User Manual

MPNC006 series

Modbus RTU interface

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1 Introduction

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

1.1 Staff qualification

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 Nomenclature

Modbus RTU interface:	MPNC006
Terminals:	MPNC020; MPNC030; MPNC035
Operator Panel:	TP1070
System:	MPNC006 with terminals
TBUS:	Internal bus for communication between MPNC006 and terminals

1.4 Security

Attention
Switch off devices before connecting them .

Attention
MPNC006 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 the correct supply voltage has been supplied (check the value of the supply voltage indicated on the instrument label under "Supply"). Provide a power supply line as direct as possible and separate from the line that supplies the power elements.

For safety regulations, it is necessary to provide a two-phase switch-disconnector with fuse located near the instrument and easily replaceable.

Avoid the presence of power elements (contactors, motors, drives, etc.), excessive humidity, heat sources and corrosive gases in the same panel.

Instruments must be powered by safety transformers or by SELV-type power supplies.

2 Hardware Installation

2.1 System description

The MPNC006 is a RTU Modbus bus coupler device. The device interfaces on an internal bus with terminals for different types of signals, both digital and analog.

The RS485 ModBus/RTU slave interface allows the MPNC006 to communicate with an operator panel for displaying PLC variables.
Analog and digital terminals (MPNC020; MPNC030; MPNC035) can be connected to the MPNC006; communication between the terminals and the MPNC006 via an internal bus called TBUS.

2.2 Features

Table 1

Mechanics	
Materials	Polycarbonate, Polyamide 6.6
Power supply	24Vdc +/-15% 3W
Dimensions W x H x L	22.5 mm x 108 mm x 115 mm
Installation	DIN 35
Environmental conditions	
Operative temperature	0 °C ... 55 °C
Storage temperature	-20 °C ... +85 °C
Relative humidity	From 5 % a 95 % no condensation
Electric isolation	
Air clearance	According to IEC 60664-1
Pollution according to IEC 61131-2	2
Degree of protecion	IP 20
Digital inputs	Input range 0V - 24Vdc +/- 15%
Max current for every digital output	500mAdc@24 Vdc
Analogue input number	2
Analogue input type	mA, V, PT100, TC: J, K, T, B, R, S
Power	2.0 W

		Input type	**Resolution**	**Note**
Analog inputs	N° 2	0÷20 mA	0.005mA	Input impedance 9Ω
		0÷10V	0.003V	Input impedance 1MΩ
		Thermocouple: J (0°C – 600°C) T (0°C – 400°C) K (0°C – 800°C) B (100°C – 1800°C) R (0°C – 1500°C) S (0°C – 1700°C)	1°C	Cold junction compensation
		PT100 E: -40°C +800°C	1°C	Degree resolution
		PT100 r: -40°C +200°C	0.1°C	Tenth of degree resolution
Configurable Digital I/O	N°8	PNP	PLC cycle time	Max 200mA for each output. 2 A max all output.

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.

Attention
Install the devices in electrical switchboards where temperature doesn't exceed 55 °C.

Dimensions

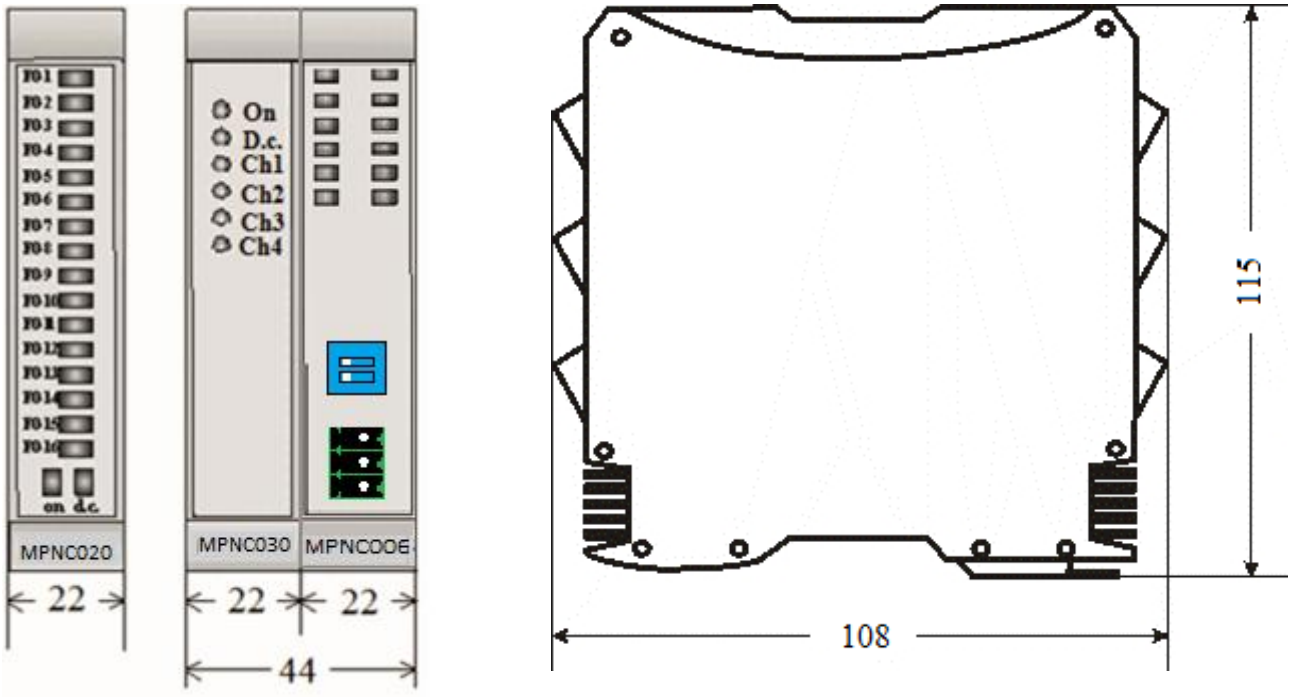

Figure 1: Dimensions

2.3 Installation

2.3.1 Distances

The system must be installed in a way that there is enough space for heat dissipation and cabling. Avoid cables superimposition to prevent EMC problems.

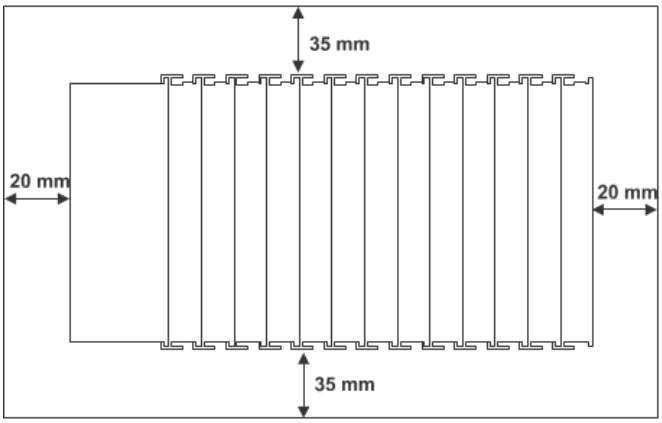

Figure 2

2.3.2 Insertion and removal of components

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

2.3.3 Assembly sequence

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. The sequence starts with the insertion of the MPNC006, then the necessary terminals are inserted in sequence. The fixing to the DIN rail is guaranteed by the hooking spring of each terminal.

Adding terminals Removing terminals

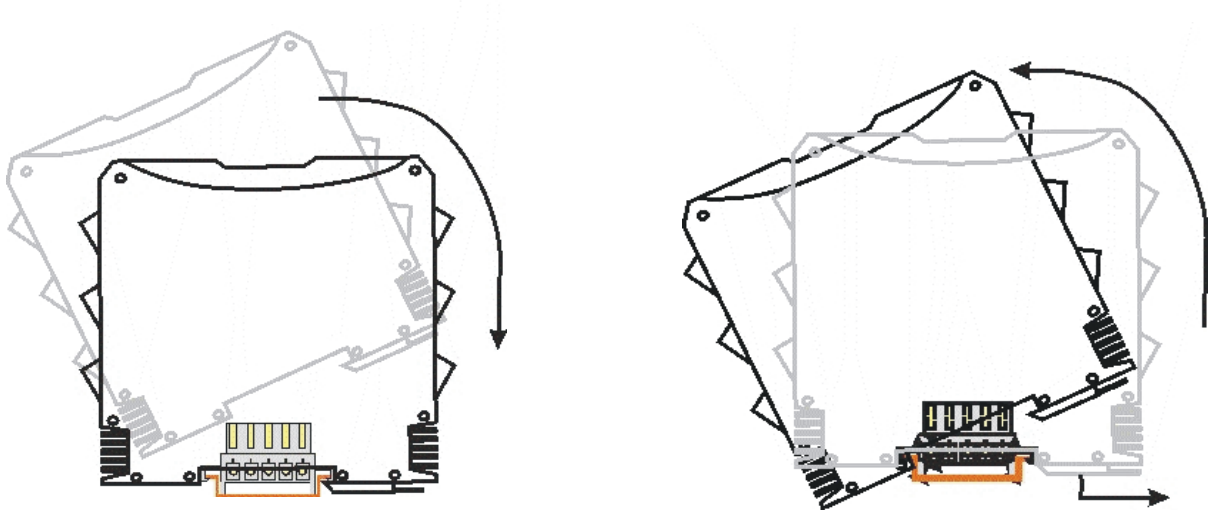

Figure 3: Insertion or removal of a terminal

The instruments must be assembled on the TBUS with the sequence shown in the figure.

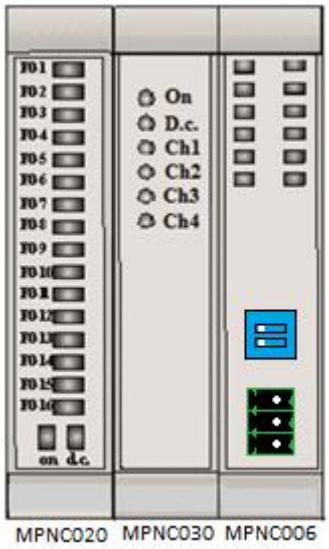

Figure 4: Assembly

2.3.4 Proprieties of DIN rail and TBUS

All the modules must be hooked directly onto DIN rail of type EN 50022 (DIN 35) on which the TBUS connection modules have been inserted, which creates the internal communication bus between the Modbus RTU interface (MPNC006) and terminals.

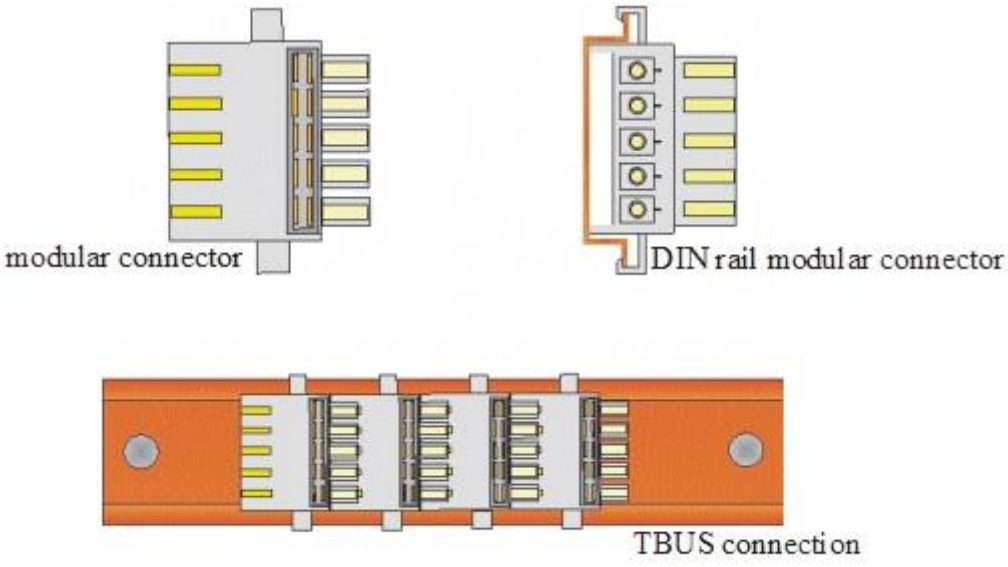

Figure 5: TBUS

3 MPNC006 Wiring

3.1 Power supply

3.1.1 Isolation

There are no galvanic isolation zones.

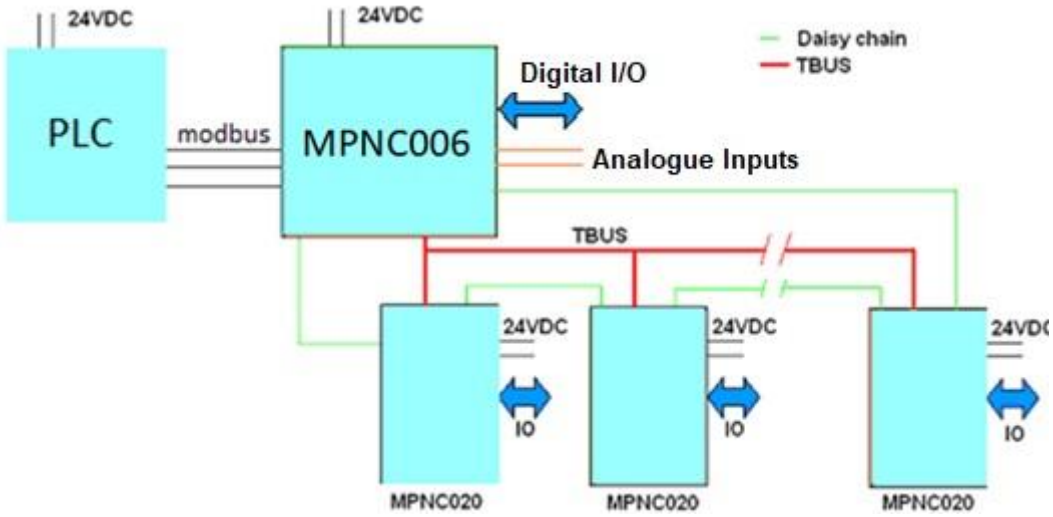

Figure 6: logical wiring scheme

As you notice from the figure, on the MPNC006 there are no zones that create an isolation between the main power supply and the internal bus (TBUS). Only on each terminal has an isolation barrier been created which allows the masses of each terminal to be separated from one another.

3.1.2 System power supply

The MPNC006 requires a 24VDC (±15%) power supply as shown in the figure. The system is protected from the power supply polarity inversion.
Before turning on the device configure the Modbus setting , see chapter: Modbus parameters configurations

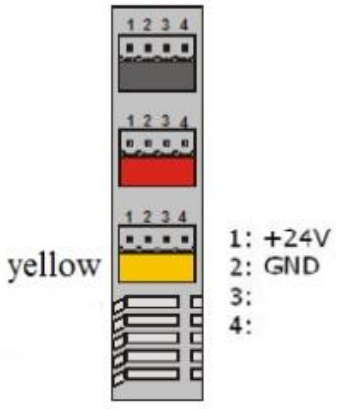

Figure 7

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

3.1.3 Digital outputs power supply

The digital outputs of the MPNC006 can provide up to 2A maximum current at 24V. The maximum allowable current per single output is 500mA. The current supplied by the outputs is supplied by the power supply of the terminal itself: it is the responsibility of the installer to correctly size the power supply to guarantee the necessary current.

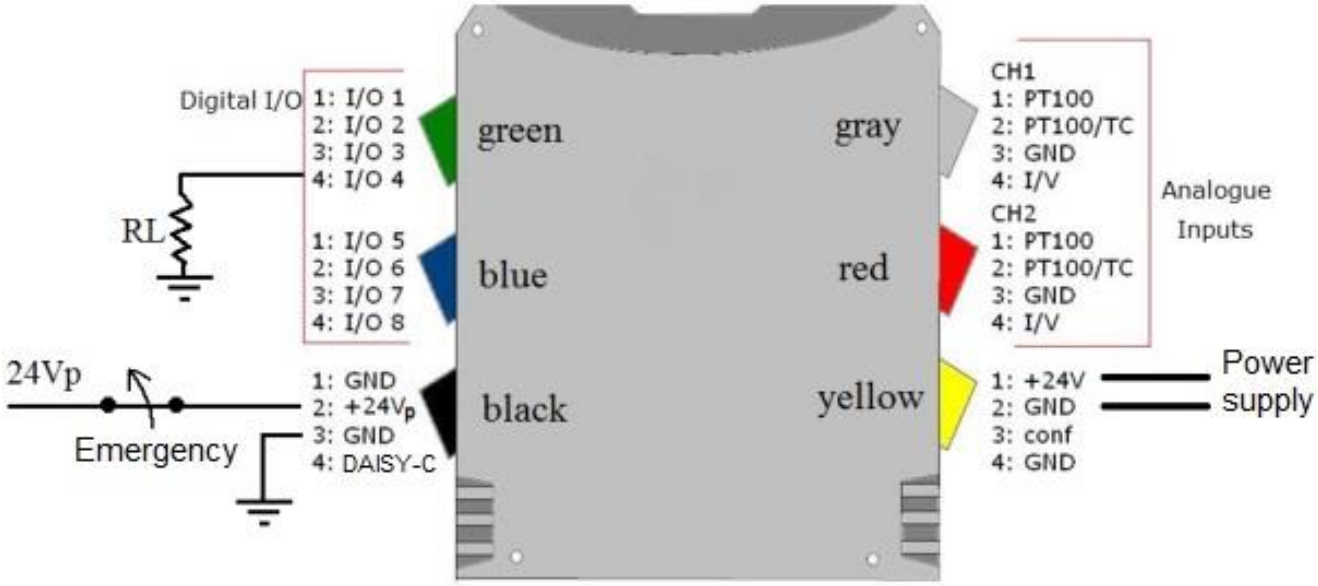

Figure 8

3.1.4 Fuses

The system has no fuses internally; however, for the protection of the input of the MPNC006 power supply, it is recommended to insert a 1 A fuse, while for the power it is necessary to put a 2,5A.

3.1.5 Grounding

The DIN rail on which are mounted the MPNC006 and the terminals must be carefully grounded in order to increase the rejection of electromagnetic disturbances.

3.1.6 Cable screen

To make the system less sensible to disturbances , the connection cable between the operator panel and the MPNC006 should be screened and connected to both devices GND.

3.2 The daisy chain

The communication between the modules take place through a chain that propagates from the MPNC006 till the last terminal. Make the connection as shown in the figure.

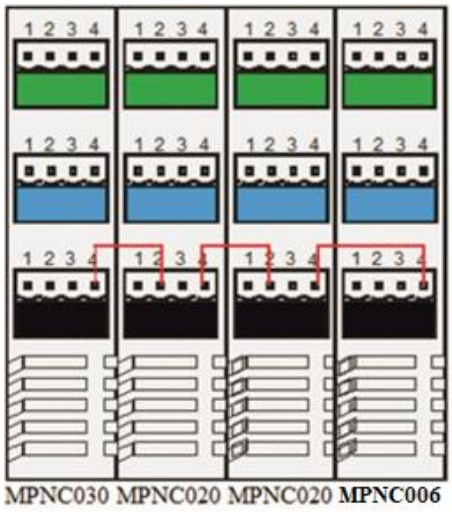

Figure 9: Daisy chain wiring

3.3 I/O Connection

The MPNC006 can be used either alone or connected to a series of MPNC-series terminals and connected via Modbus to a graphical terminal.

On MPNC006 are available:

- 8 Input – Output configurable via software
- 2 Universal analogue inputs configurable via software

The figure below shows the terminal blocks for the connections on the MPNC006.

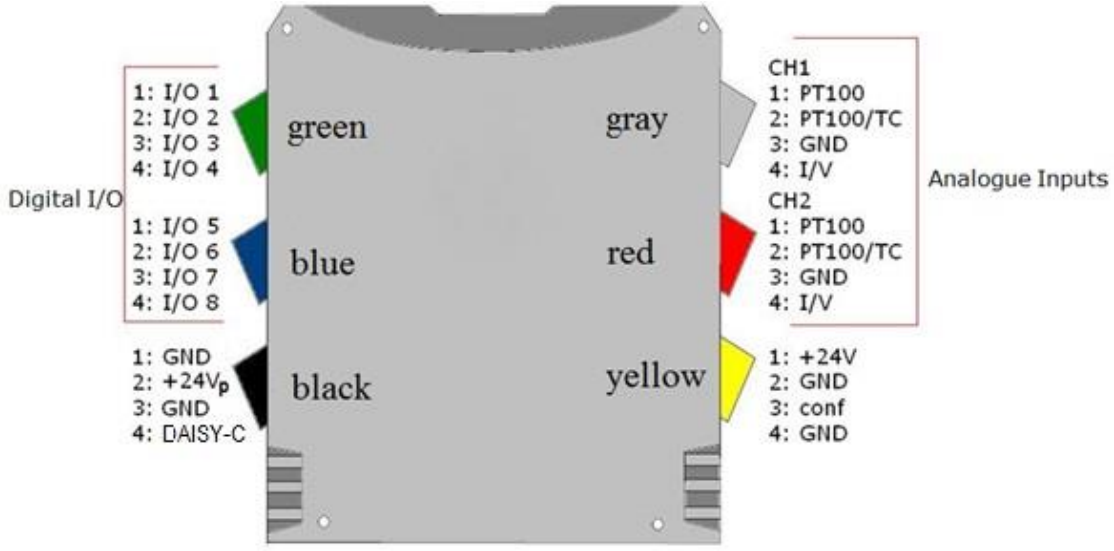

Figure 10: Connections

3.3.1 Analog input connection

The following figure shows the connections required to use the temperature sensors and analog inputs to the MPNC006.

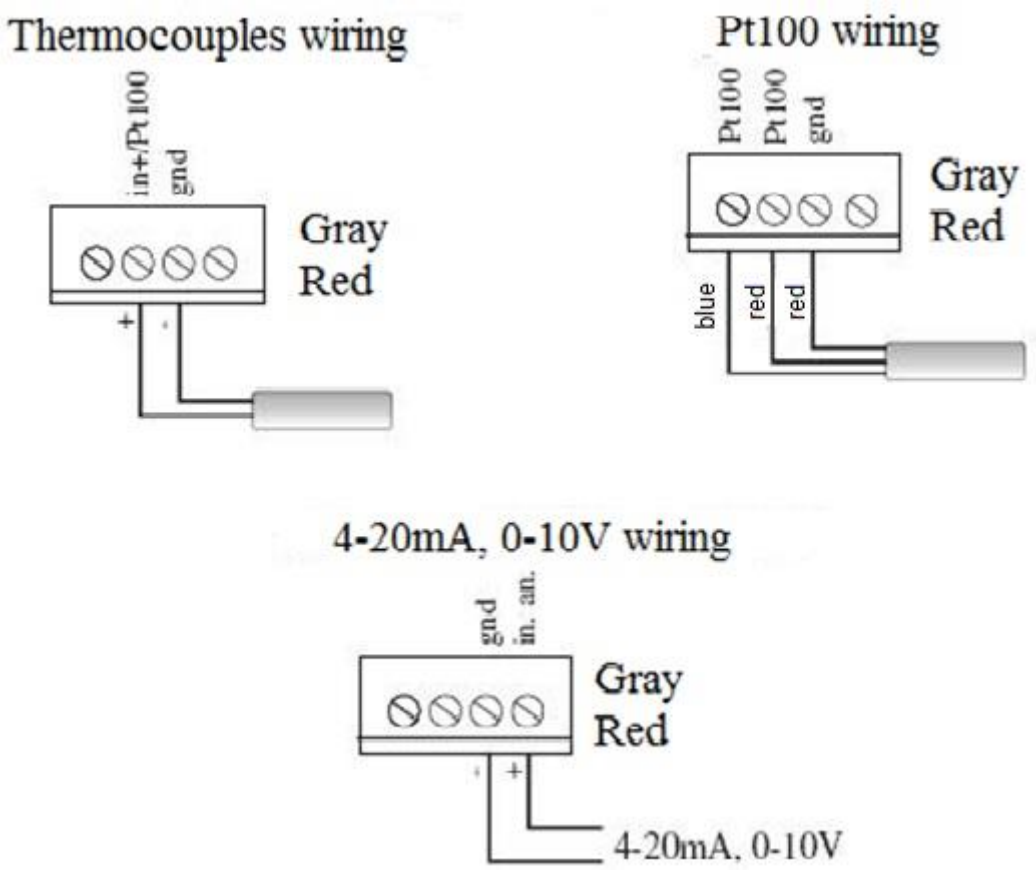

Figure 11: Analog inputs

3.3.2 Digital inputs Connection

If configured as inputs, the digital lines are PNP type.

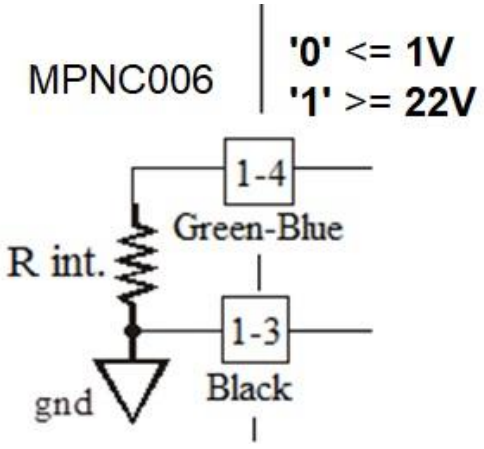

Figure 12: Digital inputs

3.3.3 Digital outputs connection

If configured as outputs, the digital lines are PNP type.

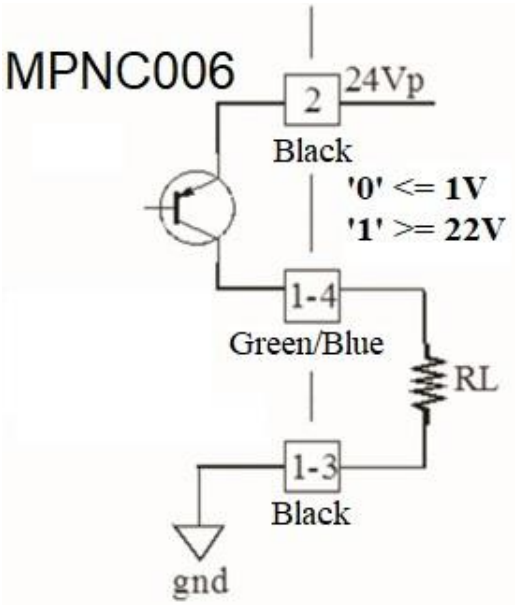

Figure 13: Digital outputs

ATTENTION: bring the 24VDC to terminal 2 of the black terminal block.

3.4 Max Configuration

The number of terminals that can be connected to the MPNC006 is limited by the internal bus line, practically they can be connected to the most:

- 4 MPNC020-01 (digital inputs)
- 4 MPNC020-02 (digital outputs)
- 4 MPNC030 (analogue inputs)
- 4 MPNC035 (analogue outputs)

For a total of:

- 64 digital inputs
- 64 digital outputs
- 16 analogue inputs
- 16 analogue outputs

In addition, the MPNC006's own inputs/outputs must also be taken into account which are: 2 analog inputs and 8 configurable digital lines.

3.5 Modbus parameters configuration

The 8-position dip-switch is used to change the baud rate, the address on the MPNC006 and the stop and parity bit.

Figure 14: Modbus parameters configuration

3.5.1 Address (ID module)

The address is set using switches **3** to **8**, so the valid addresses are 1 to 63.

It is important that the address setting is carried out before the MPNC006 is turned on because one of the first operations carried out at the turn-on is the reading of the DIP status and if it detects that the address is zero it signals the error condition the four flashing LEDs.

The address is coded according to the following table:

S-3	S-4	S-5	S-6	S-7	S-8	ID node
0	0	0	0	0	0	**Input in configuration**
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
0	0	0	1	0	0	4
						…
1	1	1	1	1	0	62
1	1	1	1	1	1	63

To set 1 on the DIP switch, the switch must be set to the ON side.

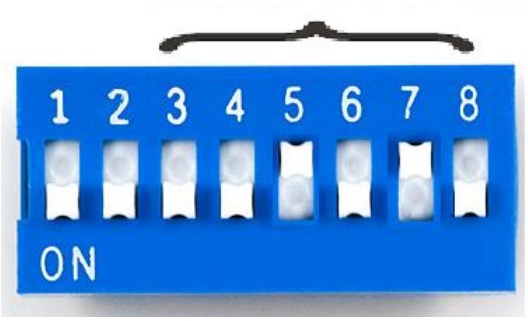

Figure 15: Node address settings (ID)

Turn the device off and on again to make the changes effective.

3.5.2 Baud Rate settings

On the MPNC006 you can set 4 different baud rates. The baud rate is set via the DIP switches 1 to 2. The permitted baud rate values are shown in the following table.

Switch settings		Baudrate
S-1	S-2	
0	0	**9600**
0	1	**19200**
1	0	**38400**
1	1	**57600**

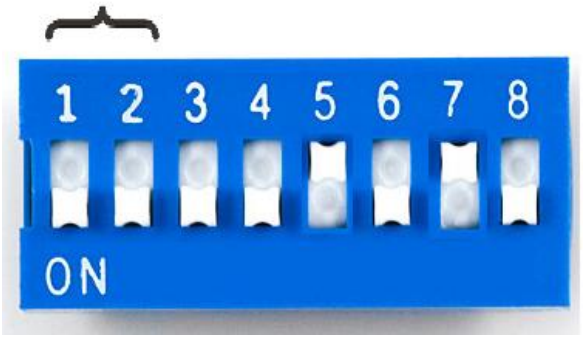

Figure 16: Baud rate setting

Turn the device off and on again to make the changes effective.

3.5.3 Parity and stop bit configuration

If at the start the address dips (module ID) are all zero, the procedure for reading/setting the configuration of the stop, parity and data bits is accessed.

The selection of the configuration type is made by reading dips **1** and **2**.

In this condition the LED_On flashes.

Switch settings		Configuration
S-1	S-2	
0	1	**Parity bit**
1	0	**Stop bit**

Depending on the type of configuration chosen, dips 1 and 2 select the configuration to be programmed.

Parity bit: S1=0; S2=1

Procedure:

- Set all dip switches to 0 except dip 2;
- Power up the instrument;
- Wait a few seconds until the LED_On flashes;
- Carry out the desired **programming** (see below);
- Set dip 2 to 0 and wait for the LEDs: Run, Ain1 and Ain 2 to light up;
- Switch off the instrument;
- Set the Baud rate and the desired address;
- Power up the instrument.

As long as dips 3 to 8 are at 0, the LEDs LED_Run, LED_Ain1 and LED_Ain 2 indicate the current parity configuration according to the following table:

Configuration	LED		
	LED_Run	LED_Ain1	LED_Ain 2
No parity	ON	OFF	OFF
Even Parity	OFF	ON	OFF
Odd parity	OFF	OFF	ON

The parity **programming** is done by setting:

Dip settings		Configuration
S-7	S-8	
0	1	No parity
1	1	Even Parity
1	0	Odd parity

To save the configured value, bits S1 and S2 must be set to OFF.

Stop bit: S1=1; S2=0

Procedure:

- Set all dip switches to 0 except dip 1;
- Power up the instrument;
- Wait a few seconds until the LED_On flashes;
- Carry out the desired **programming** (see below);
- Set dip 1 to 0 and wait for the LEDs: Run, Ain1 and Ain 2 to light up;
- Switch off the instrument;
- Set the Baud rate and the desired address;
- Power up the instrument.

As long as dips 3 to 8 are at 0, the LEDs LED_Run, LED_Ain1 and LED_Ain 2 indicate the current stop configuration according to the following table:

Configuration	LED		
	LED_Run	LED_Ain1	LED_Ain 2
1 stop bit	ON	OFF	OFF
2 stop bit	OFF	ON	OFF

The stop **programming** is done by setting:

Dip settings		Configuration
S-7	S-8	
0	1	1 stop bit
1	0	2 stop bit

To save the configured value, bits S1 and S2 must be set to OFF.

ATTENTION: It is not possible to set the "data bit" differently from the 8 bits as the Modbus RTU protocol requires data in this format.

3.5.4 Reset Configuration

If at the start all the dips are at 0, it is possible to restore the configuration to the default values, the LEDs LED_On, LED_Run, LED_Ain1 and LED_Ain 2 are flashing until the bits from S3 to S8 are brought to 1.

This causes the device to be configured as:

- Stop bit: 1
- No parity

To activate the default configuration it is necessary to turn ON all bits from S3 to S8.

3.6 ModBus Connection

The ModBus interface on the MPNC006 is a 2-wire RS485 serial port, built on removable terminals.

Figure 15: ModBus serial port

3.7 Installation example TPAC1007 / TP1043

This section describes an example for the commissioning of a system composed of:

- MPNC006
- MPNC020
- MPNC030
- Master Modbus (TPAC1007 / TP1043)

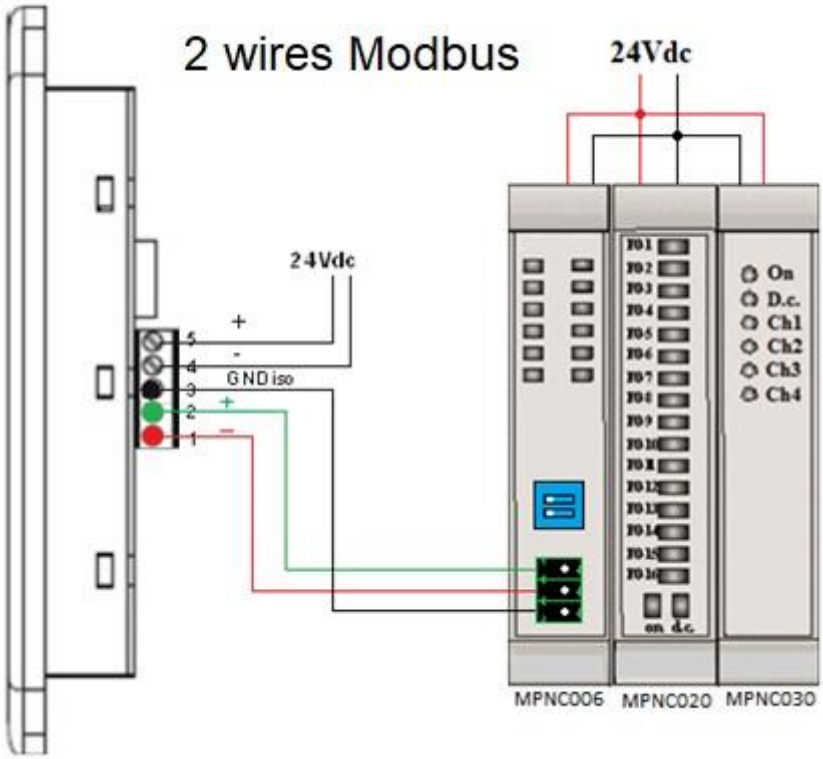

Figure 18: Modbus connection

3.8 Installation example TPAC1008 / TP1070

This section describes an example for the commissioning of a system composed of :

- MPNC006
- MPNC020
- MPNC030
- Master Modbus (TPAC1008 / TP1070)

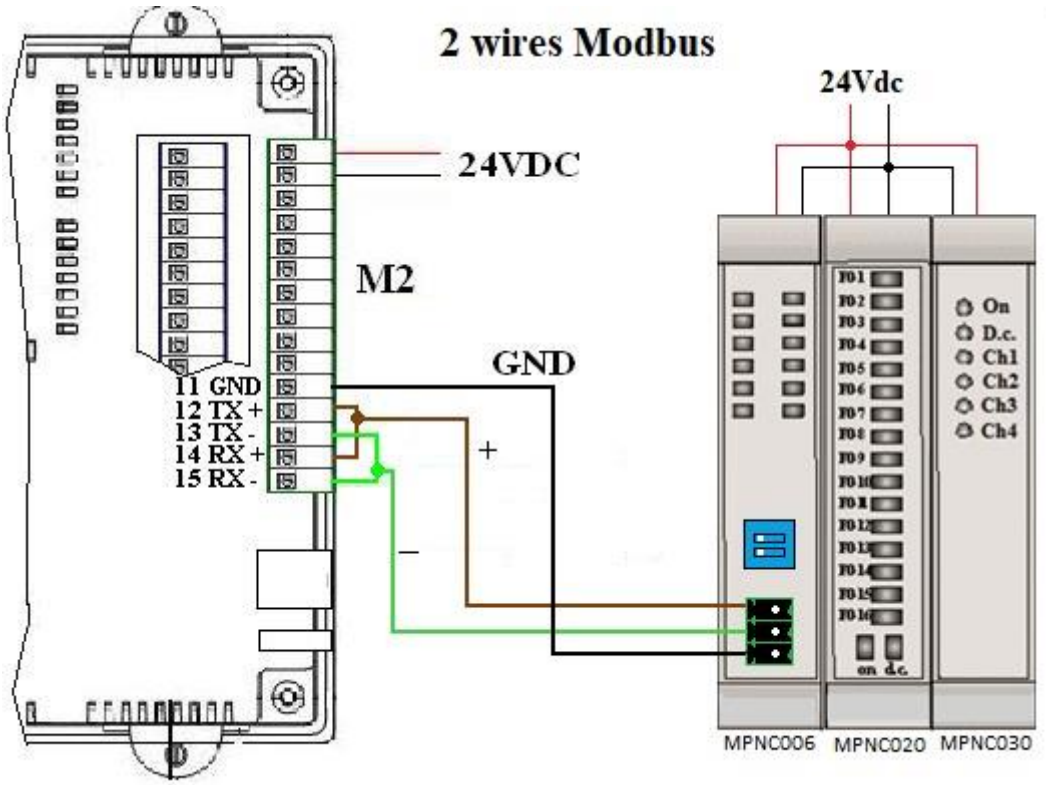

Figure 19: Modbus connection

3.9 Terminating resistence

The two-position dip switch on the top of the unit inserts a 120 Ohm resistor on the RS485 line.

Figure 20: Terminating resistence

3.10 Watchdog

MPNC006 implements a watchdog function that resets the connected digital outputs if no query is received within the time set in the variable XX_Watchdog (expressed in seconds). To disable the watchdog function (default), simply set the variable to zero.

Once the watchdog is triggered on MPNC006, the Run and On LEDs will flash rapidly.

4 RTU ModBus registers map

The MPNC006 is a RTU ModBus bridge, which can interface with MECT terminals such as MPNC020 MPNC030, MPNC035. The following table shows the memory map.

ATTENTION: within the Crosstable Editor it is possible to import directly the variables associated to the registers . Press the right button inside the table and select “Paste MPNC006 Variables”. The "Notes" column of the table below shows the reference variable for the Crosstable (in bold).

Register	Description	Note	Type
1	Curent Baudrate	Default 9600 **MPNC_Baudrate**	R
2	Current Adress	Default 1 **MPNC_NodeID**	R
3	LifeTime	Device power on time (in seconds) **MPNC_HeartBeat**	R
5	MPNC30 Module 1 Configuration channel 1 bit 0..3 channel 2 bit 4..7 channel 3 bit 8..11 channel 4 bit 12..15 Configuration values: Hex 01: 0-20mA Hex 02: 0-10V Hex 03: Thermocouple J Hex 04: Thermocouple K Hex 05: Thermocouple T Hex 06: PT100E (1°C resolution) range: -40°C ÷ +800°C Hex 07: PT100R (0.1°C resolution) range: -40.0°C ÷ +200.0°C Hex 08: not configured	Saved in ritentive variables: 0-10V Default configuration <u>Configuration example in the PLC</u>: Channel 1 = PT100E Channel 2 = 0-10V Channel 3 = Thermocoup. J Channel 4 = Thermocoup.K **MPNC_AnInConf_A := 16#4326;**	R/W

6	MPNC30 Module 2 Configuration: See module 1	**MPNC_AnInConf_B**	R/W
7	MPNC30 Module 3 Configuration: See module 1	**MPNC_AnInConf_C**	R/W
8	MPNC30 Module 4 Configuration: See module 1	**MPNC_AnInConf_D**	R/W
9	Value of Channel 1 module 1: current configuration: values 0..20000(milliampere for 1000) voltage configuration : values 0..10000 (volts for 1000) thermocouple J: (1°C resolution) range: 0 ÷ 600°C thermocouple K: (1°C resolution) range: 0 ÷ 1200°C thermocouple T : (1°C resolution) range: 0 ÷ 400°C PT100E (1°C resolution) range:-40°C ÷ +800°C PT100R (0.1°C resolution) range: -40.0°C ÷ +200.0°C	**MPNC_AnIn_A_1**	R
10	Value of Channel 2 module 1	See description module 1 **MPNC_AnIn_A_2**	R
11	Value of Channel 3 module 1	See description module 1 **MPNC_AnIn_A_3**	R
12	Value of Channel 4 module 1	See description module 1 **MPNC_AnIn_A_4**	R
13	Value of Channel 1 module 2	See description module 1 **MPNC_AnIn_B_1**	R
14	Value of Channel 2 module 2	See description module 1 **MPNC_AnIn_B_2**	R
15	Value of Channel 3 module 2	See description module 1 **MPNC_AnIn_B_3**	R
16	Value of Channel 4 module 2	See description module 1 **MPNC_AnIn_B_4**	R
17	Value of Channel 1 module 3	See description module 1 **MPNC_AnIn_C_1**	R
18	Value of Channel 2 module 3	See description module 1 **MPNC_AnIn_C_2**	R

19	Value of Channel 3 module 3	See description module 1 **MPNC_AnIn_C_3**	R
20	Value of Channel 4 module 3	See description module 1 **MPNC_AnIn_C_4**	R
21	Value of Channel 1 module 4	See description module 1 **MPNC_AnIn_D_1**	R
22	Value of Channel 2 module 4	See description module 1 **MPNC_AnIn_D_2**	R
23	Value of Channel 3 module 4	See description module 1 **MPNC_AnIn_D_3**	R
24	Value of Channel 4 module 4	See description module 1 **MPNC_AnIn_D_4**	R
25	Values of DIGITAL OUTPUTS module 1 MPNC020 Bit 1..16	**MPNC_DigOut_A_1 ….. MPNC_DigOut_A_16**	R/W
26	Values of DIGITAL OUTPUTS module 2 MPNC020 Bit 1..16	**MPNC_DigOut_B_1 ….. MPNC_DigOut_B_16**	R/W
27	Values of DIGITAL OUTPUTS module 3 MPNC020 Bit 1..16	**MPNC_DigOut_C_1 ….. MPNC_DigOut_C_16**	R/W
28	Values of DIGITAL OUTPUTS module 4 MPNC020 Bit 1..16	**MPNC_DigOut_D_1 ….. MPNC_DigOut_D_16**	R/W
29	Values of DIGITAL INPUTS module 1 MPNC020 Bit 1..16	**MPNC_DigIn_A_1 ….. MPNC_DigIn_A_16**	R
30	Values of DIGITAL INPUTS module 2 MPNC020 Bit 1..16	**MPNC_DigIn_B_1 ….. MPNC_DigIn_B_16**	R
31	Values of DIGITAL INPUTS module 3 MPNC020 Bit 1..16	**MPNC_DigIn_C_1 ….. MPNC_DigIn_C_16**	R
32	Values of DIGITAL INPUTS module 4 MPNC020 Bit 1..16	**MPNC_DigIn_D_1 ….. MPNC_DigIn_D_16**	R
33	Not used	**MPNC_Reserved_1**	
34	Not used	**MPNC_Reserved_2**	
35	Cold junction temperature	**MPNC_ColdJunctionT**	R
36	Not used	**MPNC_Reserved_3**	
37	Not used	**MPNC_Reserved_4**	

38	Reboot	If 1 reboot MPNC006 and the terminals chain **MPNC_Reboot**	R/W
39	Connected terminals	The number of the terminalis connected to MPNC006 **MPNC_ModulesNumber**	R
40	MPNC006 analogue input 1 Configuration Value of channel 1 module 1 1 = current configuration: values 0..20000(milliampere for 1000) 2 = voltage configuration: values 0..10000 (volts for 1000) 3 = thermocouple J : (Celsius deg) 4 = thermocouple K : (Celsius deg) 5 = thermocouple T : (Celsius deg) 6 = PT100E (1°C resolution) range: -40°C +800°C 7 = PT100R (0.1°C resolution) range: -40.0°C +200.0°C 8 = thermocouple S : (Celsius deg) 9 = thermocouple B : (Celsius deg) 10 = thermocouple R : (Celsius deg)	**MPNC_AnInConf_1**	R/W
41	Analog input 2 configuration	**MPNC_AnInConf_2**	R/W
42	Analog input 1 Value	**MPNC_AnIn_1**	R
43	Analog input 2 Value	**MPNC_AnIn_2**	R
44	Local digital I/O configuration	1= output 0 = input **MPNC_DigDir_1** **…..** **MPNC_DigDir_8**	R/W
45	Local digital inputs	**MPNC_DigIn_1** **…..** **MPNC_DigIn_8**	R
46	Local digital outputs	**MPNC_DigOut_1** **…..** **MPNC_DigOut_8**	R/W
47	Analog input filter 1	**MPNC_AnInFltr_1**	R/W
48	Analog input filter 2	**MPNC_AnInFltr_2**	R/W
49	Watchdog: sets in seconds the time within which the Modbus master must access the MPNC006, if the time expires the outputs are reset	**MPNC_WatchDog**	R/W
50	Configuration MPNC35 (ANALOGUE	Configuration example in	

	OUTPUT) Module 1 channel 1 bit 0..3 channel 2 bit 4..7 channel 3 bit 8..11 channel 4 bit 12..15 Configuration values : Hex 01: 0-20mA Hex 02: 0-10V	the PLC: Channel 1 = mA Channel 2 = mA Channel 3 = V Channel 4 = V **MPNC_AnOutConf_A :=** **16#2211;**	
51	Configuration MPNC35 Module 2: See module 1	**MPNC_AnOutConf_B**	R/W
52	Configuration MPNC35 Modulo 3: See module 1	**MPNC_AnOutConf_C**	R/W
53	Configuration MPNC35 Module 4: See module 1	**MPNC_AnOutConf_D**	R/W
54	Not used	**MPNC_Reserved_6**	
55	Value of Channel 1 module 1 Current configuration: values 0..20000(milliampere for 1000) Voltage configuration : values 0..10000	**MPNC_AnOut_A_1**	R/W
56	Value of Channel 2 module 1	**MPNC_AnOut_A_2**	R/W
57	Value of Channel 3 module 1	**MPNC_AnOut_A_3**	R/W
58	Value of Channel 4 module 1	**MPNC_AnOut_A_4**	R/W
59	Value of Channel 1 module 2	**MPNC_AnOut_B_1**	R/W
60	Value of Channel 2 module 2	**MPNC_AnOut_B_2**	R/W
61	Value of Channel 3 module 2	**MPNC_AnOut_B_3**	R/W
62	Value of Channel 4 module 2	**MPNC_AnOut_B_4**	R/W
63	Value of Channel 1 module 3	**MPNC_AnOut_C_1**	R/W
64	Value of Channel 2 module 4	**MPNC_AnOut_C_2**	R/W
65	Value of Channel 3 module 3	**MPNC_AnOut_C_3**	R/W
66	Value of Channel 4 module 3	**MPNC_AnOut_C_4**	R/W
67	Value of Channel 1 module 4	**MPNC_AnOut_D_1**	R/W
68	Value of Channel 2 module 4	**MPNC_AnOut_D_2**	R/W
69	Value of Channel 3 module 4	**MPNC_AnOut_D_3**	R/W
70	Value of Channel 4 module 4	**MPNC_AnOut_D_4**	R/W
80	Release firmware MPNC006	**MPNC_FirmwareVer**	R
82	Status word	**MPNC_StatusWord**	R

5 Status led

The operative conditions of the MPNC006 are indicated by the LEDs present on the rear part of the device.

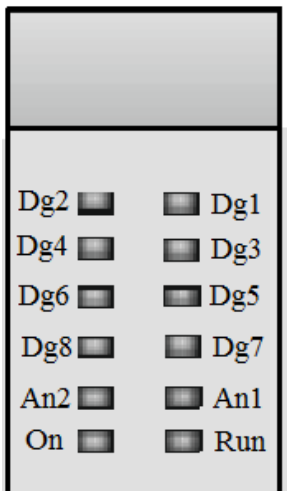

Figure 16: Led

LED	Colour	Signification
On LED	Green	Indicate a command reception from the master
Run LED	Red	If On indicates that the communication with terminals is established
An-1 LED	Red	Analog channel 1 overflow Led
An-2 LED	Red	Analog channel 2 overflow Led
Dg1-Dg8 LED	Red	Digital I/O state Led

5.1 On Led

ON when starting (switched on).

Flashes each time a command is received from the Modbus master.

5.2 Run Led

The run led has the task to signal if the communication between MPNC006 and the connected terminals is working correctly or if errors have occurred.

Flashing	TBUS error
Fixed: On	TBUS configured
Fixed: Off	TBUS not configured

5.3 Overflow/configuration Led

The overflow LEDs indicate whether the signals on the analog inputs have exceeded the permitted values. The permitted value depends on the configuration set.

Moreover, during the start phase, the overflow LEDs indicate the configurations according to the DIP switch setting. See chapter “Modbus parameters configuration”.

5.4 Digital I/O Led

The eight LEDs of the digital I/O indicate if there is a voltage of 24V on the associated line.