published (load needed)	the application was compiled and subsequently published
Published (loaded)	the application was either; published (without compiling) or, loaded into the SM Controller

Application Viewer

A tool of the Safety Builder used to view functional logic diagrams on-line.

ATEX Directive

A directive which describes equipment and protective systems intended for use in potentially explosive atmospheres.

Safety Manager ATEX modules can be used for connection to hazardous locations in compliance with EN 60079-15:2005 (zone 2, sub groups IIA, IIB and IIC).

For more information see the *Safety Manager TUV EExn Approval Manual* (PM.MAN.8183)

Availability

- The ratio of system up time to total operating time.
- The ability of an item to perform its designated function when required for use.

B

Battery and Key switch Module (BKM)

A module in the SM Controller used to:

- Supply battery power to the system memory (RAM) and the real time clock of the Control Processor modules, in case of power outage.
- Enable or disable forces, by turning the Force key switch. When enabled, forcing of certain input and output signals is allowed. When disabled, all forces are removed.
- Provide a fault reset, by turning the Reset key switch. See Fault reset.

Warning

Turning the Reset key switch during an On-Line Modification procedure may cause the Control Processors to swap status.

C

Communication module

See: Universal Safety Interface (USI)

Communication redundancy fail-over

The automated capability of a device to switch over to a redundant or dormant communication path upon the failure or abnormal termination of the active path.

Communication time-out

An error caused by an unacceptable large time interval during which there was no communication.

Control Processor (CP)

Core component of the SM Controller consisting of: Power Supply Unit (PSU), Quadruple Processor Pack (QPP) and 1 or 2 communication modules (USI).

Control Processor states

A Control Processor (CP) can have many states. For fault detection and reaction the following states are relevant.

Attention:

The states described below are presented on the display of the relevant QPP, while the key switch of that QPP is in the **RUN** position.

- `Running` (without faults); CP is fully functional and executes the application.
- `Running with Flt` (with faults); CP executes the application but the controller detected one or more faults (e.g. open loop or a hardware fault).
- `Halt`; CP does not execute the application.

The applicable CP state can be read from the User Interface Display located on each Control Processor and from the diagnostic screens available on Experion™ and Safety Stations.

Controller chassis

19” chassis to slot the BKM and Control Processor modules.

Controller Management

A tool of the Safety Builder used to perform the following functions:

- Load controller.
- View system status.

- Retrieve controller and application files.

Coordinated Universal Time (UTC)

Also referred to as “Universal Time Coordinated” and “Zulu time”.

An atomic realization of Universal Time (UT) or Greenwich Mean Time (GMT), the astronomical basis for civil time. Time zones around the world are expressed as positive and negative offsets from UT. UTC differs by an integral number of seconds from atomic time and a fractional number of seconds from UT1.

Cycle time

The time period needed to execute the application software once.

D

Dangerous failure

Failure which has the potential to put the safety-related system in a hazardous or fail-to-function state.

Note

Whether or not the potential is realized may depend on the channel architecture of the system; in systems with multiple channels to improve safety, a dangerous hardware failure is less likely to lead to the overall dangerous or fail-to-function state.

Deutsches Institut für Normung (DIN)

German Institute for Standards, which determines the standards for electrical and other equipment in Germany.

Diagnostic Test Interval (DTI)

The time period used by Safety Manager to cyclically locate and isolate safety related faults within on-line system components that could otherwise cause a hazardous situation.

With Safety Manager, the default DTI is set at 3 seconds. This setting needs to be verified for each process.

See also “Process safety time (PST)” on page 869.

Distributed Control System (DCS)

System designed to control industrial processes. A DCS receives the measured values of the process instrumentation, e.g. flow, pressure, temperature. It controls the process via analog control equipment such as control valves. In addition, a DCS may receive many digital signals for alarm and management purposes.

Dual Modular Redundant (DMR)

Safety configuration providing 1oo2 configuration. The DMR technology is used in the architecture of a non redundant QPP where on-board 1oo2D voting is based on dual-processor technology.

DMR is characterized by a high level of diagnostics and fault coverage.

E

Electrical/Electronic/Programmable Electronic (E/E/PE) device

A device based on electrical (E) and/or electronic (E) and/or programmable electronic (PE) technology.

Note

This term is intended to cover any and all devices operating on electrical principles and would include:
- electro-mechanical devices (“electrical”);
- solid state non-programmable electronic devices (“electronic”);
- electronic devices based on computer technology (“programmable electronic”).

Electrical/Electronic/Programmable Electronic system (E/E/PES)

A system based on one or more E/E/PE devices, connected to (and including) input devices (e.g. sensors) and/or output devices/final elements (e.g. actuators), for the purpose of control, protection or monitoring.

See also: “Programmable electronic system (PES)” on page 869.

Electromagnetic Compatibility (EMC)

The ability of a device, equipment or system to function satisfactory in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

ElectroStatic discharge (ESD)

The transfer of electrostatic charge between bodies of different electrostatic potential, which may cause damage to system components.

Emergency ShutDown (ESD)

Manual or automatic turning off or closing down of process equipment in case of anomalous conditions in order to prevent damage to the system or process.

EUC risk

Risk arising from the EUC or its interaction with the EUC control system.

See also “Equipment Under Control (EUC)” on page 858.

Equipment Under Control (EUC)

Equipment/machinery/apparatus/Plant used for manufacturing, process, transportation, medical or other activities for which designated safety-related systems could be used to:

- prevent hazardous events associated with the EUC from taking place; or,
- mitigate the effects of the hazardous events.

Error

Discrepancy between a computed, observed or measured value or condition and the true, specified or theoretically correct value or condition.

Ethernet

A local area network specification developed by Xerox in 1976. The specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers of the network. It uses CSMA/CD to handle simultaneous transmissions and is the most popular LAN Technology is use today.

See also: Local Area Network (LAN).

Event

- Occurrence of some programmed action within a process which can affect another process.
- Asynchronous occurrence that is detected by the control system, time and other information is recorded, e.g. process alarm.

Experion PKS

Honeywell Process Knowledge System™ for process, business and asset management.

Experion Station

Windows based station for viewing process schematics and interactions with the system. This station provides comprehensive alarm and event detection, management, reporting facilities, and history collection along with the capability of custom process graphics.

Event collection & management system

A device used to collect, log and manage sequence of events (SOE) data.

See also: Safety Historian and Sequence Of Events (SOE).

External device

A generic term for a system the SM Controller is communicating with. This may be an Experion server, a Modbus device, a Safety Station or even another SM Controller. Also known as third party device.

External risk reduction measures

Physical measures taken externally to safety-related systems to reduce or mitigate the risks. Examples would include a drain system, fire wall, etc.

F

Fail-over

See “Communication redundancy fail-over” on page 855.

Failure

The termination of the ability of a functional unit to perform a required function.

Note

- The definition in IEV 191-04-01 is the same, with additional notes.
- See figure in “Functional Safety” for the relationship between faults and failures, both in IEC 61508 and IEV 191.
- Performance of required functions necessarily excludes certain behavior, and some functions may be specified in terms of behavior to be avoided. The occurrence of such behavior is a failure.
- Failures are either random (in hardware) or systematic (in hardware or software).

Fault

Abnormal condition that may cause a reduction in, or loss of, the capability of a functional unit to perform a required function.

Note

IEV 191-05-01 defines “fault” as a state characterized by the inability to perform a required function, excluding the inability during preventative maintenance or other planned actions, or due to lack of external resources.

Fault reaction

The reaction to faults in the Controller, application and/or IO.

- The fault reaction towards Controller and/or application faults is fixed.
- The fault reaction to IO faults can be configured on a point or module level; it should be customized to the application for which Safety Manager is used.

See also “IO states” on page 864.

Fault reset

An action that clears the fault database and attempts a restart of tripped or halted components of the system.

Fault Tolerant Ethernet (FTE)

An Ethernet based control network of Experion PKS.

FC

Prefix used to identify conformal-coated module from non conformal coated modules. See also: FS.

- FC-SDI-1624 is a safe digital input module with conformal coating
- FS-SDI-1624 is a safe digital input module without conformal coating

Field Termination Assembly (FTA)

Assembly to connect field wiring to the SM chassis IO modules.

Field value

The value of a process point as present at the interface of the system with the EUC.

Fieldbus

Wiring solution and communication protocol in which multiple sensors and actuators are connected to a DCS or SIS, using a single cable.

Fire and Gas system

Independent protective system which continuously monitors certain process points (e.g. combustible gas levels) and environmental points (e.g. heat, smoke, temperature and toxic gas levels). If any of these points exceed a predetermined level, the system will raise an alarm and take automatic action to close operating valves and damper doors, activate extinguishers, cut off electrical power and vent dangerous gases.

Force

A signal override of some sort that is applied on a system level.

A force applied to an input affects the input application state as it overrides the actual field value and diagnostic state of the forced input.

A force applied to an output affects the output field state as it overrides the application value or diagnostic value with the forced value.

Caution

Forcing introduces a potentially dangerous situation as the corresponding point could go unnoticed to the unsafe state while the force is active.

FS

Prefix used to identify non conformal-coated module from conformal coated modules. See also: FC.

- FS-SDI-1624 is a safe digital input module without conformal coating
- FC-SDI-1624 is a safe digital input module with conformal coating

Function block

Element in a functional logic diagram (FLD) which performs a user defined logic function. Function blocks are designed to implement & re-use complex functions via a single (user defined) element.

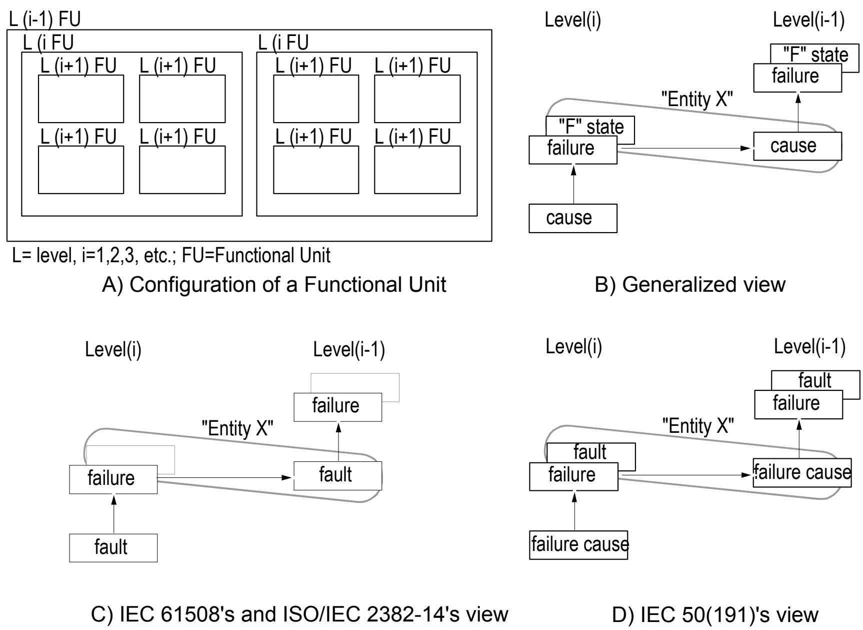
Functional Logic Diagram (FLD)

Diagrammatic representation of the application (conform the IEC 61131-3 standard) which is used to program Safety Manager. FLDs are directly translated into code that can be executed by Safety Manager, thus eliminating the need for manual programming. See also: Application Editor.

Functional safety

Part of the overall safety relating to the EUC and the EUC control system which depends on the correct functioning of the E/E/PE safety-related systems, other technology safety-related systems and external risk reduction facilities.

Figure 539 Failure model



Notes for Figure 539 on page 861

- As shown in A), a functional unit can be viewed as a hierarchical composition of multiple levels, each of which can in turn be called a functional unit. In level (i), a "cause" may manifest itself as an error (a deviation from the correct value or state) within this level (i) functional unit, and, if not corrected or circumvented, may cause a failure of this functional unit, as a result of which it falls into an "F" state where it is no longer able to perform a required function (see B)). This "F" state of the level (i) functional unit may in turn manifest itself as an error in the level (i-1) functional unit and, if not corrected or circumvented, may cause a failure of this level (i-1) functional unit.
- In this cause and effect chain the same thing ("Entity X") can be viewed as a state ("F" state) of the level (i) functional unit into which it has fallen as a result of its failure, and also as the cause of the level (i-1) functional unit. This "Entity X" combines the concept of "fault" in IEC 61508 and ISO/IEC 2382-14, which emphasizes its cause aspect as illustrated in C), and that of "fault" in IEC 50(191), which emphasizes its state aspect as illustrated in D). The "F" state is called fault in IEC 50(191), whereas it is not defined in IEC 61508 and ISO/IEC 2382-14.
- In some cases, a failure may be caused by an external event such as lightning or electrostatic noise, rather than by an internal fault. Likewise, a fault (in both vocabularies) may exist without a prior failure. An example of such a fault is a design fault.

Functional safety assessment

Investigation, based on evidence, to judge the functional safety achieved by one or more E/E/PE safety-related systems, other technology safety-related systems or external risk reduction facilities.

H

Hardware Configurator

A tool of the Safety Builder used to configure the hardware of Safety Manager.

Hardware safety integrity

Part of the safety integrity of the Safety Instrumented Systems (SIS) relating to random hardware failures in a dangerous mode of failure.

Note

The term relates to failures in a dangerous mode. That is, those failures of a safety-related system that would impair its safety integrity. The two parameters that are relevant in this context are the overall dangerous failure rate and the probability of failure to operate on demand. The former reliability parameter is used when it is necessary to maintain continuous control in order to maintain safety, the latter reliability parameter is used in the context of safety-related protection systems.

Hazard

A physical situation with a potential for human injury.

Note

The term includes danger to persons arising within a short time scale (e.g. fire and explosion) and also those that have a long-term effect on a persons health (e.g. release of a toxic substance).

High voltage

A voltage of 30VAC, 40VDC or above.

Human error

Mistake.

Human action or inaction that produces an unintended result.

I

IEC 61131-3

Part of the international standard IEC 61131, which provides a complete collection of standards on programmable controllers and their associated peripherals.

The IEC 61131-3 specifies the syntax and semantics of programming languages for programmable controllers as defined in part 1 of IEC 61131 (FLD symbols).

IEC 61508

International IEC standard on functional safety entitled “Functional safety: safety-related systems”, which sets out a generic approach for all electrically based systems that are used to perform safety functions. A major objective of this international standard is to facilitate the development of application sector standards.

Institute of Electrical and Electronic Engineers (IEEE)

An American professional organization of scientists and engineers whose purpose is the advancement of electrical engineering, electronics and allied branches of engineering and science. It also acts as a standardization body.

International Electrotechnical Commission (IEC)

An international standards development and certification group in the area of electronics and electrical engineering, including industrial process measurement, control and safety.

Interval time between faults

See: Repair timer.

IO bus

A bus-structure within Safety Manager that interconnects the Control Processor with the IO.

IO bus driver

Part of the Quad Processor Pack that controls the IO bus.

IO chassis

19” chassis to slot the (redundant) IO extender(s) and SM chassis IO modules.

IO database

Database in which input, output and configuration data is stored.

IO extender

Module which controls the IO bus of the IO chassis. A maximum of ten IO extender modules can be connected to one IO bus.

IO module

An IO module is always chassis-mounted within a Safety Manager cabinet. This type of module handles input or output functions of Safety Manager. IO modules can be digital or analog.

IO states

From a system point of view, IO can have either the healthy state, the de-energized state or the fault reaction state.

- When healthy, the IO is active and has the application value applied.
- When de-energized, the IO is de-activated (as if no power was supplied).
- When the fault reaction state is applied, the IO responds according to a predefined fault condition (fault reaction).
- When forced, the force value is applied.

L

Local Area Network (LAN)

A general term to refer to the network and its components that are local to a particular set of devices.

See also: Wide area network (WAN).

M

Maintenance override

A function, which allows the user to apply an application value to an input independent of the input channel scan value.

Maintenance Override Switch (MOS)

Switch used to file a request for a maintenance override. Acknowledgement is decided by the application program. An acknowledged maintenance override allows maintenance to be performed on field sensors or field inputs without causing the safety system to shutdown the process.

Master-clock source

The source that is responsible for the time synchronization between a group of systems or within a network.

Mean Time Between Failure (MTBF)

- For a stated period in the life of a functional unit, the mean value of the length of time between consecutive failures under stated conditions.
- The expected or observed time between consecutive failures in a system or component.

MTBF is used for items which involve repair.

See also: Mean Time To Repair (MTTR), Mean Time To Failure (MTTF).

Mean Time To Failure (MTTF)

The average time the system or component of the system works without failing.

MTTF is used for items with no repair.

See also: Mean Time To Repair (MTTR), Mean Time Between Failure (MTBF).

Mean Time To Repair (MTTR)

The mean time to repair a safety-related system, or part thereof. This time is measured from the time the failure occurs to the time the repair is completed.

Media Access Control (MAC)

The lower sublayer of the data link layer (Layer 2) unique to each IEEE 802 local area network. MAC provides a mechanism by which users access (share) the network.

Modbus

A communications protocol, based on master/slave or Node ID/Peer ID architecture, originally designed by Modicon for use with PLC and SCADA systems. It has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices.

Mode of operation

Way in which a safety-related system is intended to be used, with respect to the frequency of demands made upon it in relation to the proof check frequency, which may be either:

- **Low demand mode** - where the frequency of demands for operation made on a safety-related system is not significantly greater than the proof check frequency; or
- **High demand or continuous mode** - where the frequency of demands for operation made on a safety-related system is significantly greater than the proof check frequency.

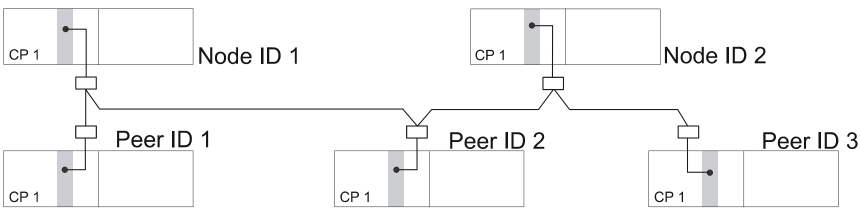
Note

Typically for low demand mode, the frequency of demands on the safety-related system is the same order of magnitude as the proof test frequency (i.e. months to years where the proof test interval is a year). While typically for high demand or continuous mode, the frequency of demands on the safety-related system is hundreds of times the proof test frequency (i.e. minutes to hours where the proof test interval is a month).

Multidrop link

A multidrop link is a physical link that interconnects multiple systems (see Figure 540 on page 866).

Figure 540 Example of a multidrop connection based on Ethernet



N

Namur

A 2-wire proximity switch operating at a working voltage of 8.2 V and an operating current of 8mA max (CENELEC Standard). Because of the small amount of energy needed to operate NAMUR sensors, they can be used in intrinsically safe applications.

Note

Special switching amplifiers or dedicated input modules, like the SDIL-1608, are required to read the status of NAMUR proximity switches.

Network Configurator

A tool of the Safety Builder used to configure the communication architecture.

Network Time Protocol (NTP)

See “Time protocol” on page 879.

Node

Hardware entity connected to a network.

Node ID

- A communication initiator on an Ethernet network. Counterpart of a Peer ID (see “Peer ID” on page 868).
- The address or ID number of a node. (See “Node” on page 867).

O

Object linking and embedding for Process Control (OPC)

Technology developed originally by Microsoft, now being standardized. Microsoft technology for application interoperability. Object Linking and Embedding (OLE) is a set of services that provides a powerful means to create documents consisting of multiple sources of information from different applications. Objects can be almost any type of information, including text, bitmap images, vector graphics, voice, or video clips.

Off-line

A system is said to be “off-line” when it is not in active control of equipment or a process.

A process or equipment is said to be “off-line” when it is in shut-down.

On-line

A system is said to be “on-line” when it is in active control of equipment or a process.

A process or equipment is said to be “on-line” when it is operating.

Operating temperature

The temperature a system and its modules are operating on.

For systems it represents the temperature within the cabinet. For modules in general it represents the temperature outside the module in its direct vicinity. For specific modules (i.e. QPP and universal modules) operating temperature is specified as ‘outside’ and ‘inside’ module temperature.

In Safety Manager cabinets temperature monitoring is done in the CP chassis within the QPP module. For remote IO locations (e.g. remote cabinets) temperature monitoring is done within the universal module(s).

Operational state

The values of an application point during normal process operation.

P

Peer Control Data Interface (PCDI)

A Honeywell licensed communication interface for non-safe peer-to-peer data communication between (Experion) Process controllers and SM Controllers.

Peer ID

A responder in Ethernet communication. Counterpart of a Node ID (See “Node ID” on page 867.)

Peer-to-peer

A logical connection between two points.

Plant

A component in Safety Builder which contains devices, controllers as well as physical and logical communication configurations used to interconnect these devices and controllers.

Point

A data structure in the IO database, usually containing information about a field entity. A point can contain one or more parameters. Safety Manager uses different point types to represent a range of different field values.

Point Configurator

A tool of the Safety Builder used to create and modify points of a SM Controller.

Point Viewer

A tool of the Safety Builder used to view points with dynamic update of states and values.

Power Supply Unit (PSU)

Separate module which supplies electrical power to the Safety Manager.

Precision Time Protocol (PTP)

See “Time protocol” on page 879

Probability of Failure on Demand (PFD)

A value that indicates the probability of a system failing to respond to a demand. PFD equals 1 minus Safety Availability. (ISA, S84.01, 1996)

Process safety time (PST)

The time a process can be left running uncontrolled without loosing the ability to regain control.

See also: Diagnostic Test Interval (DTI).

Process states

A process can have many states. Related to fault detection and reaction in the safety loop of a process, the following process states are described:

- running without detected faults
- running with detected faults
- halted

Process value

An amount, expressed in engineering units, that represents the value of a process variable, e.g. a temperature, a pressure or a flow.

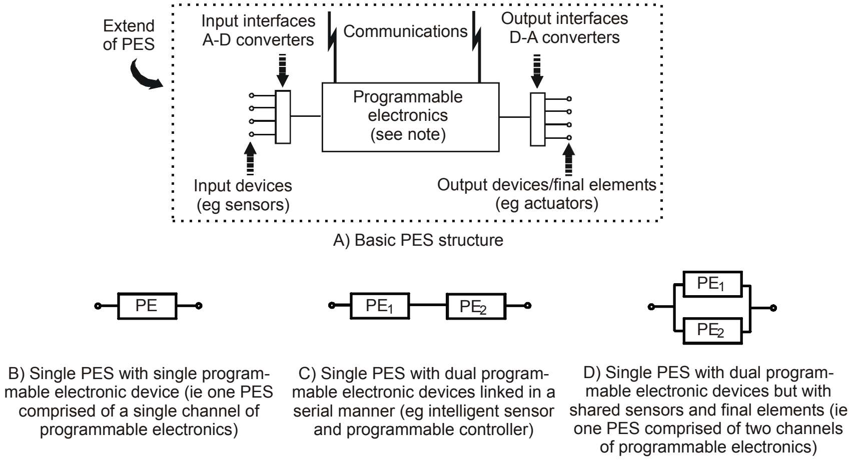
Programmable electronic system (PES)

System for control, protection or monitoring based on one or more programmable electronic devices, including all elements of the system such as power supplies, sensors and other input devices, data highways and other communication paths, and actuators and other output devices (see Figure 541 on page 870).

Note

The structure of a PES is shown in Programmable electronic system (PES): structure and terminology A). Programmable electronic system (PES): structure and terminology B) illustrates the way in which a PES is represented in IEC 61508, with the programmable electronics shown as a unit distinct from sensors and actuators on the EUC and their interfaces, but the programmable electronics could exist at several places in the PES. Programmable electronic system (PES): structure and terminology C) illustrates a PES with two discrete units of programmable electronics. Programmable electronic system (PES): structure and terminology D) illustrates a PES with dual programmable electronics (i.e. two channel), but with a single sensor and a single actuator.

Figure 541 Programmable electronic system (PES): structure and terminology



Q

Quad Processor Pack (QPP)

The main processing module of the SM Controller.

Quadruple Modular Redundant (QMR)

Safety configuration providing a 2oo4D configuration. The QMR technology is used in the architecture of a redundant QPP where on-board 1oo2D voting (see Dual Modular Redundant (DMR)) is combined with 1oo2D voting between the two QPPs.

Voting takes place on two levels: First on a module level and secondly between the Control Processors.

QMR is characterized by a high level of diagnostics, fault coverage and fault tolerance.

R

Redundancy

- In an item, the existence of more than one means of performing a required function.
- Use of duplicate (or triple or quadruple) modules or devices to minimize the chance that a failure might disable an entire system.

Repair time

The time allowed to keep a Safety Instrumented System (SIS) running with a fault present that “may affect safety upon accumulation of multiple faults”. Repair time is introduced to extend the SIS up-time for a limited time frame, allowing system repair.

Repair timer

A configurable count-down timer triggered upon detection of a fault that minimizes the safety availability of the system.

The default repair window is 200 hours, which is more than sufficient if spare parts are available. The repair timer can be deactivated.

Each Control Processor has its own repair timer. Once running, a repair timer shows the remaining time to repair the fault that triggered the repair timer in the Control Processor (200 hours default). If the fault is not repaired within the repair time the Control Processor containing the fault halts.

A repair timer protects the system from certain fault accumulations that may affect the safety of Safety Manager. The timer only starts on detection of:

- faults on output modules with fault reaction set to `Low`
- faults detected with non-redundant IO bus extenders.

Reset

See: Fault reset.

Risk

Combination of the probability of occurrence of harm and the severity of that harm.

Router

A network device which forwards packets (messages or fragments of messages) between networks.

The forwarding decision is based on network layer information and routing tables, often constructed by routing protocols.

S

Safe

A design property of an item in which the specified failure mode is predominantly in a safe direction.

Safe failure

Failure which does not have the potential to put the safety-related system in a hazardous or fail-to-function state.

Note

Whether or not the potential is realized may depend on the channel architecture of the system; in systems with multiple channels to improve safety, a safe hardware failure is less likely to result in an erroneous shutdown.

SafeNet

A SIL3 network protocol used by Safety Manager for i.e. safe data exchange between Safety Managers.

Safety

Freedom from unacceptable risk.

Safety Availability

The fraction of time (%) that a safety system is able to perform its designated safety service when the process is operating. See also Probability of Failure on Demand (PFD).

Safety Builder

- Station software used to configure, design, validate, log and monitor a Safety Manager project.
- Protocol used by Safety Manager to communicate with Safety Stations.

Safety Historian

Sequence of events collecting device. Windows-based software tool used to record, view and process sequence of events (SOE) data. SOE data is stored in a database for (re-)use at a later stage.

See also: Event collection & management system and Sequence Of Events (SOE).

Safety Instrumented Function (SIF)

A Safety Instrumented Function (SIF) is an isolated function, initially designed to protect “life and limb” against a specific hazard. A more popular term for SIF is safety loop. Each SIF operates on its own Safety Integrity Level.

See also: Safety instrumented System (SIS) and Safety integrity level (SIL).

Safety instrumented System (SIS)

A Safety Instrumented System (SIS) is a system that executes one or more SIFs. The various SIFs inside a SIS may each require a different Safety Integrity Level.

A SIS should be able to support all SIFs, including the one with the highest SIL level.

See also: Safety Instrumented Function (SIF) and Safety integrity level (SIL).

Safety integrity

Probability of a safety-related system to satisfactorily perform the required safety functions under all stated conditions within a stated period of time.

Safety integrity level (SIL)

Discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems, where safety integrity level 4 has the highest level of safety integrity and safety integrity level 1 has the lowest.

Note

- The target failure measures for the safety integrity levels are specified in Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in low demand mode of operation and Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in high demand or continuous mode of operation.

Table 88 Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in low demand mode of operation

Safety integrity level	Low demand mode of operation (average probability of failure to perform its design function on demand)
4	$\geq 10^{-5}$ to $< 10^{-4}$
3	$\geq 10^{-4}$ to $< 10^{-3}$
2	$\geq 10^{-3}$ to $< 10^{-2}$
1	$\geq 10^{-2}$ to $< 10^{-1}$
NOTE: see notes below for details on interpreting this table.	

Table 89 Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in high demand or continuous mode of operation

Safety integrity level	High demand or continuous mode of operation (probability of a dangerous failure per hour)
4	$\geq 10^{-9}$ to $< 10^{-8}$
3	$\geq 10^{-8}$ to $< 10^{-7}$

Table 89 Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in high demand or continuous mode of operation *(continued)*

Safety integrity level	High demand or continuous mode of operation (probability of a dangerous failure per hour)
2	$\geq 10^{-7}$ to $< 10^{-6}$
1	$\geq 10^{-6}$ to $< 10^{-5}$
NOTE: see notes below for details on interpreting this table.	

Note

1. The parameter in Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in high demand or continuous mode of operation, probability of a dangerous failure per hour, is sometimes referred to as the frequency of dangerous failures, or dangerous failure rate, in units of dangerous failures per hour.
2. This document sets a lower limit on the target failure measures, in a dangerous mode of failure, than can be claimed. These are specified as the lower limits for safety integrity level 4 (that is an average probability of failure of 10^{-5} to perform its design function on demand, or a probability of a dangerous failure of 10^{-9} per hour). It may be possible to achieve designs of safety-related systems with lower values for the target failure measures for non-complex systems, but it is considered that the figures in the table represent the limit of what can be achieved for relatively complex systems (for example programmable electronic safety-related systems) at the present time.
3. The target failure measures that can be claimed when two or more E/E/PE safety-related systems are used may be better than those indicated in Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in low demand mode of operation and Safety integrity levels: target failure measures for a safety function, allocated to the Safety Instrumented System operating in high demand or continuous mode of operation providing that adequate levels of independence are achieved.
4. It is important to note that the failure measures for safety integrity levels 1, 2, 3 and 4 are target failure measures. It is accepted that only with respect to the hardware safety integrity will it be possible to quantify and apply reliability prediction techniques in assessing whether the target failure measures have been met. Qualitative techniques and judgements have to be made with respect to the precautions necessary to meet the target failure measures with respect to the systematic safety integrity.
5. The safety integrity requirements for each safety function shall be qualified to indicate whether each target safety integrity parameter is either:

- the average probability of failure to perform its design function on demand (for a low demand mode of operation); or
- the probability of a dangerous failure per hour (for a high demand or continuous mode of operation).

Safety life cycle

Necessary activities involved in the implementation of safety-related systems, occurring during a period of time that starts at the concept phase of a project and finishes when all of the E/E/PE safety-related systems, other technology safety-related systems and external risk reduction facilities are no longer available for use.

Safety Manager

A safety solution to protect the integrity of a Process Under Control (PUC) and/or Equipment Under Control (EUC) in accordance with IEC 61508.
Assuming a full range configuration, Safety Manager includes the following components:

- SM Controller
- SM chassis IO
- SM universal IO
- Field interfaces (e.g. FTA's, cabling)

Safety Station is used to control and configure Safety Manager, and to enable communication with other applications.

For details see the *Overview Guide*.

Safety Manager A.R.T.

Safety Manager with Advanced Redundancy Technique. Safety Manager A.R.T. uses specific hardware in a dedicated architecture and has extended availability compared to Safety Manager. Safety Manager A.R.T. has the capability to continue normal operation with a combination of a Control Processor fault and an IO fault.

Safety related

A flag to indicate that a signal is used for a safe function.

See also: Safe and Safety-related system.

Safety-related system

Designated system that both:

- implements the required safety functions necessary to achieve or maintain a safe state for the EUC, and
- is intended to achieve, on its own or with other E/E/PE safety-related systems, other technology safety-related systems or external risk reduction facilities, the necessary safety integrity for the required safety functions.

Note

1. The term refers to those systems, designated as safety-related systems, that are intended to achieve, together with the external risk reduction facilities, the necessary risk reduction in order to meet the required tolerable risk.
2. The safety-related systems are designed to prevent the EUC from going into a dangerous state by taking appropriate action on receipt of commands. The failure of a safety-related system would be included in the events leading to the identified hazard or hazards. Although there may be other systems having safety functions, it is the safety-related systems that have been designated to achieve, in their own right, the required tolerable risk. Safety-related systems can broadly be divided into safety-related control systems and safety-related protection systems, and have two modes of operation.
3. Safety-related systems may be an integral part of the EUC control system or may interface with the EUC by sensors and/or actuators. That is, the required safety integrity level may be achieved by implementing the safety functions in the EUC control system (and possibly by additional separate and independent systems as well) or the safety functions may be implemented by separate and independent systems dedicated to safety.
4. A safety-related system may:

- be designed to prevent the hazardous event (that is if the safety-related systems perform their safety functions then no hazard arises). The key factor here is the ensuring that the safety-related systems perform their functions with the degree of certainty required (for example, for the specified functions, that the average probability of failure should not be greater than 10^{-4} to perform its design function on demand).
- be designed to mitigate the effects of the hazardous event, thereby reducing the risk by reducing the consequences. As for the first item in this list, the probability of failure on demand for the specified functions (or other appropriate statistical measure) should be met.
- be designed to achieve a combination of both kinds of systems.

5. A person can be part of a safety-related system. For example, a person could receive information from a programmable electronic device and perform a safety task based on this information, or perform a safety task through a programmable electronic device.
6. The term includes all the hardware, software and supporting services (for example power supplies) necessary to carry out the specified safety function (sensors, other input devices, final elements (actuators) and other output devices are therefore included in the safety-related system).
7. A safety-related system may be based on a wide range of technologies including electrical, electronic, programmable electronic, hydraulic and pneumatic.

Safety Station

Station running Safety Builder to control and configure Safety Manager. Safety Station can also run one or more other applications to manage loggin and communication.
Examples are: Safety Historian, Trip & Bypass management, communication with plant control systems.

Second fault timer

See: Repair timer.

Secondary Means

A means designed to drive towards a safe state in case the primary means is unable or unreliable to do so.

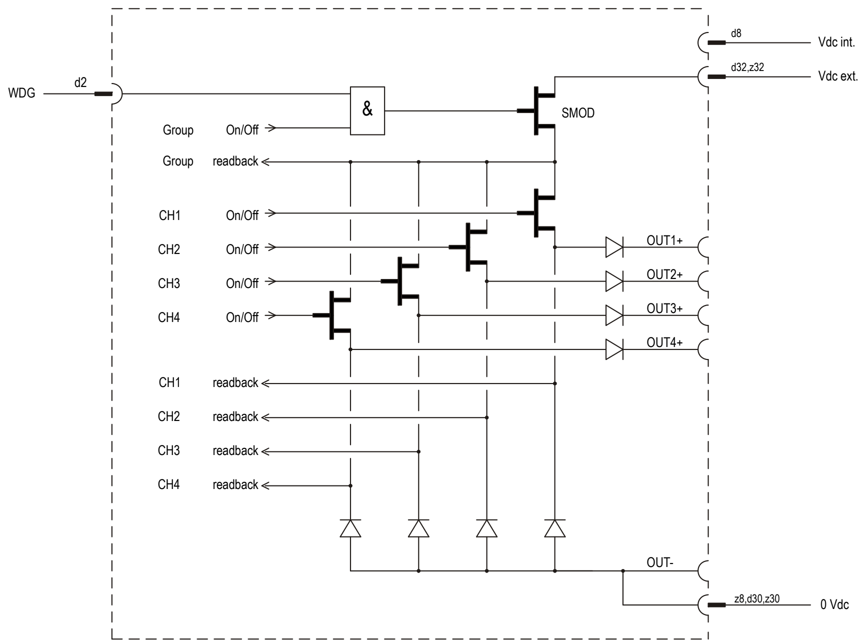
An example of a secondary means is the watchdog: The watchdog is designed to drive the Control Processor and related outputs to a safe state if the Control Processor itself is unable or unreliable to do so.

Secondary Means Of De-energization (SMOD)

A SMOD is a Secondary Means designed to de-energize the output in case the primary means is unable or unreliable to do so.

Figure 542 on page 877 shows an example of a SMOD protecting 4 output channels.

Figure 542 Schematic diagram of a SMOD with 4 channels



Sequence Of Events (SOE)

The function detecting the occurrence of events. See also: Safety Historian and Event collection & management system.

Serial communication

Communication that is based on either an RS232, RS422 or RS485 link.

Shutdown

A process by which an operating Plant or system is brought to a non-operational state.

SICC

IO signal wiring using system interconnection cables that hook up the FTA board to the IO.

SICP

IO signal wiring using system interconnection cables that hook up the screw terminals to the IO.

Single fault tolerant

Built-in ability of a system to correctly continue its assigned function in the presence of a single fault in the hardware or software.

Single fault tolerant for safety

Built-in ability of each Safety Manager configuration to continue to maintain safety in the presence of a single fault in the hardware or software.

SM Controller

Assembly of Control Processor, Controller chassis and BKM. A Controller can be redundant or non redundant. A redundant Controller contains two Control Processors. A non redundant Controller contains one Control Processor. Note that IO is not included.

SM chassis IO

SM chassis IO stands for Safety Manager chassi based IO. This type of IO is always chassis-mounted within a Safety Manager cabinet. This type of IO is also called ‘chassis IO’.

SM universal IO

SM universal IO stands for Safety Manager universal IO. This type of IO is IOTA-mounted in remote locations and/or within a Safety Manager cabinet.

SM RIO Link

A real-time communication IO-bus that uses a dedicated protocol for safe exchange of IO data between an SM Controller and one or more universal IO modules.

SM universal IO module

An SM universal IO module is a Remote Universal Safe device. It has multiple channels that can be configured individually depending on system needs. An SM universal IO module is placed on an IOTA.

Typical SM universal IO modules are:

- RUSIO modules
- RUSLS modules

Storage temperature

The temperature the system can be stored at.

Switch

A network device which forwards packets (messages or fragments of messages) by means of packet switching.

The forwarding decision is based on the most expedient route (as determined by some routing algorithm). Not all packets travelling between the same two hosts, even those from a single message, will necessarily follow the same route.

System Interconnection Cable (SIC)

Cables to connect IO modules with FTAs or terminals.

Systematic safety integrity

Part of the safety integrity of safety-related systems relating to systematic failures in a dangerous mode of failure.

Note

Systematic safety integrity cannot usually be quantified (as distinct from hardware safety integrity which usually can).

T

Third party device

See “External device” on page 858.

Time protocol

A collective for Internet protocols to provide machine readable date and time:

- The Precision Time Protocol (PTP) is a protocol that allows precise synchronization of networks. It is used in SafeNet where it reaches clock synchronization accuracies of 10ms.

- The Network Time Protocol (NTP) is an older protocol for synchronizing the clocks of computer systems over internet/ethernet. Safety Manager supports NTP3 and NTP4, reaching clock synchronization accuracies of 100ms.

Timestamp

As a verb, the act of putting the current time together with an event. As a noun, the time value held with an event.

Trend

A display defined primarily for presentation of and navigation through historical information.

Trip

An action by which part of an operating Plant or system is brought to a non-operational state.

See also: Shutdown.

Triple Modular Redundant (TMR)

Safety technology which is based on comparison principles and which requires triplicated system components.

U

Universal Safety Interface (USI)

Communication module of the SM Controller.

V

Validation

Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification

Confirmation by examination and provision of objective evidence that the specified requirements have been fulfilled.

Note

In the context of IEC 61508, verification means the process of demonstrating for each phase of the relevant safety lifecycle (overall, E/E/PES, software), by analysis and/or tests, that, for the specific inputs, the deliverables meet in all respects the objectives and requirements set for the specific phase.

Examples of verification activities would include:

1. Reviews on deliverables (documents from all phases of the safety lifecycle) to ensure compliance with the objectives and requirements of the phase taking into account the specific inputs to that phase.
2. Design reviews.
3. Tests performed on the designed products to ensure that they perform according to their specifications.
4. Integration tests performed where different parts of a system are put together in a step-by-step manner and by the performance of environmental tests to ensure that all the parts work together in the specified manner.

Voting configuration

To prevent that a safety-related system remains passive or false signals occur in this system it is possible to use voting. With voting the safety-related system makes a decision based on signals. The usage of more than one signal enhances the safety and reliability of the system.

W

Watchdog

A combination of diagnostics and an output device (typically a switch) the aim of which is to monitor the correct operation of the programmable electronic (PE) devices and takes action upon detection of an incorrect operation.

Note

The watchdog is used to de-energize a group of safety outputs when dangerous failures are detected in order to put the EUC into a safe state. The watchdog is used to increase the on-line diagnostic coverage of the logic system

Wide area network (WAN)

A general term to refer to a piece of a network and its components that are used to inter-connect multiple LANs over a wide area.

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