



TRM Project

TRM-IO

Ether**CAT**® 

Hardware Architecture

User Manual

Technical Documentation

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REVISIONS

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Rev.0	07/08/2026	First delivering
Rev.1	15/09/2026	Change front label
Rev.2	21/07/2026	Change fotos

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CONTENTS

This document is the User Manual for TRM-IO device. TRM-IO belongs to the TRM series of devices by TPA s.r.l. which are bus field devices to remote the CNC action on a tool machinery or, generally, in a controlled system; the devices are connected to a standard EtherCAT bus. TRM-IO is a module which provides 16 independent configurable digital Input / Output 0-24V. This document shows how to use TRM-IO, to connect it and all the technical specifications regarding the product.

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This description is only intended for the use of trained specialists in control and automation engineering who are invited to always use the currently valid documentation.

It is recommended that the documentation (notes, explanations, diagrams, ecc.) are followed when installing and commissioning these components.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The Company reserves the right to revise and modify the current documentation at any time.

The Company doesn't respond of not-correct or improper use of the device.

Safeguard clause

If any information about this device will result not clear, please do not esitate to take contacts with TPA.srl Service.



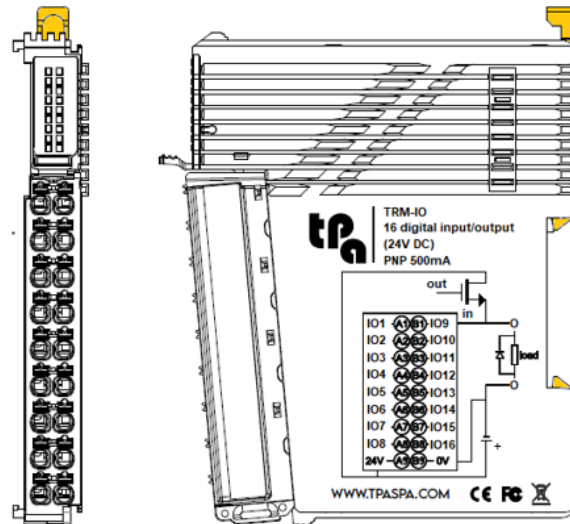
Albatros - Logo



TPA S.r.l - Logo

1 FUNCTIONAL SPECIFICATION

TRM-IO is a module which provides 16 Digital Input/Output 0-24V. It is directly joined to a bus coupler TRM-ECAT or in chain with other modules of the same serie. The connection between TRM-IO and other TRM's serie moduls is made by the internal standard E-BUS, as described in IEC61158. It must be used to connect the TRM's serie terminal modules to TRM-ECAT bus coupler. No other application is allowed.



On the right side, a gray silkscreen is printed and it reports:

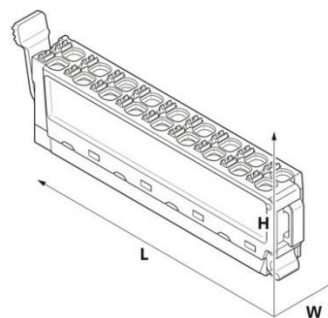
- the device Name and its main function
- the batch production number
- the consortium EtherCAT logo to specify the environment of use and compatibility
- the TPA reference - TPA's logo, QR code and site address
- CE certification logo
- a simplified schematic for input/output connections

TRM-IO sets the 16 independent optoisolated high-side MOS-FET driver (PNP configuration) as a digital word-size register located at 0xF00 address into the ESC unit. If not unused as output, each line can be configured as +24V DC input.

When the output is active, the input circuit mirrors the state of the output. Thus, this device is suitable for applications where a diagnostic over the output's condition is required.

The condition of input or output for every single position is set by the software with the configuration file of the CNC.

The 16 Digital Input/Output can be connected by a 18 positions connector provided with the device. The connector used is.



HSCP-SP 1,5-18-IO-7035 color gray
producer code 1569965 - Phoenix

Each output is driven in PNP logic, which means:

- PNP mode (High Side). Logical “0” condition is 0V (-3/+5V) weak pull-down, logical “1” by applying +24V voltage (+18/+30V), max 0,5A.

When not driven, a weak pull-down ties down the output (100K Ohm).

Each input signal can be connected to a pin of the 18 positions connector.

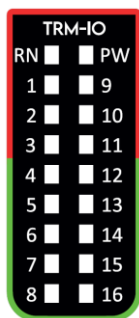
The logic of each input is:

- ON = +24V DC applied (max 5mA), OFF = 0V (< 3,5V – weak pull-down).

Inputs are optoinsulated (500V isolation).

The last 2 pins are provided to connect +24V power supply and 0V voltage. External +24V power supply and its corrispondant 0V are NOT shared with logical power supply and EBUS 0V reference.

	PIN TOP LEFT	PIN TOP RIGHT	
Input/Output 01	A1	B1	Input/Output 09
Input/Output 02	A2	B2	Input/Output 10
Input/Output 03	A3	B3	Input/Output 11
Input/Output 04	A4	B4	Input/Output 12
Input/Output 05	A5	B5	Input/Output 13
Input/Output 06	A6	B6	Input/Output 14
Input/Output 07	A7	B7	Input/Output 15
Input/Output 08	A8	B8	Input/Output 16
Power Supply +24V	A9	B9	Reference 0V
	PIN BOTTOM LEFT	PIN BOTTOM RIGHT	



LED		LED	
RN	ECAT link status	PW	Power Supply +24V
A1	output 01	B1	output 01
A2	output 02	B2	output 02
A3	output 03	B3	output 03
A4	output 04	B4	output 04
A5	output 05	B5	output 05
A6	output 06	B6	output 06
A7	output 07	B7	output 07
A8	output 08	B8	output 08
	(24V=on, 0V=off)		(24V=on, 0V=off)

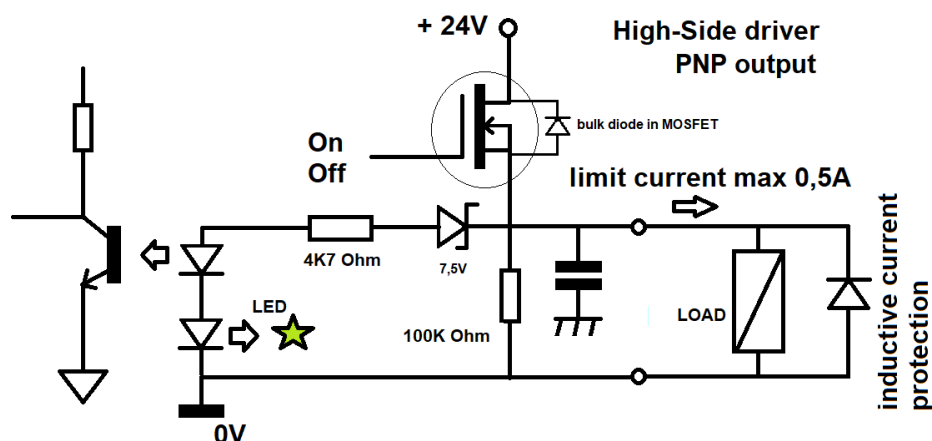
On the top of the frontal image of TRM-IO a list of LED indicators is set.

LED behaviour	ECAT State condition
Exstinguished	INIT State
Blinking (regular)	PreOP State
Single flash	SafeOP State
Bright	Operational

Regarding the RN ECAT status led

PW led shows the state of field power supply +24V.

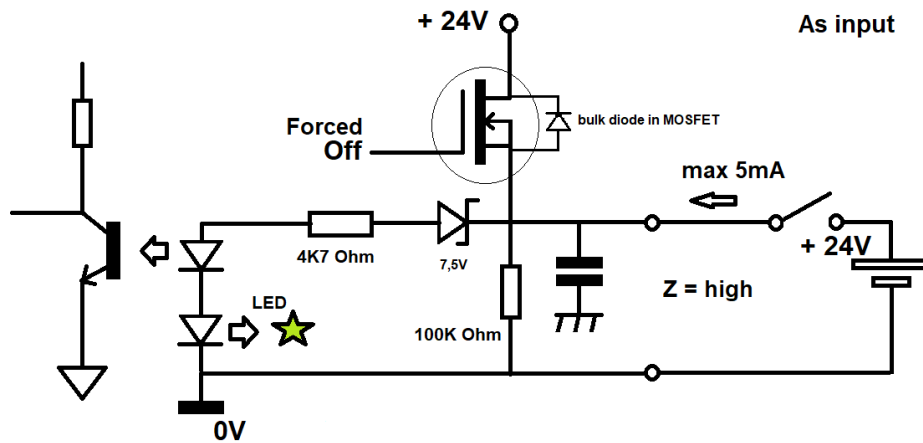
Electrical parameters	Values
Nominal voltage input	"ON" = +24Vdc (-15% / +20%) "OFF" = 0V / 3,5V
Nominal voltage output	+24Vdc (-15% / +20%)
Max. output current	0,5A (short circuit proof) per channel
Peak output current	< 1A for 1 ms
Electrical isolation	500V (ECAT line to +24V field Power Supply)
Operating Temperature	-20°C – 60°C
Storage Temperature	-40°C – 60°C
Relative humidity	5 – 95% (not condensating)
Dimensions	108x12,5x80mm.
Net weight	60g.
EMC	CE/FCC
Protection level	IP20

**Pay attention!**

Each output needs protection against inductive current and for clamping undervoltage events. Please, take adequate countermeasures (normally specified by the nature of the electric load) to avoid any damage to the output circuits (typically a fast diode or a voltage transient suppressor). Output current is limited by a resettable fuse (PTC). Typically, the same OEM of the load device explains which kind of protection must be selected.

Attention!

When the load is a lamp, limit inrush current on the first switch-on, due to cold lamp (for ex. set a few Ohm resistor in serie to the lamp, 10 Ohm 3W).



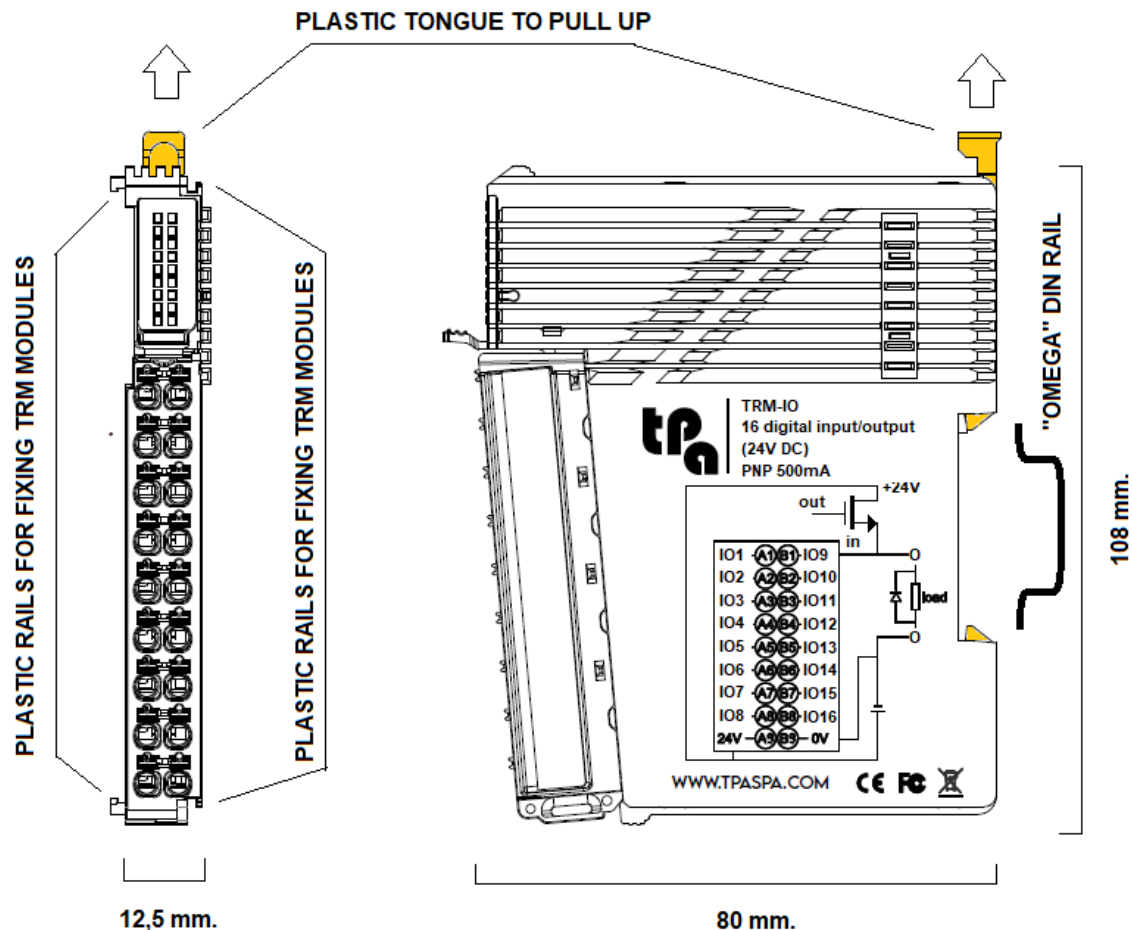
When the circuit is operating as Input, the output signal is forced "OFF", to obtain a Z=High. The schematic above shows the electrical concept of the generic input.

When the circuit is NOT powered (no +24V power supply), logical signals are all tied "OFF" to prevent in-rush current through the bulk diode could power the driver.

2 MECHANICAL DATA

TRM-IO module can be installed into a metallic rail DIN 60715, with an "OMEGA" profile, model 7,5mm. or 15mm.

To add a TRM-IO device to a TRM-ECAT or to another TRM module in a blackchain, let's introduce it along the right side of the TRM-ECAT module. There are two plastic rails on every TRM device that help to get the correct position side by side with the next TRM device. Then, throw up the orange tonge to fix it to the DIN rail.



Dimension	Value	Notes
Height	108 mm.	Let's consider the extension of the tongue and the possibility to have a min. extended space to handle it
Dept	80 mm.	Let's consider the extension of the connectors and the curves of the cables
Thickness	12,5 mm.	

3 ETHERCAT COMMUNICATION

The TRM-IO module is compliant with standard EtherCAT normed by ETG in IEC61158. TRM-IO is just a simple multi INPUT / multi OUTPUT On/Off actuator and it is addressed as a station into the EtherCAT network; it can run only in an ECAT network. Other TRM's serie devices can be mechanically and electrically joined to TRM-IO, to constitute a I/O remote block, connected in blockchain.



Data communication into the blockchain is supported by E-BUS, a local bus derived from ECAT. The communication is full-duplex, real time clocked and based on 100Base-Tx exchange on internal E-BUS. This bus is coupled toward ECAT by a TRM-ECAT modul. TRM-IO cannot be used not joined to TRM-ECAT.

The max exchange rate (the real Time Clock of the network) can be accorded in this range: 250µs, 500µs, 1ms, 2ms, 4ms or more. It is a Master station dependent parameter.

Output signals are updated in accordance with ECAT IRQ.

Methods to access and to run it are provided by a description ESI file (TRM-IO.xml is provided for setting up the device into the control system).

TRM-IO doesn't present any COE Object or protocol. It is only a simple ECAT bus station.

Thus, the ECAT control unit sees it as a node, a Hardware Station point, with no configurable objects or PDOs.

Output signals can be accessed by writing main hardware registers exponed by the ESC, using a pre-configured standard set of objects ranging from 0x1600 to 0x160F RxPDO (no mapping). Input signals can be accessed by reading main hardware registers exponed by the ESC, using a pre-configured standard set of objects ranging from 0x1A00 to 0x1A0F TxPDO (no mapping). For the list of the main registers, consult ET1100 specification – registers.

For Output access:

0x0F00 - 0x0F01 → 16 bit map, where each output reflects the condition of the corrispondant bit

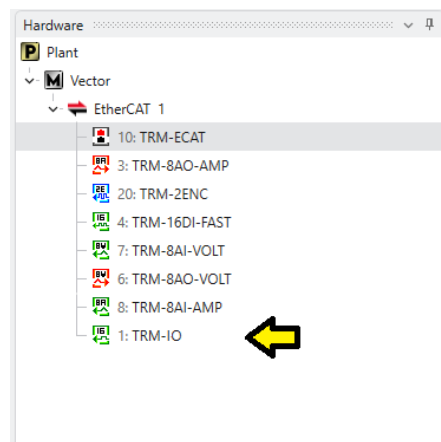
Es. Output 01 → bit[0], Output 02 → bit[1], ... , Output 16 → bit[F]
1/0 = Active / Not Active

For Input access:

0x1002 - 0x1003 → 16 bit map, where each bit reflects the condition of the corrispondant input

Es. Input A1=ON → Bit[0]=1, Input A2=ON → Bit[1]=1, ... , Input B8 = ON → Bit[15]=1

In Albatros SW by TPA, you need to introduce a TRM-ECAT node to convert EtherCAT signals into EBUS format. In the hardware configurator window, under the EtherCAT bus symbol, it is possible to select the TRM-IO device.

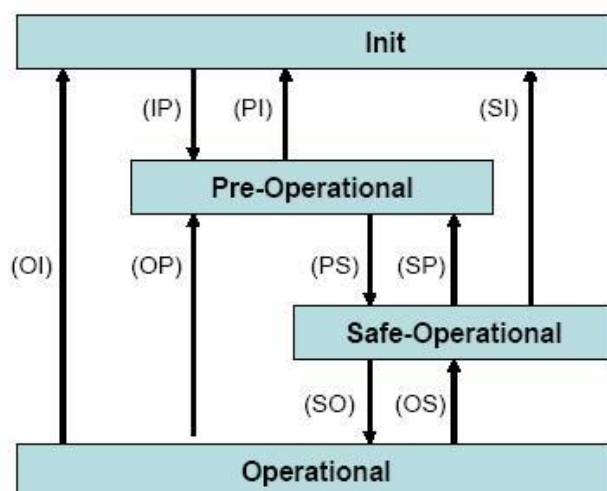


TRM-IO shows its data with 16 TxPDOs and 16 RxPDO, each one has only one entry of 1 BOOLEAN value which sets the value of the output and returns the value of the same input (1=active, 0=no active).

Index	In/Out	Sm	Tags	Size	Name
☒ 0x1600	Out	0	M F	0.1	Channel 1
☒ 0x1601	Out	0	M F	0.1	Channel 2
☒ 0x1602	Out	0	M F	0.1	Channel 3
☒ 0x1603	Out	0	M F	0.1	Channel 4
☒ 0x1604	Out	0	M F	0.1	Channel 5
☒ 0x1605	Out	0	M F	0.1	Channel 6
☒ 0x1606	Out	0	M F	0.1	Channel 7
☒ 0x1607	Out	0	M F	0.1	Channel 8
☒ 0x1608	Out	1	M F	0.1	Channel 9
☒ 0x1609	Out	1	M F	0.1	Channel 10
☒ 0x160A	Out	1	M F	0.1	Channel 11
☒ 0x160B	Out	1	M F	0.1	Channel 12
☒ 0x160C	Out	1	M F	0.1	Channel 13
☒ 0x160D	Out	1	M F	0.1	Channel 14
☒ 0x160E	Out	1	M F	0.1	Channel 15
☒ 0x160F	Out	1	M F	0.1	Channel 16
Index	In/Out	Sm	Tags	Size	Name
☒ 0x1A00	In	0	M F	0.1	Channel 1
☒ 0x1A01	In	0	M F	0.1	Channel 2
☒ 0x1A02	In	0	M F	0.1	Channel 3
☒ 0x1A03	In	0	M F	0.1	Channel 4
☒ 0x1A04	In	0	M F	0.1	Channel 5
☒ 0x1A05	In	0	M F	0.1	Channel 6
☒ 0x1A06	In	0	M F	0.1	Channel 7
☒ 0x1A07	In	0	M F	0.1	Channel 8
☒ 0x1A08	In	0	M F	0.1	Channel 9
☒ 0x1A09	In	0	M F	0.1	Channel 10
☒ 0x1A0A	In	0	M F	0.1	Channel 11
☒ 0x1A0B	In	0	M F	0.1	Channel 12
☒ 0x1A0C	In	0	M F	0.1	Channel 13
☒ 0x1A0D	In	0	M F	0.1	Channel 14
☒ 0x1A0E	In	0	M F	0.1	Channel 15
☒ 0x1A0F	In	0	M F	0.1	Channel 16

Here is the Process Data window in Albatros SW, clicking on TRM-IO icon. In this configuration, all 16 output are enabled and the corresponding values are returned.

The EtherCAT State Machine shown in figure is applicable to TRM-IO. Enabled outputs are operative exclusively in OPERATIONAL state; all inputs are operative in PREOPERATIONAL, SAFE-OPERATIONAL and OPERATIONAL.



4 OBJECT DICTIONARY

The device TRM-IO shows a reduced Object Dictionary as a direct I/O module. All the available objects are described in TRM-IO ESI file (TRM-IO.xml).

Communication implemented has only PDOs.

- PDO communication is made for a continuous command's rate.
- Sync Manager 0 is enabled to write outputs 1-8 ad address 0x0F00
- Sync Manager 1 is enabled to write outputs 9-16 ad address 0x0F01
- Sync Manager 2 is enabled to read inputs 1-16 at address 0x1002
- All SM are set in free running mode

Real Time Objects - PDOs

Index(hex) Tx	Name	Data / Object	Size(Byte)
0x1600	Digital Input A1 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6000	0.1 (2)
0x1601	Digital Input A2 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6010	0.1 (2)
0x1602	Digital Input A3 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6020	0.1 (2)
0x1603	Digital Input A4 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6030	0.1 (2)
0x1604	Digital Input A5 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6040	0.1 (2)
0x1605	Digital Input A6 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6050	0.1 (2)
0x1606	Digital Input A7 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6060	0.1 (2)
0x1607	Digital Input A8 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6070	0.1 (2)
0x1608	Digital Input B1 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6080	0.1 (2)
0x1609	Digital Input B2 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x6090	0.1 (2)
0x160A	Digital Input B3 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x60A0	0.1 (2)
0x160B	Digital Input B4 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x60B0	0.1 (2)
0x160C	Digital Input B5 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x60C0	0.1 (2)
0x160D	Digital Input B6 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x60D0	0.1 (2)
0x160E	Digital Input B7 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x60E0	0.1 (2)
0x160F	Digital Input B8 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x60F0	0.1 (2)
Index(hex) Rx	Name	Data / Object	Size(Byte)
0x1A00	Digital Output A1 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7000	0.1 (2)
0x1A01	Digital Output A2 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7010	0.1 (2)
0x1A02	Digital Output A3 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7020	0.1 (2)
0x1A03	Digital Output A4 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7030	0.1 (2)
0x1A04	Digital Output A5 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7040	0.1 (2)
0x1A05	Digital Output A6 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7050	0.1 (2)
0x1A06	Digital Output A7 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7060	0.1 (2)
0x1A07	Digital Output A8 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7070	0.1 (2)
0x1A08	Digital Output B1 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7080	0.1 (2)
0x1A09	Digital Output B2 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x7090	0.1 (2)
0x1A0A	Digital Output B3 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x70A0	0.1 (2)
0x1A0B	Digital Output B4 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x70B0	0.1 (2)
0x1A0C	Digital Output B5 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x70C0	0.1 (2)
0x1A0D	Digital Output B6 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x70D0	0.1 (2)
0x1A0E	Digital Output B7 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x70E0	0.1 (2)
0x1A0F	Digital Output B8 Value	Bit() 1/0 1=ON, 0=OFF OBJ=0x70F0	0.1 (2)

No PDO remapping.

TO BE CONFIRMED

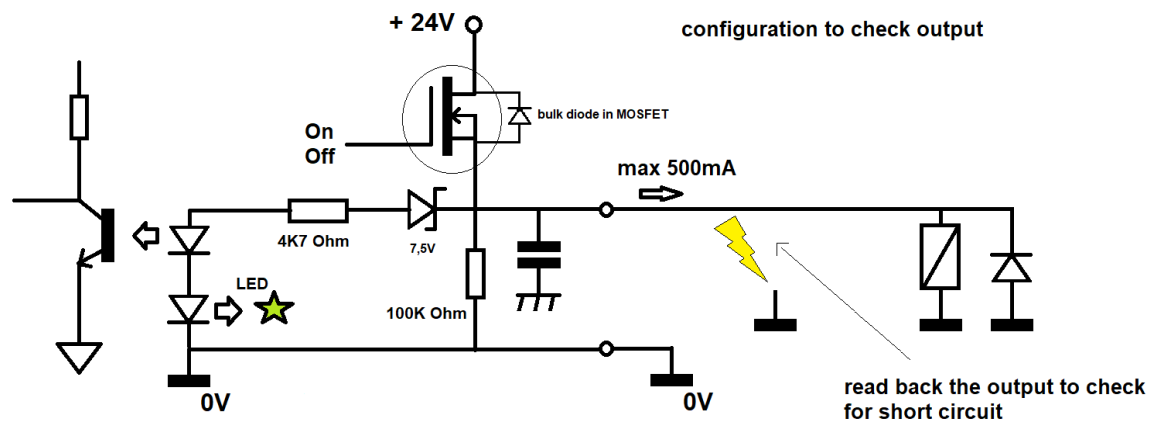
5 TRM-IO FEEDBACK

Feedback of asserted outputs can be done by enabling all input in correspondence with the relative outputs; by this way it is possible to read back the value of the output.

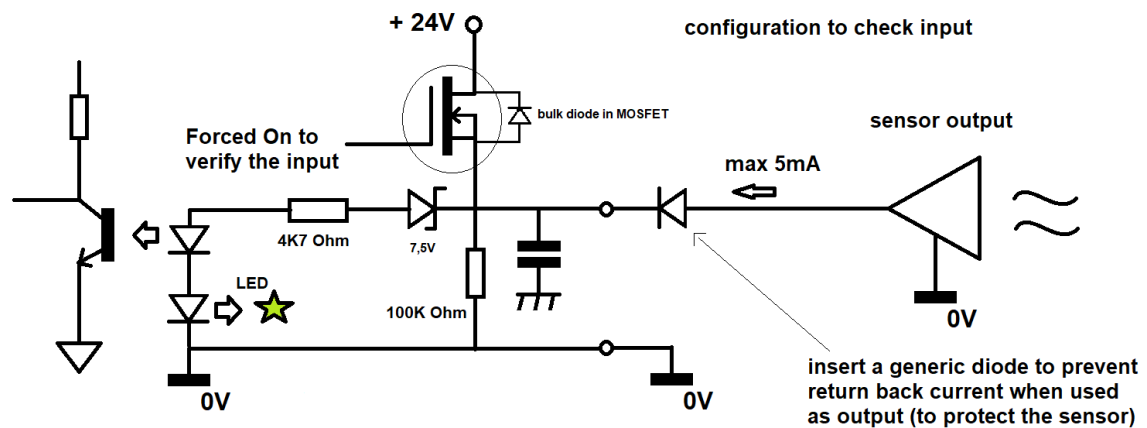
This feature can be used:

- to verify if the connected device (or generically the electric load) is in short circuit – see picture 1
- to check inputs (pay attention! to prevent condition of match with the sensor output let's insert a generic diode with $V_{breakdown} > 30V$) – see picture 2

Feedback feature has to be developed in PLC FW by the software developer.



Picture 1



Picture 2

TO BE CONFIRMED

6 TRM-IO VIEW



TRM-IO
Front view

TRM-IO
Right side view



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