

# PLC USER'S MANUAL for TPLC100



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## 1.0 Introduction

To ensure a quick installation of the device please follow carefully the information in this manual.

### 1.1 Staff skill

Products described here are to be used exclusively by personnel with experience in programming PLCs, or technician specialized in the use of electrical device for automation. MECT S.r.l. declines any responsibility for malfunctions or damages caused by improper use of MECT devices, due to the non-compliance with information in this manual. In MECT S.r.l there is an help desk service..

### 1.2 Symbols

**Danger**

Follow these advices to avoid people injury

**Warning**

Follow these advices to protect the device.

**Caution**

Follow this advice to have a more effective performance.

**ESD (Electrostatic discharge)**

Danger: possibility of components damage due to electrostatic discharge.

**Note**

Steps to follow for a correct installation

**Additional informations**

### 1.3 Terms

PLC: TPLC100

Operator Panel: TP1070

### 1.4 Security



**Attention**

Switch off the devices before connecting them



**Attention**

TPLC100 must be mounted inside cabinet or electrical switchboards whose access must be performed by qualified personnel.



**ESD (Electrostatic discharge)**

Modules have electronic components that can be damaged by electrostatic discharge. Be sure to be connected to ground when handle the devices.

The instrument has no power switch and no internal fuse, but it powers on immediately after connecting a correct power supply input (check the power supply value on the instrument label). Keep the power supply line as short as possible and keep it separate from other power lines.

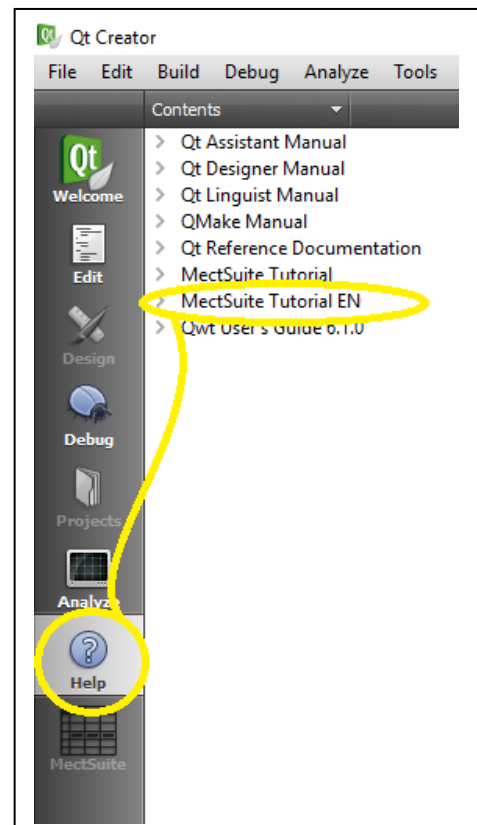
For security reasons it is necessary to have a 2 section power switch with a fuse near the instrument and easily replaceable.

Avoid the presence of other power actuators in the same control panel, high humidity, excessive heat and corrosive gas.

Instruments must have a power supply from security transformers or SELV transformers.

### 2.0 Reference manual

The **Quick Start** (downloadable from the web site) and **MectSuite Tutorial** are the reference manuals for MectSuite Software to develop HMI and PLC applications.



## 2.1 System description

The TPLC100 is a PLC equipped with digital I/O and analog inputs, fieldbus like Modbus, and a 100Mbit/s Ethernet interface.

The networks are managed simultaneously by TPLC100, and data from one network can be sent to another thus creating a bridge between the two networks.

On the PLC TPLC050 there is a USB host port, which allows the use of a key for software update and data log. Through a GPRS/UMTS or Wi-Fi key (optionally provided by Mect) it is possible to connect the operator panel to a Wi-Fi or Mobile network. The network setting is done from MENU → OPTIONS → NETWORK\_CFG → tab “Wi-Fi” or tab “Mobile” via VNC.

It is possible to create a graphic page by which you manage plc (see chapter [HMI](#)).

On the PLC TPLC100 there are up to 192 retentive variables stored on flash and more than 4800 non retentive variables.



## 2.2 Features

<b>PLC hardware features</b>	
PLC Processor	ARM926JE 454MHz
RAM	128MB
FLASH	128MB
Non volatile variables	On FLASH memory
Real Time Clock	Yes with rechargeable battery
Ethernet	10Mbit/s - 100Mbit/s self recognition
USB-A	Host 2.0
Micro SD	Not available
<b>PLC software features</b>	
Sistema operativo	LINUX 2.35
PLC	IEC61131-3
Fieldbus	Modbus RTU / TCP or CANopen
Storage memory	Possibility of history storage
<b>Fieldbus main features</b>	
Modbus RTU	Master/Client 2 wires
Modbus TCP	Master/Client

<b>Power supply</b>	
15÷36VDC	
Absorption	150mA a 24Vdc

<b>Analog accuracy class</b>	
Analog Inputs 1-4	0,5% Vfs
Analog Inputs 5-12	0,5% Vfs
Analog Outputs	0,5% Vfs

<b>Mechanics</b>	
Dimensions	105 x 136 x 60 mm - 6 DIN modules
Installation	On OMEGA DIN A rail
<b>Environmental conditions</b>	
Operative temperature	0 °C ... 55 °C
Storage temperature	-20 °C ... +85 °C
Relative humidity	Da 5 % a 95 % no condensation

<b>Electric isolation</b>	
Air clearance	According to IEC 60664-1
Pollution according to IEC 61131-2	2
<b>Degree of protection</b>	
Rear protection	IP 20

<b>Inputs / Outputs</b>					
		<b>Input type</b>	<b>Resolution</b>	<b>Bit</b>	<b>Note</b>
Universal Analog Inputs	N° 4	0÷20 mA	0.005mA	12	Input impedance 9Ω
		0÷10V	0.003V	12	Input impedance 500kΩ
Universal Analog Inputs	N° 8	Thermocouples: J(0°C ÷ 600°C), T(0°C ÷ 400°C), K(0°C ÷ 1200°C)	1°C	12	Cold junction compensation
		PT100 R -40.0°C ÷ 200.0°C	0.1°C	12	
Analog Outputs	N° 2	0-10V	0.01V	12	Min Impedance: 1KΩ
		PWM @250Hz	1%		Min Impedance : 1KΩ
Digital Inputs	N°8	PNP	PLC cycle time		
Digital Outputs	N°6	Contact relay 5A			
	N°2	Exchange realy 10A			

### **Electromagnetic compatibility**

The electromagnetic compatibility tests have been carried out at accredited laboratories, according to EN 61326-1, EN 61131-2 and EN 61000-6-2standards.

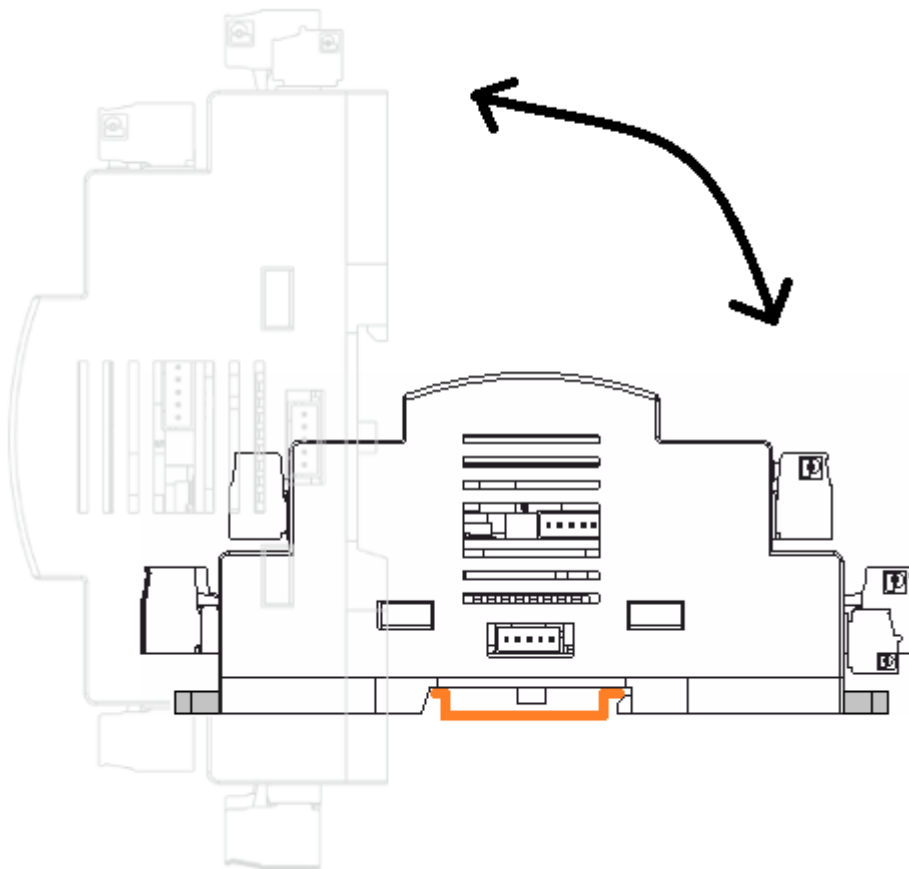


## 2.3 Installation

### 2.3.1 Distance

The system must be installed in a way that there is enough space for heat dissipation (at least 20 mm each side) and cabling. Avoid cables superimposition to prevent EMC problems.

### 2.3.2 Insertion and removal of components

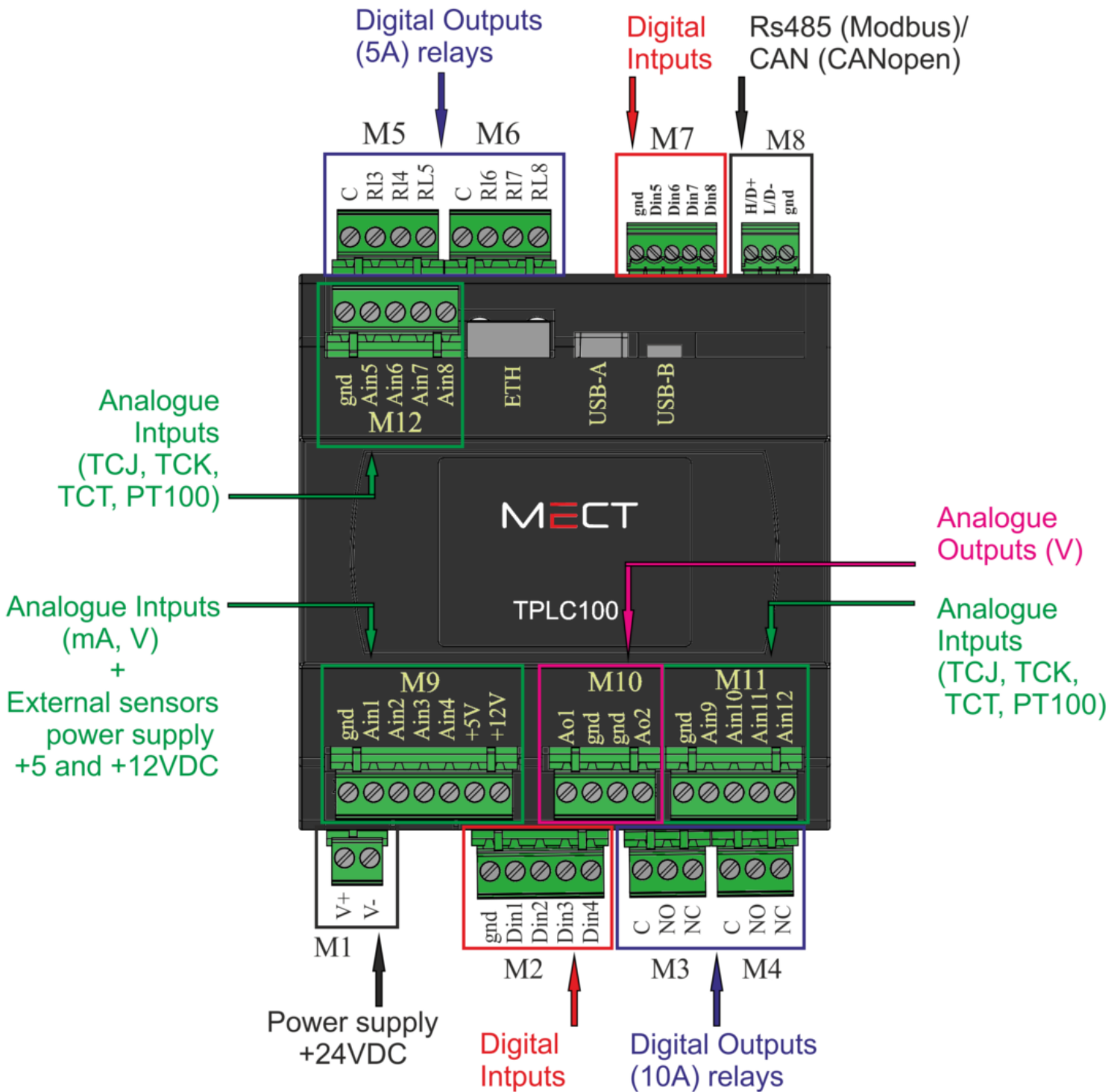


#### **Attention**

Before performing these operations make sure that devices are not supplied.

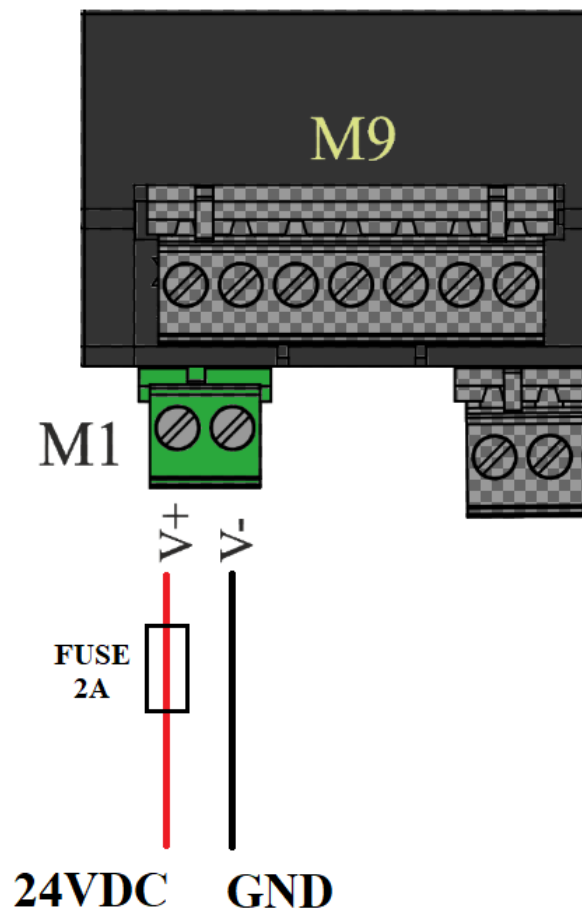
The insertion or removal of a single terminal is carried out by acting on the fastening hook to the DIN rail located at the base of the terminal itself as shown in the figure.

### 3.0 Terminal boards placement AA model and AB model



### 3.1 Power supply

The PLC TPLC100 requires a 15÷36VDC power supply as shown in the figure. The system is protected from the power supply polarity inversion.



#### Attention

A wrong value for the power supply can cause a damage to the device.

#### 3.1.1 Grounding

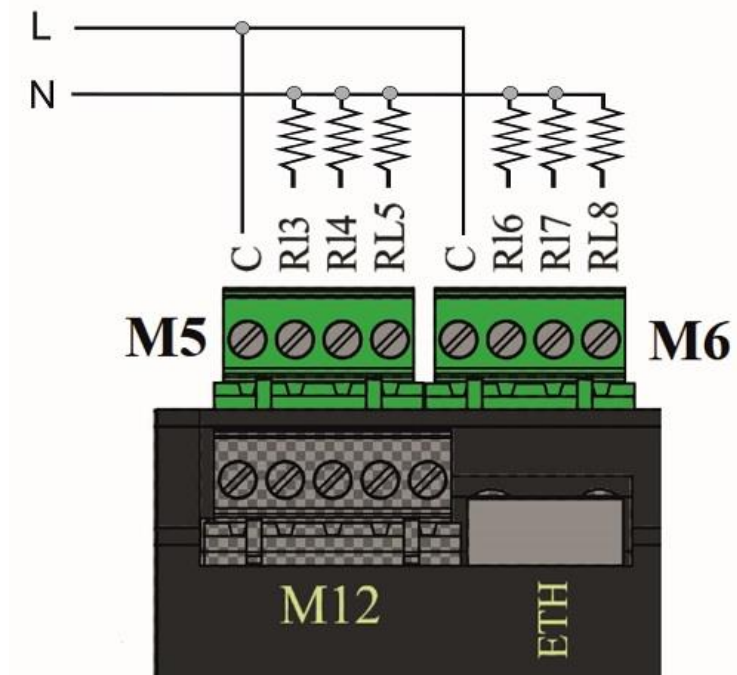
The DIN rail on which are mounted the PLC TPLC100 and the terminals must be carefully grounded in order to increase the rejection of electromagnetic disturbances.

#### 3.1.2 Cable screen

To make the system less sensible to disturbances, the connection cable between the operator panel and the PLC TPLC100 should be screened and connected to both devices GND.

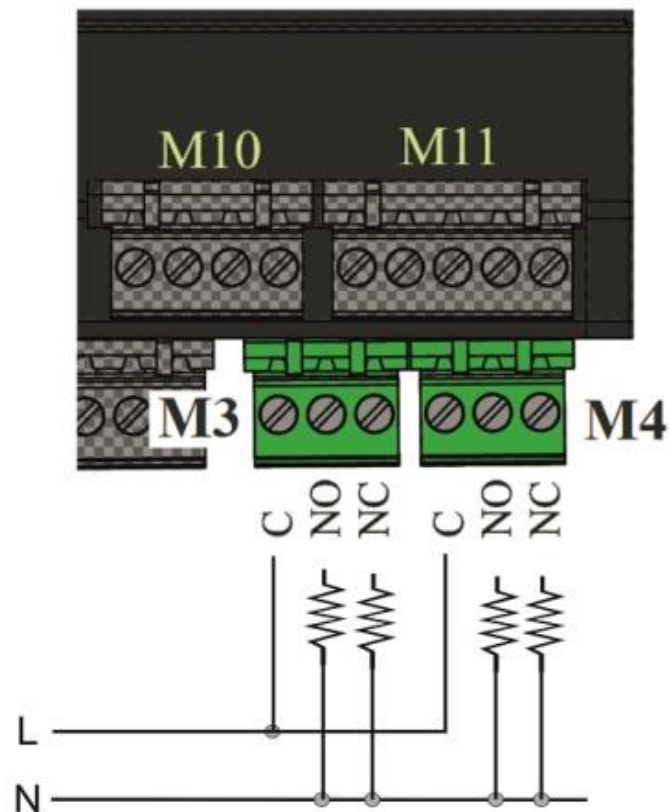
### 3.2 Digital output connections of M5 and M6

The digital outputs are relay outputs with dry contacts. Outputs 3 to 8 have contact relays (5 A).



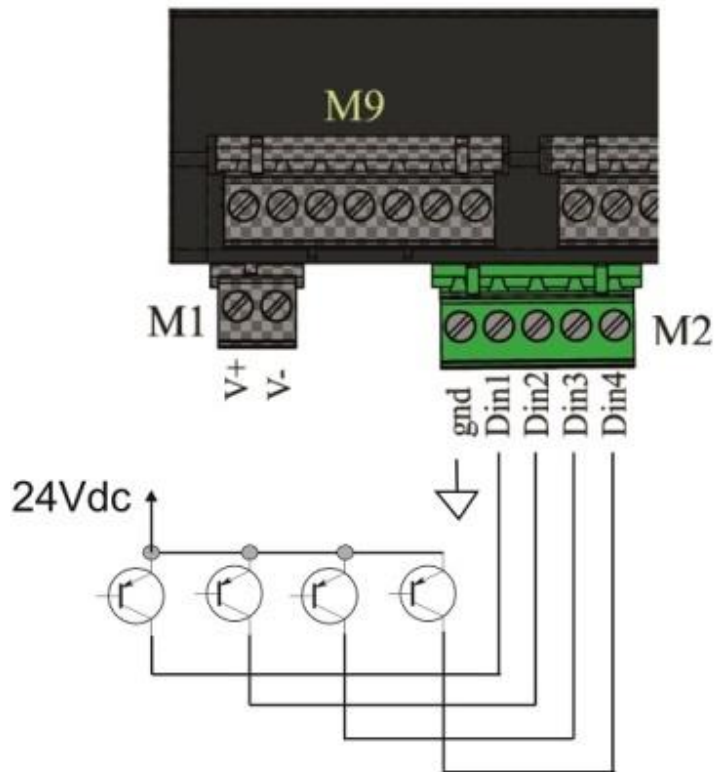
### 3.3 Digital output connections of M3 and M4

The digital outputs are relay outputs with dry contacts. Outputs 1 and 2 have exchange relays (10 A).



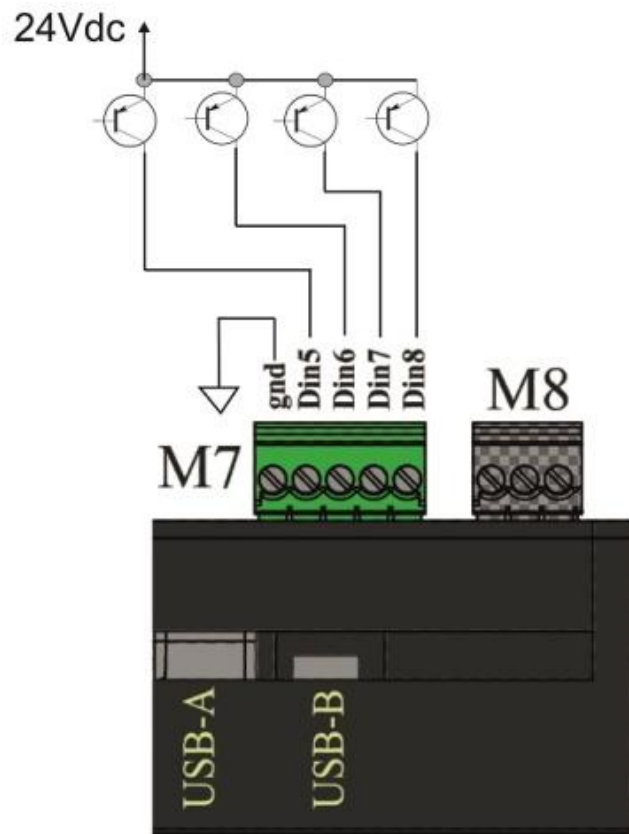
### 3.4 Digital inputs connection of M7

Digital inputs Din1 to Din4 are of type PNP.



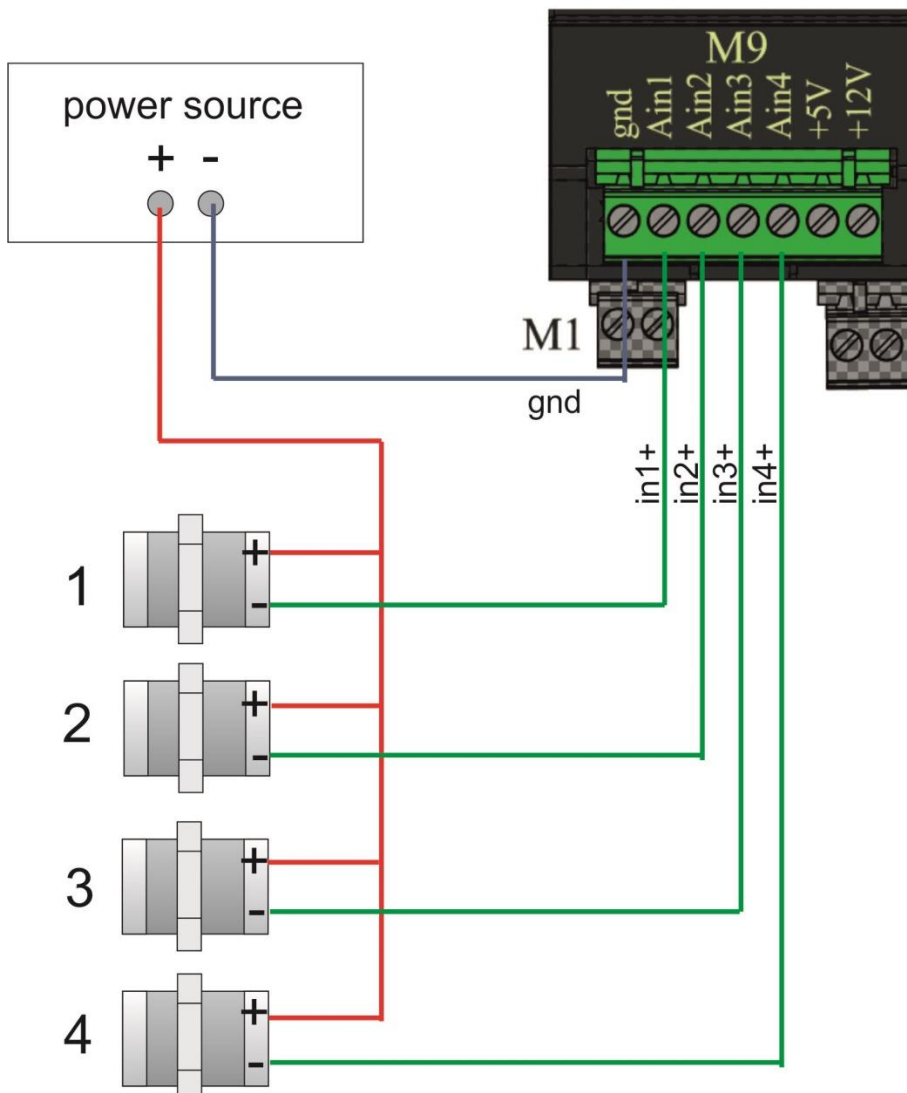
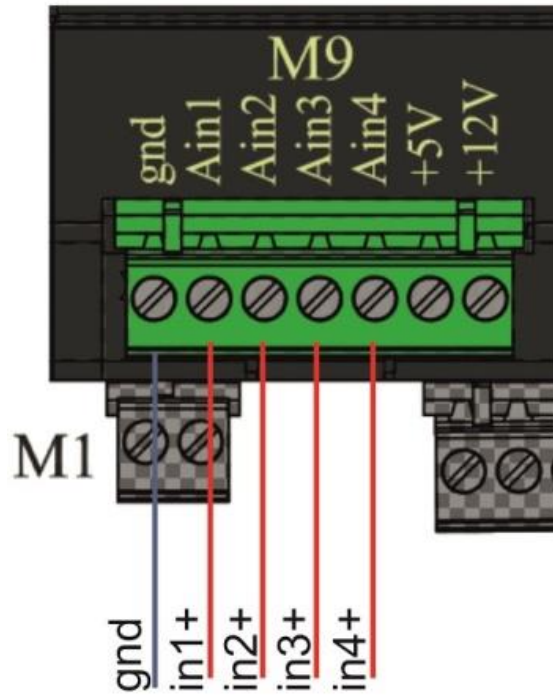
### 3.5 Digital inputs connection of M7

Digital inputs Din5 to Din8 are of type PNP.



### 3.6 Analog inputs (mA, V) connection of M9

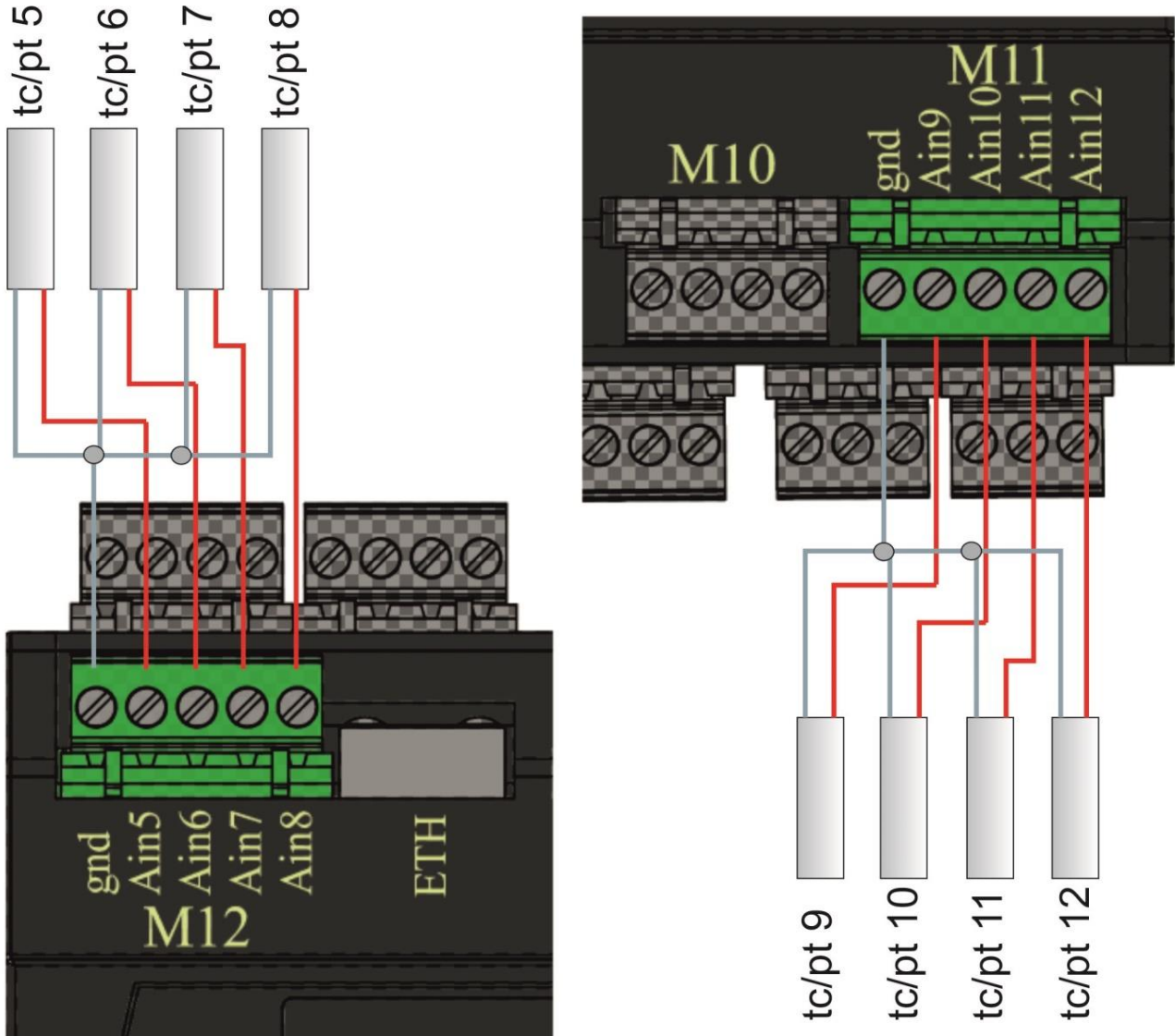
The analog inputs Ain1 to Ain4 can be configured in current and voltage, see chapter [“Analog inputs 1-4 of M9”](#).



**Example of connection: 2-wires transducers 4-20mA with external power supply**

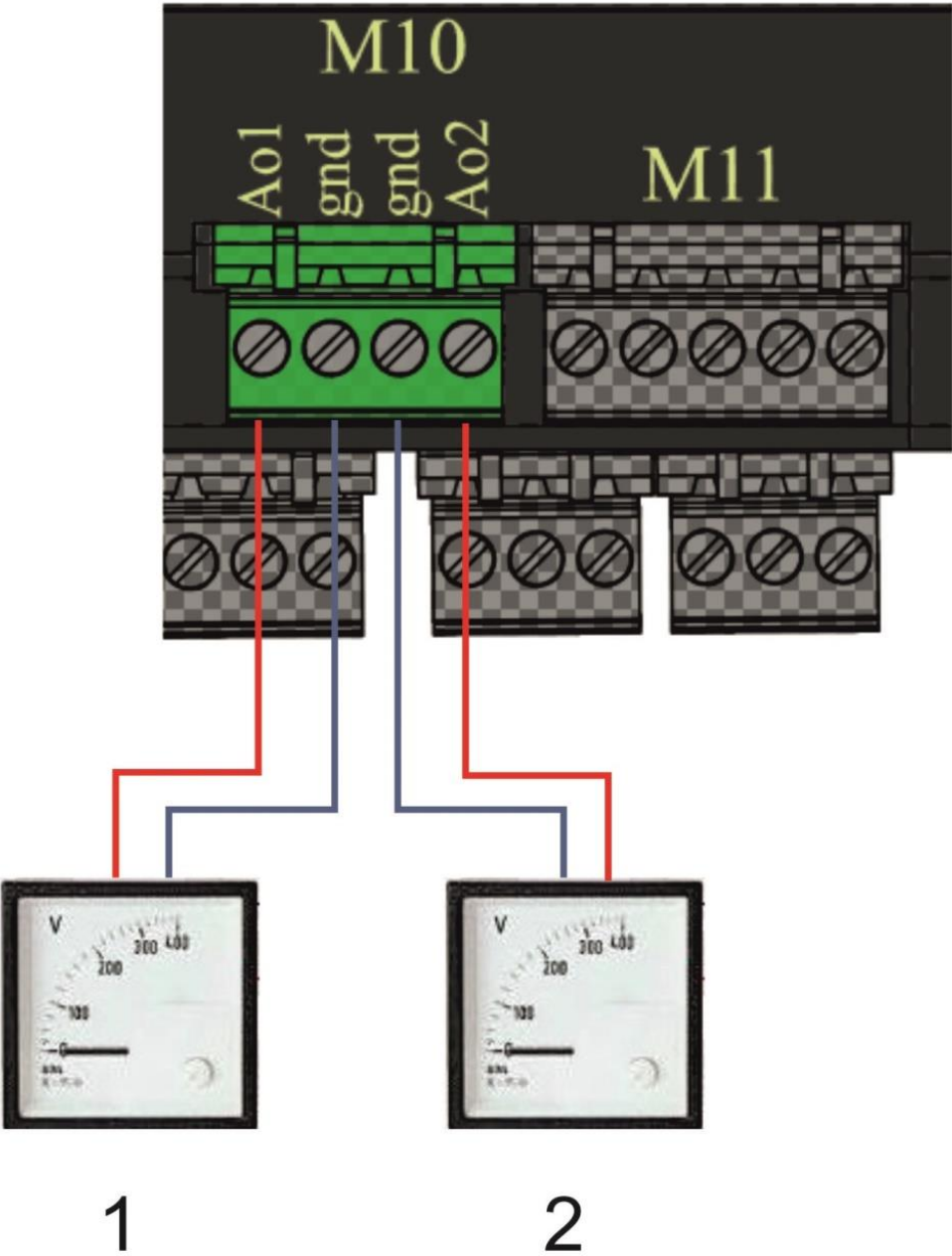
### 3.7 Analog inputs (TCJ, TCK, TCT, PT100) connections of M11 and M12

The analog inputs Ain5 to Ain12 can be configured as thermocouples (J, K, T) and PT100, see chapter “[Analog inputs 5-12 of M11 and M12](#)”.





3.8 Analog outputs connections of M10





### 3.9 Analog inputs 1-4 of M9

The PLC model TPLC100 has two sets of analog inputs: inputs 1 to 4 accept voltage 0-10V or current 0-20mA signals, while inputs 5 to 12 accept thermocouples and thermoresistances inputs (see paragraph “[Analog inputs 5-12 of M11 and M12](#)”). The channels can be configured via software by setting the appropriate value in the configuration variable associated with the input.

The configuration variables defined in Crosstable are as follows:

Variable	Current configuration	Voltage configuration
PLC_AnInConf_1	1	2
PLC_AnInConf_2	1	2
PLC_AnInConf_3	1	2
PLC_AnInConf_4	1	2

#### Example:

Analog input 1 configured as voltage and analog input 2 as current:

PLC\_AnInConf\_1 := 2;

PLC\_AnInConf\_2 := 1;

The configuration must take place within the "Init" program present in the PLC development software.

Once the configurations are set, the values are read in the variables:

Variable	Current configuration resolution	Voltage configuration resolution
PLC_AnIn_1	0.005mA	0.003V
PLC_AnIn_2	0.005mA	0.003V
PLC_AnIn_3	0.005mA	0.003V
PLC_AnIn_4	0.005mA	0.003V

Associated with inputs 1-4 there is a diagnostic variable that indicates the status of the inputs

Variable		Channel 1 Bit 0..4	Channel 2 Bit 5..7	Channel 3 Bit 8..11	Channel 4 Bit 12..15
PLC_AnInST_1_4	OK	0	0	0	0
PLC_AnInST_1_4	Out of range	2	2	2	2
PLC_AnInST_1_4	Not configured	4	4	4	4
PLC_AnInST_1_4	Error	8	8	8	8

### 3.10 Analog inputs 5-12 of M11 and M12

The inputs 5 to 12 can accept thermocouples or thermoresistances; also in this case the configuration is done via software through the variables:

Variable	Conf. TC J	Conf. TC K	Conf. TC T	Conf. Pt100
PLC_AnInConf_5	3	4	5	7
PLC_AnInConf_6	3	4	5	7
PLC_AnInConf_7	3	4	5	7
PLC_AnInConf_8	3	4	5	7
PLC_AnInConf_9	3	4	5	7
PLC_AnInConf_10	3	4	5	7
PLC_AnInConf_11	3	4	5	7
PLC_AnInConf_12	3	4	5	7

**Example:**

Analog input 5 configured as thermocouple K and analog input 6 as PT100:

```
PLC_AnInConf_5:= 4;
PLC_AnInConf_6 := 7;
```

The configuration must take place within the "Init" program present in the PLC development software

Once the configurations are set, the values are read in the variables:

Variable	Resolution for TC J (0°C ÷ 600°C)	Resolution for TC K (0°C ÷ 1200°C)	Resolution for TC T(0°C ÷ 400°C)	Resolution for PT100 (-40.0°C 200.0°C)
PLC_AnIn_5	1°C	1°C	1°C	0.1°C
PLC_AnIn_6	1°C	1°C	1°C	0.1°C
PLC_AnIn_7	1°C	1°C	1°C	0.1°C
PLC_AnIn_8	1°C	1°C	1°C	0.1°C
PLC_AnIn_9	1°C	1°C	1°C	0.1°C
PLC_AnIn_10	1°C	1°C	1°C	0.1°C
PLC_AnIn_11	1°C	1°C	1°C	0.1°C
PLC_AnIn_12	1°C	1°C	1°C	0.1°C

Associated with inputs 5 to 8 and 9 to 12 there are two diagnostic variables that indicate the status of the inputs

Variable		Channel 5 Bit 0..4	Channel 6 Bit 5..7	Channel 7 Bit 8..11	Channel 8 Bit 12..15
PLC_AnInST_5_8	OK	0	0	0	0
PLC_AnInST_5_8	Out of range	2	2	2	2
PLC_AnInST_5_8	Not configured	4	4	4	4
PLC_AnInST_5_8	Error	8	8	8	8

Variable		Channel 5 Bit 0..4	Canale 6 Bit 5..7	Canale 7 Bit 8..11	Canale 8 Bit 12..15
PLC_AnInST_9_12	OK	0	0	0	0
PLC_AnInST_9_12	Out of range	2	2	2	2
PLC_AnInST_9_12	Not configured	4	4	4	4
PLC_AnInST_9_12	Error	8	8	8	8

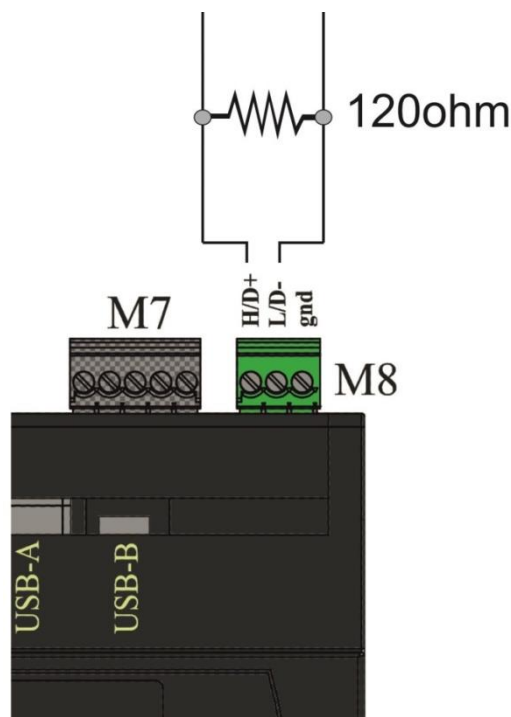
### 3.11 Analog outputs 1-2 of M10

Two voltage output channels are available. The channels are configurable as dc output or a 250Hz PWM.

### 3.12 CANopen connections (TPLC100 AA model)

The PLC TPLC100 model AA provides a CANopen interface connected on the M8 terminal board to the pins indicated in the table.

Pin M8	Signal
1	GND
2	CAN L
3	CAN H



#### Termination resistor

Connect a 120 resistor that terminates the master-side line .

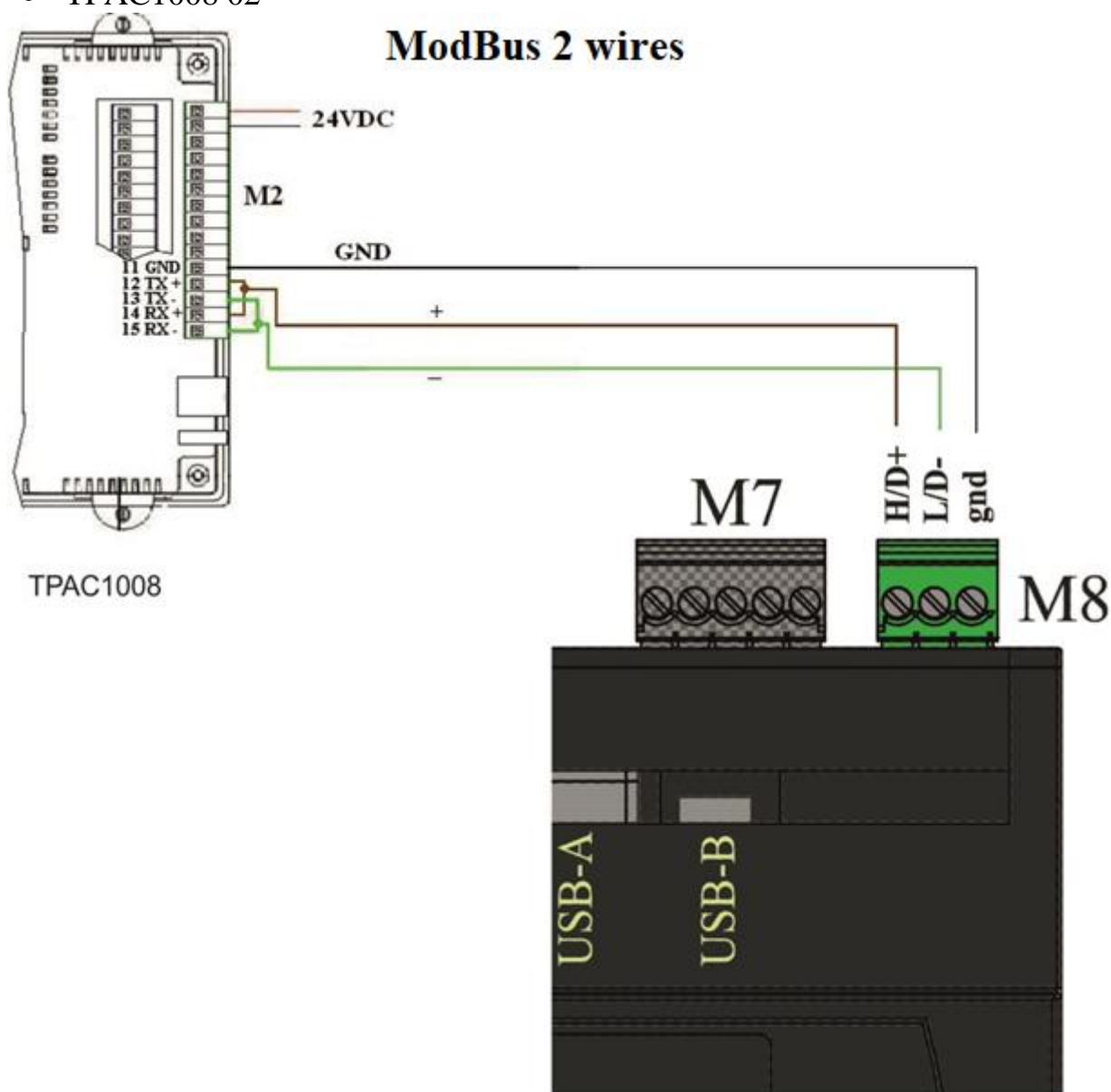
### 3.13 ModBus connections (TPLC100 AB model)

The PLC TPLC100 model AB provides a ModBus interface connected on the M8 terminal board to the pins indicated in the table.

Pin	Signal
M8 1	GND
2	D-
3	D+

This paragraph describes the example of commissioning a system composed of:

- TPLC100
- TPAC1008 02



## 4.0 Programming

### 4.1 PLC

To program the PLC model TPLC100 it is sufficient to develop a PLC program created using the IDE PLC programming software.

A PLC program can be developed in the following programming languages derived from the IEC 61131-3 standard.

FBD	Functional Block Diagram	Graph	Electrical scheme
LD	Ladder	Graph	Ladder scheme
SFC	Sequential Function Chart	Graph	States diagram
ST	Structured Text	Textual	Pascal-like language
IL (AWL)	Instruction List	Textual	Assembler-like language

### 4.2 HMI

Although it is a device without a monitor, on the PLC model TPLC100 it is possible to realize a graphic interface with the MectSuite.

This type of interface allows to create parameters configuration pages.

The visualization of the graphic pages can be done in two different ways:

- Directly in the field, with a PC and using the VNC;
- Remotely, thanks to the remote connection service sMily with which you can manage the PLC directly from your smartphone and / or PC.

### 4.3 System variables

Some system variables (present in the Crosstable) that can be used by the user in the PLC program are defined.

ID	Variable	Description	Type	R/W
5300	PLC_DigIn_1	Digital input 1 value	BIT	R
5301	PLC_DigIn_2	Digital input 2 value	BIT	R
5302	PLC_DigIn_3	Digital input 3 value	BIT	R
5303	PLC_DigIn_4	Digital input 4 value	BIT	R
5304	PLC_DigIn_5	Digital input 5 value	BIT	R
5305	PLC_DigIn_6	Digital input 6 value	BIT	R
5306	PLC_DigIn_7	Digital input 7 value	BIT	R
5307	PLC_DigIn_8	Digital input 8 value	BIT	R
5308	PLC_DigIn_9	DIP input 1 value	BIT	R
5309	PLC_DigIn_10	DIP input 2 value	BIT	R
5310	PLC_DigIn_11	DIP input 3 value	BIT	R
5311	PLC_DigIn_12	DIP input 4 value	BIT	R
5312	PLC_DigIn_13	DIP input 5 value	BIT	R
5313	PLC_DigIn_14	DIP input 6 value	BIT	R
5314	PLC_DigIn_15	DIP input 7 value	BIT	R
5315	PLC_DigIn_16	DIP input 8 value	BIT	R
5316	PLC_FWrel_Dig	Digital board fw release	BYTE	R
5317	PLC_FWrel_An	Analog board fw release	BYTE	R
5318	PLC_DigOut_1	Digital output 1	BIT	R/W
5319	PLC_DigOut_2	Digital output 2	BIT	R/W
5320	PLC_DigOut_3	Digital output 3	BIT	R/W
5321	PLC_DigOut_4	Digital output 4	BIT	R/W
5322	PLC_DigOut_5	Digital output 5	BIT	R/W
5323	PLC_DigOut_6	Digital output 6	BIT	R/W
5324	PLC_DigOut_7	Digital output 7	BIT	R/W
5325	PLC_DigOut_8	Digital output 8	BIT	R/W
5330	PLC_DigOutEn_1	Enable digital output 1	BIT	R/W
5331	PLC_DigOutEn_2	Enable digital output 2	BIT	R/W
5332	PLC_DigOutEn_3	Enable digital output 3	BIT	R/W
5333	PLC_DigOutEn_4	Enable digital output 4	BIT	R/W
5334	PLC_DigOutEn_5	Enable digital output 5	BIT	R/W
5335	PLC_DigOutEn_6	Enable digital output 6	BIT	R/W

5336	PLC_DigOutEn_7	Enable digital output 7	BIT	R/W
5337	PLC_DigOutEn_8	Enable digital output 8	BIT	R/W
5346	PLC_AnIn_1	Analog input Ain1 value	INT	R
5347	PLC_AnIn_2	Analog input Ain 2 value	INT	R
5348	PLC_AnIn_3	Analog input Ain 3 value	INT	R
5349	PLC_AnIn_4	Analog input Ain 4 value	INT	R
5350	PLC_AnIn_5	Analog input Ain 5 value	INT	R
5351	PLC_AnIn_6	Analog input Ain 6 value	INT	R
5352	PLC_AnIn_7	Analog input Ain 7 value	INT	R
5353	PLC_AnIn_8	Analog input Ain 8 value	INT	R
5354	PLC_AnIn_9	Analog input Ain 9 value	INT	R
5355	PLC_AnIn_10	Analog input Ain 10 value	INT	R
5356	PLC_AnIn_11	Analog input Ain 11 value	INT	R
5357	PLC_AnIn_12	Analog input Ain 12 value	INT	R
5358	PLC_CJT_X12	Cold junction temperature terminal board M12	INT	R
5359	PLC_CJT_X11	Cold junction temperature terminal board M11	INT	R
5360	PLC_VCC	Not used	INT	R
5361	PLC_AnInST_1_4	Analog input state 1..4 0: Ok 2: out of range 4: not config 8: error	UINT	R
5362	PLC_AnInST_5_8	Analog input state 5..8 0: Ok 2: out of range 4: not config 8: error	UINT	R
5363	PLC_AnInST_9_12	Analog input state 9..12 0: Ok 2: out of range 4: not config 8: error	UINT	R
5364	PLC_AnOutST_1_2	Analog output state 1 ..2 0: Ok 2: out of range 4: not config 8: error	UINT	R
5365	PLC_BoardStatus	Analog board state: 0:Ok 1: busy	UINT	R
5366	PLC_BoardErrors	Communication error counter on internal bus	UINT	R

5367	PLC_HeartBeat	Analog board life counter	UINT	R
5370	PLC_TempScale	Temperature Scale 0: Celsius 1:Fahrenheit 2: Kelvin	UINT	RW
5371	PLC_AnOut_1	Analog output 1 value	INT	RW
5372	PLC_AnOut_2	Analog output 2 value	INT	RW
5373	PLC_AnInConf_1	Analog input 1 Configuration 0: not configured 1: current 2:voltage	UINT	RW
5374	PLC_AnInConf_2	Analog input 2 Configuration 0: not configured 1: current 2:voltage	UINT	RW
5375	PLC_AnInConf_3	Analog input 3 Configuration 0: not configured 1: current 2:voltage	UINT	RW
5376	PLC_AnInConf_4	Analog input 4 Configuration 0: not configured 1: current 2:voltage	UINT	RW
5377	PLC_AnInConf_5	Analog input 5 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5378	PLC_AnInConf_6	Analog input 6 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5379	PLC_AnInConf_7	Analog input 7 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5380	PLC_AnInConf_8	Analog input 8	UINT	RW



		Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100		
5381	PLC_AnInConf_9	Analog input 9 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5382	PLC_AnInConf_10	Analog input 10 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5383	PLC_AnInConf_11	Analog input 11 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5384	PLC_AnInConf_12	Analog input 12 Configuration 0: not configured 3: TC J (thermocouples J) 4: TC K (thermocouples K) 5: TC T (thermocouples T) 7: PT100	UINT	RW
5385	PLC_AnOutConf_1	Analog output 1 Configuration 0: not configured 1: voltage 3: PWM	UINT	RW
5386	PLC_AnOutConf_2	Analog output 1 Configuration 0: not configured 1: voltage 3: PWM	UINT	RW
5390	PLC_time	Seconds from the start of the program	REAL	R
5391	PLC_timeMin	10 seconds window start	REAL	R
5392	PLC_timeMax	10 seconds window end	REAL	R
5393	PLC_timeWin	Graph display window	REAL	RW

5394	PLC_Version	PLC run time version	UINT	R
5395	PLC_EngineStatus	PLC Status	UINT	R
5396	PLC_ResetValues	Reset delle variabili di diagnostica	BIT	RW
5397	PLC_buzzerOn	Buzzer sound (enabled = 1 disabled = 0)	BIT	RW
5398	PLC_PLC_Version	PLC application version	UINT	RW
5399	PLC_HMI_Version	HMI application version	UINT	RW
5400	CH0_NETRUN	Active channel	BIT	R
5401	CH0_NETGOOD	Channel configuration	BIT	R
5402	CH0_NETERR	Bus status	UDINT	R
5403	CH0_NETRST	Bus reset enable	BIT	RW
5404	CH0_NETDIS	Disable the bus	BIT	RW
5405	CH0_01_NODERUN	Active channel of the I/O board	BIT	R
5406	CH0_01_NODEGOOD	Configured channel of I/O board	BIT	R
5407	CH0_01_NODEERR	The bus status of I/O board	UDINT	R
5408	CH0_01_NODERST	Enable the bus reset of I/O board	BIT	RW
5409	CH0_01_NODEDIS	Disable the bus of I/O board	BIT	RW
5410	PLC_Year	Current year	UINT	R
5411	PLC_Month	Current month	UINT	R
5412	PLC_Day	Current day	UINT	R
5413	PLC_Hours	Current hour	UINT	R
5414	PLC_Minutes	Current minutes	UINT	R
5415	PLC_Seconds	Current seconds	UINT	R
5418	PLC_WATCHDOGEN	Watchdog enabling	BIT	RW
5419	PLC_WATCHDOG_ms	Watchdog reset time	UDINT	RW
5435	PLC_BEEP_VOLUME	Buzzer volume (when buzzerOn)	BYTE	RW
5436	PLC_TOUCH_VOLUME	Touch volume	BYTE	RW
5437	PLC_ALARM_VOLUME	Alarm volume	BYTE	RW
5438	PLC_BUZZER	Buzzer dinamic parameters enabling (0x44332211 up=0x11(%) on=0x22(cs) off=0x33(cs) rep=0x44(times))	UDINT	RW

## 5.0 Peripherals

### 5.1 USB

The PLC model TPLC100 has an USB 2.0 host for:

- software update
- data storage: data logger
- connect USB peripherals as printers, mouse, etc.
- connect a Wi-Fi or Mobile key (optionally supplied by Mect) to connect to a different network from LAN.

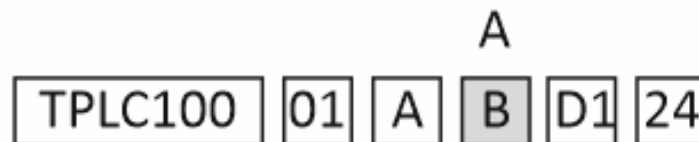
**Specific connection of external peripherals are implemented on request.**

### 5.2 Ethernet

The PLC model TPLC100 has 10/100Mbit/s Ethernet port with auto configuration, with direct or inverse connection cable.

The TPLC100, by Ethernet, can be controlled by a personal computer, it is possible to control the I/O of PLC by means of a program on a PC.

## 6.0 How to order



**A** - Interface

A = CAN

B = RS485