Distributed I/O Modules

English

User's Manual

PYRO CONTROLE
CHAUVIN ARNOUX GROUP

Index

1. Manual purpose

The purpose of this Manual is to provide the User with all information necessary to use the PDM Line modules.
This Manual contains the general characteristics and features to know and use the PDM modules.

2. Manual validity

This Manual contains informations concerning to PDM Line, in particular: Constructor data identification, electrical and communication connections, functioning, RS485 registers, decommissioning and disposal.
The PDM Line modules are shown in the following table.

PDM Line module	Description	Protocol
PDM-10DI	10-CH Digital Input module / RS485	ModBUS
PDM-5RO	5-CH Digital output module / RS485	ModBUS
PDM-10DO	10-CH digital output module / RS485	ModBUS
PDM-DIO	8-CH, 6 digital inputs - 2 digital outputs control module	ModBUS
PDM-4AI	4-CH analog input module / RS485	ModBUS
PDM-8AI	8-CH analog input module / RS485	ModBUS
PDM-3AO	3-CH analog output module / RS485	ModBUS
PDM-4TC	4-CH thermocouple input module / RS485	ModBUS
PDM-8TC	8-CH thermocouple input module / RS485	ModBUS
PDM-4RTD	4-CH RTD input module / RS485	ModBUS
PDM-PID	1-CH universal analog I/O Modbus module with PID control	ModBUS

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3. PDM Line standards

The PDM Line modules comply with the CEE 2004/108/CE.

The buses communication of PDM Line comply the following standards:
-EIA RS-232 (RS-232 serial interface for bus communication)
-EIA RS-485 (RS-485 serial interface for bus communication)

4. Distributed automation and Modbus

4.1. Distributed systems

At the same time and in very large spaces, an industrial automation system have to manage:
- **many sensors;**
- **many actuators;**
- **many control subsystems;**
- **outwards communication;**
- **data storage (the data will be used to subsequent processing);**
- **machine and human safely.**

In particular, an industrial automation system is always constituted by:
- **a microprocessor system: CPU, memories, timers, remote interface systems (RS485, RS232, TCP/IP, etc…), human interface systems (keyboards, displays, etc…);**
- **a capture-data system, which is able to acquire analog or digital signals, depending on the control application;**
- **a transducer system, which allows to carry out the control signals.**

For industrial automation, there are two types of microcontroller-based control systems:
- **embedded systems: integrated systems into a single electronic circuit;**
- **distributed systems: more electronic circuits connected to a single bus communication.**

A communication bus is a set of electrical cables through which informations (address, data, signals, etc…) are transmitted.

Embedded systems allows to optimize the control system and to obtain high performance, but they have high cost of design (hardware, software) and it isn't possible to adapt them for other automation systems.
Instead, distributed systems have low cost of design (software) and it is possible to adapt them for other automation systems, at the price of a lower optimization. Moreover, distributed systems allows:
- **to connect to a single bus a very high number of devices with variable degree of intelligence;**
- **to implement control systems with electrical strength through a simple programming.**

In this context, Pyrocontrole proposes the PDM Line: Distributed systems with ModBUS-RTU communication protocol based on RS232/RS485 serial interface. These systems are able to capture input signals (voltage, current, temperature from thermocouple, from thermoresistance, etc…) **and to provide output signals** (voltage, current, by relay, by mosfet, etc…)**, to process analog and digital signals for industrial automation control system** (drives, actuactors, etc…).

4.2. Why ModBUS protocol?

ModBUS is a high-level protocol and one of the most widespread standards used for the communication between control devices. The main features of the ModBUS protocol are shown in the following points:

- it's easy to perform electrical connections;
- it's easy to perform setting parameters;
- it's easy to perform integration on supervision, control and automation systems;
- good performance;
- there aren't hardware constraints.

The ModBUS protocol defines the format and communication modality between a single master and one/several slaves, which responds to the queries come from master by transactions; the ModBUS protocol doesn't define the interpretation of the data (contents of registers), but it defines:

- communication modality between master and slaves;
- identification modality between transmitter and receiver;
- data interchange modality;
- errors.

The ModBUS protocol implemented in PDM Line allows the single query/single response transaction, with reference to a single slave.

 The ModBUS protocol implemented in PDM Line does not allow the broadcast transaction.

The electrical data interchange is based on half-duplex transmission and the ModBUS protocol allows connection to the modules by two alternative modalities:

- point to point modality (RS232 serial interface)
- multipoint modality (RS485 serial interface)

The ModBUS protocol is used to perform communications between intelligent systems, for example: address identification of a data packet or module, implementation of control actions, response transmission, etc…
The Modbus protocol is aligned with many industrial automation products: PLCs, Human Machine Interfaces, Temperature Controllers, data registers, etc., which are able to communicate with a common supervisor easily.

4.3. ModBUS protocol description

Field buses are used as systems to transmit the data, alternative to the analog signals; in particular, the ModBUS protocol is used to connect a supervisor computer to a Remote Terminal Unit (RTU) and to control a data acquisition system (SCADA, Supervisory Control And Data Acquisition).
The ModBUS protocol has been developed to allow the information interchange between control modules in industrial field, through a Master-Slave hierarchy: the slave modules are connected to a same bus communication and each is identified by its address. These modules are queried by a single Master periodically (polling); only the master can start a transaction through RS485 bus communication.
Master devices are Personal Computer, controller, HMI. Slave devices are used to detect signals or to perform some operations. Master device sends data-packet (query) to the Slaves: as each device is associated with a univocal address, only one device will respond with the required data.
There are two versions of the ModBUS protocol, which differ for the different numeric data representation (mostly): ModBUS RTU and ModBUS ASCII.
- The ModBUS ASCII has a redundant data representation (the data representation is more readable by persons).
- **The ModBUS RTU has a hexadecimal-base data representation (the data representation is more compact; moreover ModBUS RTU is implemented using CRC, so it is safer).**

Most important ModBUS RTU specifications are shown in the following table.

Characters	Binary values between 0-255
Start of frame	Silence of 3.5 times
End of frame	Silence of 3.5 times
Initial bit	1
Data bits	8
Pause in message	1.5 times of a byte
Check redundancy	CRC (Cyclic Redundancy Check)

ModBUS RTU allows transmiting through bus a quantity of information greater than ModBUS ASCII, while ModBUS RTU is safer. Communications are managed by a master and they are half-duplex; communications between slaves are not possible.

5. RS232 and RS485 serial interfaces

Serial data transmission has many advantages, if it is compare to analog transmission:
- **More robust error check**
- **More noise immunity**
- **More precision data interchange**
- **It is possible to send through bus any information type**
- **It is possible to implement advanced function to control and configure the devices.**

In particular, the serial interface is the physical medium that realizes a serial data transmission and implements the ModBUS protocol. There are two types of physical interface: RS232 or RS485. The main features of the ModBUS protocol interfaces are:
- *Serial***: the information bits are sent in sequence (one by one) through a wire.**
- *Asynchronous***: the information bits are transmitted without additional bits necessary to synchronize the data interchange between transmitter and receiver. The synchronization between transmitter and receiver is implemented by a pause in the data packet: if the time of bus-communication pause is greater than 3.5 character time, the following received byte will be interpretated as an address (first byte of a new data packet) by receiver.**

5.1. RS232 serial interface

The electrical medium of the ModBUS protocol is the RS232 serial interface: it is based on a not-balanced communication line with a “Point to point” master/slave connection. The voltage signal is measured with reference to a common point. In particular, the amplitude of digital signal through RS232-bus communication can be: -12V or +12V. The value -12V corresponds to “1” logic value (mark), instead +12V corresponds to “0” logic value (space).

Standard	ANSI/EIA-232-D (see “EIA RS-232 specification”)
Transmission	Asynchronous, baseband
Transmission type	Not balanced
Number of transmission line	1
Logic value	Logic value is the voltage referred to the signal ground SG
Max distance	15 m
Number of transmitter	1
Number of receiver	1
Logic value “0”	+12V
Logic value “1”	-12V

For small distances, signal ground (reference) is uniquely defined; for this reason, use RS232 cable for distances less than 15 m.
Tipically, for the PDM modules, the RS232-bus sampling time is equal to 417 µs because unchangeable baud-rate is 2400 baud (1/2400 baud=417 µs). The unchangeable configuration for the RS232-bus communication parameters is shown in the following table.

Communication	**Data structure of register**	**Baud-rate**	**Address of node**
RS232	8N1	2400	1

Data structure of register equal to 8N1 means that the register is structured as follows: 8 data bits, no parity control (N), 1 stop bit.

On the PDM modules, the RS232 interface is intenteded for settings purpose only, not for normal use

5.2. RS485 serial interface

The electrical medium of the ModBUS protocol is the RS485 serial interface: it is based on a differential and balanced communication line, with characteristic impedance equal to 120 Ω. The voltage signal associated to a transmitted bit is the potential difference between two wires: A and B, with reference to a ground wire (GND). In every time, only one transmitter is enabled. Moreover, it is necessary a master that manages which device can transmit data.

Standard	ANSI/EIA-485 (see “EIA RS-485 specification”)
Transmission	Asynchronous
Transmission type	Balanced
Number of transmission line	1
Logic value	Logic value is the voltage referred to the voltage difference between two values (not referred to signal ground)
Max distance	1200 m (max shunt derivation: 2 m)
Number of transmitter	>1
Number of receiver	>1

The RS485 serial interface allows data transmission through bus with length greater than RS232 serial interface case. Moreover, the data transmission through RS485-bus communication is more robust (more noise immunity) than RS232-bus communication.
Tipically, for the PDM modules, the RS485-bus sampling time is equal to 26 µs because changeable baud-rate is 38400 baud (1/38400 baud=26 µs). The changeable configuration for the RS485-bus communication parameters is shown in the following table.

Communication	Data structure of register	Baud-rate	Address of node
RS485	8N1	1200; 2400; 4800; 9600; 19200; 38400(D); 57600; 115200	From 1(D) to 255

(D) Default value for each module of PDM Line

Data structure of register equal to 8N1 means that the register is structured as follows: 8 data bits, no parity control (N), 1 stop bit.

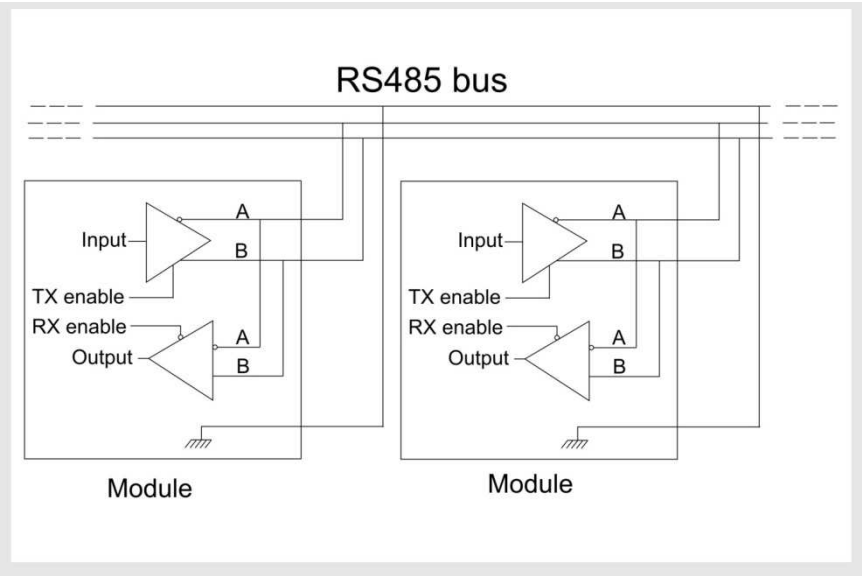
5.3. Parity

The parity is a control system to manage communication errors: infact coupled electrical noises through bus communication correspond to a change of one bit/some bits. The parity allows detecting if there is or there isn't a change of a single bit (error) in data packet but doesn't allow detecting if there is or there isn't a change of more bits (error) in data packet. If the parity is enabled, it defines the number of "0" and "1" logic values transmitted through bus; this number can be configured: even or odd.

This control system allows detecting possible communication errors, but it can not to correct them. To implement this correction, there are more advanced control system (CRC) based on complex algorithms.
The PDM Line modules allow managing the parity; in particular, there are three alternative modalities to configure the parity: no parity, even parity, odd parity.

5.4. RS485-bus electric topology

The electrical topology used to connect the PDM modules to RS485 bus is shown in the following figure.



As shown, there are three wires assigned to communication: A, B and GND. This topology allows an half-duplex transmission between electrical-equivalent modules (this means that tx and rx are not enabled at the same time). The PDM modules have an integrated transmitter and an integrated receiver.
With reference to RS485 standard, max 32 receivers with RS485-port input impedance equal to 1 ”load” can be connected to bus communication, max 64 receivers with RS485-port input impedance equal to 1/2 ”load” can be connected to bus communication, and so on.

$$32 = R \cdot U = 32 \cdot 1 = 64 \cdot \frac{1}{2} = 128 \cdot \frac{1}{4}$$

Where R is the number of the receivers and U is the unit load for each type of receiver.
Connections of receivers with input impedance different from each other are allowed: for example,

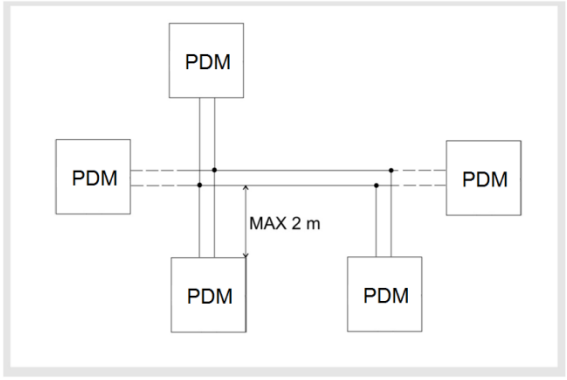
$$32 = R1 \cdot U1 + R2 \cdot U2 = 64 \cdot \frac{1}{4} + 32 \cdot \frac{1}{2}$$

WARNING

Connect the master module to slave modules using chain connections; in this configuration, **it’s forbidden** to perform length connection over 1200 m and derivations over 2 m.

NOTE!

It’s forbidden to connect the slave modules to the master module using star connections.



WARNING

The RS485 bus is a transmission line, so characteristic-impedance matching must be performed. Infact if a transmission line is mismatched, the transmitted signal isn’t absorbed by its load completely: a part of this signal is reflected back through transmission line and it can cause interferences.
To avoid reflection phenomena through RS485-bus communication (for long cable mainly), it is necessary to match characteristic-impedance. This operation consists to enable the RS485-terminator resistance in PDM Line modules. This operation has the following weakness points:

- the current absorption is greater;
- the RS485 voltage-signal damping is greater.

To choose if it’s necessary or it isn’t necessary to match characteristic-impedance, look on the baud-rate and RS-485 cable length.

A pratical example

In the following hypothesis:

- RS-485 bus length is equal to 1200 m (EIA RS-485 max value)
- RS-485 signal propagation velocity through RS485 bus cable is equal to 70% of light velocity

the RS-485 signal takes 5.7 µs to complete a round trip.

$$t = \frac{1}{0.7 \cdot c} \cdot 1200 = 5.7\ \mu s$$

If the baud-rate is equal to 4800, the bit time is equal to 208 µs: since 208 µs is greater than $10 \cdot 5.7$ µs, characteristic-impedance matching is not required.

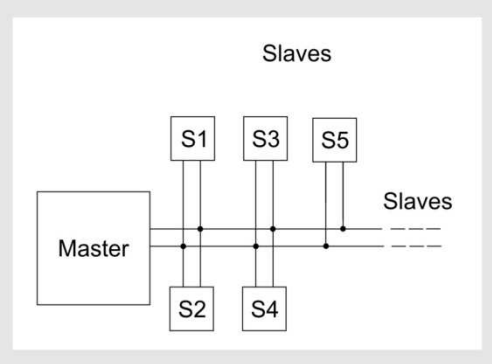
If the baud-rate is equal to 115200, the bit time is equal to 9 µs: since 9 µs isn't greater than $10 \cdot 5.7$ µs, characteristic-impedance matching is required.

In the following table are shown some examples about the use of RS485 terminator.

Bus length	Time to complete a round trip	If Baudrate=4800 (bit time=208µs)	If Baudrate=115200 (bit time=9µs)
1200 m	5.7 µs	208 µs >> 57 µs (**TERMINATOR CAN BE OFF**)	9 µs < 57 µs (**TERMINATOR MUST BE ON**)
600 m	2.9 µs	208 µs >> 29 µs (**TERMINATOR CAN BE OFF**)	9 µs < 29 µs (**TERMINATOR MUST BE ON**)
300 m	1.43 µs	208 µs >> 14 µs (**TERMINATOR CAN BE OFF**)	9 µs < 14 µs (**TERMINATOR MUST BE ON**)
10 m	47.6 ns	208 µs >> 480 ns (**TERMINATOR CAN BE OFF**)	9 µs > 480 ns (**TERMINATOR MUST BE ON**)
1 m	4.76 ns	208 µs >> 48 ns (**TERMINATOR CAN BE OFF**)	9 µs >> 48 ns (**TERMINATOR CAN BE OFF**)

To match characteristic-impedance in RS485-bus communication (for long cable mainly), execute the following operations (with reference to the following figure, which shows an example of a ModBUS network):

- switch the "RS485-terminator" resistance in Master and Slave5 modules to "ON" (see the following figure: Master and Slave5 modules are the two opposite ends of the RS485-bus communication)
- switch the "RS485-terminator" resistance in Slave2-Slave4 modules to "OFF" (see the following figure: Slave2-Slave4 modules are connected to RS485-bus communication and they allow data transmission)



5.5. Cable selection

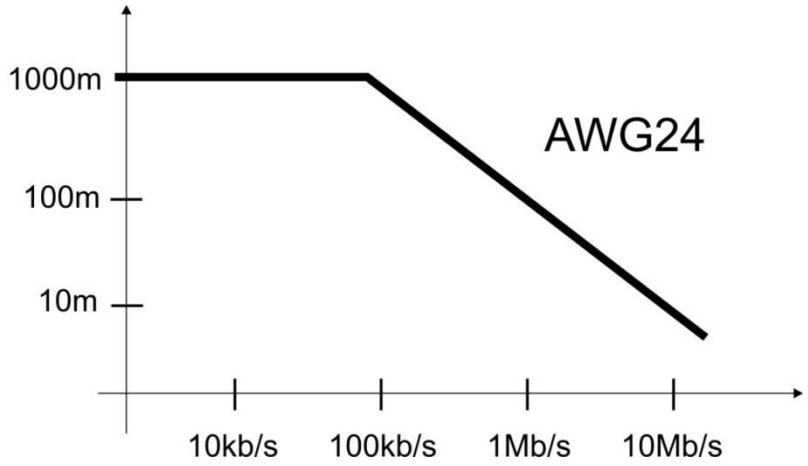
Cable selection is important especially for plants that require high baud rate, high distance and in very-noise environment.

In these conditions, the signal through the cable decreases its amplitude because there is a non-zero resistance and there are losses due to dielectric-type used for insulation; tipically, a twisted pair cable is used.

To implement a RS485-bus communication, three cables are necessary: two for signal (A, B), one for reference (GND). Moreover, for high baud rate, is important to watch the characteristic impedance.
The sizing of RS485-bus electrical cable has to look on:

- number of the wires (for RS485-bus: A, B, GND)
- cable characteristic impedance (tipically: 120 Ω)
- shielding

Tipically, the RS485-bus communication is constituted by a twisted-pair cable AWG24 or AWG22.
Cable manufacturers provide specific diagrams that show cable length in function of the required baud rate (example: see the following figure for AWG24). For this type of diagrams it is important to consider the operative conditions used to obtain these ones (signal type, RS485 terminator).



5.6. Shielding

In very noised industrial plants and/or for long distances (> 100 m), use a shield twisted-pair cable. To avoid closed rings, connect the shield to the GND in only one point of the network. Moreover, the shielded cables are used to have a mechanical strength greater than no-shielded cables mainly too.

NOTE!

It's forbidden to use the shield as ground connector.
High-frequencies: for each cable, connect the shield to the GND at both of ends, but ground connection have to be performed to one point (to avoid loops); for very-noised environment, connect every GND to ground using a 10 nF 400 V capacitance.
In the following table are shown the RS485 communication cable features.

Distance between Master and Slave – RS485 communication cable length	RS485 communication cable features
Few meters	No-shielded cable
<100m	Twisted and shielded cable
>100m	Special cable (example: CEAM CPR 6003 or BELDEN 9841)

6. Message format

With reference to the PDM Line, the ModBUS transactions always involving the master module (it manages the RS485-bus communication) and a single slave to each data interchange.

6.1. Data communication modality

The PDM Line has been developed using ModBUS RTU protocol, which is based on a communication message constituted by: 1 start bit (unchangeable), 8 data bits, 1 parity bit (optional), 1 or 2 stop bits and a bit sequence to control the data packet (CRC-16, 16 bit Cyclic Redundancy Checksum). The structure of a data packet is shown in the following figure:

Module Address	Functional Code	Data Field	CRC-16

- Module Address **(first byte). When a Master node requires the data, it sends (through bus) a data packet with Module Address equal to the queried-Slave address;**
- Functional Code**: it represents the function to execute or has already been executed;**
- Data Field **(2 bytes to each value). it represents all the data necessary to detail the operation to execute;**
- CRC-16.

 With reference to the PDM Line, the module address can't be "0".

A typical communication through ModBUS consists in three steps:

1) **a node makes a request to another node;**
2) **execution of actions necessary to satisfy the request;**
3) **return to initial node of the resulting informations.**

ModBUS functional code

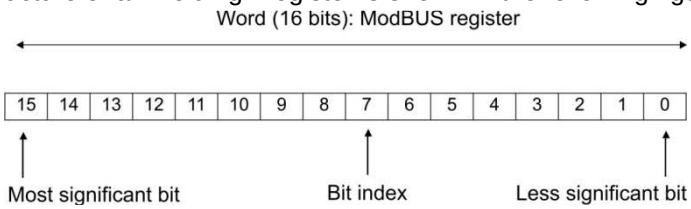
The module is designed to communicate as slave according to the ModBUS-RTU protocol rules. The functional codes supported by PDM Line modules are shown in the following table.

Functional code	First register address	Name	Functional code	Name
01	00001	Read Coil Status	05	Force Single Coil
02	10001	Read Input Status	06	Preset Single Register
03	40001	Read Holding Register	15	Write Multiple Coils
04	30001	Read Input Register	16	Write Multiple Registers

 Some PDM modules do not support all functional codes shown in the previous table.

 To each functional code there is a registers range, and the first register has physical address equal to 0000. In particular, in nxxxx notation: "n" means functional code, "xxxx" means address register (for example: if functional code=03, the first address is 40001).

In particular, the structure of a «Holding» register is shown in the following figure:



Many PDM modules are able to manage floating point data format, with reference to Holding Registers:

- to have at disposal an amount information greater than word data format;
- to identify very different type of numbers at the same time (for example: 23.367°C and 5.23e-6).

In this case, the content of two 16 bits-registers with consecutives addresses needs to be interpreted as a 32 bits-floating point number:

Holding register address	Interpretation (Reverse floating point)
4xxxx	More significant 16 bits, with reference to a FP-32bit number
4xxxx+1	Less significant 16 bits, with reference to a FP-32bit number

Holding register address	Interpretation (Floating point)
4xxxx	Less significant 16 bits, with reference to a FP-32bit number
4xxxx+1	More significant 16 bits, with reference to a FP-32bit number

To understand the RS485 registers table (for each module), see the following table.

LEGEND OF REGISTERS TABLE	
Term	**Meaning**
/	The number in registers table require a decimal-base interpretation
0x	As prefix, the following number N requires a hexadecimal-base interpretation
0b	As prefix, the following number N requires a binary-base interpretation
M(L)SB	More (Less) significant 8 bits, with reference to one word (=16 bit register)
FP 32bit	The content of two 16 bits-registers with consecutive addresses needs to be interpreted as a 32 bit-floating point number. The register description and scale range refer to the FP 32 bit number
M(L)SW	More (Less) significant 16 bits, with reference to a FP 32 bit number
Bit [x:y]	Bit sequence between x and y (x, y included), with reference to one 16 bits register (=1 word). If the term “Bit [x:y]” does not appear in a line, the register description refers to full 16-bits sequence in connection with this word (“Bit [15:0]”)
/	For registers with “R/W” (reading/writing) equal to “R”, the terms in column “Default” represent the unchangeable contents of these ones

6.2. Error management in ModBUS protocol

There are two types of error in ModBUS protocol:
1) Transmission Errors**: these errors change the message format, message parity (if there is the parity) or CRC. A drive detects if there is a transmission errors into message: it considers "invalid" the message and it does not reply;**
2) Operative Errors**: if there is an operative error, the function can't be executed and the drive replies with an exception message. This message has: drive address, required function code, error code and CRC.**

An example:
A master requires the content of Coil 1180 (=0x049C) register at drive address 11 (=0x0B); read outputs status has "0x01" function code.

ADDR	FUNCTION CODE	DATA start (Addr HI)	DATA start (Addr LO)	DATA Bit # HI	DATA Bit # LO	CRC HI	CRC LO
0x0B	0x01	0x04	0x9C	XX	XX	XX	XX

The Coil 1180 register does not exist into slave: the slave replies with a message that contains the "Illegal data address" error code ("0x02") and function code "129" (=0x81).

ADDR	FUNCTION CODE	DATA Exception code	CRC HI	CRC LO
0x0B	0x81	0x04	XX	XX

As a rule, ModBUS protocol allows to manage four types of exception code:

Exception Code	Name	Meaning
01	Illegal function	The received function code (it is "0x01" in the previous example) does not correspond to a function that can be executed in addressed slave (it is "0x0B" in the previous example)
02	Illegal data address	The address in DATA field (it is "0x049C" in the previous example) does not correspond to a register in addressed slave (it is "0x0B" in the previous example)
03	Illegal data value	The data value to assign does not correspond to a valid value with reference to this register
07	Negative acknowledgement	The function can be executed or attempt to write in a only-read parameter

7. PDM-Studio

To configure the PDM modules, it is possible to use PDM-Studio software, downloadable from www.pyro-controle.com; the configuration can be performed by RS232 or RS485 bus communication.

8. The PDM line Modules

The PDM Line is a component line developed for automation and industrial-processes control: it represents an effective and reliable mean used to manage machine automation and small-medium size plants.

8.1. The common strengths of PDM Line

The PDM modules have interesting strengths:
- 1500 Vac isolation between: inputs, outputs, RS485-bus communications, power supply
- Configuration of the module (node) address and baud-rate by Dip-Switches
- It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply
- Switching automatically RS485 to RS232 or vice versa
- Diagnostic available on front-side panel
- Integrated ModBUS protocol.

Each module of PDM Line is compact, integrated and reliable; it allows:
- the acquisition/generation of each industrial signal type;
- the data-processing by effective supervision and control systems.

The wide range of modules allows managing all I/O signal type: analog and digital, voltage and current, from thermocouple and thermo-resistance, relay and MOSFET. Moreover, these components provide PID controller, input filter, pulse counter, etc.. through bus communication (RS232 or RS485 serial interface), web-control, etc….

8.2. The most common types of analog input

PDM Line modules allow signal acquisition from

Voltage generator	DC voltage signal (up to 10 V) supplied by active sensors, proportional to the physical quantity to measure (flow, pressure, speed, etc…)
Current generator	DC voltage signal (up to 20 mA) supplied by active or passive sensors, proportional to the physical quantity to measure (flow, pressure, speed, etc…)
Potentiometer	Voltage value between two limits; it is given as percent value
Thermo-couple (TC)	A TC is a couple of electric conductors with different material, united between them (hot junction). The connection with module causes another one (cold junction). Every junction causes a potential difference. These parameters allow to calculate hot junction absolute temperature
Thermo-resistance (RTD)	A RTD is a particular conductor material: its resistive value depends on the temperature change

8.3. The most common types of analog output

PDM Line modules can supply voltage signal and current signal (active and passive).

Active signal	Current loop is powered externally; to measure current value, a passive shunt (resistance) is used
Passive signal	Current loop is powered internally; to measure current value, the module supplies the sensor

8.4. Common characteristics of PDM Line

Each PDM Line module is designed to ensure an accurate measure: noises from field must affect the measures at minimum possible. Moreover, the module must be protected against the electrical discharge. To obtain these conditions, a galvanic isolation is required: each PDM Line module has a 1500 Vac isolation between most important internal circuits (inputs, outputs, RS485, power supply, etc…).

MODULE CASE	
Case-type	PBT, black
Dimensions	Width W = 100 mm, Height H = 112 mm, Depth D = 17.5 mm Width W = 100 mm, Height H = 112 mm, Depth D = 35 mm (PDM-SUPPLY only)
Terminal board	Removable 3-way screw terminals: pitch 5.08 mm, sections 2.5 mm^2
Protection class	IP20 (International Protection)
ENVIROMENTAL CONDITIONS	
Operating temperature	-10°C ... +65°C
Humidity	30 ... 90% to 40°C not condensing (during operation)
Max environmental pollution degree	2
Storage temperature	-20°C ... +85°C

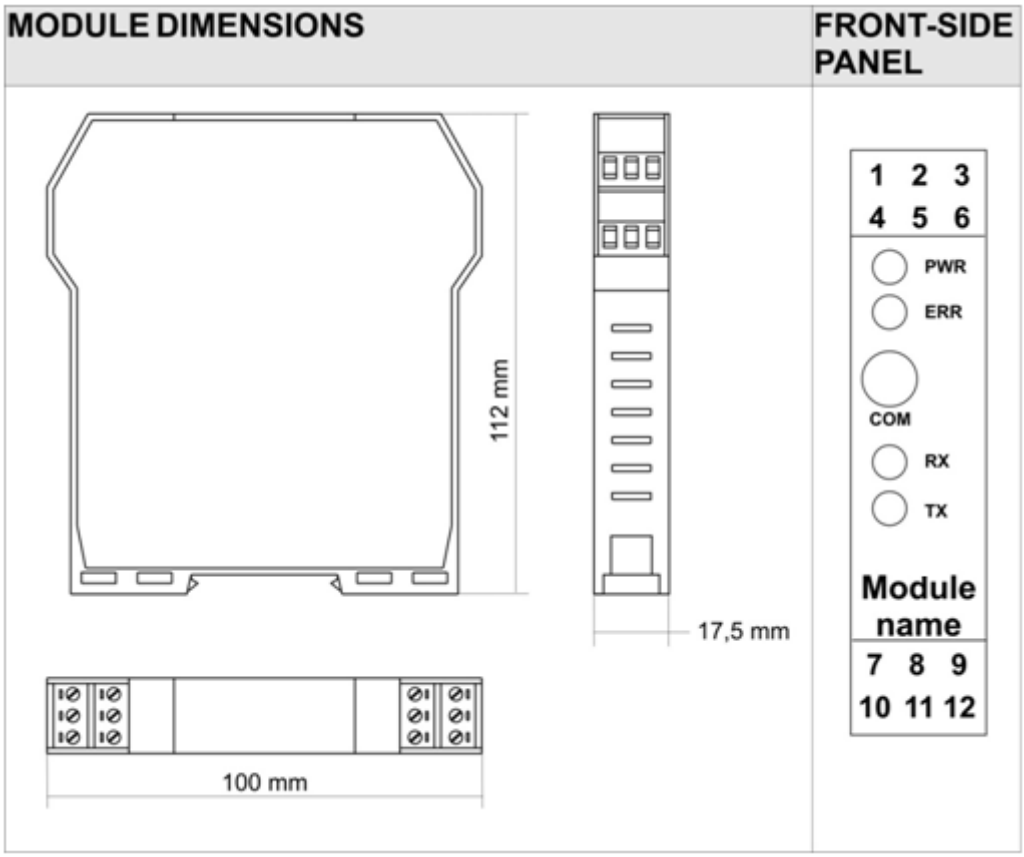
The PDM-4RTD, PDM-8TC, modules have removable 4-way screw terminals: pitch 3.5 mm, sections 1.5 mm^2.

Protection class equal to IP20 (International Protection) means device protection degree against the external environmental factors. With reference to the “20” suffix, “2” is protection degree against solid and dust objects, “0” is protection degree to liquids.

In the following figure is shown the module dimensions and front-side panel for the most part of PDM Line modules. To know the meaning of the LEDs, see “Signalling LEDs” at the end of each module chapter.

Some modules (for example: PDM-10DI) have LEDs for input/output state too.

In the following figure is shown the PDM module case.



8.5. Connections

To ensure a long duration and a proper functioning of the module, it's necessary to execute the following notes.

WARNING

It is forbidden to obstruct the module ventilation openings.
It is forbidden to install the module near heat-emitting devices.

«Severe operating conditions» are defined as follows:
- high power supply voltage: exceed 30 Vcc or exceed 26 Vac;
- the module supplies the sensor;
- active current-type output (the output: has already powered on, needs to be connected to passive module).

WARNING

If the modules are installed side by side, **separate them by at least 5 mm** in the following cases:
- the operating temperature exceeds 45°C and at least one of the severe operating conditions exists; or
- the operating temperature exceeds 35°C and at least two of the severe operating conditions exist.

The module is designed to be installed on DIN 46277 rail in vertical position: in this way, ventilation and easy installation are guaranteed.

Purchase codes	Versions
PDM-DIN-C-1L	DIN rail support with screw terminals, 1 large slot =35 mm
PDM-DIN-C-2S	DIN rail support with screw terminals, 2 small slots =17.5 mm
PDM-DIN-1L	DIN rail support, 1 Large slots =35 mm
PDM-DIN-2S	DIN rail support, 2 small slots =17.5 mm
PDM-DIN-8S	DIN rail support, 8 small slots =17.5 mm

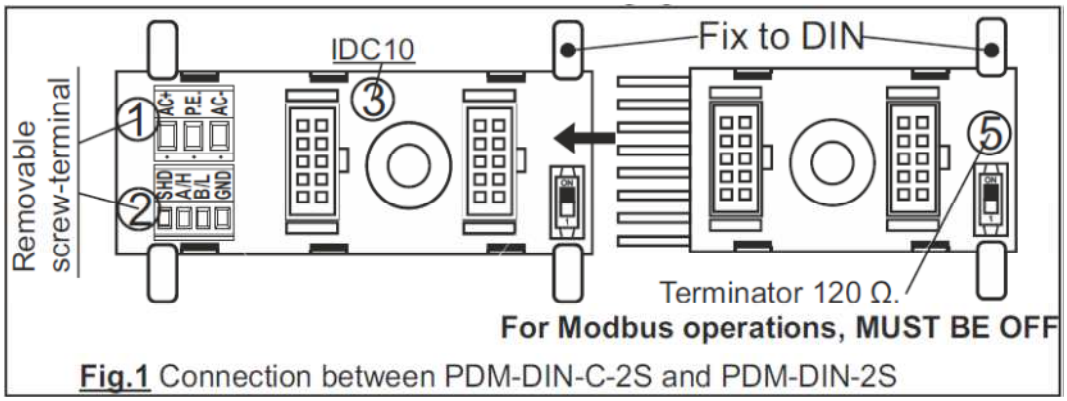


Fig.1 Connection between PDM-DIN-C-2S and PDM-DIN-2S

A PDM-DIN unit with screw terminals is to power the modules and to connect the modules to RS485-bus communication.

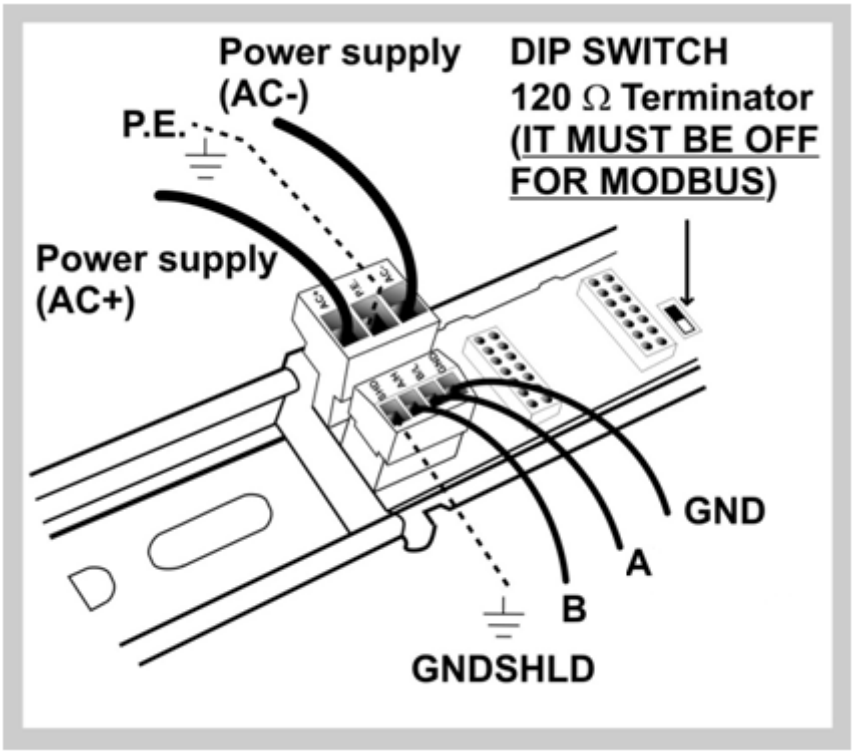
To power the module and to connect it to the RS485-bus communication by screw terminals, connect to DIN rail the PDM-DIN-C-2S (or PDM-DIN-C1L) unit and the PDM-DIN-2S units (or PDM-DIN-8S or PDM-DIN-1L units); use the screw terminals placed in PDM-DIN-C-2S unit

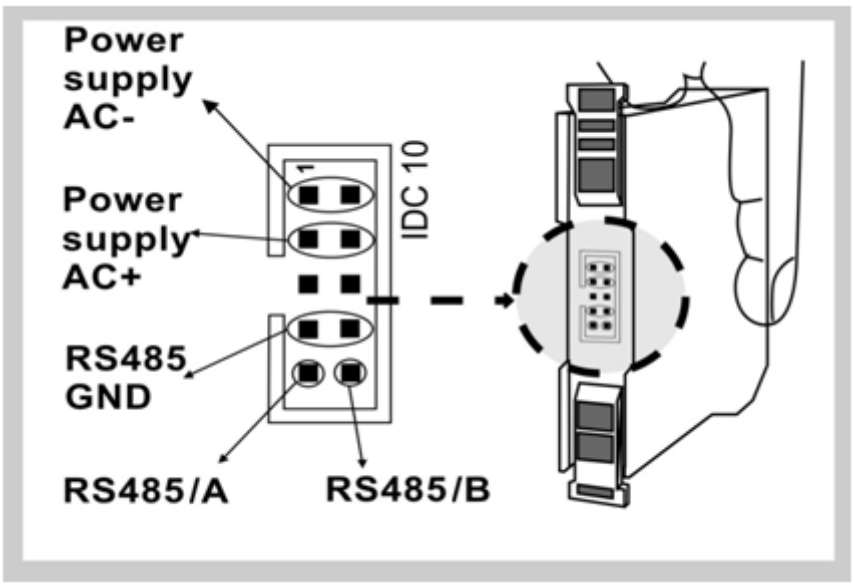
The PDM-DIN units are constituted by PA6-Polyamide (Nylon) 6 with fiberglass at 30%;

In particular, the PDM-DIN units are suitable:

1) to decrease the wiring time**, because there is no need to connect 5 cables (the same ones for each node): two cables for power supply (AC+, AC-) and three cables for RS485-bus communication (A, B, GND);**
2) to perform the hot swapping**: it is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply;**
3) to respect the recommended distance between adjacent modules**: the ventilation slits is guaranteed.**
4) to ensure a easy connection.

To power the module and to connect the module to RS485-bus, there is a connector (IDC10) in back-side panel.



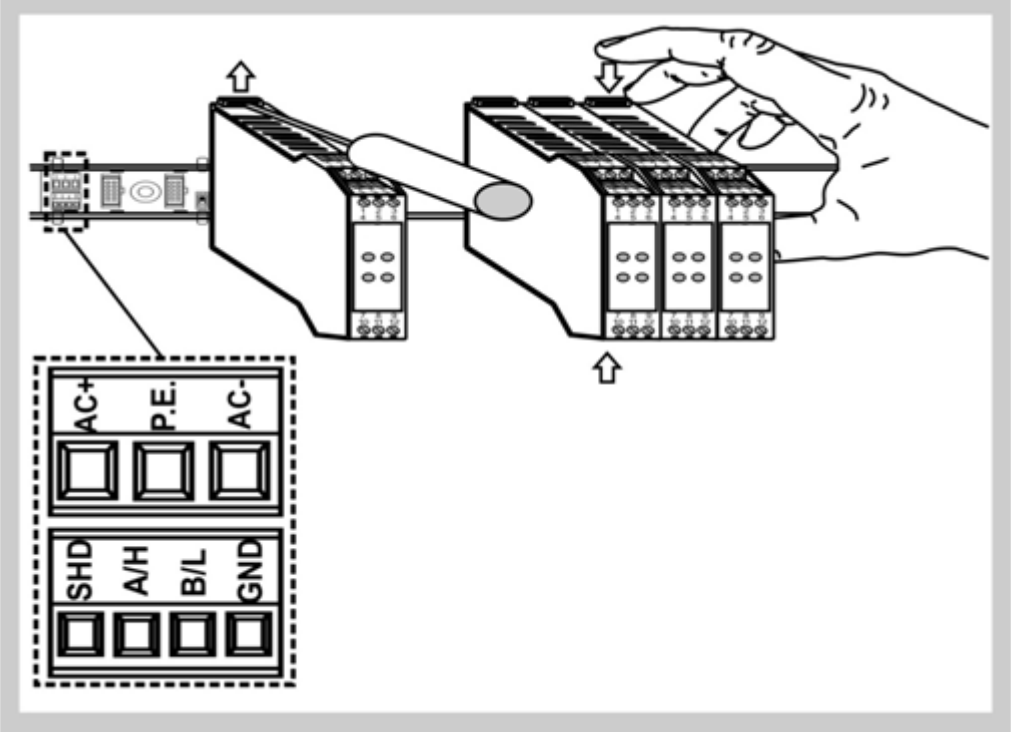


To lock on DIN 46277 rail the module, execute in the order the following operations:

1) pull the two latchs outwards (latchs are placed in the back-side panel, near IDC10-connector);
2) insert the IDC10-connector in a DIN rail free slot;
3) make sure that the IDC10-connector pins are inserted on the slot correctly;

It is important to insert the pins on the slot correctly because IDC10-connector is polarized; this connection is facilitated by use of a female/male insertion between IDC10 connector and DIN rail slot.

4) press the two latchs inwards.



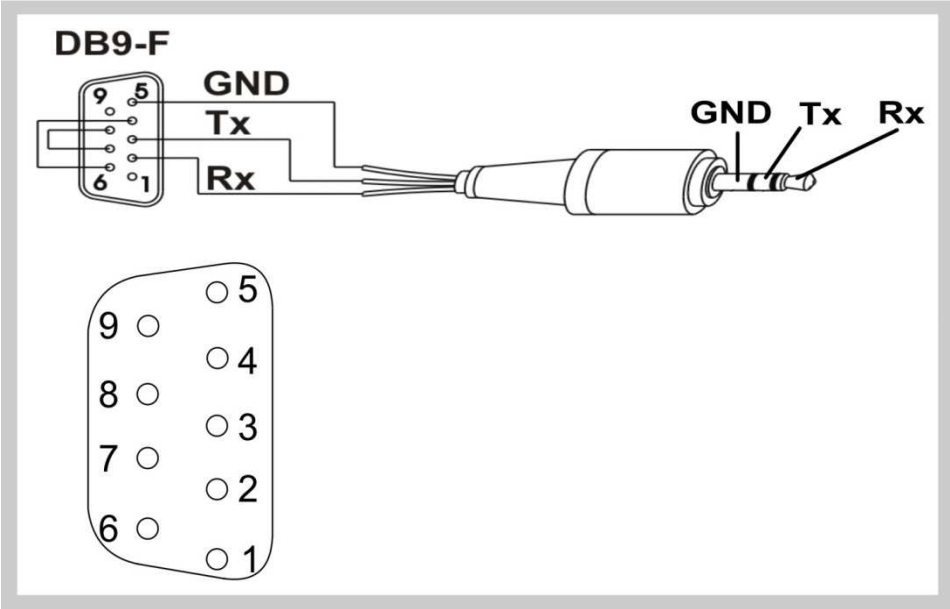
WARNING

Power off the module before connecting: RS232 serial interface, RS485 serial interface, input, output.

To satisfy the electromagnetic compliance requirements:
- use shielded cables for signal transmission;
- connect the shield to a earth wire used specifically for instrumentation;
- insert space between these shielded cables and other cables used for power appliances (inverters, motors, induction ovens, etc...).

RS232 bus communication

Some modules are equipped with a Jack stereo connector in order to connect it to RS232-bus communication.
This is designed to data interchange according to the ModBUS protocol rules, implemented by RS232 serial interface. The RS232 communication (with unchangeable parameters) has priority over the RS485 communication, and is mostly intended for configuration purpose.



DB9 pin	Signal	Signal name	RS232 code	V.24 code
1	**DCD**	**Data-Carrier Detection**	**CF**	**109**
2	**RD**	**Received Data**	**BB**	**104**
3	**TD**	**Transmitted Data**	**BA**	**103**
4	**DTR**	**Data Terminal Ready**	**CD**	**108/2**
5	**SG**	**Signal Ground**	**AB**	**102**
6	**DSR**	**Data Set Ready**	**CC**	**107**
7	**RTS**	**Request To Send**	**CA**	**105**
8	**CTS**	**Clear To Send**	**CB**	**106**
9	**RI**	**Ring Indicator**	**CE**	**125**

9. Decommissioning and disposal

Disposal of Electrical & Electronic Equipment (Applicable throughout the European Union and other European countries with separate collections programs). This symbol, found on your product or on its packaging, indicates that this product should not be treated as household waste when you wish to dispose of it. Instead, it should be handed over to an applicable collection point for the recycling of electrical & electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences to the environment and human health, which could otherwise be caused by inappropriate disposal of this product. The recycling of materials will help to conserve natural resources. For more detailed information about the recycling of the product, please contact your local city office, waste disposal service of the retail store where you purchased this product.

10. PDM-10DI

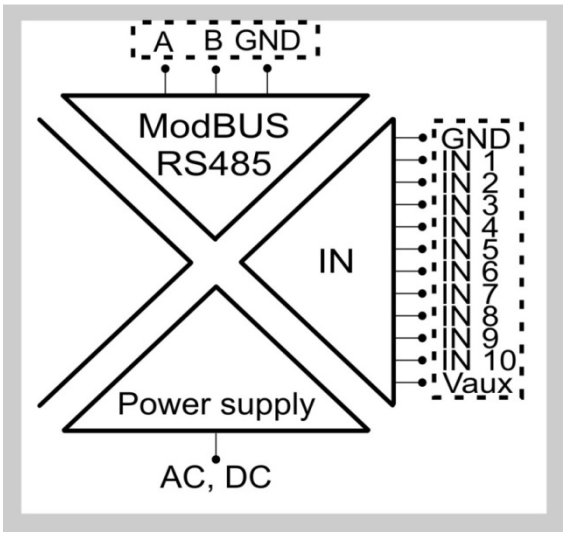
The PDM-10DI module acquires 10 single-ended digital signals, it converts them to a digital format (IN 1-10 state) and it counts the input-pulse number (pulse counter for IN 1-10).

10.1. General characteristics

- **Acquisition of digital signals from sensor: Reed, NPN, PNP, Proximity, contact, etc...**
- **Configuration of a filter applied to the input signals IN1-IN8 (Filter(1-254)) to attenuate the noise overlapped to the digital signals**
- **Pulse counters for digital signals, with max frequency equal to:**
  - **100 Hz, 16bit-registers (the signal is acquired from IN1-8);**
  - **10kHz, 32bit-registers (the signal is acquired from IN9-IN10)**
- **Advanced management of the pulse counters for digital signals IN9-IN10 (see table 1)**
- **Power of 10 sensors by internal supply voltage (Vaux=16V)**
- **It is possible to configure the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**

10.2. Features

INPUT	
Number	10
Input filter	Cut-off frequency: 100Hz (for IN1-8); 10kHz (for IN9-10)
Filter(1-254) to attenuate the noise	Configurable between: 1[ms] and 254[ms]
Protection	This module provides inputs and power supply(Vaux) protection against the overvoltage surge transient by transient suppressor TVS (600W/ms); max current supplied from Vaux is 100mA (limited by internal series PTC)
Pulse min duration (ton)	4ms (for IN1-IN8); 50µs (for IN9-IN10)
Sensor=closed	The sensor is detected «closed» if: acquired signal voltage >12 Vdc and acquired signal current > 3 mA
Sensor=open	The sensor is detected «open» if: acquired signal voltage <10 Vdc and acquired signal current < 2 mA
Internal supply Vaux	The screw terminal 12 (Vaux) supplies 16 V with reference to the screw terminal 1 (GND)
Measure error for frequency: 2% of fmax (for IN1-IN8: ±2Hz; for IN9-IN10: ±200Hz) Measure error for period, ton, toff: 1ms	
CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel)
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, digital inputs



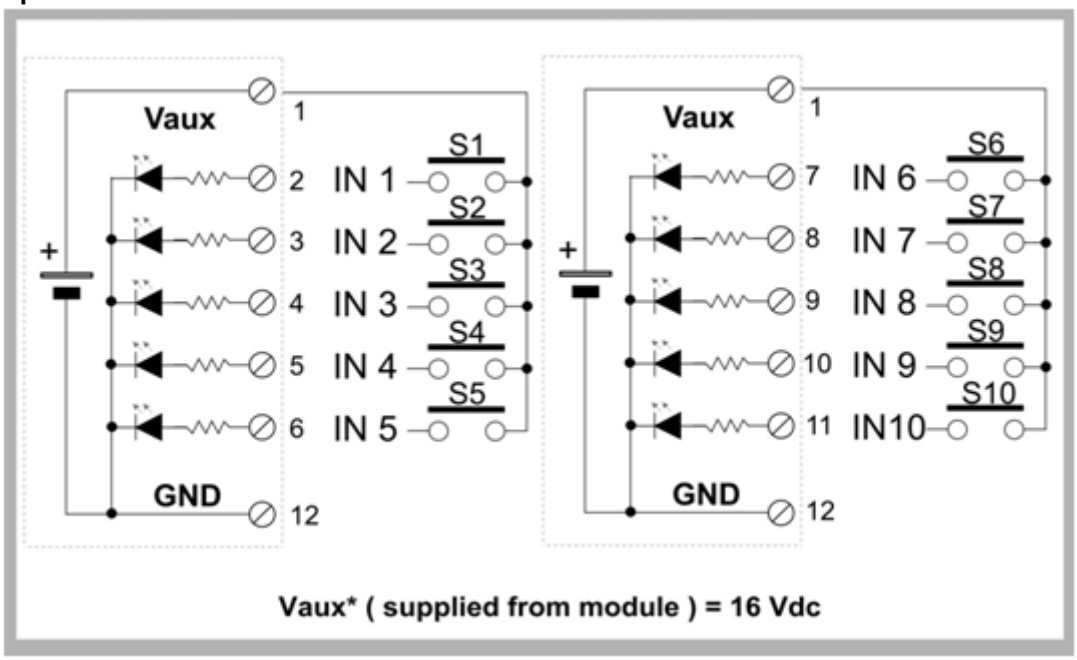
POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5W; Max: 2.5W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

10.3. Input connections

Power on the module with < 40 Vdc or < 28 Vac voltage supply. These upper limits must not be exceeded to avoid serious damage to the module.

In the following figure is shown the connection of the sensors to the 10 inputs of PDM-10DI module. It's possible to connect to the module the sensors: Reed, NPN, PNP, Proximity, contact, etc... To power these sensors, connect each of them between the screw terminal 1 (Vaux=16V with reference to the screw terminal 12=GND) and one of the inputs IN1-10.



10.4. Dip-switches table

Power off the module before configuring it by Dip-Switches to avoid serious damage due to electrostatic discharges.

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

10.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x0A	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40024
	Firmware Code				
Status	/	Bit	R/W		40022
	These bits aren't used			/	Bit [15:2]
	Save configuration in memory (EEPROM). The content of 40018, 40019, 40020, 40021 registers is overwritten, respectively, in the 40082, 40083, 40084, 40085 registers (these ones are in memory EEPROM): 0=deactivated; 1=activated			0	Bit 1
	Reset of module: 0=deactivated; 1=activated			0	Bit 0
Eprflag	/	Bit	R/W		40020 (EEPROM 40084)
	These bits aren't used			/	Bit[15:13]
	Count modality of "pulse counter for IN9 and IN10" for each acquired pulse through inputs IN9 and IN10. To know the configurations of the bit 40020.[12:8], see table 1			0b00000	Bit [12:8]

TABLE 1 - COUNT MODALITY OF PULSE COUNTERS FOR IN9 AND IN10			
Bit 40020.[12:8]	PulseCounter9	PulseCounter10	
0b00000	+1 for each pulse acquired through IN9	+1 for each pulse acquired through IN10	
0b00001	-1 for each pulse acquired through IN9	+1 for each pulse acquired through IN10	
0b00010	+1 for each pulse acquired through IN9	-1 for each pulse acquired through IN10	
0b00100	-1 for each pulse acquired through IN9	-1 for each pulse acquired through IN10	
0b01000	+1 for each pulse acquired through IN9;-1 for each pulse acquired through IN10	Deactivated	
0b10000	if IN10=1, +1 for each pulse acquired through IN9; if IN10=0, -1 for each pulse acquired through IN9	Deactivated	
	These bits aren't used	/	Bit [7:5]
	Parity for RS485: 0=even; 1=odd	0	Bit 4
	Parity for RS485: 0=there isn't; 1=there is	0	Bit 3
	(*) Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message): 0=there isn't; 1=there is	0	Bit 2
	(*) Count modality of "pulse counter for IN1-8" for each acquired pulse through inputs IN1-8: 0=+1 for each pulse acquired through IN1-8; 1=-1 for each pulse acquired through IN1-8	0	Bit 1
	(*) Sensors-state representation logic for switches S1-S10, with reference to the «Input Status» registers 10001-10010, to the «Coil Status» registers 00001-00010 and to the bit40002.0-bit40002.9. If bit 40020.0=0: switch open (closed) corresponds to "0"("1"); if bit 40020.0=1: switch open(closed) corresponds to "1"("0")	0	Bit 0

(*) To modify the bit 40020.0, 40020.1 e 40020.2 state, it isn't necessary to reset the module because the modification is immediate; to modify the other bit state, execute in the order the following operations:
-write the new configuration in the register;
-reset the module (switch bit 40022.0 to 1).

Name	Range	Interpretation of register	R/W	Default	Address
Baudrate Address	Address: from 0x01=1 to 0xFF=255	MSB, LSB	R/W		40021 (EEPROM 40085)
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Address for RS485 (address of module/node if parameters are configurated by memory modality)			1	Bit [7:0]
Filter1-254	Between:1[ms]; 254[ms]	Word	R/W		40019 (EEPROM 40083)
	Filter(1-254) applied to all input-signals (except IN9 and IN10). Limiting values: if reg.40019=1[ms]=filtering action to attenuate noise with frequency<1kHz (period>1ms); if reg.40019=254[ms]=filtering action to attenuate noise with frequency<4Hz (period>254ms)			3[ms]	

(**) The content of the 40008, 40009 and 40010 registers is stored in the 40072, 40073 and 40074 respectively (memory EEPROM), too. The module writes the content of the register: 40072 in 40008, 40073 in 40009, 40074 in 40010 in one of the following cases:
-when the module is connected to the RS485-bus (registers initialization);
-when the module is resetted (bit 40011.0 switched to 1).

Name	Range	Interpretation of register	R/W	Default	Address
Pulse Counter IN1	Between:0; 32767	Word	R		40003
	16-bit pulse counter for input 1. To know the overflow of Pulse CounterIN1 register, see bit 40015.0 or reg. 00017			/	
Pulse Counter IN2	Between:0; 32767	Word	R		40004
	16-bit pulse counter for input 2. To know the overflow of Pulse CounterIN2 register, see bit 40015.1 or reg. 00018			/	
Pulse Counter IN3	Between:0; 32767	Word	R		40005
	16-bit pulse counter for input 3. To know the overflow of Pulse CounterIN3 register, see bit 40015.2 or reg. 00019			/	
Pulse Counter IN4	Between:0; 32767	Word	R		40006
	16-bit pulse counter for input 4. To know the overflow of Pulse CounterIN4 register, see bit 40015.3 or reg. 00020			/	
Pulse Counter IN5	Between:0; 32767	Word	R		40007
	16-bit pulse counter for input 5. To know the overflow of Pulse Counter IN5 register, see bit 40015.4 or reg. 00021			/	
Pulse Counter IN6	Between:0; 32767	Word	R		40008
	16-bit pulse counter for input 6. To know the overflow of Pulse Counter IN6 register, see bit 40015.5 or reg. 00022			/	
Pulse Counter IN7	Between:0; 32767	Word	R		40009
	16-bit pulse counter for input 7. To know the overflow of Pulse Counter IN7 register, see bit 40015.6 or reg. 00023			/	
Pulse Counter IN8	Between:0; 32767	Word	R		40010
	16-bit pulse counter for input 8. To know the overflow of Pulse Counter IN8 register, see bit 40015.7 or reg. 00024			/	
PulseCounter9 MSW	Between:0; (2^31)-1	FP32bit-MSW	R		40012
PulseCounter9 LSW		FP32bit-LSW	R		40011
	32-bit pulse counter for input 9 and input 10 (to configure it, see bit40020.[12:8]). To know the overflow of PulseCounter9 register, see bit 40015.8 or reg. 00025			/	
Pulse Counter 10 MSW	Between:0; (2^31)-1	FP32bit-MSW	R		40014
Pulse Counter 10 LSW		FP32bit-LSW	R		40013
	32-bit pulse counter for input 9 and input 10 (to configure it, see bit40020.[12:8]). To know the overflow of PulseCounter10 register, see bit 40015.9 or reg. 00026			/	

Name	Range	Interpretation of register	R/W	Default	Address
Inputs		Word	R		40002
	These bits aren't used			/	Bit[15:10]
	IN10 state: 0=S10 open(closed); 1=S10 closed(open), if bit40020.0=0(1)			/	Bit 9
	IN9 state: 0=S9 open(closed); 1=S9 closed(open), if bit40020.0=0(1)			/	Bit 8
	IN8 state: 0=S8 open(closed); 1=S8 closed(open), if bit40020.0=0(1)			/	Bit 7
	IN7 state: 0=S7 open(closed); 1=S7 closed(open), if bit40020.0=0(1)			/	Bit 6
	IN6 state: 0=S6 open(closed); 1=S6 closed(open), if bit40020.0=0(1)			/	Bit 5
	IN5 state: 0=S5 open(closed); 1=S5 closed(open), if bit40020.0=0(1)			/	Bit 4
	IN4 state: 0=S4 open(closed); 1=S4 closed(open), if bit40020.0=0(1)			/	Bit 3
	IN3 state: 0=S3 open(closed); 1=S3 closed(open), if bit40020.0=0(1)			/	Bit 2
	IN2 state: 0=S2 open(closed); 1=S2 closed(open), if bit40020.0=0(1)			/	Bit 1
	IN1 state: 0=S1 open(closed); 1=S1 closed(open), if bit40020.0=0(1)			/	Bit 0
Pulse Counters overflow		Word	R		40015
	These bits aren't used			/	Bit[15:10]
	PulseCounter10 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 9
	PulseCounter9 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 8
	PulseCounter8 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 7
	PulseCounter7 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 6
	PulseCounter6 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 5
	PulseCounter5 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 4
	PulseCounter4 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 3
	PulseCounter3 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 2
	PulseCounter2 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 1
	PulseCounter1 overflow: 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 0

Name	Range	Interpretation of register	R/W	Default	Address
Measure Type		Bit	R/W		40018 (EEPROM 40082)
	Measure A performed on input A. If bit[15:12]=0b0000: frequency; if bit[15:12]=0b0001: period; if bit[15:12]=0b0010: ton; if bit[15:12]=0b0011: toff			0b0001	Bit[15:12]
	Acquired input A, with reference to bit40018.[15:12]. If bit[11:8]=0b0001: IN1; if bit[11:8]=0b0010: IN2; if bit[11:8]=0b0011: IN3; if bit[11:8]=0b0100: IN4; if bit[11:8]=0b0101: IN5; if bit[11:8]=0b0110: IN6; if bit[11:8]=0b0111: IN7; if bit[11:8]=0b1000: IN8; if bit[11:8]=0b1001: IN9 (only frequency); if bit[11:8]=0b1010: IN10 (only frequency)			0b0001	Bit[11:8]
	Measure B performed on input B. If bit[7:4]=0b0000: frequency; if bit[7:4]=0b0001: period; if bit[7:4]=0b0010: ton; if bit[7:4]=0b0011: toff			0b0001	Bit[7:4]
	Acquired input B, with reference to bit40018.[7:4]. If bit[3:0]=0b0001: IN1; if bit[3:0]=0b0010: IN2; if bit[3:0]=0b0011: IN3; if bit[3:0]=0b0100: IN4; if bit[3:0]=0b0101: IN5; if bit[3:0]=0b0110: IN6; if bit[3:0]=0b0111: IN7; if bit[3:0]=0b1000: IN8; if bit[3:0]=0b1001: IN9 (only frequency); if bit[3:0]=0b1010: IN10 (only frequency)			0b0010	Bit[3:0]
Measure A	/	Word	R		40017
	Measure A value: to know the measure type, see bit40018.[15:12], to know the acquired input, see bit40018.[11:8]			/	
Measure B	/	Word	R		40016
	Measure B value: to know the measure type, see bit40018.[7:4], to know the acquired input, see bit40018.[3:0]			/	

The «Input Status»-type registers used for PDM-10DI module are shown in the following table:

Name	Range	Interpretation of register	R/W	Default	Address
State IN1	0-1	Word	R		10001
	IN1 state: 0=S1 open(closed); 1=S1 closed(open), if bit40020.0=0(1)			/	
State IN2	0-1	Word	R		10002
	IN2 state: 0=S2 open(closed); 1=S2 closed(open), if bit40020.0=0(1)			/	
State IN3	0-1	Word	R		10003
	IN3 state: 0=S3 open(closed); 1=S3 closed(open), if bit40020.0=0(1)			/	
State IN4	0-1	Word	R		10004
	IN4 state: 0=S4 open(closed); 1=S4 closed(open), if bit40020.0=0(1)			/	
State IN5	0-1	Word	R		10005
	IN5 state: 0=S5 open(closed); 1=S5 closed(open), if bit40020.0=0(1)			/	
State IN6	0-1	Word	R		10006
	IN6 state: 0=S6 open(closed); 1=S6 closed(open), if			/	

	bit40020.0=0(1)				
State IN7	0-1	Word	R		10007
	IN7 state: 0=S7 open(closed); 1=S7 closed(open), if bit40020.0=0(1)			/	
State IN8	0-1	Word	R		10008
	IN8 state: 0=S8 open(closed); 1=S8 closed(open), if bit40020.0=0(1)			/	
State IN9	0-1	Word	R		10009
	IN9 state: 0=S9 open(closed); 1=S9 closed(open), if bit40020.0=0(1)			/	
State IN10	0-1	Word	R		10010
	IN10 state: 0=S10 open(closed); 1=S10 closed(open), if bit40020.0=0(1)			/	

The «Coil Status»-type registers used for PDM-10DI module are shown in the following table:

Name	Range	Interpretation of register	R/W	Default	Address
Overflow PulseCounter1	0-1	Word	R		00017
	PulseCounter1 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter2	0-1	Word	R		00018
	PulseCounter2 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter3	0-1	Word	R		00019
	PulseCounter3 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter4	0-1	Word	R		00020
	PulseCounter4 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter5	0-1	Word	R		00021
	PulseCounter5 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter6	0-1	Word	R		00022
	PulseCounter6 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter7	0-1	Word	R		00023
	PulseCounter7 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter8	0-1	Word	R		00024
	PulseCounter8 overflow: 0=there isn't; 1=there is			/	
Overflow PulseCounter9	0-1	Word	R		00025
	PulseCounter9 overflow: 0=there isn't; 1=there is			/	
Overflow Pulse Counter10	0-1	Word	R		00026
	PulseCounter10 overflow: 0=there isn't; 1=there is			/	

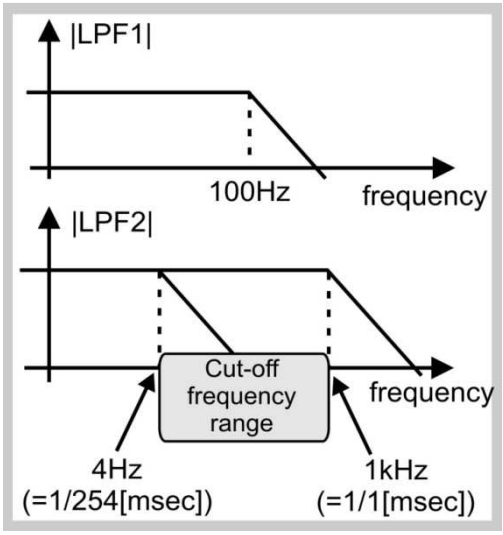
10.6. LEDs for signalling

In the front-side panel there are 14 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
FAIL	Blinking light	The module has at least one of the errors/overflows described in RS485 Registers table
	Constant light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Verify if the bus connection is corrected
1-10	Constant light	IN1-10 state equal to «1»
	No light	IN1-10 state equal to «0» (if the power is on)

10.7. Filtering actions

In the following figure is shown the filtering action applied to the digital signals IN1-IN10.



LPF1 action: Input filter
Cut-off frequency equal to 100Hz for IN1-8 (equal to 10kHz for IN9, IN10 with bypass Filter 1-254).

LPF2 action: Filter 1-254
Cut-off frequency range to attenuate lower-frequencies noise: from 4Hz to 1kHz. The noise is overlapped to the desired digital signal.

11. PDM Line module: PDM-5RO

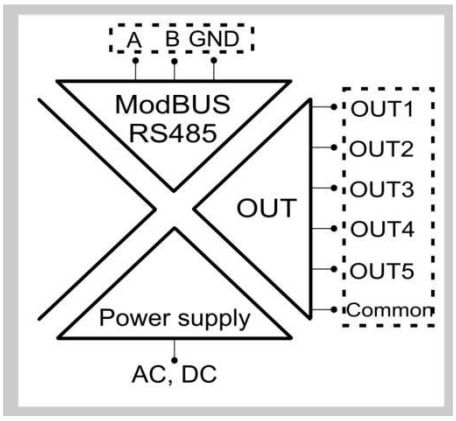
The module PDM-5RO controls 5 relays digital output (OUT1-OUT5).

11.1. General characteristics

- **Management of the output state if the interval time of RS485-bus communication failure is greater than a configurable time (up to 25 sec)**
- **Configuration of the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**

11.2. Features

OUTPUT	
Number	5
Type	Relays SPST (Single Pole Single Throw) normally open, with common
Max current through screw terminals	Screw terminals 7,8,9,10,11: 5A with 250Vac(if resistive load); 2A (if inductive load). Screw terminal 12: 12A
Max relay switching frequency	6 cycles/min(with resistive load); 1200 cycles/min(with no load)
Pick-up relay voltage	18V
Drop-out relay voltage	2.4V
Relay internal supply	With reference to the screw terminal 12 (GND), the relays are supplied with 24Vdc internally
No-load adsorbed current by a relay	9mA
Relay response time	5/2ms
CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel) or screw terminals: 4 (GND), 5(B), 6(A)
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, digital output

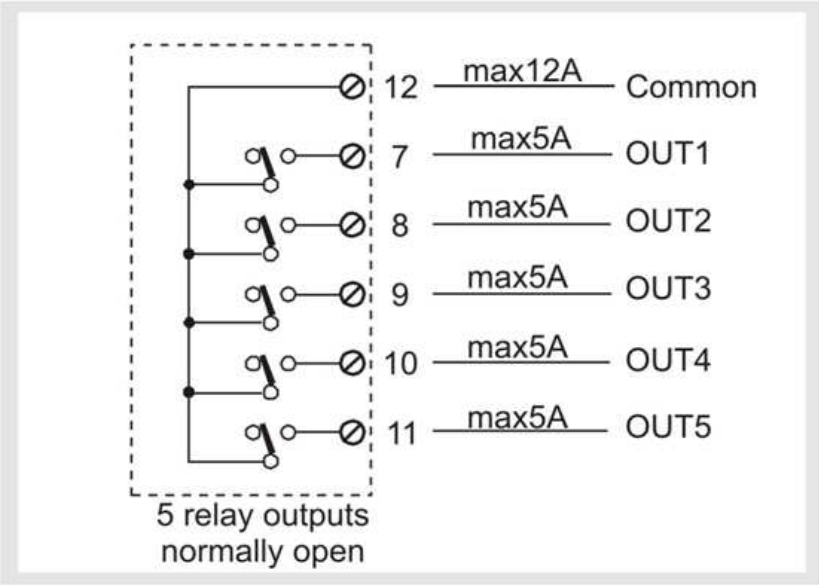


POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5W; Max: 2.5W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

11.3. Output connections

Power on the module with < 40 Vdc or < 28 Vac voltage supply. These upper limits must not be exceeded to avoid serious damage to the module.



It's forbidden **that the current through the screw terminal 12 (common) is greater than 12A.**
It's forbidden **that the current through the screw terminals 7,8,9,10,11 is greater than 5A.**

11.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

11.5. RS485 register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x02	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40009
	Firmware Code				
Status	0-1	Bit	R/W		40007
	These bits aren't used			/	Bit [15:2]
	Reset of module: 0=deactivated; 1=activated			0	Bit 1
	Save configuration in memory (EEPROM). The content of 40003, 40004, 40005, 40006 registers is overwritten, respectively, in the 40067, 40068, 40069, 40070 registers (these ones are in memory EEPROM): 0=deactivated; 1=activated			0	Bit 0
Eprflag	0-1	Bit	R/W		40005 (EEPROM 40069)
	These bits aren't used			/	Bit [15:8]
	(*)Fault state enabling. If bit40005.7=1 and if the interval time of RS485-bus communication failure **is greater than Timeout/10** [sec], the relays 1-5 and the LEDs1-5 will have the configuration that correspond to bit40003.X. If bit40005.7=1 and if the module is connected to RS485-bus communication **for the first time**, the relays 1-5 and the LEDs1-5 will have the configuration that correspond to bit40003.X and the bit 40003.X is overwritten to bit 40002.X, with X=0;4. 0=deactivated; 1=activated			1	Bit 7
	(*)Timer reset type. The module has a timer: if the interval time of RS485-bus communication failure is greater than Timeout/10[sec], the module overwrites the content of Fault Output (bits 40003.[0:4]) to Output (bits 40002.[0:4] and registers 00001-00005) It's possible to reset this timer (the timer returns to «Timeout/10[sec]» automatically) when one of the following event occurs: 1) event=the PDM-5RO module receives a valid message within Timeout/10[sec] (if bit 40005.6=1); 2) event=any module connected to the bus RS485 receives a valid message within Timeout/10[sec] (if bit 40005.6=0)			0	Bit 6
	This bit isn't used			/	Bit 5
	Parity for RS485: 0=even parity; 1=odd parity			0	Bit 4
	Parity for RS485: 0=deactivated; 1=activated			0	Bit 3
	(*)Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message): 0=there isn't; 1=there is			0	Bit 2
	This bit isn't used			/	Bit 1
	(*) With reference to the «Coil Status» ModBUS registers 00001-00005 and to the bit40002.0-bit40002.4, it is the state of the relay 1-5. If bit 40005.0=0: relay 1-5 open(closed) corresponds to "0"("1") and LED1-5 turned off(on); if bit 40005.0=1: relay 1-5 open(closed) corresponds to "1"("0") and LED1-5 turned on (off)			0	Bit 0

(*) To modify the bit 40005.0, 40005.2, 40005.6 and 40005.7 state, it isn't necessary to reset the module because the modification is immediate; to modify the other bit state, execute in the order the following operations: write the new configuration in the register and reset the module (switch bit 40007.0 to 1).

Name	Range	Interpretation of register	R/W	Default	Address
Dip-Switch state	0-1	Bit	R		40008
	These bits aren't used			/	Bit [15:8]
	Dip-Switches [1:2] state. They correspond to module address for RS485			/	Bit [7:6]
	Dip-Switches [3:8] state. They correspond to module baud-rate for RS485			/	Bit [5:0]
Baudrate Address	Address: from 0x01=1 to 0xFF=255	MSB, LSB	R/W		40006 (EEPROM 40070)
	Baudrate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Address for RS485 (address of module/node if parameters are configurated by memory modality)			1	Bit [7:0]
Output	0-1	Bit	R/W		40002
	These bits aren't used			/	Bit [15:5]
	Output OUT5 state:0=relay5 deactivated and LED5 turned off (there is no current through relay5); 1=relay5 activated and LED5 turned on (there is current through relay5)			0	Bit 4
	Output OUT4 state:0=relay4 deactivated and LED4 turned off (there is no current through relay4); 1=relay4 activated and LED4 turned on (there is current through relay4)			0	Bit 3
	Output OUT3 state:0=relay3 deactivated and LED3 turned off (there is no current through relay3); 1=relay3 activated and LED3 turned on (there is current through relay3)			0	Bit 2
	Output OUT2 state:0=relay2 deactivated and LED2 turned off (there is no current through relay2); 1=relay2 activated and LED2 turned on (there is current through relay2)			0	Bit 1
	Output OUT1 state:0=relay1 deactivated and LED1 turned off (there is no current through relay4); 1=relay1 activated and LED1 turned on (there is current through relay1)			0	Bit 0
Fault Output	0-1	Bit	R/W		40003 (EEPROM 40067)
	These bits aren't used			/	Bit [15:5]
	Fault value of Output OUT5 state:0=relay5 deactivated and LED5 turned off (there is no current through relay5); 1=relay5 activated and LED5 turned on (there is current through relay5)			0	Bit 4
	Fault value of Output OUT4 state:0=relay4 deactivated and LED4 turned off (there is no current through relay4); 1=relay4 activated and LED4 turned on (there is current through relay4)			0	Bit 3
	Fault value of Output OUT3 state:0=relay3 deactivated and LED3 turned off (there is no current through relay3); 1=relay3 activated and LED3 turned on (there is current through relay3)			0	Bit 2

	Fault value of Output OUT2 state:0=relay2 deactivated and LED2 turned off (there is no current through relay2); 1=relay2 activated and LED2 turned on (there is current through relay2)			0	Bit 1
	Fault value of Output OUT1 state:0=relay1 deactivated and LED1 turned off (there is no current through relay1); 1=relay1 activated and LED1 turned on (there is current through relay1)			0	Bit 0
Timeout	Between: 5 (=0.5[sec]); 250 (=25[sec])	Word	R/W		40004 (EEPROM 40068)
	Timeout [sec/10] (if bit40005.7=1, it is the interval time of RS485-bus communication failure, after which the bit 40003.X is overwritten to bit 40002.X, with X=0;4)			100 (=10[sec])	

The «Coil Status»-type registers are shown in the following table:

Name	Range	Interpretation of register	R/W	Default	Address
State OUT1	0-1	Word	R/W		00001
	Output OUT1 state:0=relay1 deactivated and LED1 turned off (there is no current through relay1); 1=relay1 activated and LED1 turned on (there is current through relay1)			0	
State OUT2	0-1	Word	R/W		00002
	Output OUT2 state:0=relay2 deactivated and LED2 turned off (there is no current through relay2); 1=relay2 activated and LED2 turned on (there is current through relay2)			/	
State OUT3	0-1	Word	R/W		00003
	Output OUT3 state:0=relay3 deactivated and LED3 turned off (there is no current through relay3); 1=relay3 activated and LED3 turned on (there is current through relay3)			/	
State OUT4	0-1	Word	R/W		00004
	Output OUT4 state:0=relay4 deactivated and LED4 turned off (there is no current through relay4); 1=relay4 activated and LED4 turned on (there is current through relay4)			/	
State OUT5	0-1	Word	R/W		00005
	Output OUT5 state:0=relay5 deactivated and LED5 turned off (there is no current through relay5); 1=relay5 activated and LED5 turned on (there is current through relay5)			/	

11.6. LEDs for signalling

In the front-side panel there are 9 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
FAIL	Blinking light	The module has at least one of the errors/overflows described in RS485 Registers table
	Constant light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Verify if the bus connection is corrected
1-5	Constant light	OUT1-5 state equal to «1»
	No light	OUT1-5 state equal to «0» (if the power is on)

12. PDM Line module: PDM-10DO

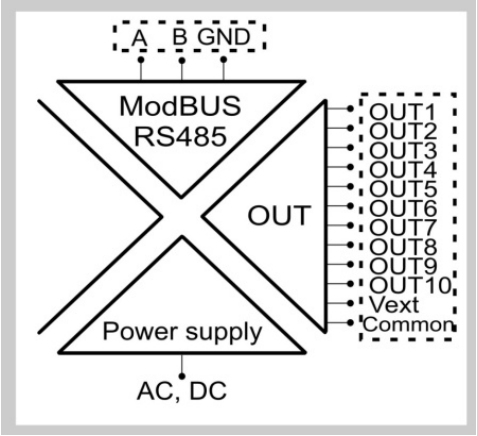
The module PDM-10DO controls 10 digital outputs (OUT1-OUT10), each of them (by MOSFET) actives/deactivates an output load (LOAD1-LOAD10).

12.1. General characteristics

- **It is possible to manage the output state if the interval time of RS485-bus communication failure is greater than a configurable time (up to 2000sec)**
- **Management of the output state if the interval time of a load short-circuited is greater than a configurable time (up to 8sec)**
- **It is possible to measure and control the outputs supply Vext**
- **Configuration of the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**

12.2. Features

OUTPUT	
Number	10 (type: MOSFET with negative common)
Max current through each load	0.5 A (if resistive load); 0.5 A (if inductive load). The supplied currents sum through all loads (these currents are inwards with reference to the screw terminal 1): <5 A (see «Output connections»). For each MOSFET: max0.5 A
Max state-switching frequency for each load	2Hz
MOSFET protection	The MOSFETs are protected against: load short-circuited, over-temperature
MOSFET supply	With reference to the screw terminal 12 (common), power the MOSFETs by screw terminal 1 (Vext): min 6 V, max 30 V
MOSFET max energy	40 mJ with inductive load
MOSFET response time	5/2 ms
R_{DSON}	0.75 Ω
Switching delay	1 ms (max)
CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel)
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, digital outputs

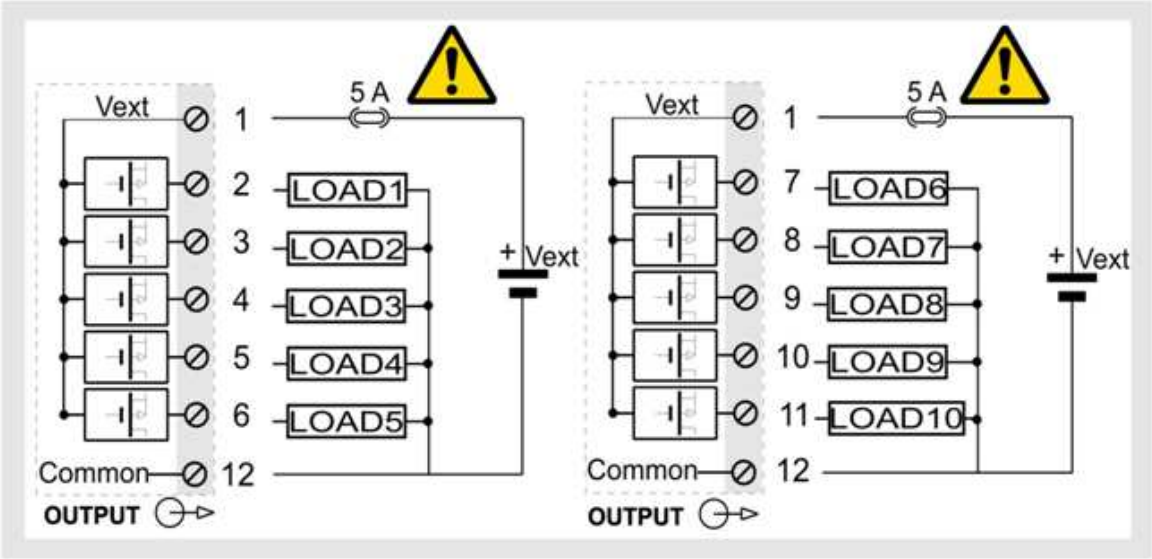


POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5 W; Max: 2.5 W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

12.3. Output connections

Power on the module with < 40 Vdc or < 28 Vac voltage supply. These upper limits must not be exceeded to avoid serious damage to the module.



It's forbidden **that the current through the screw terminal 1 (Vext) is greater than 5A.**

12.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

12.5. RS485 registers table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x0D	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40023
	Firmware Code				
Errors	0-1	Bit	R		40002
	These bits aren't used			/	Bit [15:7]
	Output supply voltage Vext (applied to screw terminal 1, with reference to screw terminal 12) (if bit40012.1=1): 0=the outputs are correctly supplied (Vext>VextTh); 1=the outputs aren't correctly supplied (Vext<VextTh)			/	Bit 6
	These bits aren't used			/	Bit [5:4]
	Outputs OUT1-OUT10 error: 0=no one output has an error; 1=at least one output has an error			/	Bit 3
	These bits aren't used			/	Bit [2:1]
	Loads short-circuited error: 0=no one load short-circuited; 1=at least one load short-circuited (see reg.40007)			/	Bit 0
Diagnostics Enabling	0-1	Bit	R/W		40015
	These bits aren't used			/	Bit [15:10]
	Output OUT10 diagnostics: 0=deactivated; 1=activated (if bit40015.9=1, bit40004.9 is enabled)			1	Bit 9
	Output OUT9 diagnostics: 0=deactivated; 1=activated (if bit40015.8=1, bit40004.8 is enabled)			1	Bit 8
	Output OUT8 diagnostics: 0=deactivated; 1=activated (if bit40015.7=1, bit40004.7 is enabled)			1	Bit 7
	Output OUT7 diagnostics: 0=deactivated; 1=activated (if bit40015.6=1, bit40004.6 is enabled)			1	Bit 6
	Output OUT6 diagnostics: 0=deactivated; 1=activated (if bit40015.5=1, bit40004.5 is enabled)			1	Bit 5
	Output OUT5 diagnostics: 0=deactivated; 1=activated (if bit40015.4=1, bit40004.4 is enabled)			1	Bit 4
	Output OUT4 diagnostics: 0=deactivated; 1=activated (if bit40015.3=1, bit40004.3 is enabled)			1	Bit 3
	Output OUT3 diagnostics: 0=deactivated; 1=activated (if bit40015.2=1, bit40004.2 is enabled)			1	Bit 2
	Output OUT2 diagnostics: 0=deactivated; 1=activated (if bit40015.1=1, bit40004.1 is enabled)			1	Bit 1
	Output OUT1 diagnostics: 0=deactivated; 1=activated (if bit40015.0=1, bit40004.0 is enabled)			1	Bit 0
Diagnostics	0-1	Bit	R/W		40004
	These bits aren't used			/	Bit [15:10]
	Output OUT10 error (if bit 40015.9=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 9
	Output OUT9 error (if bit 40015.8=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master			/	Bit 8

	Output OUT8 error (if bit 40015.7=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 7
	Output OUT7 error (if bit 40015.6=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 6
	Output OUT6 error (if bit 40015.5=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 5
	Output OUT5 error (if bit 40015.4=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 4
	Output OUT4 error (if bit 40015.3=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 3
	Output OUT3 error (if bit 40015.2=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 2
	Output OUT2 error (if bit 40015.1=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 1
	Output OUT1 error (if bit 40015.0=1): 0=there isn't; 1=there is. To reset, overwrite "0" from master	/	Bit 0

If at least one bit 40004.X (X=0;9) is equal to «1», the bit 40002.3 switches to «1». To reset the bit 40002.3 (bit40002.3=0), overwrite «0» to all the bits 40004.X.

Name	Range	Interpretation of register	R/W	Default	Address
Shorted Outputs	0-1	Bit	R		40007
	These bits aren't used			/	Bit [15:10]
	LOAD10 short-circuited error: 0=there isn't; 1=there is (if bit40007.9=1 then bit 40002.0=1)			/	Bit 9
	LOAD9 short-circuited error: 0=there isn't; 1=there is (if bit40007.8=1 then bit 40002.0=1)			/	Bit 8
	LOAD8 short-circuited error: 0=there isn't; 1=there is (if bit40007.7=1 then bit 40002.0=1)			/	Bit 7
	LOAD7 short-circuited error: 0=there isn't; 1=there is (if bit40007.6=1 then bit 40002.0=1)			/	Bit 6
	LOAD6 short-circuited error: 0=there isn't; 1=there is (if bit40007.5=1 then bit 40002.0=1)			/	Bit 5
	LOAD5 short-circuited error: 0=there isn't; 1=there is (if bit40007.4=1 then bit 40002.0=1)			/	Bit 4
	LOAD4 short-circuited error: 0=there isn't; 1=there is (if bit40007.3=1 then bit 40002.0=1)			/	Bit 3
	LOAD3 short-circuited error: 0=there isn't; 1=there is (if bit40007.2=1 then bit 40002.0=1)			/	Bit 2
	LOAD2 short-circuited error: 0=there isn't; 1=there is (if bit40007.1=1 then bit 40002.0=1)			/	Bit 1
	LOAD1 short-circuited error: 0=there isn't; 1=there is (if bit40007.0=1 then bit 40002.0=1)			/	Bit 0
Address Parity		MSB, LSB	R/W		40010
	Address for RS485 (address of module/node if parameters are configurated by memory modality): from 0x01=1 to 0xFF=255			1	Bit [15:8]
	Parity for RS485: 0=there isn't; 1=even parity; 2=odd parity			0	Bit [7:0]
Baudrate Delay	Delay: from 0x00=0 to 0xFF=255	MSB, LSB	R/W		40011

	Baudrate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message)			0	Bit [7:0]
Command	0xC1A0; 0xBDAC	Word	R/W		40024
	Module reset, if reg.40024=0xC1A0; the module writes the Dip-Switch state in reg.40025, if reg.40024=0xBDAC				
Command aux	/	Word	R		40025
	These bits aren't used			/	Bit [15:8]
	Dip-Switch [1:2] state. They correspond to the module address (if reg.40024=0xBDAC)			/	Bit [7:6]
	Dip-Switch [3:8] state. They correspond to the module baud-rate (if reg.40024=0xBDAC)			/	Bit [5:0]
Vext measure	/	Bit	R		40009
	Output supply voltage (Vext) measure (screw terminals 1-12) [V/10]. If Vext < VextTh (see bit40016.[7:0]) and if bit40012.1=1, then the LED FAIL is on			/	
Outputs	0-1	Bit	R/W		40003
	These bits aren't used			/	Bit [15:10]
	Output OUT10 state: 0=LOAD10 is deactivated (there is no current through LOAD10); 1=LOAD10 is activated (there is current through LOAD10)			/	Bit 9
	Output OUT9 state: 0=LOAD9 is deactivated (there is no current through LOAD9); 1=LOAD9 is activated (there is current through LOAD9)			/	Bit 8
	Output OUT8 state: 0=LOAD8 is deactivated (there is no current through LOAD8); 1=LOAD8 is activated (there is current through LOAD8)			/	Bit 7
	Output OUT7 state: 0=LOAD7 is deactivated (there is no current through LOAD7); 1=LOAD7 is activated (there is current through LOAD7)			/	Bit 6
	Output OUT6 state: 0=LOAD6 is deactivated (there is no current through LOAD6); 1=LOAD6 is activated (there is current through LOAD6)			/	Bit 5
	Output OUT5 state: 0=LOAD5 is deactivated (there is no current through LOAD5); 1=LOAD5 is activated (there is current through LOAD5)			/	Bit 4
	Output OUT4 state: 0=LOAD4 is deactivated (there is no current through LOAD4); 1=LOAD4 is activated (there is current through LOAD4)			/	Bit 3
	Output OUT3 state: 0=LOAD3 is deactivated (there is no current through LOAD3); 1=LOAD3 is activated (there is current through LOAD3)			/	Bit 2
	Output OUT2 state: 0=LOAD2 is deactivated (there is no current through LOAD2); 1=LOAD2 is activated (there is current through LOAD2)			/	Bit 1
	Output OUT1 state: 0=LOAD1 is deactivated (there is no current through LOAD1); 1=LOAD1 is activated (there is current through LOAD1)			/	Bit 0

If one of the bits40003.X (or one "Input Status" register) is equal to «1», it's possible to detect if the corresponding load is short-circuited after TimeoutShort/30[sec]. In this case: bit40002.0=1, bit40002.3=1, bit40004.X=1, bit 40007.X=1 (X=[0;9]) and the LED FAIL is on (see reg.40012). If one of the bits40003.X (or one "Input Status" register) is equal to «0», it isn't possible to detect if the corresponding load is short-circuited, though bit 40003.X switches from «0» to «1». In this case, reset the bit 40004.X.

Name	Range	Interpretation of register	R/W	Default	Address
Fault Outputs	0-1	Bit	R/W		40005
	These bits aren't used			/	Bit [15:10]
	Fault value for output OUT10 state: 0=LOAD10 is deactivated (there is no current through LOAD10); 1=LOAD10 is activated (there is current through LOAD10)			0	Bit 9
	Fault value for output OUT9 state: 0=LOAD9 is deactivated (there is no current through LOAD9); 1=LOAD9 is activated (there is current through LOAD9)			0	Bit 8
	Fault value for output OUT8 state: 0=LOAD8 is deactivated (there is no current through LOAD8); 1=LOAD8 is activated (there is current through LOAD8)			0	Bit 7
	Fault value for output OUT7 state: 0=LOAD7 is deactivated (there is no current through LOAD7); 1=LOAD7 is activated (there is current through LOAD7)			0	Bit 6
	Fault value for output OUT6 state: 0=LOAD6 is deactivated (there is no current through LOAD6); 1=LOAD6 is activated (there is current through LOAD6)			0	Bit 5
	Fault value for output OUT5 state: 0=LOAD5 is deactivated (there is no current through LOAD5); 1=LOAD5 is activated (there is current through LOAD5)			0	Bit 4
	Fault value for output OUT4 state: 0=LOAD4 is deactivated (there is no current through LOAD4); 1=LOAD4 is activated (there is current through LOAD4)			0	Bit 3
	Fault value for output OUT3 state: 0=LOAD3 is deactivated (there is no current through LOAD3); 1=LOAD3 is activated (there is current through LOAD3)			0	Bit 2
	Fault value for output OUT2 state: 0=LOAD2 is deactivated (there is no current through LOAD2); 1=LOAD2 is activated (there is current through LOAD2)			0	Bit 1
	Fault value for output OUT1 state: 0=LOAD1 is deactivated (there is no current through LOAD1); 1=LOAD1 is activated (there is current through LOAD1)			0	Bit 0

Fault state. If the interval time of RS485-bus communication failure is greater than Timeout/30 [sec], the outputs OUT1-OUT10 and LED1-10 have the bit40005.X configuration. If the module is connected to the RS485-bus for the first time, the outputs OUT1-OUT10 and LED1-10 have the bit40005.X configuration and the bits40005.X are overwritten to the bits40003.X, with X=0;9.

Name	Range	Interpretation of register	R/W	Default	Address
Timeout	0=timeout deactivated; between: 1 (=1/30[sec]); 60000 (=2000[sec])	Word	R/W		40013
	Timeout [sec/30] (if reg.40013 is different to 0: it is interval time of RS485-bus communication failure, after which the bit 40005.X is overwritten in the bit 40003.X, with X=0;9)			150 (=5[sec])	
Reset Timer Timeout		Word	R/W		40012
	These bits aren't used			/	Bit [15:10]
	LED FAIL state to signal if there is a error (see reg.40002): 0b00=constant light; 0b01=slow blinking light; 0b10=quick blinking light; 0b11=double blinking light			0b00	Bit [9:8]
	These bits aren't used			/	Bit [7:2]
	Voltage Vext detection through LED FAIL. If bit 40012.1=0: LED FAIL is Vext-value indipendent. If bit40012.1=1: LED FAIL «off» means that Vext>VextTh; LED FAIL «on» means that Vext<VextTh (see bit40016.[7:0])			0	Bit 1
	Timer reset type. The module has a timer: if the interval time of RS485-bus communication failure is greater than Timeout/30[sec], the module overwrites the content of FaultOutputs (bits 40015.[0:9]) to Outputs (bits 40003.[0:9]). It's possible to reset this timer (the timer returns to «Timeout/30[sec]» automatically) when one of the following event occurs: 1) event=writing of an output within Timeout/30[sec] (if bit 40012.0=1); 2) event=sending of any command through RS485-bus within Timeout/30[sec] (if bit 40012.0=0)			0	Bit 0
TimeoutShort LowPower	TimeoutShort: from 1(=1/30[sec]) to 240(=8[sec])	MSB, LSB	R/W		40016
	Short-circuited timeout [sec/30] (interval time of short-circuited load, after which the corresponding bit in reg.40007 switches to «1»)			30 (=1[sec])	Bit [15:8]
	Output supply threshold voltage (VextTh) for screw terminals 1-12 [V/10] (see bit40012.1)			60 (=6[V])	Bit [7:0]

The «Input Status» registers used are shown in the following table:

Name	Range	Interpretation of register	R/W	Default	Address
State OUT1	0-1	Word	R		10001
	Output OUT1 state: 0=LOAD1 is deactivated (there is no current through LOAD1); 1=LOAD1 is activated (there is current through LOAD1)			/	
State OUT2	0-1	Word	R		10002
	Output OUT2 state: 0=LOAD2 is deactivated (there is no current through LOAD2); 1=LOAD2 is activated (there is current through LOAD2)			/	
State OUT3	0-1	Word	R		10003
	Output OUT3 state: 0=LOAD3 is deactivated (there is no current through LOAD3); 1=LOAD3 is activated (there is current through LOAD3)			/	

State OUT4	0-1	Word	R		10004
	Output OUT4 state: 0=LOAD4 is deactivated (there is no current through LOAD4); 1=LOAD4 is activated (there is current through LOAD4)			/	
State OUT5	0-1	Word	R		10005
	Output OUT5 state: 0=LOAD5 is deactivated (there is no current through LOAD5); 1=LOAD5 is activated (there is current through LOAD5)			/	
State OUT6	0-1	Word	R		10006
	Output OUT6 state: 0=LOAD6 is deactivated (there is no current through LOAD6); 1=LOAD6 is activated (there is current through LOAD6)			/	
State OUT7	0-1	Word	R		10007
	Output OUT7 state: 0=LOAD7 is deactivated (there is no current through LOAD7); 1=LOAD7 is activated (there is current through LOAD7)			/	
State OUT8	0-1	Word	R		10008
	Output OUT8 state: 0=LOAD8 is deactivated (there is no current through LOAD8); 1=LOAD8 is activated (there is current through LOAD8)			/	
State OUT9	0-1	Word	R		10009
	Output OUT9 state: 0=LOAD9 is deactivated (there is no current through LOAD9); 1=LOAD9 is activated (there is current through LOAD9)			/	
State OUT10	0-1	Word	R		10010
	Output OUT10 state: 0=LOAD10 is deactivated (there is no current through LOAD10); 1=LOAD10 is activated (there is current through LOAD10)			/	

12.6. LEDs for signalling

In the front-side panel there are 14 LEDs and their state refers to important operating conditions of the module.

LED	**LED status**	**Meaning**
PWR	Constant light	The power is on
FAIL	Blinking light	The module has at least one of the errors/overflows described in RS485 Registers table
	Constant light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Verify if the bus connection is corrected
1-10	Constant light	OUT1-10 state equal to «1»
	No light	OUT1-10 state equal to «0» (if the power is on and the outputs are supplied)

13. PDM Line module: PDM-DIO

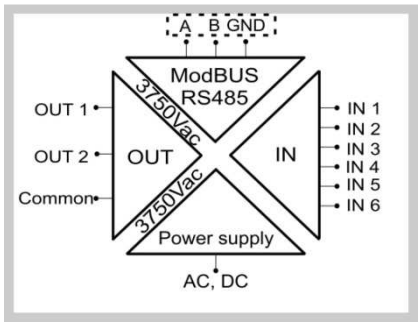
The PDM-DIO module acquires up to 6 single-ended digital signals (IN1…IN6) and controls up to 2 relay digital signals (OUT1 and OUT2). It also performs three alternative functioning modalities: pneumatic valve command modality, motor control modality, motorized valve command modality.

13.1. General characteristics

- **It is possible to choose the PDM-DIO functioning modality by Dip-Switches**
- **Internal logic to control the motors, pneumatic valve, motorized valve**
- **Configuration of the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

13.2. Features

INPUT	
Number	6
Type	REED, PROXIMITY PNP, NPN, contact, etc…
Protection	This module provides inputs and power supply (Vaux) protection against the overvoltage surge transient by transient suppressor TVS (600W/ms)
Sensor=closed	The sensor is detected «closed» if: acquired signal voltage >12 Vdc and acquired signal current > 3 mA. Minimum pulse width: 20ms
Sensor=open	The sensor is detected «open» if: acquired signal voltage <10 Vdc and acquired signal current < 2 mA
Discrimination limits	According to IEC1131.2 type 1
Internal supply Vaux	The #1 screw terminal: powers 24V with reference to a internal ground (if J1 jumper is in “Int”)
OUTPUT	
Number	2
Type	Relays SPST (Single Pole Single Throw) normally open with common contact
Max current through screw terminals	Screw terminals 10,11: 2A with 250Vac
Max relay switching frequency	6 cycles/min(with resistive load); 1200 cycles/min(with no load)
Pick-up relay voltage	18V
Drop-out relay voltage	2.4V
No-load adsorbed current by a relay	9mA
Relay response time	5/2ms
CONNECTIONS	
RS485 interface	IDC10 connector
ISOLATIONS	
	1500Vac isolations between: power supply, ModBUS RS485, input. 3750Vac isolations between: output and other parts



POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Max: 2.5W (@10Vdc)

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

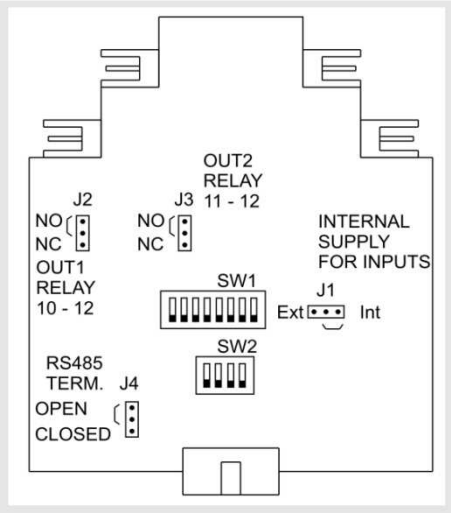
13.3. Functioning

13.3.1. I/O modality

I/O functioning modality allows having 6 digital inputs and 2 relay digital outputs.

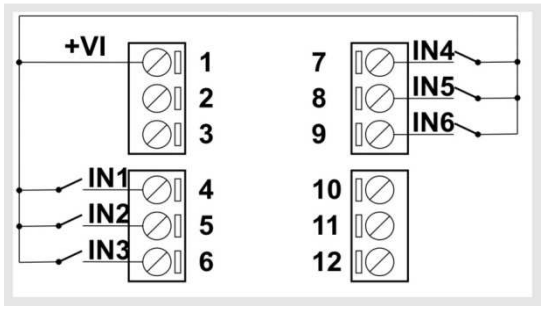
FUNCTIONING MODALITY (Dip-Switches: SW2)					
1	2	3	4	Meaning	
				I/O modality	
INPUT					
Screw terminals				Meaning	Default
4-1				Input 1	Normally open
5-1				Input 2	Normally open
6-1				Input 3	Normally open
7-1				Input 4	Normally open
8-1				Input 5	Normally open
9-1				Input 6	Normally open
OUTPUT					
Screw terminals				Meaning	Default
10-12				Output 1	Normally no-excited
11-12				Output 2	Normally no-excited

To set PDM-DIO module it is necessary open the lateral panel of module case to modify Jumpers position.

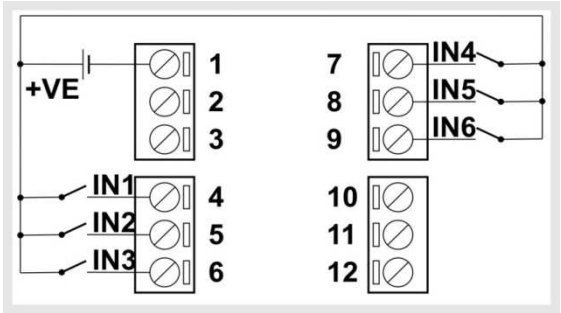


In the following figure are shown the J1, J2, J3, J4 jumpers in default position: J1 in "Int" position, J2 in "NO" position, J3 in "NO" position, J4 in "OPEN" position.

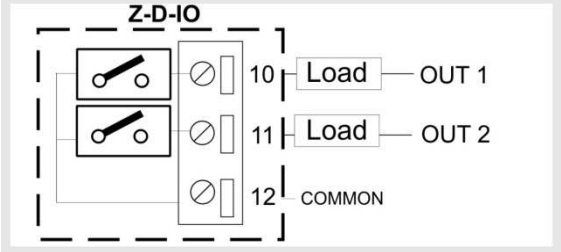
It is possible to connect the following type of sensors: REED, PROXIMITY PNP, NPN, contact, etc… To supply these inputs, an internal supply is available (if Jumper J1 is in "Int" position).
If jumper J1 is in "Int" position, input screw terminals configuration is shown in the following figure.



If jumper J1 is in "Ext" position, input screw terminals configuration is shown in the following figure. In this configuration, **a external voltage supply is necessary**.



To configure output1 and output2, set J2 and J3 jumpers.

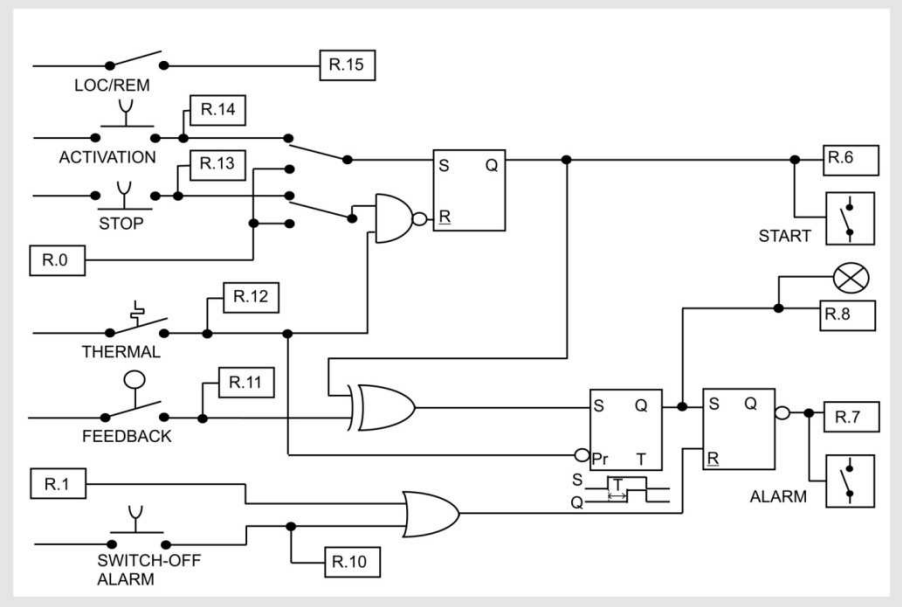


13.3.2. Motor control modality

Before using PDM-DIO in motor control modality, set motor control delay (through reg.40005 or Dip-Switches SW2-3 and SW2-4).

FUNCTIONING MODALITY (Dip-Switches: SW2)				
1	2	3	4	Meaning
●				Motor command modality

INPUT		
Screw terminals	Meaning	Default
4-1	Local/Remote	Normally open
5-1	Start	Normally open
6-1	Stop	Normally closed
7-1	Thermal protection	Normally closed
8-1	Feedback	Normally open
9-1	Switch off alarm	Normally open
OUTPUT		
Screw terminals	Meaning	Default
10-12	Alarm	Normally excited
11-12	Start	Normally no-excited

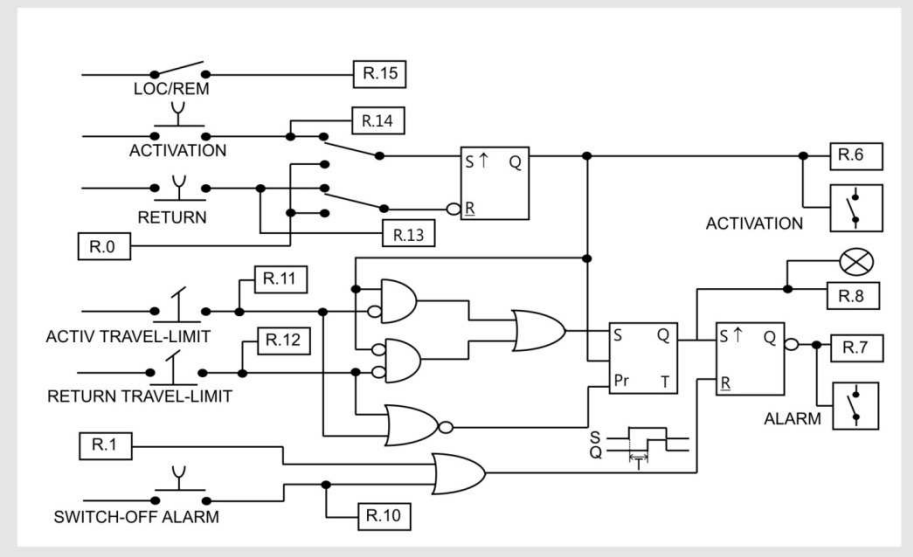


- To start the motor, close “Start” input. Module controls the “Thermal protection” input and “Stop” input closing.
- If “Thermal protection” input and “Stop” input are closed, PDM-DIO enables “Start” output. After motor command delay (see Dip-Switches SW2-3 and SW2-4 or reg.40005), closure of “Feedback” input is verified. If it is still open, “Alarm” output is enabled by module (“Start” output remains enabled).
- If “Thermal protection” input opens during operation, “Alarm” output is enabled immediately, and “Start” output is disabled.
- To switch off alarm, close “Switch off alarm” input.
- To stop motor, open “Stop” input: the module disables “Start” output.
- The “Feedback” input must open within motor command delay, otherwise the module enables “Alarm” output.

13.3.3. Pneumatic valve command modality

Before using PDM-DIO in pneumatic valve command modality, set pneumatic valve delay (through reg.40006 or Dip-Switches SW2-3 and SW2-4).

FUNCTIONING MODALITY (Dip-Switches: SW2)					
1	2	3	4	Meaning	
	•			Pneumatic valve command modality	
INPUT					
Screw terminals	Meaning				Default
4-1	Local/Remote				Normally open
5-1	Activation				Normally open
6-1	Return				Normally closed
7-1	Return travel-limit				Closed in position
8-1	Activation travel-limit				Closed in position
9-1	#9 Screw terminal isn't used				/
OUTPUT					
Screw terminals	Meaning				Default
10-12	Alarm				Normally excited
11-12	Activation				Normally no-excited



- To enable the pneumatic valve, close "Activation" input. Module controls the "Return" input closing.
- If "Return" input is closed, PDM-DIO enables "Activation" output. After pneumatic valve command delay (see Dip-Switches SW2-3 and SW2-4 or reg.40006), opening of "Activation travel-limit" input is verified. If it is still closed, "Alarm" output is enabled by module ("Activation" output remains enabled).
- To switch off alarm, close "Switch off alarm" input.
- If you open "Return" input, PDM-DIO disables "Activation" output.
- "Return travel-limit" input must open within pneumatic valve command delay, otherwise the module enables "Alarm" output.
- If "Activation travel-limit" and "Return travel-limit" inputs are opened at the same time, "Alarm" output is activated and LED FAIL is on.

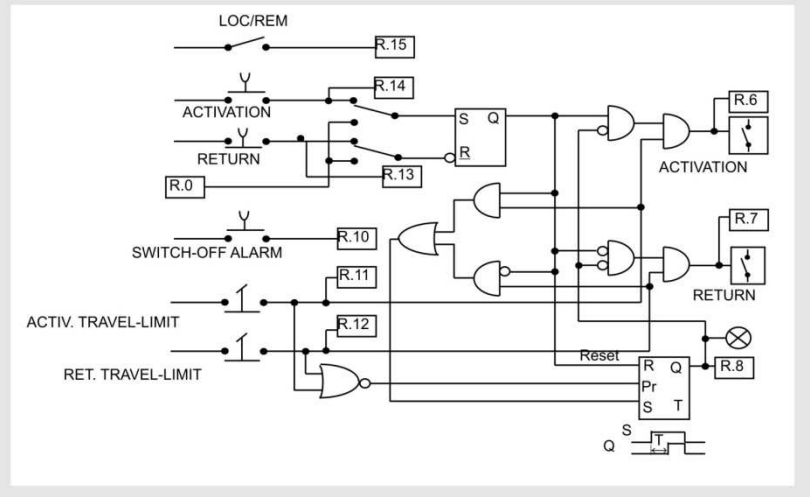
13.3.4. Motorized valve command modality

Before using PDM-DIO in pneumatic valve command modality, set motorized valve delay (through reg.40007 or Dip-Switches SW2-3 and SW2-4).

FUNCTIONING MODALITY (Dip-Switches: SW2)				
1	2	3	4	Meaning
●	●			Motorized command valve command modality

INPUT		
Screw terminals	Meaning	Default
4-1	Local/Remote	Normally open
5-1	Activation	Normally open
6-1	Return	Normally closed
7-1	Return travel-limit	Closed in position
8-1	Activation travel-limit	Closed in position
9-1	#9 Screw terminal isn't used	/

OUTPUT		
Screw terminals	Meaning	Default
10-12	Return	Normally no-excited
11-12	Activation	Normally no-excited



- To enable the motorized valve, close "Activation" input. Module controls the "Return" input closing.
- If "Return" input is closed, PDM-DIO disables "Return" output (if it was enabled) and enables "Activation" output. After motorized valve command delay (see Dip-Switches SW2-3 and SW2-4 or reg.40007), opening of "Activation travel-limit" input is verified. If it is still closed, "Activation" output is disabled and LED FAIL in on.
- If you open "Return" input, PDM-DIO disables "Activation" output (if it was enabled) and enables "Return" output.
- After motorized valve command delay, opening of "Return travel-limit is verified" (if it is closed), module enables the alarm.
- If "Activation travel-limit" and "Return travel-limit" inputs are opened at the same time, LED FAIL is on.

13.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

In the following tables: to change jumper status, it is necessary to open lateral panel because J1, J2, J3, J4 jumpers are placed into the module.

BAUD-RATE (Dip-Switches: SW1)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: SW1)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	…….
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (J4 JUMPER)		
Open	Closed	Meaning
●		RS485 terminator disabled
	●	RS485 terminator enabled

FUNCTIONING MODALITY (Dip-Switches: SW2)				
1	2	3	4	Meaning
				I/O modality
	●			Pneumatic valve modality
●				Motor command modality
●	●			Motorized valve command modality

ALARM DELAY (Dip-Switches: SW2)							
1	2	3	4	Meaning	**Motor command modality**	**Pneumatic valve modality**	**Motorized valve comm. modality**
				Delay is acquired from EEPROM memory	See reg. 40005	See reg.40006	See reg.40007
			●	Short alarm delay	2 sec	4 sec	15 sec
		●		Average alarm delay	5 sec	30 sec	120 sec
		●	●	Long alarm delay	30 sec	120 sec	300 sec

INTERNAL SUPPLY VAUX: screw terminal 1 (J1 JUMPER)		
Int	Ext	Meaning
●		Internal supply Vaux enabled (to power digital inputs)
	●	Internal supply Vaux disabled (to power digital inputs, use a external voltage Vext)

OUT1 TYPE: screw terminals 10-12 (J2 JUMPER)		
NO	NC	Meaning
●		OUT1 is normally open
	●	OUT1 is normally closed

OUT2 TYPE: screw terminals 11-12 (J3 JUMPER)		
NO	NC	Meaning
●		OUT2 is normally open
	●	OUT2 is normally closed

13.5. RS485 Register table

The function codes supported by PDM-DIO are shown in the following table.

Functional code	First register address	Name	Functional code	Name
01	00001	Read Coil Status	05	Force Single Coil
02	10001	Read Input Status	06	Preset Single Register
03	40001	Read Holding Register	15	Write Multiple Coils
04	30001	Read Input Register	16	Write Multiple Registers

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x10	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
Dip Switches status	/	Bit	R		40003
	Switch1 of “SW2” state. Bit40003.15=0 corresponds to Switch1=”0”, bit40003.15=1 corresponds to Switch1=”1”			/	Bit 15
	Switch2 of “SW2” state. Bit40003.14=0 corresponds to Switch2=”0”, bit40003.15=1 corresponds to Switch2=”1”			/	Bit 14
	Switch3 of “SW2” state. Bit40003.13=0 corresponds to Switch3=”0”, bit40003.13=1 corresponds to Switch3=”1”			/	Bit 13
	Switch4 of “SW2” state. Bit40003.12=0 corresponds to Switch4=”0”, bit40003.12=1 corresponds to Switch4=”1”			/	Bit 12
	These bits aren’t used			/	Bit [11:8]
	Switch1 of “SW1” state. Bit40003.7=0 corresponds to Switch1=”0”, bit40003.7=1 corresponds to Switch1=”1”			/	Bit 7
	Switch2 of “SW1” state. Bit40003.6=0 corresponds to Switch2=”0”, bit40003.6=1 corresponds to Switch2=”1”			/	Bit 6
	Switch3 of “SW1” state. Bit40003.5=0 corresponds to Switch3=”0”, bit40003.5=1 corresponds to Switch3=”1”			/	Bit 5
	Switch4 of “SW1” state. Bit40003.4=0 corresponds to Switch4=”0”, bit40003.4=1 corresponds to Switch4=”1”			/	Bit 4
	Switch5 of “SW1” state. Bit40003.3=0 corresponds to Switch5=”0”, bit40003.3=1 corresponds to Switch5=”1”			/	Bit 3
	Switch6 of “SW1” state. Bit40003.2=0 corresponds to Switch6=”0”, bit40003.2=1 corresponds to Switch6=”1”			/	Bit 2
	Switch7 of “SW1” state. Bit40003.1=0 corresponds to Switch7=”0”, bit40003.1=1 corresponds to Switch7=”1”			/	Bit 1
	Switch8 of “SW1” state. Bit40003.0=0 corresponds to Switch8=”0”, bit40003.0=1 corresponds to Switch8=”1”			/	Bit 0
Address Parity	/	MSB, LSB	R/W		40008
	Address for RS485 (address of module/node if parameters are configurated by memory modality): from 0x01=1 to 0xFF=255			1	Bit [15:8]
	Parity for RS485: 0=there isn’t; 1=even; 2=odd			0	Bit [7:0]
Baudrate Delay	/	MSB, LSB	R/W		40009
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]

	Delay for RS485 (delay of communication response: it represents the number of the pauses(*) between the end of Rx message and the start of Tx message): from 0x00=0 to 0xFF=255 (*)1 pause=6 characters			0	Bit [7:0]
IN and OUT	/	Bit	R/W		40002
	Input1 state (if I/O modality): 0=open; 1=closed Local/remote state (if motor control modality, motorized valve command modality, pneumatic valve command modality): 0=local control; 1=remote control			See note below	Bit 15
	Input2 state (if I/O modality): 0=open; 1=closed Start state (if motor control modality): 0=open; 1=closed Activation state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 14
	Input3 state (if I/O modality): 0=open; 1=closed Stop state (if motor control modality): 0=open; 1=closed Return state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 13
	Input4 state (if I/O modality): 0=open; 1=closed Thermal protection state (if motor control modality): 0=open; 1=closed Return travel-limit state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 12
	Input5 state (if I/O modality): 0=open; 1=closed Feedback (if motor control modality): 0=open; 1=closed Activation travel-limit (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 11
	Input6 state (if I/O modality): 0=open; 1=closed Switch off alarm state (if motor control modality, motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 10
	These bits aren't used			/	Bit 9
	Alarm: 0=there isn't; 1=there is			See note below	Bit 8
	Alarm output state (if motor control modality, pneumatic valve command modality): 0=deactivated; 1=activated Return output state (if motorized valve command modality): 0=deactivated; 1=activated			See note below	Bit 7
	Start output state (if motor control modality): 0=deactivated; 1=activated Activation output state (if motorized valve command modality, pneumatic valve command modality): 0=deactivated; 1=activated			See note below	Bit 6
	These bits aren't used			/	Bit [5:2]
	Output1 state (if I/O modality): 0=OFF; 1=ON Alarm (if motor command modality, pneumatic valve command modality) Return (if motorized valve command modality)			/	Bit 1
	Output2 state (if I/O modality): 0=OFF; 1=ON Alarm (if motor command modality) Return (if motorized valve command modality, pneumatic valve command modality)			/	Bit 0

	To know default values, see “Functioning” for selected functioning modality.				
IN and OUT state	/	Bit	R		40014
	Input1 state (if I/O modality): 0=open; 1=closed Local/remote state (if motor control modality, motorized valve command modality, pneumatic valve command modality): 0=local control; 1=remote control			See note below	Bit 15
	Input2 state (if I/O modality): 0=open; 1=closed Start state (if motor control modality): 0=open; 1=closed Activation state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 14
	Input3 state (if I/O modality): 0=open; 1=closed Stop state (if motor control modality): 0=open; 1=closed Return state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 13
	Input4 state (if I/O modality): 0=open; 1=closed Thermal protection state (if motor control modality): 0=open; 1=closed Return travel-limit state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 12
	Input5 state (if I/O modality): 0=open; 1=closed Feedback (if motor control modality): 0=open; 1=closed Activation travel-limit (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 11
	Input6 state (if I/O modality): 0=open; 1=closed Switch off alarm state (if motor control modality, motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			See note below	Bit 10
	These bits aren’t used			/	Bit 9
	Alarm: 0=there isn’t; 1=there is			See note below	Bit 8
	Output1 state (if I/O modality): 0=OFF; 1=ON Alarm output state (if motor control modality, pneumatic valve command modality): 0=OFF; 1=ON Return output state (if motorized valve command modality): 0=OFF; 1=ON			See note below	Bit 7
	Output2 state (if I/O modality) Start output state (if motor control modality): 0=OFF; 1=ON Activation output state (if motorized valve command modality, pneumatic valve command modality): 0=OFF; 1=ON			See note below	Bit 6
	These bits aren’t used			/	Bit [5:0]
	To know default values, see “Functioning” for selected functioning modality.				

Command state	/	Bit	R/W		40015
	These bits aren't used			/	Bit [15:2]
	Output1 state (if I/O modality): 0=OFF; 1=ON Alarm command (if motor command modality, pneumatic valve command modality): 0=OFF; 1=ON Return command (if motorized valve command modality): 0=OFF; 1=ON			/	Bit 1
	Output2 state (if I/O modality): 0=OFF; 1=ON Alarm (if motor command modality): 0=OFF; 1=ON Return (if motorized valve command modality, pneumatic valve command modality): 0=OFF; 1=ON			/	Bit 0
 To know default values, see "Functioning" for selected functioning modality.					
Delay DipSw	/	Word	R		40004
	Delay between input action and corresponding output effect [sec/10] (if delay is configurated by Dip-Switches)			/	
Motor control delay	/	Word	R/W		40005
	Delay between input action and corresponding output effect [sec/10] (if motor control modality)			100 (10sec)	
Pneumatic valve comm. delay	/	Word	R/W		40006
	Delay between input action and corresponding output effect [sec/10] (if pneumatic valve command modality)			100 (10sec)	
Motorized valve comm. delay	/	Word	R/W		40007
	Delay between input action and corresponding output effect [sec/10] (if motorized valve command modality)			100 (10sec)	

The «Input Status»-type registers used for PDM-DIO module are shown in the following table:

Name	Range	Interpretation of register	R/W	Default	Address
IN1 state	0-1	Word	R		10001
	Input1 state (if I/O modality): 0=open; 1=closed Local/remote state (if motor control modality, motorized valve command modality, pneumatic valve command modality): 0=local control; 1=remote control			/	
IN2 state	0-1	Word	R		10002
	Input2 state (if I/O modality): 0=open; 1=closed Start state (if motor control modality): 0=open; 1=closed Activation state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			/	
IN3 state	0-1	Word	R		10003
	Input3 state (if I/O modality): 0=open; 1=closed Stop state (if motor control modality): 0=open; 1=closed Return state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			/	

IN4 state	0-1	Word	R		10004
	Input4 state (if I/O modality): 0=open; 1=closed Thermal protection state (if motor control modality): 0=open; 1=closed Return travel-limit state (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			/	
IN5 state	0-1	Word	R		10005
	Input5 state (if I/O modality): 0=open; 1=closed Feedback (if motor control modality): 0=open; 1=closed Activation travel-limit (if motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			/	
IN6 state	0-1	Word	R		10006
	Input6 state (if I/O modality): 0=open; 1=closed Switch off alarm state (if motor control modality, motorized valve command modality, pneumatic valve command modality): 0=open; 1=closed			/	
Alarm	0-1	Word	R		10008
	Alarm: 0=there isn't; 1=there is			/	
OUT1 state	0-1	Word	R		10009
	Output1 state (if I/O modality) : 0=OFF; 1=ON Alarm output state (if motor control modality, pneumatic valve command modality): 0=OFF; 1=ON Return output state (if motorized valve command modality): 0=OFF; 1=ON			/	
OUT2 state	0-1	Word	R		10010
	Output2 state (if I/O modality): 0=OFF; 1=ON Start output state (if motor control modality): 0=OFF; 1=ON Activation output state (if motorized valve command modality, pneumatic valve command modality): 0=OFF; 1=ON			/	

The «Coil Status»-type registers used for PDM-DIO module are shown in the following table:

Name	**Range**	**Interpretation of register**	**R/W**	**Default**	**Address**
OUT1 command	0-1	Word	R/W		00002
	Output1 state (if I/O modality) : 0=OFF; 1=ON Alarm output state (if motor control modality, pneumatic valve command modality): 0=OFF; 1=ON Return output state (if motorized valve command modality): 0=OFF; 1=ON			/	
OUT2 command	0-1	Word	R/W		00003
	Output2 state (if I/O modality): 0=OFF; 1=ON Alarm (if motor command modality): 0=OFF; 1=ON Return (if motorized valve command modality, pneumatic valve command modality): 0=OFF; 1=ON			/	

13.6. LEDs for signaling

In the front-side panel there are 12 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
IN 1-6	Constant light	IN1-6 state equal to «1»
	No light	IN1-6 state equal to «0» (if the power is on)
OUT 1-2	Constant light	OUT1-2 state equal to «1»
	No light	OUT1-2 state equal to «0» (if the power is on)

14. PDM Line module: PDM-4AI

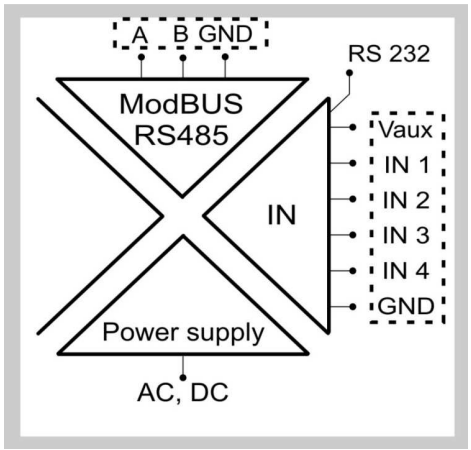
The PDM-4AI module acquires up to 4 single-ended input signals (voltage or current type) and it converts them to a digital format (normalized measure).

14.1. General characteristics

- **It is possible to choose if each input is voltage or current type**
- **It is possible to enable/disable each input**
- **It is possible to change: the electrical start/end scale between ± 10 V, 0/ 20 mA, the normalized start/end scale between ± 32000**
- **Configuration of the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

14.2. Features

INPUT	
Number	4
Resolution	16 bits (15+1 sign). If Electrical End-Scale (E.E.S.)<2V, resolution=60µV; if 2V<E.E.S.<10V, resolution=300µV
Sampling time	Configurable between: 120 ms or 60 ms
Accuracy	Initial: 0.1% of E.E.S.. If E.E.S.<2V, accuracy=2mV; if 2V<E.E.S.<10V, accuracy=10mV
	Linearity: 0.03% of E.E.S. (see initial accuracy)
	Zero: 0.05% of E.E.S. (see initial accuracy)
	Thermal stability: < 100 ppm/°K
	EMI: < 1%
Protection	± 30Vdc and 25mA
Voltage-type IN	Bipolar with E.S.S./E.E.S.(Electrical Start/End Scale) configurable between: ± 10Vdc. Input impedance: > 100 kΩ
Current-type IN	Bipolar with E.S.S./E.E.S. configurable between: ±20mA.Internal shunt:50Ω. To enable these shunts, use the «Analog inputs» Dip-switches
Internal supply Vaux	The #7 screw terminals: power 13V to max90mA
CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel) or (alternative) the screw terminals: 4(GND), 5(B), 6(A)
RS232 interface	Jack stereo 3.5mm connector: plugs into COM port
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, analog input



POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5W; Max: 2W (to power 4 current loop)

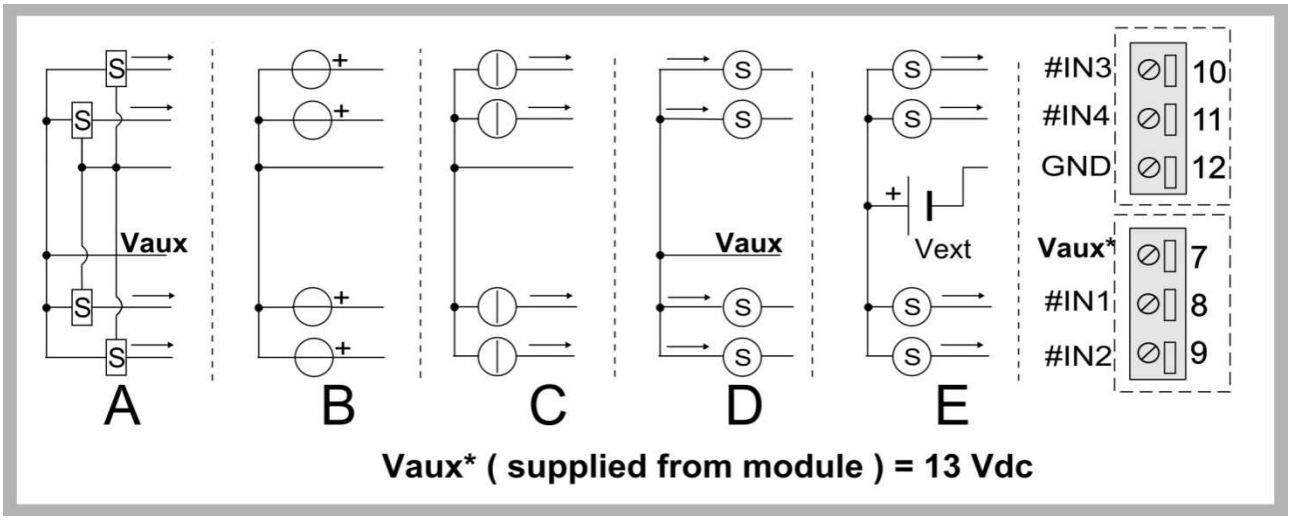
The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

14.3. Input connections

It is possible to connect two types of sensors to the PDM-4AI module:

- passive sensors**, indicated with "S" label (these sensors have to be supplied: by a module external voltage Vext or by the module internal voltage Vaux);**
- active sensors**, indicated with "voltage generator" or "current generator" label (these sensors have already been supplied).**

In the following figure are shown five possible sensor connections.



	Acquired signal	Up to	Connection modality	Sensors power supply
A	**Voltage or current type**	**4 passive sensors**	**3-wire**	**Vaux (*)**
B	**Voltage type**	**4 sensors as voltage generator**	**2-wire**	**/**
C	**Current type**	**4 sensors as current generator**	**2-wire**	**/**
D	**Current-active type**	**4 passive sensors**	**2-wire**	**Vaux (*)**
E	**Current-passive type**	**4 passive sensors**	**2-wire**	**Vext (connect "-" to GND)**

(*) A and D connections are possible only if the absorbed currents sum from all sensors: <90mA.

14.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

INPUT TYPE (Dip-Switches: ANALOG INPUTS)								
1	2	3	4	5	6	7	8	Meaning
								IN 1=voltage
●								IN 1=current
								IN 2=voltage
	●							IN 2=current
								IN 3=voltage
		●						IN 3=current
								IN 4=voltage
			●					IN 4=current

14.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x07	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40035
	Firmware Code				
Status	/	Bit	R/W		40016
	Input 4 underflow: 0=there isn't; 1=there is			/	Bit 15
	Input 4 overflow: 0=there isn't; 1=there is			/	Bit 14
	Input 3 underflow: 0=there isn't; 1=there is			/	Bit 13
	Input 3 overflow: 0=there isn't; 1=there is			/	Bit 12
	Input 2 underflow: 0=there isn't; 1=there is			/	Bit 11
	Input 2 overflow: 0=there isn't; 1=there is			/	Bit 10
	Input 1 underflow: 0=there isn't; 1=there is			/	Bit 9
	Input 1 overflow: 0=there isn't; 1=there is			/	Bit 8
	Save configuration in memory (EEPROM): 0=deactivated; 1=activated			0	Bit 7
	These bits aren't used			/	Bit [6:2]
	Reset of filter: 0=deactivated; 1=activated			0	Bit 1
	Reset of module: 0=deactivated; 1=activated			0	Bit 0
Errors	/	Bit	R		40036
	These bits aren't used			/	Bit[15:10]
	Setting error (in memory): 0=there isn't; 1=there is			/	Bit 9
	Calibration error (in memory): 0=there isn't;1=there is			/	Bit 8
	These bits aren't used			/	Bit [7:1]
	ADC error: 0=there isn't; 1=there is			/	Bit 0
Eprflag	/	MSB, LSB	R/W		40003
	These bits aren't used			/	Bit [15:5]
	Parity for RS485: 0=even parity; 1=odd parity			0	Bit 4
	Parity for RS485: 0=there isn't; 1=there is			0	Bit 3
	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message): 0=there isn't; 1=there is			0	Bit 2
	Sampling time: 0=120 ms; 1=60 ms			0	Bit 1
	Compatibility with: 0=PDM-4AI-0; 1=PDM-4AI-1			1	Bit 0
Baudrate Address	/	MSB, LSB	R/W		40002
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Address for RS485(address of module if parameters are configurated by memory modality):from 0x01=1 to 0xFF=255			1	Bit [7:0]
INType	/	Bit	R/W		40025
	These bits aren't used			/	Bit [15:4]
	Input 4-type: 0=voltage; 1=current			0	Bit 3
	Input 3-type: 0=voltage; 1=current			0	Bit 2
	Input 2-type: 0=voltage; 1=current			0	Bit 1
	Input 1-type: 0=voltage; 1=current			0	Bit 0

INPUT 1					
IN 1	Between: IN 1-NSS, IN 1-NES (if bit 40003.0=0); unchangeable between: 0,10000 (if bit40003.0=1)	Word	R		40017
	Normalized measure of input 1			/	
IN1-FILTER	Between: 0, 6	Word	R/W		40004
	Filter applied to input 1 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			0	
IN 1-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40012
	Electrical Start Scale (E.S.S.) of input 1 [mV or µA]			0 [mV]	
IN 1-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40008
	Electrical End Scale (E.E.S.) of input 1 [mV or µA]			10000 [mV]	
IN 1-NSS	±32000	Word	R/W		40030
	Normalized Start Scale (N.S.S.) of input 1			0	
IN 1-NES	±32000	Word	R/W		40026
	Normalized End Scale (N.E.S.) of input 1			10000	
INPUT 2					
IN 2	Between: IN 2-NSS, IN 2-NES (if bit 40003.0=0); unchangeable between: 0,10000 (if bit40003.0=1)	Word	R		40018
	Normalized measure of input 2				
IN2-FILTER	Between: 0, 6	Word	R/W		40005
	Filter applied to input 2 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			/	
IN 2-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40013
	Electrical Start Scale (E.S.S.) of input 2 [mV or µA]			0 [mV]	
IN 2-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40009
	Electrical End Scale (E.E.S.) of input 2 [mV or µA]			10000 [mV]	
IN 2-NSS	±32000	Word	R/W		40031
	Normalized Start Scale (N.S.S.) of input 2			0	
IN 2-NES	±32000	Word	R/W		40027
	Normalized End Scale (N.E.S.) of input 2			10000	
INPUT 3					
IN 3	Between: IN 3-NSS, IN 3-NES (if bit 40003.0=0); unchangeable between: 0,10000 (if bit40003.0=1)	Word	R		40019
	Normalized measure of input 3				
IN3-FILTER	Between: 0, 6	Word	R/W		40006
	Filter applied to input 3 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			/	
IN 3-ESS	±10000 [mV] (if voltage),	Word	R/W		40014

	±20000 [µA] (if current)				
	Electrical Start Scale (E.S.S.) of input 3 [mV or µA]			0 [mV]	
IN 3-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40010
	Electrical End Scale (E.E.S.) of input 3 [mV or µA]			10000 [mV]	
IN 3-NSS	±32000	Word	R/W		40032
	Normalized Start Scale (N.S.S.) of input 3			0	
IN 3-NES	±32000	Word	R/W		40028
	Normalized End Scale (N.E.S.) of input 3			10000	
INPUT 4					
IN 4	Between: IN 4-NSS, IN 4-NES (if bit 40003.0=0); unchangeable between: 0,10000 (if bit40003.0=1)	Word	R		40020
	Normalized measure of input 4				
IN4-FILTER	Between: 0, 6	Word	R/W		40007
	Filter applied to input 4 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			/	
IN 4-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40015
	Electrical Start Scale (E.S.S.) of input 4 [mV or µA]			0 [mV]	
IN 4-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40011
	Electrical End Scale (E.E.S.) of input 4 [mV or µA]			10000 [mV]	
IN 4-NSS	±32000	Word	R/W		40033
	Normalized Start Scale (N.S.S.) of input 4			0	
IN 4-NES	±32000	Word	R/W		40029
	Normalized End Scale (N.E.S.) of input 4			10000	

14.6. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet

15. PDM Line module: PDM-8AI

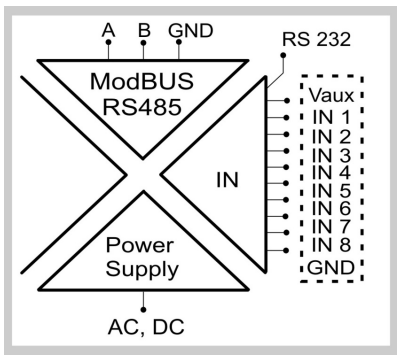
The PDM-8AI module acquires up to 8 single-ended input signals (voltage or current type) and it converts them to a digital format (normalized measure).

15.1. General characteristics

- **It is possible to choose if each input is voltage or current type**
- **It is possible to enable/disable each input**
- **It is possible to change: the electrical start/end scale between ± 10 V, ± 20 mA, the normalized start/end scale between ± 32000**
- **Configuration of the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

15.2. Features

INPUT	
Number	8
Resolution	16 bits (15+1 sign). If Electrical End-Scale (E.E.S.)<2.5V, resolution=80µV; se 2.5V<E.E.S.<10V, resolution=300µV
Sampling time	Configurable between: 10, 20, 40 or 120 ms
Accuracy	Initial: 0.1% of E.E.S.. If E.E.S.<2.5V, accuracy=2.5mV; if 2.5V<E.E.S.<10V, accuracy=10mV
	Linearity: 0.03% of E.E.S. (see initial accuracy)
	Zero: 0.05% of E.E.S. (see initial accuracy)
	Thermal stability: < 100 ppm/°K
	EMI: < 1%
Protection	± 30Vdc and 25mA
Voltage-type IN	Bipolar with E.S.S./E.E.S.(Electrical Start/End Scale) configurable between: ± 10Vdc. Input impedance: > 100 kΩ
Current-type IN	Bipolar with E.S.S./E.E.S. configurable between: ±20mA.Internal shunt:50Ω. To enable these shunts, use the «Analog inputs» Dip-Switches
Internal supply Vaux	The #4 and #7 screw terminals: power 13V to max180mA (figure10)
CONNECTIONS	
RS485 interface	IDC10 connector
RS232 interface	Jack stereo 3.5mm connector: plugs into COM port
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, analog inputs



POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5W; Max: 3.5W (to power 8 current loop)

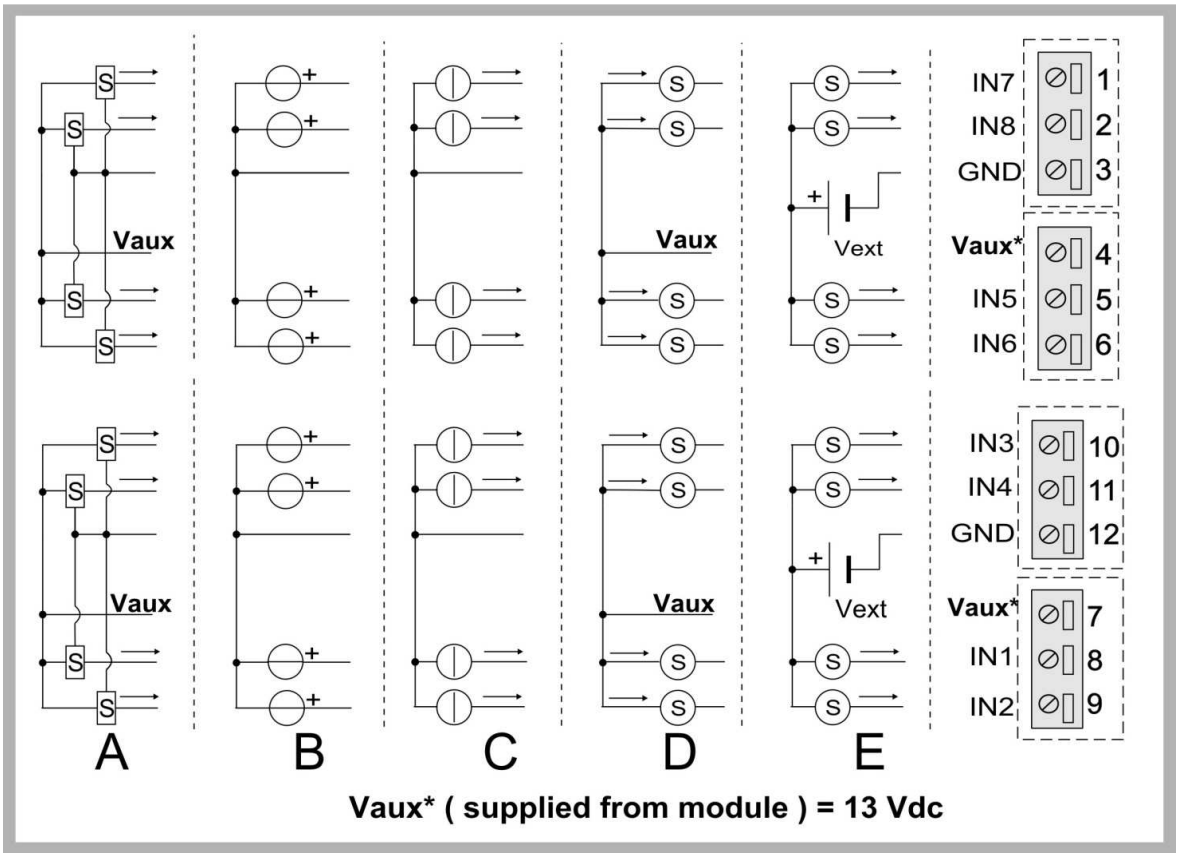
The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

15.3. Input connections

It is possible to connect to the PDM-8AI module two types of sensors:

- passive sensors**, indicated with "S" label (these sensors have to be supplied: by a module external voltage Vext or by the module internal voltage Vaux);**
- active sensors**, indicated with "voltage generator" or "current generator" label (these sensors have already been supplied).**

In the following figure are shown five possible sensor connections.



	Acquired signal	Up to	Connection modality	Sensors power supply
A	**Voltage or current type**	**8 passive sensors**	**3-wire**	**Vaux (*)**
B	**Voltage type**	**8 sensors as voltage generator**	**2-wire**	**/**
C	**Current type**	**8 sensors as current generator**	**2-wire**	**/**
D	**Current-active type**	**8 passive sensors**	**2-wire**	**Vaux (*)**
E	**Current-passive type**	**8 passive sensors**	**2-wire**	**Vext (connect "-" to GND)**

(*) A and D connections are possible only if the absorbed currents sum from all sensors: <180mA.

15.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

INPUT TYPE (Dip-Switches: ANALOG INPUTS)								
1	2	3	4	5	6	7	8	Meaning
								IN 1=voltage
●								IN 1=current
								IN 2=voltage
	●							IN 2=current
								IN 3=voltage
		●						IN 3=current
								IN 4=voltage
			●					IN 4=current

INPUT TYPE (Dip-Switches: ANALOG INPUTS)								
1	2	3	4	5	6	7	8	Meaning
								IN 5=voltage
				●				IN 5=current
								IN 6=voltage
					●			IN 6=current
								IN 7=voltage
						●		IN 7=current
								IN 8=voltage
							●	IN 8=current

15.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x0E	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40062
	Firmware Code				
Status	/	Bit	R/W		40002
	Generic error: 0=there isn't; 1=there is			/	Bit 15
	Configuration error: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM): 0=there isn't; 1=there is			/	Bit 13
	Save configuration in memory (EEPROM): 0=deactivated; 1=activated			/	Bit 12
	These bits aren't used			/	Bit [11:9]
	Reset of module: 0=deactivated; 1=activated			/	Bit 8
	These bits aren't used			/	Bit [7:0]
Errors	/	Bit	R		40063
	These bits aren't used			/	Bit[15:10]
	Setting error (in memory): 0=there isn't; 1=there is			/	Bit 9
	Calibration error (in memory): 0=there isn't;1=there is			/	Bit 8
	These bits aren't used			/	Bit [7:1]
	ADC error: 0=there isn't; 1=there is			/	Bit 0
Address Parity	/	MSB, LSB	R/W		40012
	Address for RS485 (address of module/node if parameters are configurated by memory modality): from 0x01=1 to 0xFF=255			1	Bit [15:8]
	Parity for RS485: 0=there isn't; 1=even parity; 2=odd parity			0	Bit [7:0]
Baudrate Delay	/	MSB, LSB	R/W		40013
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Delay for RS485 (delay of communication response: it represents the number of the pauses(*) between the end of Rx message and the start of Tx message): from 0x00=0 to 0xFF=255 (*)1 pause=6 characters			0	Bit [7:0]
INPUT 1					
IN1	Between: IN 1-NSS, IN 1-NES	Word	R		40003
	Normalized measure of input 1			/	
IN 1-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40014
	Electrical Start Scale (E.S.S.) of input 1 [mV or µA]			0 [mV]	
IN 1-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40015
	Electrical End Scale (E.E.S.) of input 1 [mV or µA]			10000 [mV]	

IN 1-NSS	±32000	Word	R/W		40016
	Normalized Start Scale (N.S.S.) of input 1			0	
IN 1-NES	±32000	Word	R/W		40017
	Normalized End Scale (N.E.S.) of input 1			10000	
IN 1-FLAGS	/	Bit	R/W		40019
	These bits aren't used			/	Bit [15:8]
	Input enabling: 0=deactivated; 1=activated			1	Bit 7
	These bits aren't used			/	Bit [6:4]
	Sampling time: 0b00=10 ms; 0b01=30 ms; 0b10=40 ms; 0b11=120 ms			10 [ms]	Bit [3:2]
	This bit isn't used			/	Bit 1
	Acquired-input type: 0=voltage; 1=current			0	Bit 0
INPUT 2					
IN 2	Between: IN 2-NSS, IN 2-NES	Word	R		40004
	Normalized measure of input 2			/	
IN 2-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40020
	Electrical Start Scale (E.S.S.) of input 2 [mV or µA]			0 [mV]	
IN 2-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40021
	Electrical End Scale (E.E.S.) of input 2 [mV or µA]			10000 [mV]	
IN 2-NSS	±32000	Word	R/W		40022
	Normalized Start Scale (N.S.S.) of input 2			0	
IN 2-NES	±32000	Word	R/W		40023
	Normalized End Scale (N.E.S.) of input 2			10000	
IN 2-FLAGS	/	Bit	R/W		40025
	See IN 1-FLAGS register (40019)			/	
INPUT 3					
IN 3	Between: IN 3-NSS, IN 3-NES	Word	R		40005
	Normalized measure of input 3			/	
IN 3-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40026
	Electrical Start Scale (E.S.S.) of input 3 [mV or µA]			0 [mV]	
IN 3-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40027
	Electrical End Scale (E.E.S.) of input 3 [mV or µA]			10000 [mV]	
IN 3-NSS	±32000	Word	R/W		40028
	Normalized Start Scale (N.S.S.) of input 3			0	
IN 3-NES	±32000	Word	R/W		40029
	Normalized End Scale (N.E.S.) of input 3			10000	
IN 3-FLAGS	/	Bit	R/W		40031
	See IN 1-FLAGS register (40019)			/	
INPUT 4					
IN 4	Between: IN 4-NSS, IN 4-NES	Word	R		40006
	Normalized measure of input 4			/	
IN 4-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40032
	Electrical Start Scale (E.S.S.) of input 4 [mV or µA]			0 [mV]	

IN 4-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40033
	Electrical End Scale (E.E.S.) of input 4 [mV or µA]			10000 [mV]	
IN 4-NSS	±32000	Word	R/W		40034
	Normalized Start Scale (N.S.S.) of input 4			0	
IN 4-NES	±32000	Word	R/W		40035
	Normalized End Scale (N.E.S.) of input 4			10000	
IN 4-FLAGS	/	Bit	R/W		40037
	See IN 1-FLAGS register (40019)			/	
INPUT 5					
IN 5	Between: IN 5-NSS, IN 5-NES	Word	R		40007
	Normalized measure of input 5			/	
IN 5-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40038
	Electrical Start Scale (E.S.S.) of input 5 [mV or µA]			0 [mV]	
IN 5-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40039
	Electrical End Scale (E.E.S.) of input 5 [mV or µA]			10000 [mV]	
IN 5-NSS	±32000	Word	R/W		40040
	Normalized Start Scale (N.S.S.) of input 5			0	
IN 5-NES	±32000	Word	R/W		40041
	Normalized End Scale (N.E.S.) of input 5			10000	
IN 5-FLAGS	/	Bit	R/W		40043
	See IN 1-FLAGS register (40019)			/	
INPUT 6					
IN 6	Between: IN 6-NSS, IN 6-NES	Word	R		40008
	Normalized measure of input 6			/	
IN 6-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40044
	Electrical Start Scale (E.S.S.) of input 6 [mV or µA]			0 [mV]	
IN 6-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40045
	Electrical End Scale (E.E.S.) of input 6 [mV or µA]			10000 [mV]	
IN 6-NSS	±32000	Word	R/W		40046
	Normalized Start Scale (N.S.S.) of input 6			0	
IN 6-NES	±32000	Word	R/W		40047
	Normalized End Scale (N.E.S.) of input 6			10000	
IN 6-FLAGS	/	Bit	R/W		40049
	See IN 1-FLAGS register (40019)			/	
INPUT 7					
IN 7	Between: IN 7-NSS, IN 7-NES	Word	R		40009
	Normalized measure of input 7			/	
IN 7-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40050
	Electrical Start Scale (E.S.S.) of input 7 [mV or µA]			0 [mV]	
IN 7-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40051

	Electrical End Scale (E.E.S.) of input 7 [mV or µA]			10000 [mV]	
IN 7-NSS	±32000	Word	R/W		40052
	Normalized Start Scale (N.S.S.) of input 7			0	
IN 7-NES	±32000	Word	R/W		40053
	Normalized End Scale (N.E.S.) of input 7			10000	
IN 7-FLAGS	/	Bit	R/W		40055
	See IN 1-FLAGS register (40019)			/	
INPUT 8					
IN 8	Between: IN 8-NSS, IN 8-NES	Word	R		40010
	Normalized measure of input 8			/	
IN 8-ESS	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40056
	Electrical Start Scale (E.S.S.) of input 8 [mV or µA]			0 [mV]	
IN 8-EES	±10000 [mV] (if voltage), ±20000 [µA] (if current)	Word	R/W		40057
	Electrical End Scale (E.E.S.) of input 8 [mV or µA]			10000 [mV]	
IN 8-NSS	±32000	Word	R/W		40058
	Normalized Start Scale (N.S.S.) of input 8			0	
IN 8-NES	±32000	Word	R/W		40059
	Normalized End Scale (N.E.S.) of input 8			10000	
IN 8-FLAGS	/	Bit	R/W		40061
	See IN 1-FLAGS register (40019)			/	

15.6. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet

16. PDM Line module: PDM-3AO

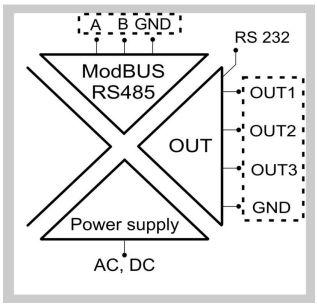
The PDM-3AO module supplies 3 single-ended analog signals (voltage or current type).

16.1. General characteristics

- **It is possible to choose if each output is voltage or current type**
- **It is possible to change the electrical start/end scale between ± 10 V, 0-20 mA**
- **It's possible to manage the electrical values (for each output) if the interval time of RS485-bus communication failure is greater than a configurable time (see Timeout register)**
- **Output protection against the overvoltage surge transients and short-circuits**
- **Configuration of the module (node) address, baud-rate and output-type (voltage or current) by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

16.2. Features

OUTPUT	
Number	3
Resolution	12 bit. If output is voltage-type, resolution=5mV; if output is current-type, resolution=5µA
Response time	< 50 ms (step response, 10%-90%)
Accuracy	Initial: 0.1% of Electrical End Scale (E.E.S.)
	Linearity: 0.05% of E.E.S.
	Calibration: 0.2% of E.E.S.
	Thermal stability: 0.01%/°C
	EMI: < 1%
Protection	Protection against the overvoltage surge transients by transient suppressor (400W/ms); protection against the output short-circuits by internal series PTC
Voltage-type OUT	Bipolar with E.S.S./E.E.S.(Electrical Start/End Scale) configurable between: ± 10Vdc. Output impedance: > 600 Ω
Current-type OUT	Unipolar with E.S.S./E.E.S.(Electrical Start/End Scale) configurable between: 0-20mA. Output impedance: < 600 Ω
Internal supply Vaux	The #4 and #7 screw terminals: power 13V to max180mA
CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel) or (alternative) the screw terminals: 4(GND), 5(B), 6(A)
RS232 interface	Jack stereo 3.5mm connector:plugs into COMport(front-side panel)
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, analog output

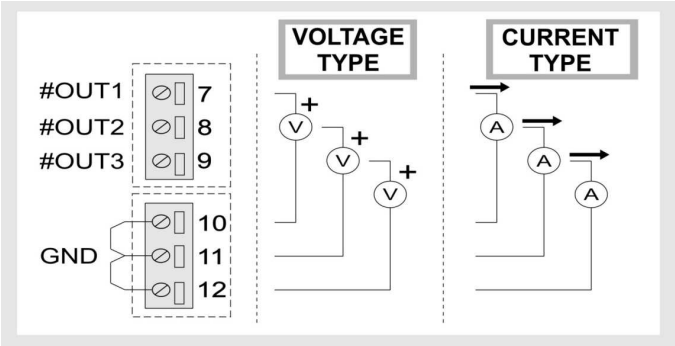


POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5W; Max: 3.2W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

16.3. Output connections

The 3 analog outputs (voltage or current type) are avaliable at the screw terminals 7, 8, 9 and they refer to the equipotential screw terminals 10, 11, 12 (GND) (connected internally).



16.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switch: TERM)	
1	Meaning
	RS485 terminator disabled
●	RS485 terminator enabled

OUTPUT TYPE (Dip-Switches: ANALOG OUTPUT)											
1	2	3	Meaning	1	2	3	Meaning	1	2	3	Meaning
			OUT1=voltage				OUT2=voltage				OUT3=voltage
●			OUT1=current		●		OUT2=current			●	OUT3=current

16.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x0F (=15 decimal)	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40011
	Firmware Code				
Errors	/	Bit	R		40008
	These bits aren't used			/	Bit [15:5]
	Memory loss of data (in EEPROM):0=there isn't;1=there is			/	Bit 4
	This bit isn't used			/	Bit 3
	Fault error (there is if the interval time of RS485-bus communication failure is greater than Timeout/10 [sec]): 0=there isn't; 1=there is			/	Bit 2
	These bits aren't used			/	Bit [1:0]
Eprflag	/	Bit	R/W		40004
	These bits aren't used			/	Bit[15:8]
	Module behavior if there is a fault error: 0=no operation; 1=the module overwrites the content of the register: 40069 in 40005, 40070 in 40006, 40071 in 40007). See register 40003			0	Bit 7
	These bits aren't used			/	Bit [6:5]
	Parity for RS485: 0=even parity; 1=odd parity			0	Bit 4
	Parity for RS485: 0=deactivated; 1=activated			0	Bit 3
	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message): 0=there isn't; 1=there is			0	Bit 2
	These bits aren't used			/	Bit [1:0]
Baudrate Address	Address: from 0x01=1 to 0xFF=255	MSB, LSB	R/W		40002
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Address for RS485 (address of module if parameters are configurated by memory modality)			1	Bit [7:0]
Command	0xBAB0, 0xCAC0, 0xC1A0	Word	R/W		40009
	Save configuration in memory (EEPROM), if reg.40009=0xBAB0 The module writes the Dip-Switches-state in reg.40010, if reg.40009=0xCAC0 Module reset, if reg.40009=0xC1A0			0	
Command aux		Bit	R		40010
	These bits aren't used			/	Bit [15:11]
	Dip-Switch "Analog Output 3" state. It corresponds to the selected output3-type. Bit40010.10=0 corresponds to the current-type output, bit40010.10=1 corresponds to the voltage-type output (if reg.40009=0xCAC0)			/	Bit 10

	Dip-Switch "Analog Output 2" state. It corresponds to the selected output2-type. Bit40010.9=0 corresponds to the current-type output, bit40010.9=1 corresponds to the voltage-type output (if reg.40009=0xCAC0)			/	Bit 9
	Dip-Switch "Analog Output 1" state. It corresponds to the selected output1-type. Bit40010.8=0 corresponds to the current-type output, bit40010.8=1 corresponds to the voltage-type output (if reg.40009=0xCAC0)			/	Bit 8
	Dip-Switches "DipSwitchStatus [1:2]" state. They correspond to the module baud-rate (if reg.40009=0xCAC0)			/	Bit [7:6]
	Dip-Switches "DipSwitchStatus [3:8]" state. They correspond to the module address (if reg.40009=0xCAC0)			/	Bit [5:0]
Timeout	Between: 10(=1msec); 2500(=250msec)	Word	R/W		40003
	Timeout [sec/10] (if bit40004.7=1: it is interval time of RS485-bus communication failure, after which the bit40008.2 switches to 1 and the module overwrites the content of the register: 40069 in 40005, 40070 in 40006, 40071 in 40007)			100 (=10sec)	
OUTPUT 1					
OUT1	Between:-10000; 10000 (if voltage), 0;10000 (if current)	Word	R/W		40005
	Normalized value of output1. The corresponding electric value is the voltage or current-type value available at the screw terminals 7-GND (see figure 1 and 2)			OUT1 Fault	
OUT1-mV 0	Between: -11000[mV]; +11000[mV]	Word	R/W		40012
	Electrical value of output 1 [mV] corresponding to the normalized value OUT1=0 (if output 1 is voltage-type) (see figure 1 and 2)			0 [mV]	
OUT1-mV 10000	Between: -11000[mV]; +11000[mV]	Word	R/W		40013
	Electrical value of output 1 [mV] corresponding to the normalized value OUT1=10000 (if output 1 is voltage-type). This value coincides with the Electrical End Scale (E.E.S.) of the output1 (see figure 1 and 2)			10000 [mV]	
OUT1-µA 0	Between: 0[µA]; +22000[µA]	Word	R/W		40018
	Electrical value 1 [µA] corresponding to the normalized value OUT1=0 (if output 1 is current-type) (see figure 1 and 2)			4000 [µA]	
OUT1-µA 10000	Between: 0[µA]; +22000[µA]	Word	R/W		40019
	Electrical value 1 [µA] corresponding to the normalized value OUT1=10000 (if output 1 is current-type). This value coincides with the Electrical End Scale (E.E.S.) of the output1 (see figure 1 and 2)			20000 [µA]	
OUT1 Fault	Between:-10000; 10000 (if voltage), 0;10000 (if current)	Word	R/W		40069

	Normalized fault value of output 1. The corresponding electric value is the voltage or current-type value available at the screw terminals 7-GND (see figure 1 and 2). This register is overwritten in the reg.40005: if the module is connected to the RS485 bus communication (to initialize it) or if: bit 40008.2=1 and bit40004.7=1			0	
OUTPUT 2					
OUT2	Between:-10000; 10000 (if voltage), 0;10000 (if current)	Word	R/W		40006
	Normalized value of output2. The corresponding electric value is the voltage or current-type value available at the screw terminals 8-GND (see figure 1 and 2)			OUT1 Fault	
OUT2-mV 0	Between: -11000[mV]; +11000[mV]	Word	R/W		40014
	Electrical value of the output 2 [mV] corresponding to the normalized value OUT2=0 (if output 2 is voltage-type) (see figure 1 and 2)			0[mV]	
OUT2-mV 10000	Between: -11000[mV]; +11000[mV]	Word	R/W		40015
	Electrical value of output 2 [mV] corresponding to the normalized value OUT2=10000 (if output 2 is voltage-type). This value coincides with the Electrical End Scale (E.E.S.) of the output1 (see figure 1 and 2)			10000 [mV]	
OUT2-µA 0	Between: 0[µA]; +22000[µA]	Word	R/W		40020
	Electrical value 2 [µA] corresponding to the normalized value OUT2=0 (if output 2 is current-type) (see figure 1 and 2)			4000 [µA]	
OUT2-µA 10000	Between: 0[µA]; +22000[µA]	Word	R/W		40021
	Electrical value 2 [µA] corresponding to the normalized value OUT2=10000 (if output 2 is current-type). This value coincides with the Electrical End Scale (E.E.S.) of the output2 (see figure 1 and 2)			20000 [µA]	
OUT2 Fault	Between: -10000; 10000 (if voltage), 0;10000 (if current)	Word	R/W		40070
	Normalized fault value of output 2. The corresponding electric value is the voltage or current-type value available at the screw terminals 8-GND (see figure 1 and 2). This register is overwritten in the reg.40006: if the module is connected to the RS485 bus communication (to initialize it) or if: bit 40008.2=1 and bit40004.7=1			0	
OUTPUT3					
OUT3	Between:-10000; 10000 (if voltage), 0;10000 (if current)	Word	R/W		40007
	Normalized value of output3. The corresponding electric value is the voltage or current-type value available at the screw terminals 9-GND (see figure 1 and 2)			OUT3 Fault	
OUT3-mV 0	Between: -11000[mV]; +11000[mV]	Word	R/W		40016
	Electrical value of the output 3 [mV] corresponding to the normalized value OUT3=0 (if output 3 is voltage-type) (see figure 1 and 2)			0[mV]	

OUT3-mV 10000	Between: -11000[mV]; +11000[mV]	Word	R/W		40017
	Electrical value of output 3 [mV] corresponding to the normalized value OUT1=10000 (if output 3 is voltage-type). This value coincides with the Electrical End Scale (E.E.S.) of the output3 (see figure 1 and 2)			10000 [mV]	
OUT3-µA 0	Between: 0[µA]; +22000[µA]	Word	R/W		40022
	Electrical value 3 [µA] corresponding to the normalized value OUT3=0 (if output 3 is current-type) (see figure 1 and 2)			4000 [µA]	
OUT3-µA 10000	Between: 0[µA]; +22000[µA]	Word	R/W		40023
	Electrical value 3 [µA] corresponding to the normalized value OUT3=10000 (if output 3 is current-type). This value coincides with the Electrical End Scale (E.E.S.) of the output3 (see figure 1 and 2)			20000 [µA]	
OUT3 Fault	Between:-10000; 10000 (if voltage), 0;10000 (if current)	Word	R/W		40071
	Normalized fault value of output 3. The corresponding electric value is the voltage or current-type value available at the screw terminals 9-GND (see figure 1 and 2). This register is overwritten in the reg.40007: if the module is connected to the RS485 bus communication (to initialize it) or if: bit 40008.2=1 and bit40004.7=1			0	

With reference to the output1 (and, in the same way, to the output2 and output3), the electrical value "OUT1-mV 0" ("OUT1-µA 0") is NOT the Electrical Start Scale (E.S.S.), if output is voltage (current)-type. The Electrical Start Scale is the electrical value corresponding to the normalized value=-10000 (unchangeable).

In the following lines is described the register configuration of the output1 to obtain the desired electrical value; the register configuration of the output 2 and 3 is similar.

To configure the analog output 1 in voltage (current)-type, execute the following operations:

1) **configure the register "OUT1-mV 0" ("OUT1-µA 0") corresponding to the normalized value=0 and "OUT1-mV 10000" ("OUT1-µA 10000") corresponding to the normalized value=10000 (figure 1);**
2) **configure the register OUT1: it is the normalized value corresponding to the desired electrical value available at the screw terminals (mV or µA) (figure 1);**

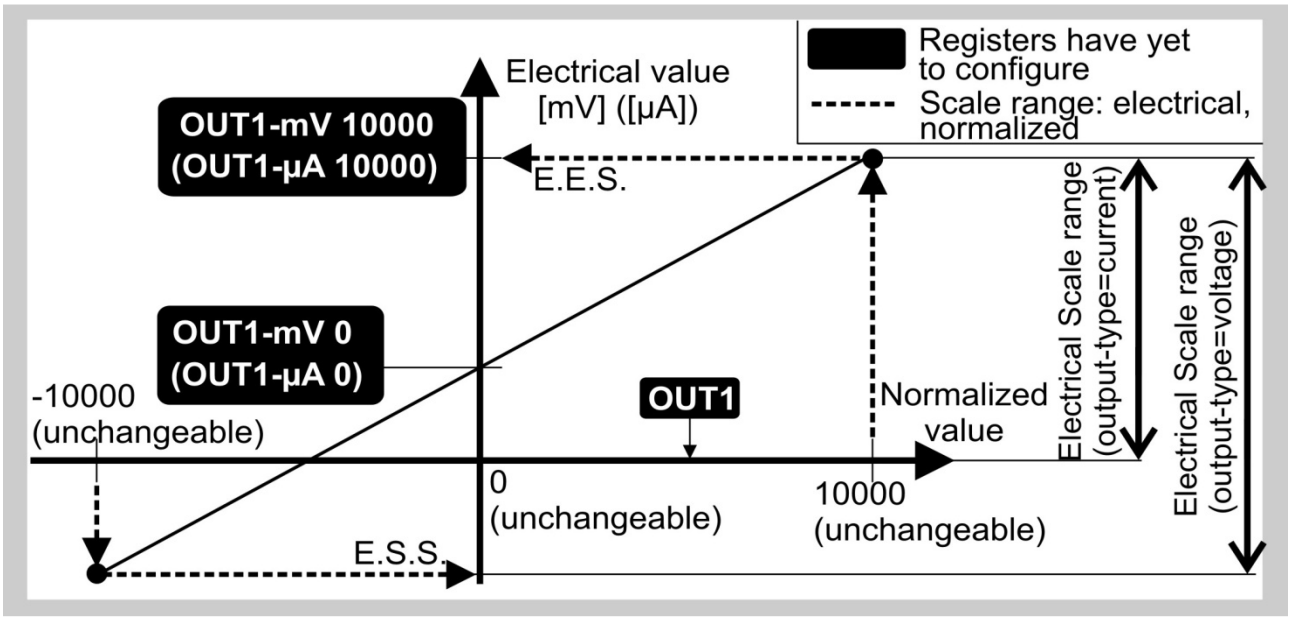


Fig.1 – Description of output configuration (step 1 and step 2)

The content of the register "OUT1-mV 10000" ("OUT1-µA 10000") coincides with the Electrical End Scale (E.E.S.); the Electrical Start Scale (E.S.S.) is the electrical value corresponding to the normalized value=-10000, and it isn't a register.

3) **it's possible to read the electrical value through the screw terminals (7-GND for output 1) corresponding to the normalized value=OUT1. If the output is current-type and if**
OUT1=[-10000;0], E.S.S.=0µA.

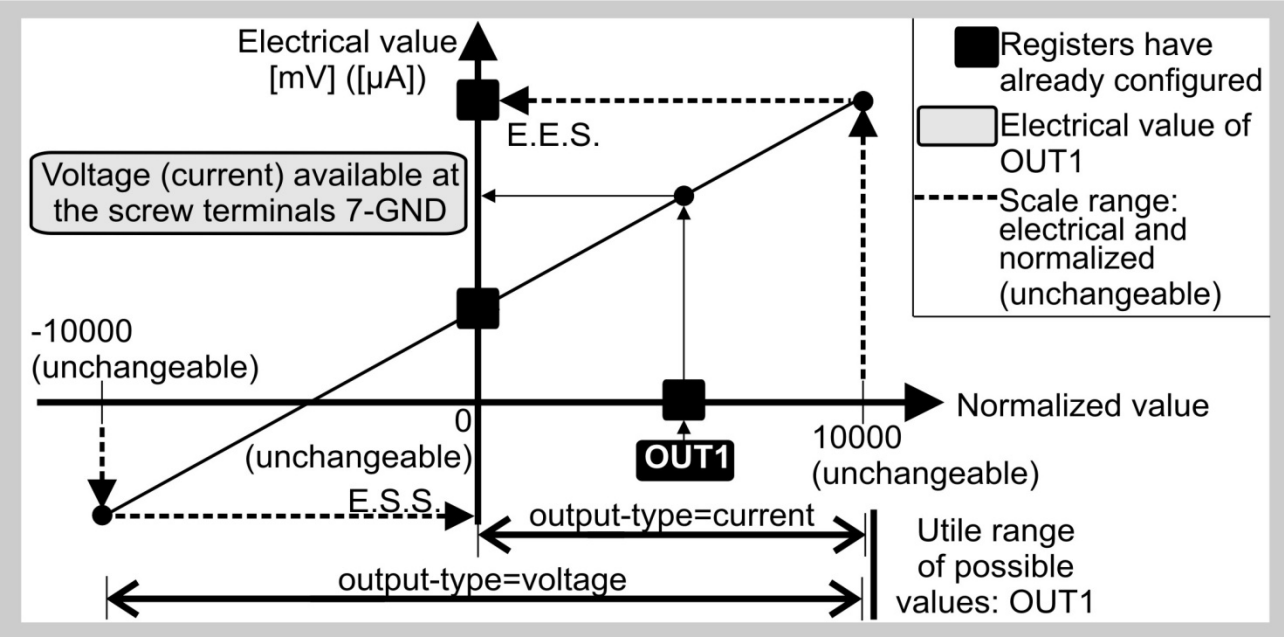


Fig.2 - Description of output configuration (step 3)

16.6. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The module power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
	Constant light	Module failure or there is a fault error (bit40008.2=1)
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet

17. PDM Line module: PDM-4TC

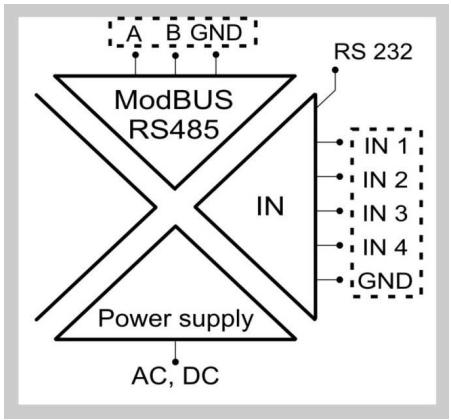
The PDM-4TC module acquires up to 4 single-ended signals (voltage-type, from the: signal generator or thermocouple) and it converts them to a digital format (normalized measure).

17.1. General characteristics

- **Capture of each voltage-type input from the: generator or thermocouple**
- **Configuration of a filter applied to each input signal**
- **It is possible to disable the automatic detection of thermocouple interruptions (to decrease the measure error of the acquired signals from the thermocouples)**
- **Configuration of the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

17.2. Features

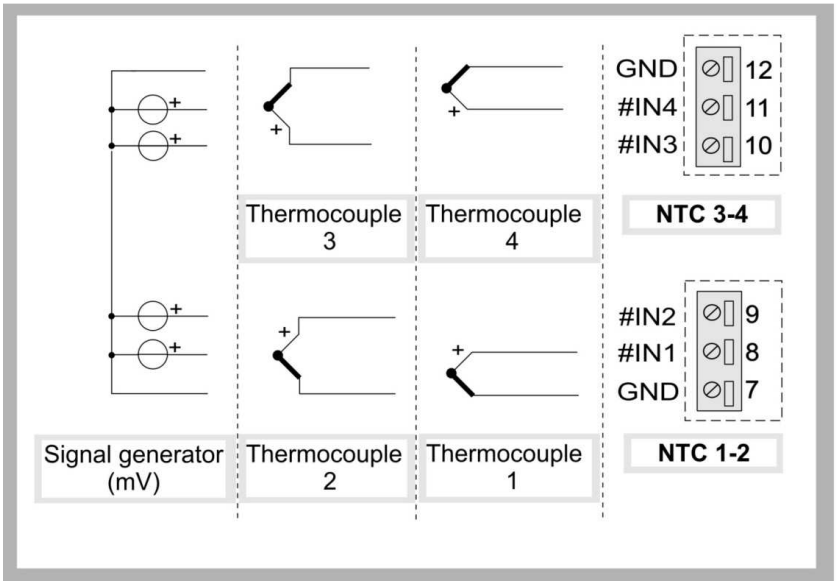
INPUT	
Number	4
Resolution	16 bits (15+1 sign). If input is acquired: from the generator, resolution=5µV; from the thermocouple, resolution=0.1°C
Sampling time	Configurable between: 120 ms or 60 ms
Filter	Configurable between: 0(no filter is applied), from 1(min) to 6(max)(*)
Accuracy	Initial: 0.1% of E.E.S.(Electrical End Scale)
	Linearity: 0.05°C (if TC J, TC K); 0.04°C (if TC N, TC T); 0.03°C (if TC B); 0.02°C (if TC E, TC S, TC R)
	Thermal stability: < 50 ppm/°K
	EMI: < 1%
	Cold-junction compensation (for TC-type input):<2°C (0-50°C)
Protection	± 30Vdc and 25mA
Voltage-type IN (from the generator)	Bipolar with E.S.S./E.E.S.(Electrical Start/End Scale) unchangeable between: ± 160mV. Input impedance: > 10 MΩ
Voltage-type IN (from the thermocouple)	TC-type: J, K, R, S, T, B, E, N. Automatic detection if a TC interruption occurs: if this option is enabled, test current:<200nA. Input impedance: > 10 MΩ
CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel) or (alternative) the screw terminals: 4(GND), 5(B), 6(A)
RS232 interface	Jack stereo 3.5mm connector: plugs into COM port
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, analog input



POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5W; Max: 1W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

17.3. Input connections



The term «NTC 1-2» means the NTC sensor related to the thermocouple 1 and 2 cold-junctions, instead the term «NTC 3-4» means the NTC sensor related to the thermocouple 3 and 4 cold-junctions.

The four voltage-type analog inputs (from the signal generator or from the thermocouple) refer to the ground GND; GND can be found at the screw terminals 7 and 12 (they are equipotentials because internally connected).

To decrease the signal-acquisition errors due to noise effects, short-circuit each unused TC-type input (screw terminals 8, 9, 10 or 11) to the GND (equipotential screw terminals: 7 or 12).

In the following figure are shown the cable colors for each type of thermocouple.

THERMOCOUPLE	ALLOY	ANSI MC96.1 (USA)		DIN43710 (D)		IEC 584-3 (EUROPE)	
		-	+	-	+	-	+
TC J	Fe-Co	red	white	blue	red	white	black
TC K	Cr-Al	red	yellow	green	red	white	green
TC R	Pt13%Rh-Pt	red	black	white	red	white	orange
TC S	Pt10%Rh-Pt	red	black	white	red	white	orange
TC T	Cu-Co	red	blue	brown	red	white	brown
TC E	Cr-Co	red	purple	black	red	white	purple
TC B	Pt30%Rh-Pt6%Rh	red	grey	red	grey	white	grey
TC N	Nicrosil-Nisil	red	brown	/	/	white	pink

17.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

The module is designed to configure each input depending on whether the voltage-type signal is acquired from the: generator or thermocouple. In particular the input scale range values, for thermocouple-type input selected, are shown in the following table.

TC-type	**Scale range**	**TC-type**	**Scale range**
J	-210°C..1200°C	S	-50°C..1768°C
K	-200°C..1372°C	R	-50°C..1768°C
E	-200°C..1000°C	B	250°C..1820°C
N	-210°C..1300°C	T	-200°C..400°C

17.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x06	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40017
	Firmware Code				
Status	/	Bit	R/W		40012
	Input 4 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 15
	Input 3 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 14
	Input 2 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 13
	Input 1 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 12
	Input 4 temperature-acquired error (if TC-type input): 0=there isn't; 1=there is			/	Bit 11
	Input 3 temperature-acquired error (if TC-type input): 0=there isn't; 1=there is			/	Bit 10
	Input 2 temperature-acquired error (if TC-type input): 0=there isn't; 1=there is			/	Bit 9
	Input 1 temperature-acquired error (if TC-type input): 0=there isn't; 1=there is			/	Bit 8
	Save configuration in memory (EEPROM): 0=deactivated; 1=activated			0	Bit 7
	These bits aren't used			/	Bit [6:4]
	Configuration error: 0=there isn't; 1=there is			/	Bit 3
	Data-configuration acquisition error: 0=there isn't; 1=there is			/	Bit 2
	Generic error: 0=there isn't; 1=there is (bit 40012.1=1 corresponds to LED ERR=blinking light)			/	Bit 1
	Reset of module: 0=deactivated; 1=activated			0	Bit 0
Errors	/	Bit	R		40019
	These bits aren't used			/	Bit[15:12]
	Zero ADC error: 0=there isn't; 1=there is			/	Bit 11
	This bit isn't used			/	Bit 10
	Setting error (in memory): 0=there isn't; 1=there is			/	Bit 9
	Calibration error (in memory): 0=there isn't; 1=there is			/	Bit 8
	These bits aren't used			/	Bit [7:3]
	Temperature acquisition error in the thermocouple 3 and 4 cold-junctions (if TC-type input, see input connections): 0=there isn't; 1=there is			/	Bit 2
	Temperature acquisition error in the thermocouple 1 and 2 cold-junctions (if TC-type input, see input connections): 0=there isn't; 1=there is			/	Bit 1
	ADC error: 0=there isn't; 1=there is			/	Bit 0
Eprflag	/	MSB, LSB	R/W		40003
	These bits aren't used			/	Bit [15:5]
	Parity for RS485: 0=even parity; 1=odd parity			0	Bit 4
	Parity for RS485: 0=there isn't; 1=there is			0	Bit 3

	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message): 0=there isn't; 1=there is			0	Bit 2
	Sampling time: 0=120 ms; 1=60 ms			0	Bit 1
	Automatic detection if a TC interruption occurs (damaged): 0=activated; 1=deactivated			0	Bit 0
Baudrate Address	/	MSB, LSB	R/W		40002
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Address for RS485(address of module if parameters are configurated by memory modality): from 0x01=1 to 0xFF=255			1	Bit [7:0]
INPUT 1					
IN1-Type	Between:0,8	Word	R/W		40004
	Input 1-type: 0=from the voltage generator (±160mV); 1=from TC J; 2=from TC K; 3=from TC R; 4=from TC S; 5= from TC T; 6=from TC B; 7=from TC E; 8=from TC N			0	
IN 1	Between: ± 32000	Word	R		40013
	Normalized measure of input 1 (1bit=5µV if input from the voltage generator; 1bit=0.1°C if input from the TC)			/	
IN1-FILTER	Between: 0, 6	Word	R/W		40008
	Filter applied to input 1 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			0	
INPUT 2					
IN2-Type	Between:0,8	Word	R/W		40005
	Input 2-type: 0=from the voltage generator (±160mV); 1=from TC J; 2=from TC K; 3=from TC R; 4=from TC S; 5= from TC T; 6=from TC B; 7=from TC E; 8=from TC N			0	
IN 2	Between: ± 32000	Word	R		40014
	Normalized measure of input 2 (1bit=5µV if input from the voltage generator; 1bit=0.1°C if input from the TC)			/	
IN2-FILTER	Between: 0, 6	Word	R/W		40009
	Filter applied to input 2 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			0	
INPUT 3					
IN3-Type	Between:0,8	Word	R/W		40006
	Input 3-type: 0=from the voltage generator (±160mV); 1=from TC J; 2=from TC K; 3=from TC R; 4=from TC S; 5= from TC T; 6=from TC B; 7=from TC E; 8=from TC N			0	
IN 3	Between: ± 32000	Word	R		40015
	Normalized measure of input 3 (1bit=5µV if input from the voltage generator; 1bit=0.1°C if input from the TC)			/	
IN3-FILTER	Between: 0, 6	Word	R/W		40010
	Filter applied to input 3 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			0	
INPUT 4					
IN4-Type	Between:0,8	Word	R/W		40007

	Input 4-type: 0=from the voltage generator (±160mV); 1=from TC J; 2=from TC K; 3=from TC R; 4=from TC S; 5= from TC T; 6=from TC B; 7=from TC E; 8=from TC N			0	
IN 4	Between: ± 32000	Word	R		40016
	Normalized measure of input 4 (1bit=5µV if input from the voltage generator; 1bit=0.1°C if input from the TC)			/	
IN4-FILTER	Between: 0, 6	Word	R/W		40011
	Filter applied to input 4 signal: 0=deactivated; 1=filtering min-value; 6=filtering max-value			0	

(*) Correspondence between filter-levels and filter time constants: 1=1[sec]; 2=2[sec]; 3=5[sec]; 4=10[sec];5=20[sec]; 6=60[sec].

17.6. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
	Constant light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Module failure

18. PDM Line module: PDM-8TC

The PDM-8TC module acquires up to 8 single-ended signals (voltage-type, from the: signal generator or thermocouple) and it converts them to a digital format (normalized measure).

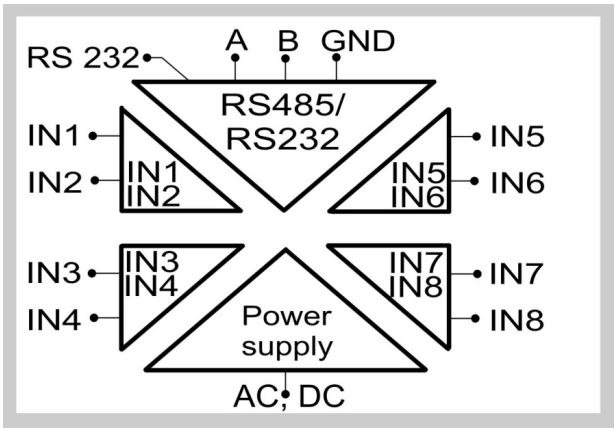
18.1. General characteristics

- **It is possible to choose if measure is voltage (mV) or temperature (°C) type, for each couple of input signals: IN1 and IN2, IN3 and IN4, IN5 and IN6, IN7 and IN8**
- **It is possible to enable/disable each input**
- **Configuration of a filter applied to each couple of input signals**
- **It is possible to enable/disable cold-junction compensation, for each couple of input signals**
- **It is possible to configure module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

18.2. Features

INPUT	
Number	8
Resolution	14bits (if filter=0-1); 15 bits (if filter=2-7)
Sampling frequency	Configurable between: 48Hz (if the filter is deactivated), 20Hz (if filter=1), 11Hz (if filter=2-7)
Rejection	50Hz or 60 Hz
Filter (0-7)	IIR and FIR; configurable between: 0 (deactivated), from 1(min) to 7(max)
Accuracy	Initial: 0.1% of E.E.S. (Electrical End Scale)
	Thermal stability: < 100 ppm/°K
	EMI: < 1%
Protection	This module provides inputs protection against the ESD (up to 4kV)
Voltage-type IN (from the thermocouple)	Bipolar with E.S.S./E.E.S. (Electrical Start/End Scale) unchangeable between: -10.1mV..+81.4mV. TC-type: J, K, R, S, T, B, E, N. Automatic detection if a TC interruption occurs: if this option is enabled, test current:<50nA. Input impedance: > 10 MΩ

CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel)
RS232 interface	Jack stereo 3.5mm connector: plugs into COM port
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485/RS232, inputs 1/2, inputs 3/4, inputs 5/6, inputs 7/8



POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Max: 0.6W

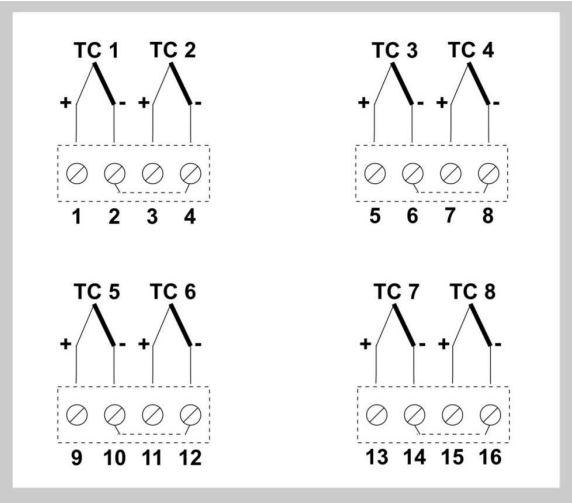
The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

18.3. Input connections

The PDM-8TC module has a digital thermometer (DT sensor) internally to compensate the cold-junction effect, if a thermocouple is connected to input.

To decrease the signal-acquisition errors due to noise effects, short-circuit each unused TC-type input to the GND, for each couple of inputs. In particular:

- **unused screw terminal 1 and/or 3 to the screw terminal 2 or 4 (GND for input 1 and input 2);**
- **unused screw terminal 5 and/or 7 to the screw terminal 6 or 8 (GND for input 3 and input 4);**
- **unused screw terminal 9 and/or 11 to the screw terminal 10 or 12 (GND for input 5 and input 6);**
- **unused screw terminal 13 and/or 15 to the screw terminal 14 or 16 (GND for input 7 and input 8).**



In the following figure are shown the cable colors for each type of thermocouple.

THERMOCOUPLE	ALLOY	ANSI MC96.1 (USA)		DIN43710 (D)		IEC 584-3 (EUROPE)	
		-	+	-	+	-	+
TC J	Fe-Co	red	white	blue	red	white	black
TC K	Cr-Al	red	yellow	green	red	white	green
TC R	Pt13%Rh-Pt	red	black	white	red	white	orange
TC S	Pt10%Rh-Pt	red	black	white	red	white	orange
TC T	Cu-Co	red	blue	brown	red	white	brown
TC E	Cr-Co	red	purple	black	red	white	purple
TC B	Pt30%Rh-Pt6%Rh	red	grey	red	grey	white	grey
TC N	Nicrosil-Nisil	red	brown	/	/	white	pink

The input scale range values, for selected thermocouple-type input, are shown in the following table.

TC-type	Scale range	TC-type	Scale range
J	-210°C..1200°C	S	-50°C..1768°C
K	-200°C..1372°C	R	-50°C..1768°C
E	-200°C..1000°C	B	250°C..1820°C
N	-210°C..1300°C	T	-200°C..400°C

18.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)		
9	10	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

18.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x18 (24 decimal)	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
Errors	/	Bit	R		40002
	Input 1 and input 2 error: 0=there isn't; 1=there is			/	Bit 15
	Input 3 and input 4 error: 0=there isn't; 1=there is			/	Bit 14
	Input 5 and input 6 error: 0=there isn't; 1=there is			/	Bit 13
	Input 7 and input 8 error: 0=there isn't; 1=there is			/	Bit 12
	Input 1 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 11
	Input 2 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 10
	Input 3 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 9
	Input 4 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 8
	Input 5 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 7
	Input 6 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 6
	Input 7 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 5
	Input 8 burn-out error (if TC-type input): 0=there isn't; 1=there is			/	Bit 4
	Input 1 and input 2 communication error: 0=there isn't; 1=there is			/	Bit 3
	Input 3 and input 4 communication error: 0=there isn't; 1=there is			/	Bit 2
	Input 5 and input 6 communication error: 0=there isn't; 1=there is			/	Bit 1
	Input 7 and input 8 communication error: 0=there isn't; 1=there is			/	Bit 0
Errors IN1-2 IN3-4	/	Bit	R		40037
	Supply-voltage error for input 1 and input 2: 0=there isn't; 1=there is			/	Bit 15
	RS485-reception error for input 1 and input 2: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM) for input 1 and input 2: 0=there isn't; 1=there is			/	Bit 13
	These bits aren't used			/	Bit [12:9]
	CRC EEPROM error for input 1 and input 2: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 8
	Supply-voltage error for input 3 and input 4: 0=there isn't; 1=there is			/	Bit 7
	RS485-reception error for input 3 and input 4: 0=there isn't; 1=there is			/	Bit 6

	Memory error (EEPROM) for input 3 and input 4: 0=there isn't; 1=there is			/	Bit 5
	These bits aren't used			/	Bit [4:1]
	CRC EEPROM error for input 3 and input 4: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 0
Errors IN5-6 IN7-8	/	Bit	R		40038
	Supply-voltage error for input 5 and input 6: 0=there isn't; 1=there is			/	Bit 15
	RS485-reception error for input 5 and input 6: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM) for input 5 and input 6: 0=there isn't; 1=there is			/	Bit 13
	These bits aren't used			/	Bit [12:9]
	CRC EEPROM error for input 5 and input 6: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 8
	Supply-voltage error for input 7 and input 8: 0=there isn't; 1=there is			/	Bit 7
	RS485-reception error for input 7 and input 8: 0=there isn't; 1=there is			/	Bit 6
	Memory error (EEPROM) for input 7 and input 8: 0=there isn't; 1=there is			/	Bit 5
	These bits aren't used			/	Bit [4:1]
	CRC EEPROM error for input 7 and input 8: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 0
Config IN1-2	/	Bit	R/W		40054
	Input1 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input2 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input1 and input 2 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 1 and input2: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input1 and input2. To know the configurations of bit40054.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 1. To know the configurations of bit40054.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 2. To know the configurations of bit40054.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Config IN3-4	/	Bit	R/W		40055
	Input3 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input4 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input3 and input 4 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 3 and input4: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input3 and input4. To know the configurations of bit40055.[10:8], see table1			0b010	Bit [10:8]

	Thermocouple type of input 3. To know the configurations of bit40055.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 4. To know the configurations of bit40055.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Config IN5-6	/	Bit	R/W		40056
	Input5 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input6 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input5 and input 6 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 5 and input6: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input5 and input6. To know the configurations of bit40055.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 5. To know the configurations of bit40056.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 6. To know the configurations of bit40056.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Config IN7-8	/	Bit	R/W		40057
	Input7 enabling: 0=deactivated; 1=activated			1	Bit 15
	Input8 enabling: 0=deactivated; 1=activated			1	Bit 14
	Input7 and input 8 measure type: 1=voltage [mV]; 0=temperature [°C]			0	Bit 13
	Cold-junction compensation for input 7 and input8: 0=deactivated; 1=activated			1	Bit 12
	Rejection: 0=50Hz; 1=60Hz			0	Bit 11
	Filter applied to acquired input7 and input8. To know the configurations of bit40057.[10:8], see table1			0b010	Bit [10:8]
	Thermocouple type of input 7. To know the configurations of bit40057.[7:4], see table 2			0b0000 (TC J)	Bit [7:4]
	Thermocouple type of input 8. To know the configurations of bit40057.[3:0], see table 2			0b0000 (TC J)	Bit [3:0]
Configuration aux	/	Bit	R/W		40058
	Floating point (32bits) registers interpretation. If bit 40058.15=0, FP32bit_MSW is most significant word of 32bits registers and FP32bit_LSW is less significant word of 32bit registers; if bit40058.15=1, FP32bit_LSW is most significant word of 32bits registers and FP32bit_MSW is less significant word of 32bit registers			0	Bit 15
	These bits aren't used			/	Bit [14:8]
	Module behavior if there is input 1 error: 0=register 40059 is overwritten in 40003 (word register) and in 40011,40012(floating point register); 1= content of register 40003 (word) and 40011, 40012 (FP) is the last measure acquired through input 1 correctly			0	Bit 7
	Module behavior if there is input 2 error: 0=register 40060 is overwritten in 40004 (word register) and in 40013,40014(floating point register); 1= content of register 40004 (word) and 40013, 40014 (FP) is the last measure acquired through input 2 correctly			0	Bit 6

	Module behavior if there is input 3 error: 0=register 40061 is overwritten in 40005 (word register) and in 40015,40016(floating point register); 1= content of register 40005 (word) and 40015, 40016 (FP) is the last measure acquired through input 3 correctly			0	Bit 5
	Module behavior if there is input 4 error: 0=register 40062 is overwritten in 40006 (word register) and in 40017,40018(floating point register); 1= content of register 40006 (word) and 40017, 40018 (FP) is the last measure acquired through input 4 correctly			0	Bit 4
	Module behavior if there is input 5 error: 0=register 40063 is overwritten in 40007 (word register) and in 40019,40020(floating point register); 1= content of register 40007 (word) and 40019, 40020 (FP) is the last measure acquired through input 5 correctly			0	Bit 3
	Module behavior if there is input 6 error: 0=register 40064 is overwritten in 40008 (word register) and in 40021,40022(floating point register); 1= content of register 40008 (word) and 40021,40022(FP) is the last measure acquired through input 6 correctly			0	Bit 2
	Module behavior if there is input 7 error: 0=register 40065 is overwritten in 40009 (word register) and in 40023,40024(floating point register); 1= content of register 40009 (word) and 40023,40024(FP) is the last measure acquired through input 7 correctly			0	Bit 1
	Module behavior if there is input 8 error: 0=register 40066 is overwritten in 40010 (word register) and in 40025,40026(floating point register); 1= content of register 40010 (word) and 40025,40026(FP) is the last measure acquired through input 8 correctly			0	Bit 0
Baudrate Delay	Delay: from 0x00=0 to 0xFF=255	MSB, LSB	R/W		40053
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message). 1 pause=6 characters			0	Bit [7:0]
Address Parity	Address: from 0x01=1 to 0xFF=255	MSB, LSB	R/W		40052
	Address for RS485 (baud-rate of module/node if parameters are configurated by memory modality)			1	Bit [15:8]
	Parity for RS485: 0=there isn't; 1=even parity; 2=odd parity			0	Bit [7:0]
Reset	0xCCCC	Word	R/W		40041
	Reset of module, if reg.40041=0xCCCC			/	
INPUT 1					
IN1	/	Bit	R/W		40003
	Measure of input 1 [°C/10] (if bit 40054.13=0), [10 -mV] (if bit 40054.13=1)			/	
IN1 MSW		FP32bit_MSW	R		40011
IN1 LSW		FP32bit_LSW	R		40012

	Floating point measure of input 1 [°C] (if bit40054.13=0), [mV] (if bit40054.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN1 Fault	Between: -32000, 32000	Word	R/W		40059
	Fault value of input 1 [°C/10] (if bit40054.13=0), [mV/100] (if bit40054.13=1)			20000	
	INPUT 2				
IN2	/	Bit	R/W		40004
	Measure of input 1 [°C/10] (if bit 40054.13=0), [10-mV] (if bit 40054.13=1)			/	
IN2 MSW		FP32bit_MSW	R		40013
IN2 LSW		FP32bit_LSW	R		40014
	Floating point measure of input 2 [°C] (if bit40054.13=0), [mV] (if bit40054.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN2 Fault	Between: -32000, 32000	Word	R/W		40060
	Fault value of input 1 [°C/10] (if bit40054.13=0), [mV/100] (if bit40054.13=1)			20000	
IN1-2 ColdJunction		Word	R		40028
	Input 1-2 cold junction temperature [°C/10]			/	
	INPUT 3				
IN3	/	Bit	R/W		40005
	Measure of input 3 [°C/10] (if bit 40055.13=0), [10-mV] (if bit 40055.13=1)			/	
IN3 MSW		FP32bit_MSW	R		40015
IN3 LSW		FP32bit_LSW	R		40016
	Floating point measure of input 1 [°C] (if bit40055.13=0), [mV] (if bit40055.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN3 Fault	Between: -32000, 32000	Word	R/W		40061
	Fault value of input 3 [°C/10] (if bit40055.13=0), [mV/100] (if bit40055.13=1)			20000	
	INPUT 4				
IN4	/	Bit	R/W		40006
	Measure of input 4 [°C/10] (if bit 40055.13=0), [10-mV] (if bit 40055.13=1)			/	
IN4 MSW		FP32bit_MSW	R		40017
IN4 LSW		FP32bit_LSW	R		40018
	Floating point measure of input 4 [°C] (if bit40055.13=0), [mV] (if bit40055.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN4 Fault	Between: -32000, 32000	Word	R/W		40062
	Fault value of input 4 [°C/10] (if bit40055.13=0), [mV/100] (if bit40055.13=1)			20000	
IN3-4 ColdJunction		Word	R		40029
	Input 3-4 cold junction temperature [°C/10]			/	
	INPUT 5				
IN5	/	Bit	R/W		40007

	Measure of input 5 [°C/10] (if bit 40056.13=0), [10·mV] (if bit 40056.13=1)			/	
IN5 MSW		FP32bit_MSW	R		40019
IN5 LSW		FP32bit_LSW	R		40020
	Floating point measure of input 5 [°C] (if bit40056.13=0), [mV] (if bit40056.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN5 Fault	Between: -32000, 32000	Word	R/W		40063
	Fault value of input 5 [°C/10] (if bit40056.13=0), [mV/100] (if bit40056.13=1)			20000	
	INPUT 6				
IN6	/	Bit	R/W		40008
	Measure of input 6 [°C/10] (if bit 40056.13=0), [10·mV] (if bit 40056.13=1)			/	
IN6 MSW		FP32bit_MSW	R		40021
IN6 LSW		FP32bit_LSW	R		40022
	Floating point measure of input 6 [°C] (if bit40056.13=0), [mV] (if bit40056.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN6 Fault	Between: -32000, 32000	Word	R/W		40064
	Fault value of input 6 [°C/10] (if bit40056.13=0), [mV/100] (if bit40056.13=1)			20000	
IN5-6ColdJunction		Word	R		40030
	Input 5-6 cold junction temperature [°C/10]			/	
	INPUT 7				
IN7	/	Bit	R/W		40009
	Measure of input 7 [°C/10] (if bit 40057.13=0), [10·mV] (if bit 40057.13=1)			/	
IN7 MSW		FP32bit_MSW	R		40023
IN7 LSW		FP32bit_LSW	R		40024
	Floating point measure of input 7 [°C] (if bit40057.13=0), [mV] (if bit40057.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN7 Fault	Between: -32000, 32000	Word	R/W		40065
	Fault value of input 7 [°C/10] (if bit40057.13=0), [mV/100] (if bit40057.13=1)			20000	
	INPUT 8				
IN8	/	Bit	R/W		40010
	Measure of input 8 [°C/10] (if bit 40057.13=0), [10·mV] (if bit 40057.13=1)			/	
IN8 MSW		FP32bit_MSW	R		40025
IN8 LSW		FP32bit_LSW	R		40026
	Floating point measure of input 8 [°C] (if bit40057.13=0), [mV] (if bit40057.13=1). To interpret the FP32bit register, see bit40058.15			/	
IN8 Fault	Between: -32000, 32000	Word	R/W		40066
	Fault value of input 8 [°C/10] (if bit40057.13=0), [mV/100] (if bit40057.13=1)			20000	

IN7-8 ColdJunction		Word	R		40031
	Input 7-8 cold junction temperature [°C/10]			/	

TABLE 1 – CONFIGURATIONS FOR FILTER APPLIED TO ACQUIRED INPUTS IN1 and IN2 (bit40054.[10:8]), IN3 and IN4 (bit40055.[10:8]), IN5 and IN6 (bit40056.[10:8]), IN7 and IN8 (bit40057.[10:8])			
Bit[10:8]	Filter type	Propagation time (if IN<T)	Propagation time (if IN>T)
0b000	Deactivated	45ms	45ms
0b001	Average (14bits)	236ms	103ms
0b010	Average (15bits)	405ms	179ms
0b011	Average + exp (15bits)	1s	179ms
0b100	Average + exp (15bits)	3s	179ms
0b101	Average + exp (15bits)	8s	179ms
0b110	Average + exp (15bits)	24s	179ms
0b111	Average + exp (15bits)	72s	179ms

Threshold value: T=0.75mV

Propagation time: interval time between a step change of input electrical signal and corresponding change of measure in register (at 115kBaud). The propagation times shown in table 1 refer to 50Hz rejection; to obtain the propagation times refer to 60Hz rejection, divide them for 1.2.

TABLE 2 – THERMOCOUPLE TYPE OF INPUT IN 1 (bit40054.[7:4]), IN 2 (bit40054.[3:0]), IN 3 (bit40055.[7:4]), IN 4 (bit40055.[3:0]) IN 5 (bit40056.[7:4]), IN 6 (bit40056.[3:0]), IN 7 (bit40057.[7:4]), IN 8 (bit40057.[3:0])			
Bit [7:4]	TC for IN1, IN3, IN5, IN7	Bit [3:0]	TC for IN2, IN4, IN6, IN8
0b0000	TC J	0b0000	TC J
0b0001	TC K	0b0001	TC K
0b0010	TC R	0b0010	TC R
0b0011	TC S	0b0011	TC S
0b0100	TC T	0b0100	TC T
0b0101	TC B	0b0101	TC B
0b0110	TC E	0b0110	TC E
0b0111	TC N	0b0111	TC N

18.6. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	**LED status**	**Meaning**
PWR	Constant light	The module power is on
ERR	Constant light	The module has at least one of the errors described in RS485 Registers table
	Blinking light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Module failure

19. PDM Line module: PDM-4RTD

The PDM-4RTD module acquires up to 4 RTD signals (through 4 inputs regardless and isolated with each other) and it converts them it to a temperature or resistance measure.

19.1. General characteristics

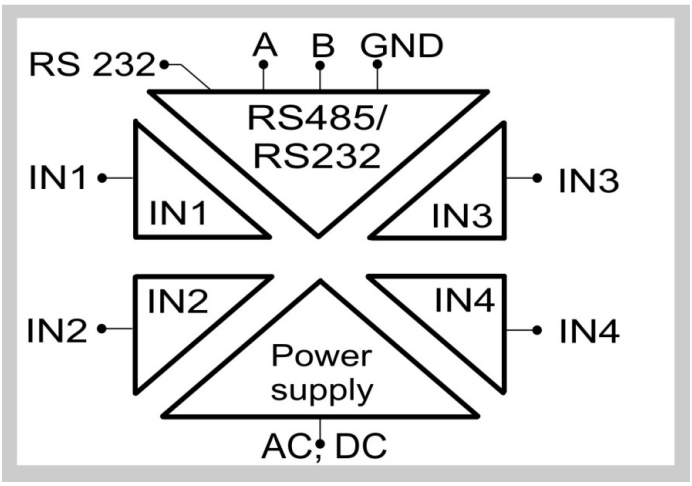
- **It's possible to choose if the input is RTD-type: PT100, NI100, PT500, PT1000**
- **It's possible to choose the RTD-measure type: temperature (°C) or resistance (Ω) (for each input)**
- **It's possible to choose if RTD-wire connection: 2-wire, 3-wire or 4-wire (for each input)**
- **Wire measure and wire resistance compensation (if 3-wire connection)**
- **Configuration of a filter applied to each input signal**
- **It is possible to configure the module (node) address and baud-rate by Dip-Switches**
- **It is possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **It is possible to switch automatically RS485 to RS232 or vice versa**

19.2. Features

INPUT	
Number	1
Resolution	13bit (if filter=0-1); 14 bit (if filter=2-7)
Sampling frequency	Configurable between: 48Hz (if the filter is deactivated), 20Hz (if filter=1), 11Hz (if filter=2-7)
Rejection	50Hz or 60 Hz
Filter (0-7)	IIR and FIR; configurable between: 0 (deactivated), from 1(min) to 7(max)
Accuracy	Initial:0.05% of 350 Ω (PT100, NI100 end scale); 0.05% of 1850 Ω (PT500, PT1000 end scale)
	Linearity:0.025% of 350 Ω (PT100, NI100 end scale); 0.025% of 1850 Ω (PT500, PT1000 end scale)
	Thermal stability: < 50 ppm/°K
	EMI: < 1%
Protection	This module provides inputs protection against the ESD (up to 4kV)

	Temperature range	**Resistance range (RTD=Rx)**	**Burn-out error if (RTD=Rx)**	**Max wire resistance (Rf)**	**Rated current through RTD**
RTD:PT100-type input (EN 60751)	From -200°C to 650°C	From 18.5Ω to 330Ω	Rx<18 Ω Rx>341 Ω	20Ω	875µA
RTD:NI100-type input (DIN 43760)	From -60°C to 250°C	From 69Ω to 295Ω	Rx<60 Ω Rx>301 Ω	30Ω	875µA
RTD:PT500-type input (EN 60751)	From -200°C to 750°C	From 92.5Ω to 1800Ω	Rx<90 Ω Rx>1851 Ω	30Ω	333µA
RTD:PT1000-type input (EN 60751)	From -200°C to 210°C	From 185Ω to 1850Ω	Rx<180 Ω Rx>1851 Ω	30Ω	333µA

CONNECTIONS	
RS485 interface	IDC10 connector for DIN 46277 rail (back-side panel)
RS232 interface	Jack stereo 3.5mm connector: plugs into COMport
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485/RS232, input 1, input 2, input 3, input 4



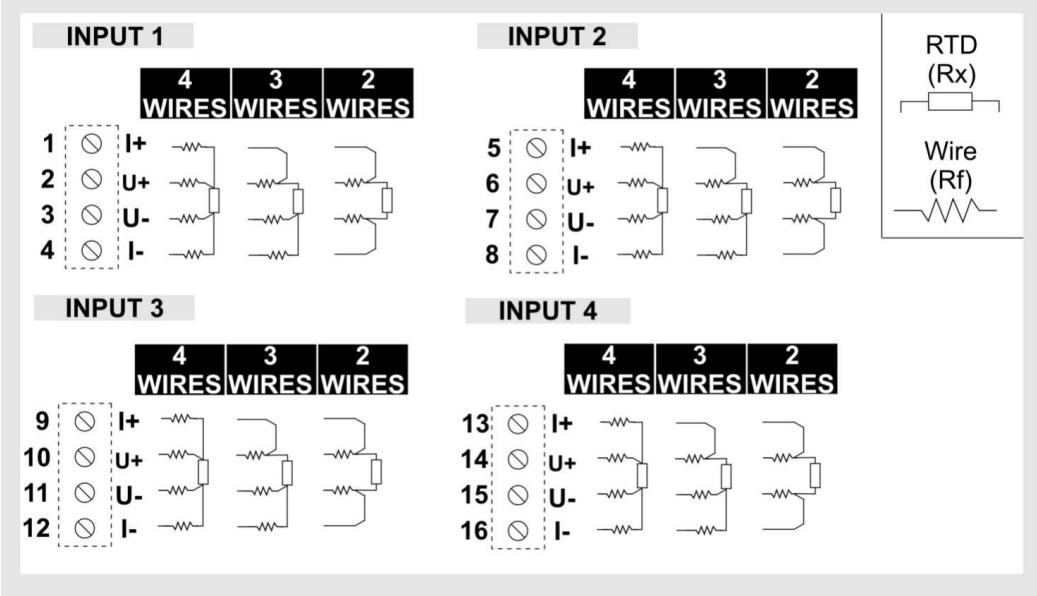
POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Max: 0.7W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements). To protect the power supply, it is recommended to install a fuse.

MODULE CASE	
Case-type	PBT, black
Dimensions	Width W = 100 mm, Height H = 112mm, Depth D = 17.5 mm
Terminal board	Removable 4-way screw terminals: pitch 3.5mm, sections 2.5mm^2
Protection class	IP20 (International Protection)

19.3. Input connections

It is possible to connect to PDM-4RTD module Platinum or Nichel thermoresistances with 2,3,4 wires.



RTD-wires connection	Distance between RTD and module	Wires compensation	RTD measure (°C-Ω) depends/does not depend on wire-resistances
2 wires	<10m	NO	Depends
3 wires	>10m	YES (the compensation is performed on the average value of wire resistances)	Does not depend (if the wire resistances are equal)
4 wires	>10m	NO	Does not depend (max accuracy)

19.4. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: DIP-SWITCH STATUS)						
1	2	Meaning				
		Baud-rate=9600 Baud				
	●	Baud-rate=19200 Baud				
●		Baud-rate=38400 Baud				
●	●	Baud-rate=57600 Baud				
ADDRESS (Dip-Switches: DIP-SWITCH STATUS)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63
RS485 TERMINATOR (Dip-Switches: DIP-SWITCH STATUS)						
9	10	Meaning				
		RS485 terminator disabled				
	●	RS485 terminator enabled				

19.5. RS485 Register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x16	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
Errors	/	Bit	R		40002
	Input 1 error: 0=there isn't; 1=there is			/	Bit 15
	Input 2 error: 0=there isn't; 1=there is			/	Bit 14
	Input 3 error: 0=there isn't; 1=there is			/	Bit 13
	Input 4 error: 0=there isn't; 1=there is			/	Bit 12
	Input 1 burn-out error: 0=there isn't; 1=there is			/	Bit 11
	Input 2 burn-out error: 0=there isn't; 1=there is			/	Bit 10
	Input 3 burn-out error: 0=there isn't; 1=there is			/	Bit 9
	Input 4 burn-out error: 0=there isn't; 1=there is			/	Bit 8
	Input 1 temperature-acquired error: 0=there isn't; 1=there is			/	Bit 7
	Input 2 temperature-acquired error: 0=there isn't; 1=there is			/	Bit 6
	Input 3 temperature-acquired error: 0=there isn't; 1=there is			/	Bit 5
	Input 4 temperature-acquired error: 0=there isn't; 1=there is			/	Bit 4
	Initialization error for input 1: 0=there isn't; 1=there is			/	Bit 3
	Initialization error for input 2: 0=there isn't; 1=there is			/	Bit 2
	Initialization error for input 3: 0=there isn't; 1=there is			/	Bit 1
	Initialization error for input 4: 0=there isn't; 1=there is			/	Bit 0
Errors IN1&IN2	/	Bit	R		40025
	Supply-voltage error for input1: 0=there isn't; 1=there is			/	Bit 15
	RS485-reception error for input1: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM) for input 1: 0=there isn't; 1=there is			/	Bit 13
	This bit isn't used			/	Bit 12
	RTD (Rx) measure error for input 1: 0=there isn't; 1=there is			/	Bit 11
	Wire-resistance (Rf) measure error for input 1 (if 3-wires connection): 0=there isn't; 1=there is			/	Bit 10
	Acquisition error for input 1: 0=there isn't; 1=there is			/	Bit 9
	CRC EEPROM error for input 1: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 8
	Supply-voltage error for input2: 0=there isn't; 1=there is			/	Bit 7
	RS485-reception error for input2: 0=there isn't; 1=there is			/	Bit 6
	Memory error (EEPROM) for input 2: 0=there isn't; 1=there is			/	Bit 5
	This bit isn't used			/	Bit 4
	RTD (Rx) measure error for input 2: 0=there isn't; 1=there is			/	Bit 3
	Wire-resistance (Rf) measure error for input 2 (if 3-wires connection): 0=there isn't; 1=there is			/	Bit 2
	Acquisition error for input 2: 0=there isn't; 1=there is			/	Bit 1
	CRC EEPROM error for input 2: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 0
Errors IN3&IN4	/	Bit	R		40026
	Supply-voltage error for input3: 0=there isn't; 1=there is			/	Bit 15
	RS485-reception error for input3: 0=there isn't; 1=there is			/	Bit 14
	Memory error (EEPROM) for input 3: 0=there isn't; 1=there is			/	Bit 13
	This bit isn't used			/	Bit 12
	RTD (Rx) measure error for input 3: 0=there isn't; 1=there is			/	Bit 11
	Wire-resistance (Rf) measure error for input 3 (if 3-wires			/	Bit 10

	connection): 0=there isn't; 1=there is				
	Acquisition error for input 3: 0=there isn't; 1=there is			/	Bit 9
	CRC EEPROM error for input 3: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 8
	Supply-voltage error for input4: 0=there isn't; 1=there is			/	Bit 7
	RS485-reception error for input4: 0=there isn't; 1=there is			/	Bit 6
	Memory error (EEPROM) for input 4: 0=there isn't; 1=there is			/	Bit 5
	This bit isn't used			/	Bit 4
	RTD (Rx) measure error for input 4: 0=there isn't; 1=there is			/	Bit 3
	Wire-resistance (Rf) measure error for input 4 (if 3-wires connection): 0=there isn't; 1=there is			/	Bit 2
	Acquisition error for input 4: 0=there isn't; 1=there is			/	Bit 1
	CRC EEPROM error for input 4: 0=there isn't; 1=there is. If "1", it is not possible to save in memory (EEPROM)			/	Bit 0
Configuration	/	Bit	R/W		40041
	Floating point (32bits) registers interpretation. If bit 40041.15=0, FP32bit_MSW is most significant word of 32bits registers and FP32bit_LSW is less significant word of 32bit registers; if bit40041.15=1, FP32bit_LSW is most significant word of 32bits registers and FP32bit_MSW is less significant word of 32bit registers			0	Bit 15
	These bits aren't used			/	Bit [14:8]
	LED ERR status to signal if there is input 1 error (see bit40002.15): 0=LED ERR "ON" means that there is input 1 error; 1=LED ERR is regardless of input 1 error			0	Bit 7
	LED ERR status to signal if there is input 2 error (see bit40002.14): 0=LED ERR "ON" means that there is input 2 error; 1=LED ERR is regardless of input 2 error			0	Bit 6
	LED ERR status to signal if there is input 3 error (see bit40002.13): 0=LED ERR "ON" means that there is input 3 error; 1=LED ERR is regardless of input 3 error			0	Bit 5
	LED ERR status to signal if there is input 4 error (see bit40002.12): 0=LED ERR "ON" means that there is input 4 error; 1=LED ERR is regardless of input 4 error			0	Bit 4
	Module behavior if there is input 1 error: 0=register 40042 is overwritten in 40003 (word register) and in 40007,40008 (floating point register); 1=content of register 40003 (word) and 40007,40008(FP) is the last measure acquired through input 1 correctly			0	Bit 3
	Module behavior if there is input 2 error: 0=register 40043 is overwritten in 40004 (word register) and in 40009,40010(floating point register); 1= content of register 40004 (word) and 40009,40010(FP) is the last measure acquired through input 2 correctly			0	Bit 2
	Module behavior if there is input 3 error: 0=register 40044 is overwritten in 40005 (word register) and in 40011,40012(floating point register); 1= content of register 40005 (word) and 40011,40012(FP) is the last measure acquired through input 3 correctly			0	Bit 1
	Module behavior if there is input 4 error: 0=register 40045 is overwritten in 40006 (word register) and in 40013,40014 (floating point register); 1= content of register 40006 (word) and 40013,40014(FP) is the last measure acquired through			0	Bit 0

	input 4 correctly				
Baudrate Delay	Delay: from 0x00=0 to 0xFF=255	MSB, LSB	R/W		40036
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=4800; 1=9600; 2=19200; 3=38400; 4=57600; 5=115200; 6=1200; 7=2400			38400	Bit [15:8]
	Delay for RS485 (delay of communication response: pauses between the end of Rx message and the start of Tx message)			0	Bit [7:0]
Address Parity	Address: from 0x01=1 to 0xFF=255	MSB, LSB	R/W		40035
	Address for RS485 (address of module/node if parameters are configurated by memory modality)			1	Bit [15:8]
	Parity for RS485: 0=there isn't; 1=even parity; 2=odd parity			0	Bit [7:0]
Reset	0xCCCC	Word	R/W		40029
	Reset of module, if reg.40029=0xCCCC			/	
INPUT 1					
IN1 Flags	/	Bit	R/W		40037
	These bits aren't used			/	Bit [15:8]
	RTD-type input. If bit40037.[7:6]=0b00: PT100; if bit40037.[7:6]=0b01: NI100; if bit40037.[7:6]=0b10: PT500; if bit40037.[7:6]=0b11: PT1000			0b00	Bit [7:6]
	Input measure type: 0=temperature; 1=resistance			0	Bit 5
	RTD connection type: 2 or 4 wires (if bit40037.4=0), 3 wires (if bit40037.4=1)			0	Bit 4
	Rejection: 0=50Hz; 1=60Hz			0	Bit 3
	Filter applied to acquired input. To know the configurations of bit40037.[2:0], see table1			0b010	Bit [2:0]
IN1	/	Word	R		40003
	Measure of input 1 [°C/10] (if bit40037.5=0), [Ω/100] (if bit40037.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40037.5=1 and RTD-type is PT1000, PT500)			/	
IN1 MSW		FP32bit_MSW	R		40007
IN1 LSW		FP32bit_LSW	R		40008
	Floating point measure of input 1 [°C] (if bit40037.5=0), [Ω] (if bit40037.5=1 and RTD-type is PT100, NI100), [Ω] (if bit40037.5=1 and RTD-type is PT1000, PT500). To interpret the FP32bit register, see bit40041.15			/	
IN1 wire		Word	R		40016
	Wire-connection measure of input 1 [mΩ]			/	
IN1 Fault	Between: -32000, 32000 (if temperature); 0, 32000 (if resistance)	Word	R/W		40042
	Fault value of input 1 [°C/10] (if bit40037.5=0), [Ω/100] (if bit40037.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40037.5=1 and RTD-type is PT1000, PT500).			8500	
INPUT 2					
IN2 Flags	/	Bit	R/W		40038
	These bits aren't used			/	Bit [15:8]
	RTD-type input. If bit40038.[7:6]=0b00: PT100; if bit40038.[7:6]=0b01: NI100; if bit40038.[7:6]=0b10: PT500; if bit40038.[7:6]=0b11: PT1000			0b00	Bit [7:6]

	Input measure type: 0=temperature; 1=resistance			0	Bit 5
	RTD connection type: 2 or 4 wires (if bit40038.4=0), 3 wires (if bit40038.4=1)			0	Bit 4
	Rejection: 0=50Hz; 1=60Hz			0	Bit 3
	Filter applied to acquired input. To know the configurations of bit40038.[2:0], see table1			0b010	Bit [2:0]
IN2	/	Word	R		40004
	Measure of input 2 [°C/10] (if bit40038.5=0), [Ω/100] (if bit40038.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40038.5=1 and RTD-type is PT1000, PT500)			/	
IN2 MSW		FP32bit_MSW	R		40009
IN2 LSW		FP32bit_LSW	R		40010
	Floating point measure of input 2 [°C] (if bit40038.5=0), [Ω] (if bit40038.5=1 and RTD-type is PT100, NI100), [Ω] (if bit40038.5=1 and RTD-type is PT1000, PT500). To interpret the FP32bit register, see bit40041.15			/	
IN2 wire		Word	R		40017
	Wire-connection measure of input 2 [mΩ]			/	
IN2 Fault	Between: -32000, 32000 (if temperature); 0, 32000 (if resistance)	Word	R/W		40043
	Fault value of input 2 [°C/10] (if bit40038.5=0), [Ω/100] (if bit40038.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40038.5=1 and RTD-type is PT1000, PT500).			8500	
INPUT 3					
IN3 Flags	/	Bit	R/W		40039
	These bits aren't used			/	Bit [15:8]
	RTD-type input. If bit40039.[7:6]=0b00: PT100; if bit40039.[7:6]=0b01: NI100; if bit40037.[7:6]=0b10: PT500; if bit40039.[7:6]=0b11: PT1000			0b00	Bit [7:6]
	Input measure type: 0=temperature; 1=resistance			0	Bit 5
	RTD connection type: 2 or 4 wires (if bit40039.4=0), 3 wires (if bit40039.4=1)			0	Bit 4
	Rejection: 0=50Hz; 1=60Hz			0	Bit 3
	Filter applied to acquired input. To know the configurations of bit40039.[2:0], see table1			0b010	Bit [2:0]
IN3	/	Word	R		40005
	Measure of input 3 [°C/10] (if bit40039.5=0), [Ω/100] (if bit40039.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40039.5=1 and RTD-type is PT1000, PT500)			/	
IN3 MSW		FP32bit_MSW	R		40011
IN3 LSW		FP32bit_LSW	R		40012
	Floating point measure of input 1 [°C] (if bit40039.5=0), [Ω] (if bit40039.5=1 and RTD-type is PT100, NI100), [Ω] (if bit40039.5=1 and RTD-type is PT1000, PT500). To interpret the FP32bit register, see bit40041.15			/	
IN3 wire		Word	R		40018
	Wire-connection measure of input 3 [mΩ]			/	
IN3 Fault	Between: -32000, 32000 (if temperature); 0, 32000 (if resistance)	Word	R/W		40044
	Fault value of input 3 [°C/10] (if bit40039.5=0), [Ω/100] (if bit40039.5=1 and RTD-type is PT100, NI100), [Ω/10] (if			8500	

	bit40039.5=1 and RTD-type is PT1000, PT500).				
INPUT 4					
IN4 Flags	/	Bit	R/W		40040
	These bits aren't used			/	Bit [15:8]
	RTD-type input. If bit40040.[7:6]=0b00: PT100; if bit40040.[7:6]=0b01: NI100; if bit40040.[7:6]=0b10: PT500; if bit40040.[7:6]=0b11: PT1000			0b00	Bit [7:6]
	Input measure type: 0=temperature; 1=resistance			0	Bit 5
	RTD connection type: 2 or 4 wires (if bit40040.4=0), 3 wires (if bit40040.4=1)			0	Bit 4
	Rejection: 0=50Hz; 1=60Hz			0	Bit 3
	Filter applied to acquired input. To know the configurations of bit40040.[2:0], see table1			0b010	Bit [2:0]
IN4	/	Word	R		40006
	Measure of input 4 [°C/10] (if bit40040.5=0), [Ω/100] (if bit40040.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40040.5=1 and RTD-type is PT1000, PT500)			/	
IN4 MSW		FP32bit_MSW	R		40013
IN4 LSW		FP32bit_LSW	R		40014
	Floating point measure of input 4 [°C] (if bit40040.5=0), [Ω] (if bit40040.5=1 and RTD-type is PT100, NI100), [Ω] (if bit40040.5=1 and RTD-type is PT1000, PT500). To interpret the FP32bit register, see bit40041.15			/	
IN4 wire		Word	R		40019
	Wire-connection measure of input 4 [mΩ]			/	
IN4 Fault	Between: -32000, 32000 (if temperature); 0, 32000 (if resistance)	Word	R/W		40045
	Fault value of input 4 [°C/10] (if bit40040.5=0), [Ω/100] (if bit40040.5=1 and RTD-type is PT100, NI100), [Ω/10] (if bit40040.5=1 and RTD-type is PT1000, PT500).			8500	

TABLE 1 – CONFIGURATIONS FOR FILTER APPLIED TO ACQUIRED INPUT IN1 (bit40037.[2:0]), IN2 (bit40038.[2:0]), IN3 (bit40039.[2:0]), IN4 (bit40040.[2:0])

Bit [2:0]	Filter type	Propagation time (if IN<T)	Propagation time (if IN>T)
0b000	Deactivated	45ms	45ms
0b001	Average (13bits)	236ms	103ms
0b010	Average (14bits)	405ms	179ms
0b011	Average + exp (14bits)	1s	179ms
0b100	Average + exp (14bits)	3s	179ms
0b101	Average + exp (14bits)	8s	179ms
0b110	Average + exp (14bits)	24s	179ms
0b111	Average + exp (14bits)	72s	179ms

Threshold values T: PT100, T=8°C; NI100, T=5°C; PT500, T=9°C; PT1000, T=5°C.

Propagation time: interval time between a step change of input electrical signal and corresponding change of measure in register (at 115kBaud). The propagation times shown in table 1 refer to 50Hz rejection; to obtain the propagation times refer to 60Hz rejection, divide them for 1.2.

19.6. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
	Constant light	Module failure
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet
	Constant light	Module failure

20. PDM Line module: PDM-PID

The PDM-PID module acquires 1 universal input signal (voltage, current, potentiometer, thermo-couple, thermo-resistance, milli-voltmeter) and converts it to an analog format (with PID regulation), sent through 1 universal and isolated output signal (voltage, current).

20.1. General characteristics

- **Three operating modalities: conversion with PID regulator, conversion without PID regulator, manual (constant output configurated through ModBUS register)**
- **Two output types: analog or ON/OFF (time of high-state digital signal is directly proportional to the analog signal)**
- **Possible inputs: voltage type, current type, potentiometer type, thermocouple (TC) type, RTD (Resistance Temperature Detector) type, millivoltmeter type**
- **Possible outputs: voltage type, active current type, passive current type**
- **Management of: slew-rate, burn-out, output limiters**
- **Configuration of the module (node) address and baudrate by Dip-Switches**
- **It's possible to add/remove the module to/from RS485-bus without disconnecting the communication or power supply**
- **Switching automatically RS485 to RS232 or vice versa**

20.2. Features

INPUT	
Number	1
Resolution	14 bits
Sampling time	Configurable between: 5 ms ("Fast", no rejection), 16.66 ms (rejection to 60 Hz) or 20 ms (rejection to 50 Hz)
Filter	Configurable between: 0 (no filter is applied), from 1 (min) to 19 (max)
Response time	Sampling time + 6 ms
Voltage-type IN	Scale range is configurable: from 0 V to 10 V. Input impedance:>5MΩ
Current-type IN (mA-passive module/mA-active module)	Scale range is configurable: from 0 mA to 20 mA. Internal shunt: 50Ω. It's possible to power the sensor by: itself (mA-passive module) or module (mA-active module) using #7 screw terminal (max 25 mA to max 17 V, short-circuited protected)
Potentiometer-type IN	Scale range is configurable: from 1 kΩ to 100 kΩ (with parallel resistor R=330Ω to connect externally). Excitation current:1 mA. Input impedance:>5MΩ
Thermocouple-type IN	For TC type: J, K, R, S, T, B, E, N. Input impedance:>5 MΩ. Automatic detection if a TC interruption occurs
RTD-type IN	For RTD type: PT100, PT500, PT1000, NI100. Resistance measure (for 2,3,4-wires connection) and wire-resistance measure (for 3,4-wires connection). Excitation current: 1.1 mA (PT100) and 0.11 mA(PT1000, PT500). Automatic detection if a wire or RTD interruption occurs
Millivoltmeter-type IN	Scale range is configurable: from -10 mV to 80 mV. Input impedance:>5 MΩ

Errors related to max measuring range	**Accuracy**	**Thermal stability**	**Linearity error**	**EMI**
Voltage or current-type input	0.1%	0.01%/°K	0.05%	<1% (2)
TC-type input: J,K,E,T,N	0.1%	0.01%/°K	0.2°C	<1% (2)

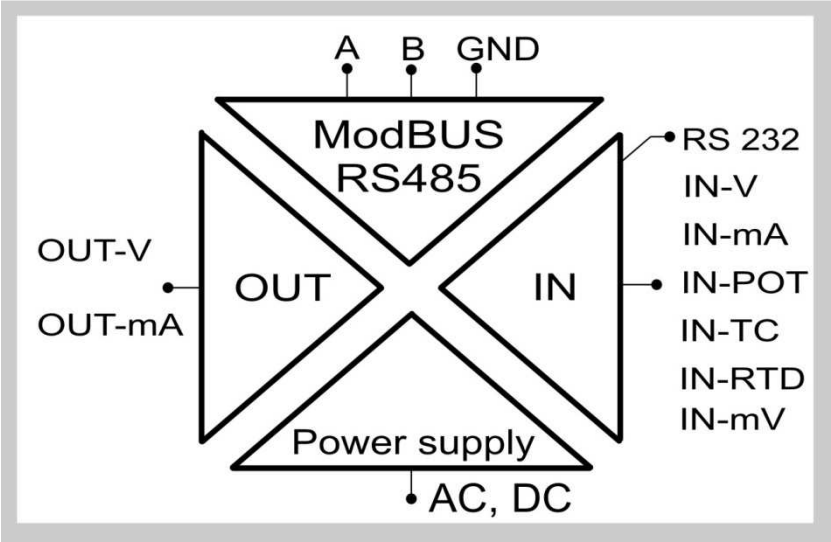
TC-type input:R,S	0.1%	0.01%/°K	0.5°C	<1% (2)
TC-type input:B (3)	0.1%	0.01%/°K	1.5°C	<1% (2)
Cold junction compensation (for TC-type input)	2°C between 0-50°C	/	/	/
POT-type IN	0.1%	0.01%/°K	0.1%	<1%
RTD-type IN (4)	0.1%	0.01%/°K	0.02% (if t>0°C) 0.05% (if t<0°C)	<1% (5)

(1) For the input scale ranges, see “Connections”
(2) Influence of wire resistance: 0.1 µV/Ω
(3) Output zero if t<400°C
(4) For RTD type: PT100, PT500, PT1000, NI100. All the errors have to be calculated with reference to resistive value
(5) Influence of wires resistance: 0.005%/Ω, max20Ω

OUTPUT	
Number	1
Resolution	14 bit
Signal-amplitude limiting	The output signal can be amplitude-limited by an “output limiter”
Voltage-type OUT	Configurable between: 0-5 V, 0-10 V (with minimum load resistance: 1 kΩ). Saturation value: 10.5 V
Current-type OUT (active or passive)	Configurable between: 0-20 mA, 4-20 mA (with maximum load resistance: 600 Ω). Saturation value: 21 mA. “Active current” =the output: already powered on, needs to be connected to the passive module; “passive current” =the output: powered off, needs to be connected to the active module

Errors related to max measuring range	**Errors related to max measuring range**	**Accuracy**	**Thermal stability**	**Linearity error**
Voltage-type OUT	0.1%	0.01%/°K	0.01%	<1%
Voltage-type OUT (active or passive)	0.1%	0.01%/°K	0.01%	<1%

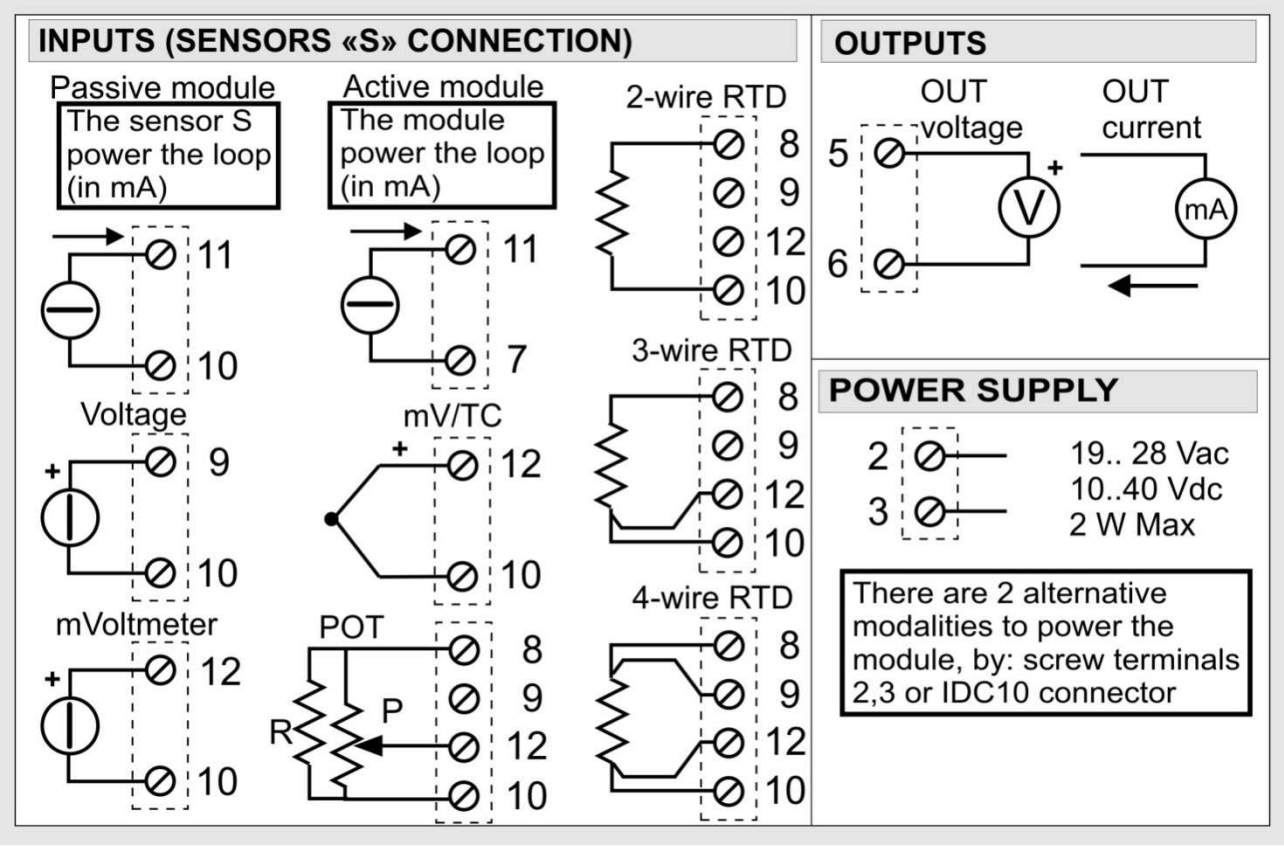
CONNECTIONS	
RS485 interface	IDC10 connector
RS232 interface	Jack stereo 3.5 mm connector: plugs into COM port
1500 Vac ISOLATIONS	
	Between: power supply, ModBUS RS485, analog input, analog output



POWER SUPPLY	
Supply voltage	10 – 40 Vdc or 19 – 28 Vac (50Hz - 60Hz)
Power consumption	Min: 0.5 W; Max: 2 W

The power supply transformer necessary to supply the module must comply with EN60742 (Isolated transformers and safety transformers requirements).

20.3. Connections



For potentiometer input connection: with R=330 Ω (R needs to be added externally), P=1 kΩ-100 kΩ

In particular the input scale range values, for thermocouple-type input selected, are shown in the following table.

TC-type	Scale range	TC-type	Scale range
J	-210°C..1200°C	S	-50°C..1768°C
K	-200°C..1372°C	R	-50°C..1768°C
E	-200°C..1000°C	B	250°C..1820°C
N	-210°C..1300°C	T	-200°C..400°C

The input scale range values, for RTD-type input selected, are shown in the following table.

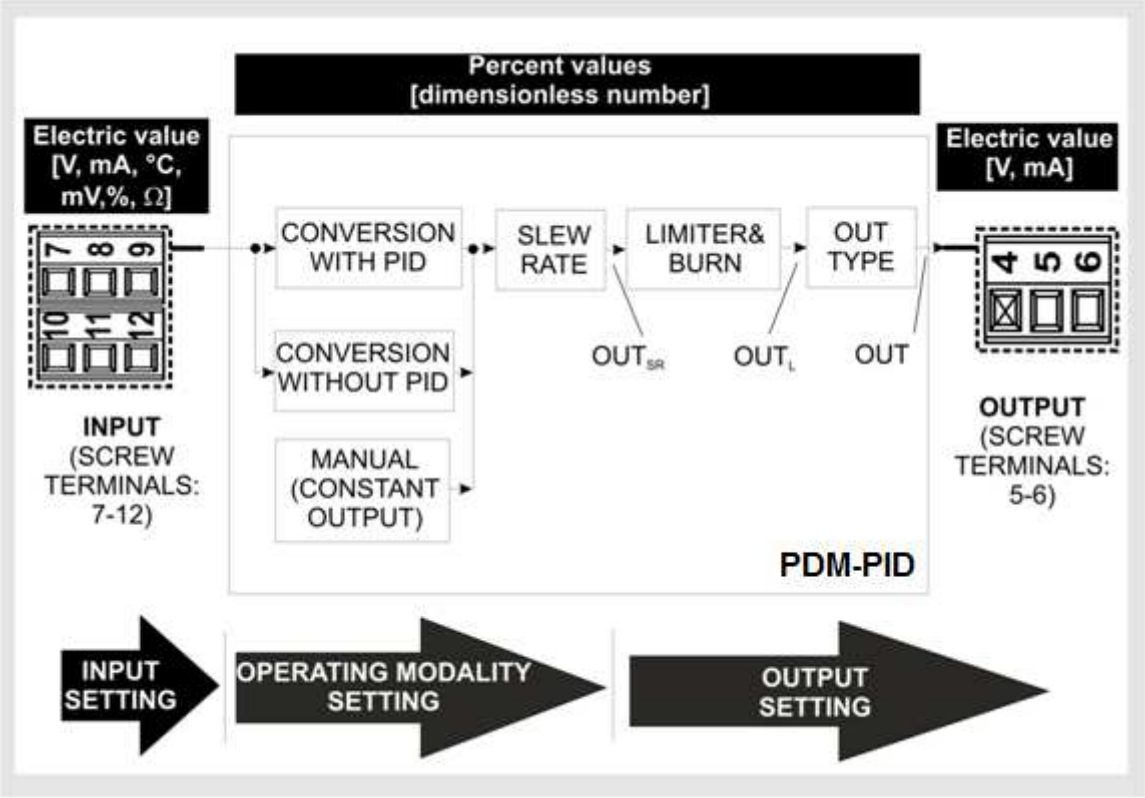
RTD-type	Scale range	RTD-type	Scale range
PT100	-210°C..650°C	PT1000	-200°C..210°C
PT500	-200°C..750°C	NI100	-60°C..250°C

20.4. Functioning

There are six possible functioning modalities of the PDM-PID module, with reference to the following figure:

- conversion with PID, analog output
- conversion with PID, ON/OFF output
- conversion without PID, analog output
- conversion without PID, ON/OFF output
- manual (constant output), analog output
- manual (constant output), ON/OFF output

With reference to the following figure, the lowest part shows the PDM-PID setting procedure in three steps: input setting, operating modality setting, output setting.



In particular, there are three operating modalities, each of them allows to supply a ON/OFF output or an analog output:

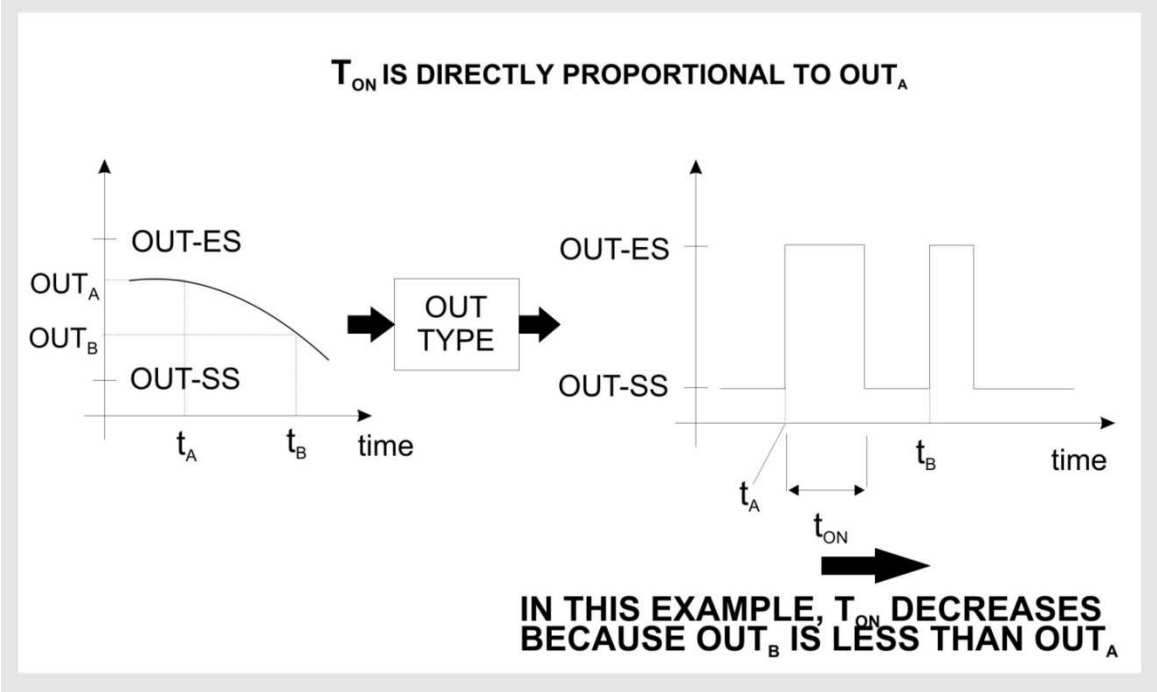
Operating modality	Description
Conversion with PID	The analog output is a function of the analog input processed by the PID transfer function. Moreover, analog output is directly proportional to the analog input
Conversion without PID	The analog output is directly proportional to the analog input
Manual (constant output without PID)	The analog output is input-indipendent. Anyhow, the input is acquired and can be found in the RS485 registers (only reading)

Slew rate allows to limit the slope of the signal (see reg.40031 and 40032) and burn-out allows to overwrite the OUT-Fault value (reg.40020, 40021) to the reg.40105, 40106 (burn-out overwriting is available only for analog output).

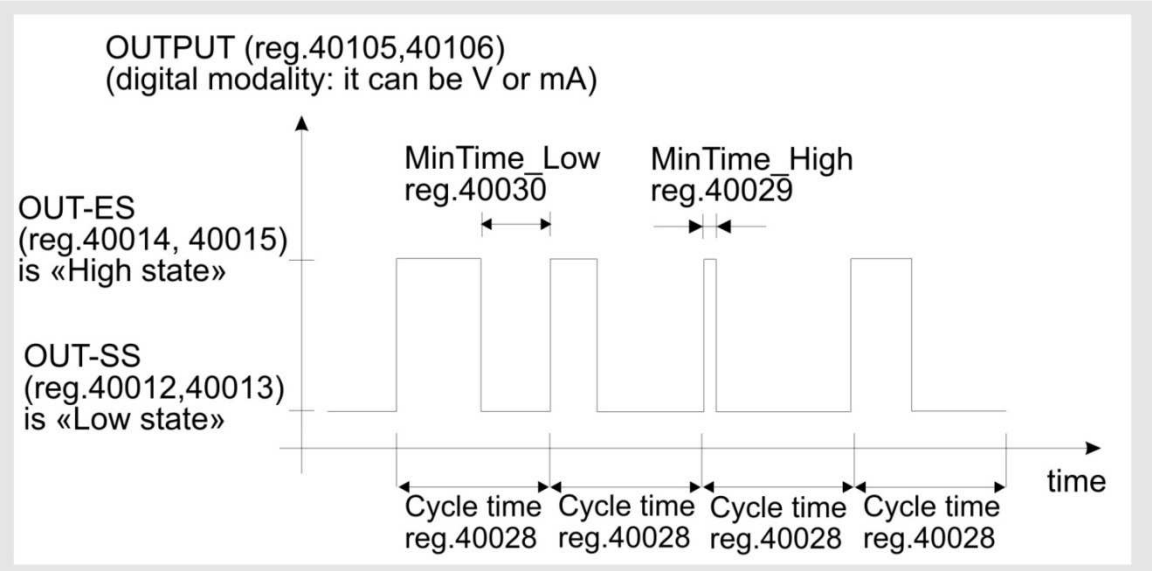
Operating modality is configurable by software or by FunctionMod register (40007.[15:8]), with reference to the “RS485 registers table”.
There are two output type of PDM-PID, regardless of operating modality:

Out type	Description
Analog	OUT is an analog signal
ON-OFF (see the following figures)	OUT is a ON/OFF signal. High state output is OUT-ES, low state output is OUT-SS

If out type is “ON/OFF”, the PDM-PID module allows to have a ON/OFF output with activation time t_{ON} (time corresponding to the high-state output) directly proportional to OUT_L.
To understand the ON/OFF out type functioning, see the following figure.



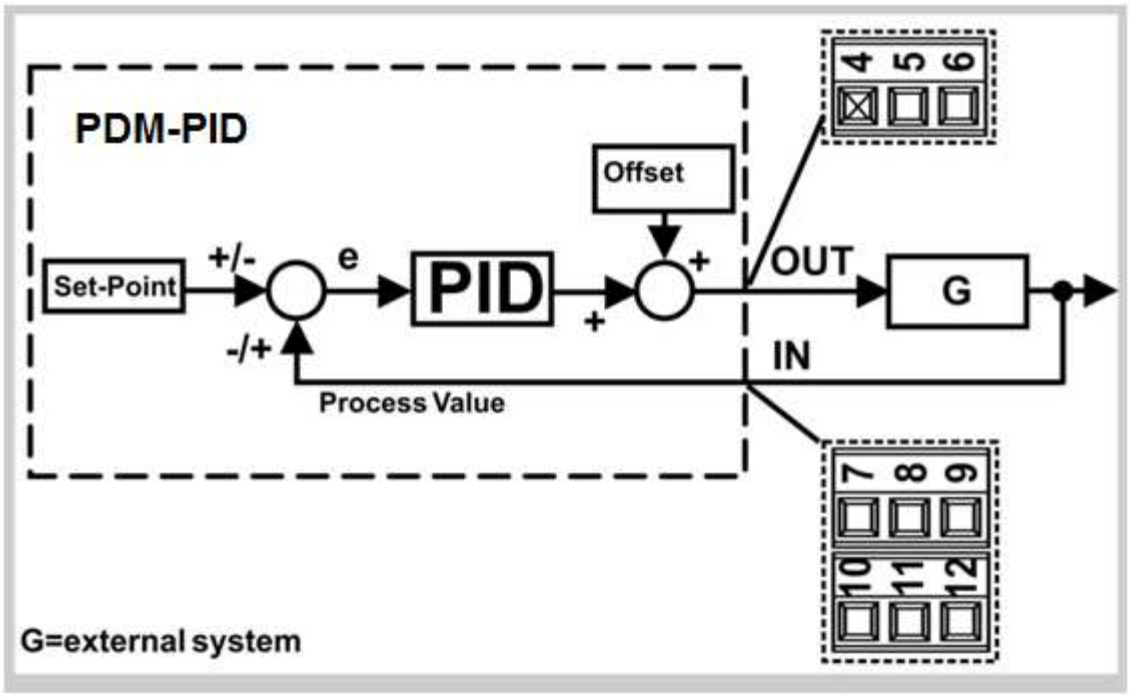
It is possible to limit inferiorly the time of high-state ON/OFF output (reg.40029) and to limit inferiorly the time of low-state ON/OFF output (reg.40030). The cycle time is reg.40028 (constant frequency of ON/OFF output=1/cycle time).



Most important operating modality: CONVERSION WITH PID

In “Conversion with PID” operating modality, the output (analog or ON/OFF) is a function of the analog input processed by the PID transfer function. Moreover, output is directly proportional to the analog input.

PID regulation allows inclining input signal PV (process value) to SP (set point value) with particular properties (rise time, overshoot, steady-state error, settling time, etc…). In the following figure is shown the PDM-PID module used as PID.



In particular, “e” means the difference between set-point and process-value:

Signal error e = (process value – set point) means PID regulation direct-type (for example: used for cooling)

Signal error e = (set point – process value) means PID regulation reverse-type (for example: used for heating)

The PID regulation is described by the following parameters:

Term	Parameter	Meaning	Register
Proportional	BP	Proportional band	40025
Integral	Ti	Integral time	40026
Derivative	Td	Derivative time	40027

where Tsample means the PID sampling time (it is equal to 100ms).

If BP decreases

Proportional action strengths	Proportional action weaknesses
Rise time decreases	Ringing and overshoot increases
Steady-state error decreases	

If Ti decreases

Integral action strengths	Integral action weaknesses
Steady-state error is equal to zero (if input is a constant value)	Rise time increases
	Settling time increases

If Td increases

Derivative action strengths	Derivative action weaknesses
Settling time decreases	Noise is amplified

20.5. Setting

20.5.1. Input setting

To set PDM-PID input characteristics, configure the following registers:

Description of register	Option/Meaning	Address
Input type	V, mA, %, °C, Ω, mV (see RS485 register table)	40003
Cold-junction compensation (if TC-type input)	0=deactivated 1=activated	40005.8
Input start scale	Value in [V, mA, %, °C, Ω, mV]	40008 (MSW) 40009 (LSW)
Input end scale	Value in [V, mA, %, °C, Ω, mV]	40010 (MSW) 40011 (LSW)
Filter applied to input signal	0=deactivated 1-19=filtering values	40005.[7:0]
Rejection	0b00=50Hz rejection 0b01=60Hz rejection 0b10=Fast (no rejection)	40006.[9:8]

20.5.2. Operating modality setting

To set PDM-PID functioning modality characteristics, configure the following registers:

Description of register	Option/Meaning	Address
Functioning modality	0=Conversion with PID, analog output 1=Conversion without PID, analog output 2=Conversion with PID, ON/OFF output 3=Conversion without PID, ON/OFF output 4=Manual, analog output 5=Manual, ON/OFF output	40007.[15:8]
Cycle time	Time in [sec/10] (if output modality=ON/OFF)	40028
Minimum time of high-state ON/OFF output	Time in [sec/10] (if output modality=ON/OFF)	40029
Minimum time of low-state ON/OFF output	Time in [sec/10] (if output modality=ON/OFF)	40030
SlewRate enabling	0=deactivated 1=activated	40031
SlewRate	Value in [%/sec]	40032
PID regulation sign	0=direct-type (example: cooling) 1=reverse-type (example: heating) (if operating modality=conversion with PID)	40007.[7:0]
Set point (it corresponds to the process-value desired)	Value in [%], with reference to the input scale range (if operating modality=conversion with PID)	40022 (MSW) 40023 (LSW)
Proportional band (BP)	Value in [%], with reference to the input scale range (if operating modality=conversion with PID)	40025
Integral time	Time in [sec/10] (if operating modality=conversion with PID)	40026
Derivative time	Time in [sec/10] (if operating modality=conversion with PID)	40027
Offset	Value in [%/100], with reference to the output scale range (if operating modality=conversion with PID)	40024

20.5.3. Output setting

To set PDM-PID output characteristics, configure the following registers:

Description of register	Option/Meaning	Address
Output type	0=current 1=voltage	40004.8
Output current type	0=active current (the module supplies the loop) 1=passive current (the sensor supplies the loop) (if output type is current)	40004.12
Output start scale	Value in [V, mA]	40012 (MSW) 40013 (LSW)
Output end scale	Value in [V, mA]	40014 (MSW) 40015 (LSW)
Output limiter enabling	0=deactivated 1=activated	40004.0
Limit inferior of the output limiter	Value in [%], with reference to the output scale range	40018 (MSW) 40019 (LSW)
Limit superior of the output limiter	Value in [%], with reference to the output scale range	40016 (MSW) 40017 (LSW)

20.6. Dip-switches table

In the following tables: box without circle means Dip-Switch=0 (OFF state); box with circle means Dip-Switch=1 (ON state).

BAUD-RATE (Dip-Switches: SW1)		
1	2	Meaning
		Baud-rate=9600 Baud
	●	Baud-rate=19200 Baud
●		Baud-rate=38400 Baud
●	●	Baud-rate=57600 Baud

ADDRESS (Dip-Switches: SW1)						
3	4	5	6	7	8	Meaning
						Address and Baud-Rate are acquired from memory(EEPROM)
					●	Address=1
				●		Address=2
				●	●	Address=3
			●			Address=4
X	X	X	X	X	X	……
●	●	●	●	●	●	Address=63

RS485 TERMINATOR (Dip-Switches: SW2)		
1	2	Meaning
		RS485 terminator disabled
	●	RS485 terminator enabled

20.7. RS485 register table

Name	Range	Interpretation of register	R/W	Default	Address
MachineID	/	MSB, LSB	R		40001
	Id_Code (Module ID)			0x42	Bit [15:8]
	Ext_Rev (Module version)				Bit [7:0]
FWREV	/	Word	R		40002
	Firmware Code				
Errors	/	Bit	R		40069
	These bits aren't used			/	Bit [15:6]
	Over-scale range error for acquired input (over hardware limits): 0=there isn't; 1=there is			/	Bit 5
	Amplitude detection of acquired input signal: 0=amplitude is between input start scale and input end scale; 1=amplitude is less than input start scale			/	Bit 4
	Amplitude detection of acquired input signal: 0=amplitude is between input start scale and input end scale; 1=amplitude is greater than input end scale			/	Bit 3
	Input burn-out error (if bit40006.0=1 and the input is greater than input scale range): 0=there isn't; 1=there is.			/	Bit 2
	Temperature acquisition error in the thermocouple cold-junctions (if TC-type input): 0=there isn't; 1=there is			/	Bit 1
	Memory loss-of-data: 0=there isn't; 1=there is			/	Bit 0
Rejection Burn	/	Bit	R/W		40006
	These bits aren't used			/	Bit[15:10]
	Rejection: 0b00=50Hz; 0b01=60Hz; 0b10=No rejection ("fast" sampling)			0b00	Bit [9:8]
	These bits aren't used			/	Bit [7:1]
	Burn-out enabling: 0=deactivated; 1=activated (if 1: fault output value is overwritten into output register)			0	Bit 0
Filter Cold-junction	/	Bit, LSB	R/W		40005
	These bits aren't used			/	Bit [15:9]
	Cold-junction compensation (if TC-type input): 0=deactivated; 1=activated			0	Bit 8
	Filter applied to the acquired input signal: 0=deactivated; 1=filtering min-value; 19=filtering max-value			0	Bit [7:0]
IN Type	/	Word	R/W		40003
	Input-type: 0=current; 1=voltage; 2=potentiometer; 3=TC J; 4=TC K; 5=TC R; 6=TC S; 7=TC T; 8=TC B; 9=TC E; 10=TC N; 11= 2-wires PT100; 12=3-wires PT100; 13=4-wires PT100; 14=2-wires NI100; 15=3-wires NI100; 16=4-wires NI100; 17=2-wires PT500; 18=3-wires PT500; 19=4-wires PT500; 20=2-wires PT1000; 21=3-wires PT1000; 22=4-wires PT1000; 23=millivoltmeter			0	
Address Parity	/	MSB, LSB	R/W		40033
	Address for RS485 (address of module/node if parameters are configurated by memory modality): from 0x01=1 to 0xFF=255			1	Bit [15:8]

	Parity for RS485: 0=there isn't; 1=even parity; 2=odd parity			0	Bit [7:0]
Baudrate Delay	/	MSB, LSB	R/W		40034
	Baud-rate for RS485 (baud-rate of module/node if parameters are configurated by memory modality): 0=1200; 1=2400; 2=4800; 3=9600; 4=19200; 5=38400; 6=57600; 7=115200			38400	Bit [15:8]
	Delay for RS485 (delay of communication response: it represents the number of the pauses(*) between the end of Rx message and the start of Tx message): from 0x00=0 to 0xFF=255 (*)1 pause=6 characters			0	Bit [7:0]
Function modality	/	Word	R/W		40007
	Functioning modality: 0=Conversion with PID, analog output 1=Conversion without PID, analog output 2=Conversion with PID, ON/OFF output 3=Conversion without PID, ON/OFF output 4=Manual, analog output 5=Manual, ON/OFF output			0	Bit [15:8]
IN-SS MSW	See "Input"	FP-32bit_MSW	R/W		40008
IN-SS LSW		FP-32bit_LSW	R/W		40009
	Input Start Scale: [mA] (if current-type input); [V] (if voltage-type input) [mV] (if millivoltmeter-type input); [%] (if potentiometer-type input); [°C] (if TC or RTD-type input)			0 [mA]	
IN-ES MSW	See "Input"	FP-32bit_MSW	R/W		40010
IN-ES LSW		FP-32bit_LSW	R/W		40011
	Input End Scale: [mA] (if current-type input); [V] (if voltage-type input or millivoltmeter-type input); [%] (if potentiometer-type input); [°C] (if TC or RTD-type input)			20 [mA]	
IN Percent MSW	Between:0-1	FP-32bit_MSW	R		40110
IN Percent LSW		FP-32bit_LSW	R		40111
	Percent measure of input: [%] with reference to the Input Scale range (for selected input-type) (if it is equal to 0, it corresponds to the 0% of the Input Scale range; if it is equal to 1, it corresponds to the 100% of the Input Scale range)			/	
mA MSW	FP between: IN-SS, IN-ES	FP-32bit_MSW	R		40091
mA LSW		FP-32bit_LSW	R		40092
	Electric measure of input: [mA] (if current-type input)			/	
V MSW	FP between: IN-SS, IN-ES	FP-32bit_MSW	R		40093
V LSW		FP-32bit_LSW	R		40094
	Electric measure of input: [V] (if voltage-type input)			/	
POT MSW	FP between: IN-SS, IN-ES	FP-32bit_MSW	R		40099
POT LSW		FP-32bit_LSW	R		40100
	Electric measure of input: [%] (if potentiometer-type input)			/	
TC MSW	FP between: IN-SS, IN-ES	FP-32bit_MSW	R		40083

TC LSW		FP-32bit_LSW	R		40084
	Electric measure of input: [mV] (if TC-type input) without cold-junction compensation (if bit40005.8=0), with cold-junction compensation (if bit40005.8=1)			/	
TCT MSW	FP between: IN-SS, IN-ES	FP-32bit_MSW	R		40085
TCT LSW		FP-32bit_LSW	R		40086
	Electric measure of input: [°C] (if TC-type input) with compensation				
CJ MSW	/	FP-32bit_MSW	R		40079
CJ LSW		FP-32bit_LSW	R		40080
	Equivalent electric measure of the cold-junction: [mV] (if TC-type input)			/	
RTDO MSW	/	FP-32bit_MSW	R		40087
RTDO LSW		FP-32bit_LSW	R		40088
	Electric measure of input: [Ω] (if RTD-type input)			/	
RTD MSW	FP between: IN-SS, IN-ES	FP-32bit_MSW	R		40089
RTD LSW		FP-32bit_LSW	R		40090
	Electric measure of input: [°C] (if RTD-type input)			/	
3wires-RTD MSW	/	FP-32bit_MSW	R		40095
3wires-RTD LSW		FP-32bit_LSW	R		40096
	Measure of the wire resistance for 3 wires RTD connection [Ω] (if RTD-type input)			/	
4wires-RTD MSW	/	FP-32bit_MSW	R		40097
4wires-RTD LSW		FP-32bit_LSW	R		40098
	Measure of the wire resistance for 4 wires RTD connection [Ω] (if RTD-type input)			/	
OUT Type Limiter	/	Bit	R/W		40004
	These bits aren't used			/	Bit[15:13]
	Output current type: 0=active current (the module supplies the loop); 1=passive current (the sensor supplies the loop)			0	Bit 12
	These bits aren't used			/	Bit [11:9]
	Output type: 0=current; 1=voltage			0	Bit 8
	These bits aren't used			/	Bit [7:1]
	Output limiter: 0=deactivated; 1=activated			0	Bit 0
OUT-SS MSW	See "Output"	FP-32bit_MSW	R/W		40012
OUT-SS LSW		FP-32bit_LSW	R/W		40013
	Output Start Scale: [mA] (if current-type output); [V] (if voltage-type output)			0 [mA]	
OUT-ES MSW	See "Output"	FP-32bit_MSW	R/W		40014
OUT-ES LSW		FP-32bit_LSW	R/W		40015
	Output End Scale: [mA] (if current-type output); [V] (if voltage-type output)			20 [mA]	
OUT MSW		FP-32bit_MSW	R		40105
OUT LSW		FP-32bit_LSW	R		40106
	Output value: [mA] (if current-type output); [V] (if voltage-type output)			/	
OUT		Word	R		40109

	Output value: [µA] (if current-type output); [mV] (if voltage-type output)			/	
OUT-Fault MSW		FP-32bit_MSW	R/W		40020
OUT-Fault LSW		FP-32bit_LSW	R/W		40021
	Fault output value (measure unit is the same of output) Reg.40105,40106 are equal to reg.40020,40021 if 40069.2=1 (there is input burn-out error) (if out type = analog)			0 [%]	
OUT-Manual	Between: 0; 10000	Word	R/W		40107
	Output manual value [%·100] (if it is equal to 0, it corresponds to the 0% of the Output Scale range; if it is equal to 10000, it corresponds to the 100% of the Output Scale range); for selected output-type, see reg.40004 (if operating modality=manual, constant output)			0 [%]	
Lim Inf MSW		FP-32bit_MSW	R/W		40018
Lim Inf LSW		FP-32bit_LSW	R/W		40019
	Limit inferior of the output limiter (measure unit is the same of output)			0 (=0 [mA])	
Lim Sup MSW		FP-32bit_MSW	R/W		40016
Lim Sup LSW		FP-32bit_LSW	R/W		40017
	Limit superior of the output limiter (measure unit is the same of output)			1 (=20[mA])	
PID-sign		Bit	R/W		40007
	PID regulation sign: 0=direct-type (cooling); 1=reverse-type (heating)			0	Bit [7:0]
Proportional Band		Word	R/W		40025
	PID regulation proportional band [%], with reference to the Input Scale range (if operating modality=conversion with PID)			100%	
Integral time		Word	R/W		40026
	PID regulation integral time [sec/10]. 0=there is no integral action (if operating modality=conversion with PID)			2400 [sec/10] (=240sec)	
Derivative time		Word	R/W		40027
	PID regulation derivative time [sec/10]. 0=there is no derivative action (if operating modality=conversion with PID)			0 [sec/10]	
Set point MSW		FP-32bit_MSW	R/W		40022
Set point LSW		FP-32bit_LSW	R/W		40023
	Input set point for the PID regulation [%] with reference to the Input Scale range (if it is equal to 0, it corresponds to the 0% of the Input Scale range; if it is equal to 1, it corresponds to the 100% of the Input Scale range) (if operating modality=conversion with PID)			50%	
Process Value MSW		FP-32bit_MSW	R		40103
Process Value LSW		FP-32bit_LSW	R		40104

	Process value for the PID regulation: [mA] (if current-type input); [V] (if voltage-type input); [mV] (if millivoltmeter-type input); [%] (if potentiometer-type input); [°C] (if TC or RTD-type input)			/	
Process value		Word	R		40108
	Process value for the PID regulation: [µA] (if current-type input); [mV] (if voltage-type input); [mV/100] (if millivoltmeter-type input); [%/100] (if potentiometer-type input); [°C/10] (if TC or RTD-type input)			/	
Offset		Word	R/W		40024
	Output offset for the PID regulation [%/100] with reference to the Output Scale range (if it is equal to 0, it corresponds to the 0% of the Output Scale range; if it is equal to 1, it corresponds to the 100% of the Output Scale range) (if operating modality=conversion with PID)			5000 (=50%)	
Slew Rate enabling		Word	R/W		40031
	Output slew rate: 0=deactivated; 1=activated			1	
Slew Rate		Word	R/W		40032
	Output slew rate [%/sec]			100 [%/sec]	
Cycle Time	From 1 to 1310	Word	R/W		40028
	Output cycle time [sec/10] (if output modality=ON/OFF)			300 (=30 sec)	
MinTime-High	From 1 to 1310	Word	R/W		40029
	Minimum time of high-state output [sec/10] (if output modality=ON/OFF)			0 (=0 sec)	
MinTime-Low	From 1 to 1310	Word	R/W		40030
	Minimum time of low-state output [sec/10] (if output modality=ON/OFF)			0 (=0 sec)	

20.8. LEDs for signalling

In the front-side panel there are 4 LEDs and their state refers to important operating conditions of the module.

LED	LED status	Meaning
PWR	Constant light	The power is on
ERR	Blinking light	The module has at least one of the errors described in RS485 Registers table
RX	Constant light	Verify if the bus connection is corrected
	Blinking light	The module received a data packet
TX	Blinking light	The module sent a data packet

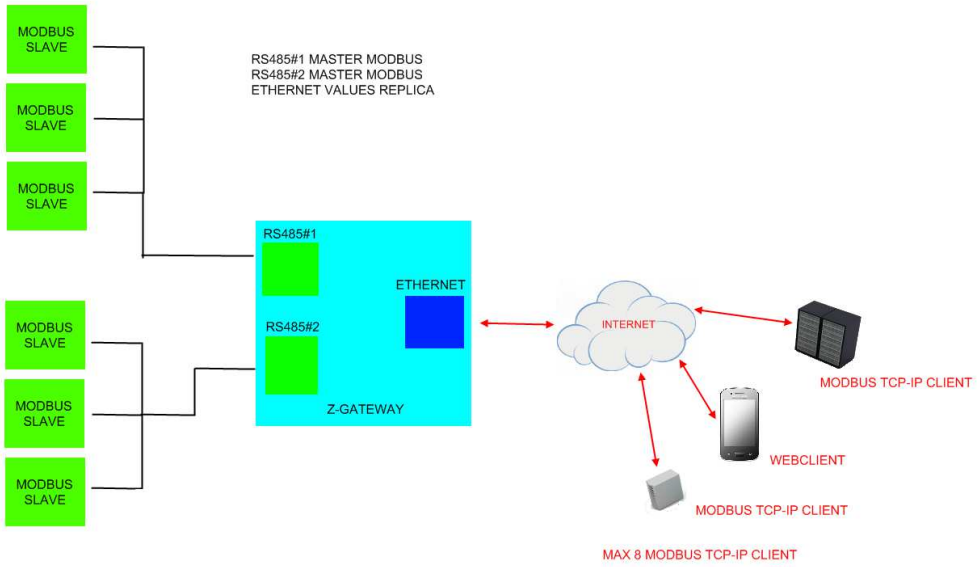
21. PDM-ETH

PDM-ETH is a Modbus RTU to Modbus TCP-IP protocol Gateway, two RS485 independent ports are available, a Fast Ethernet 10-100MBits and an USB port.

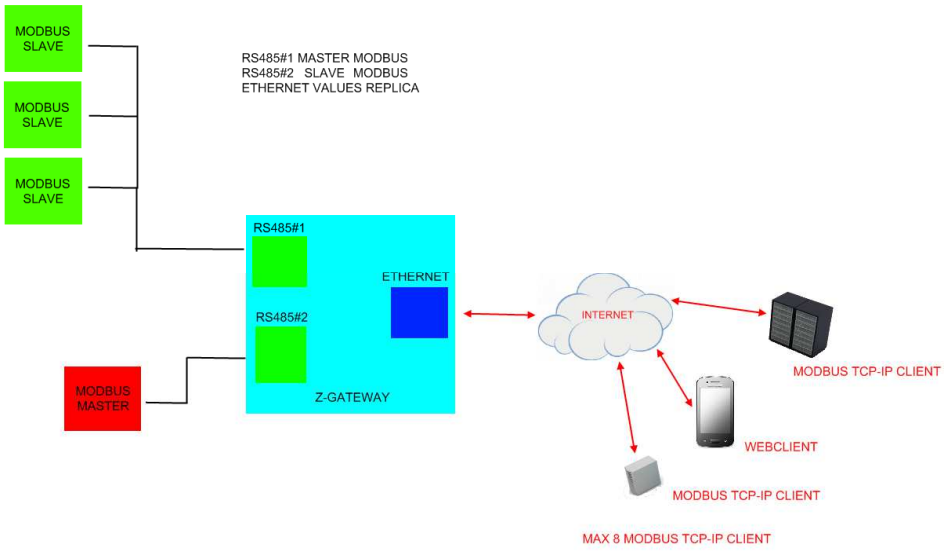
The USB port can be used also like a communication port supporting the Modbus RTU protocol.

A powerful Webserver is also available for configuration and real time values view.
PDM-ETH is configurable in 4 modes:

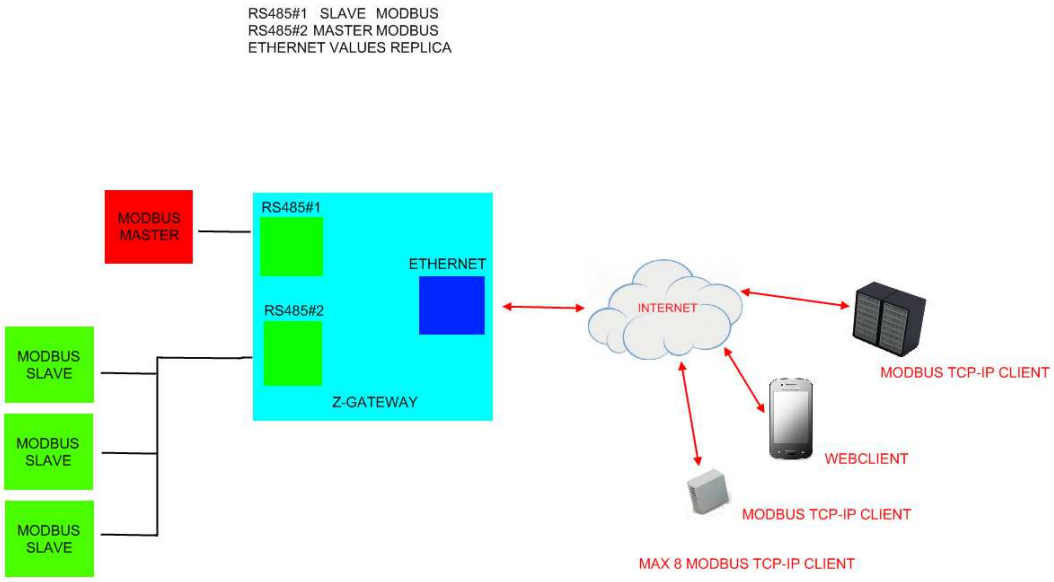
RS485#1 Modbus RTU Master and RS485#2 Modbus RTU Master, replica values on Ethernet Modbus TCP-IP server, for example:



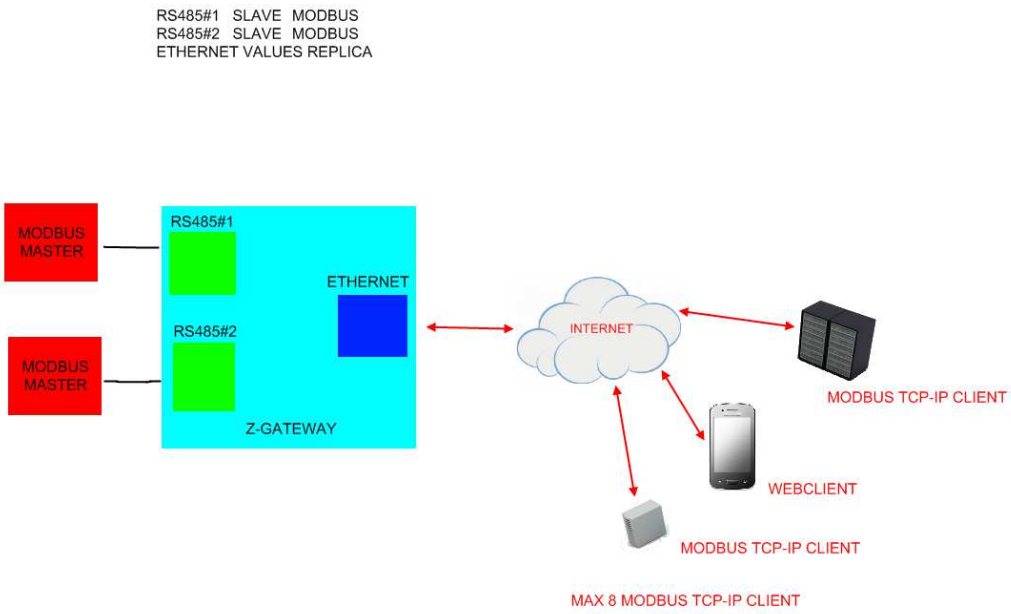
RS485#1 Modbus RTU Master, replica values on RS485#2 Modbus RTU Slave or Ethernet Modbus TCP-IP server, for example:



RS485#2 Modbus RTU Master, replica values on RS485#1 Modbus RTU Slave or Ethernet Modbus TCP-IP server, for example:



Shared Memory: RS485#1 and RS485#2 Modbus RTU Slave, Ethernet Modbus TCP-IP server (200 Modbus Registers that can be written and read from a Modbus RTU Master or Ethernet Modbus TCP-IP server, for example:



21.1. Features

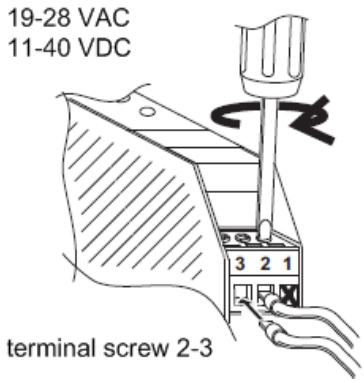
- Fast Ethernet port (10-100 Mbit/s)
- Multiprotocol support: Modbus TCP-IP server protocol (by the fast Ethernet), Modbus RTU master/slave independent configurable on the NR 2 RS485 ports.
- Up to 8 client Modbus TCP-IP supported
- Up to 100 Modbus TAG (up to 200 Modbus registers)
- Embedded Webserver with CGI support
- Configurable by Webserver or by USB (Easy PDM-ETH software)
- Replica of the Modbus registers on TCP-IP protocol, Modbus RTU (NR.2 RS485 independent ports) and USB port
- Baud rate for Modbus RTU: 1200 baud up to 115200 baud
- 1500 Vac galvanic isolation between power supply and communication
- Quick installation on DIN 46277 rail
- Removable screw terminals with section of 2.5 mm2
- Firmware update by USB port

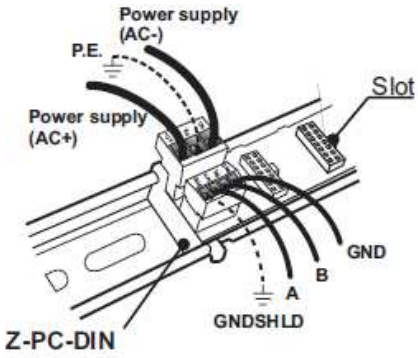
21.2. General Specification

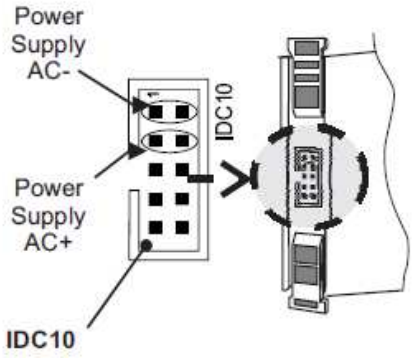
GENERAL SPECIFICATIONS	
Power supply	19.. 28 Vac (50..60 Hz), 11.. 40Vdc
maximum power consumption	1,2 W
Isolation	1500 Vac
ETHERNET	
Ethernet	10 - 100 Mbit/s
Protocol	Modbus TCP-IP
Max connection length	100 m
Connection	RJ 45 on frontal
RS485 COMMUNICATION PORTS	
Number	2
Port #1	IDC10 connector (Modbus RTU Master or slave port)
Port #2	Screw terminals 10-11-12 (Modbus RTU Master or slave port)
Baudrate	1200..115200 configurable
Baudrate	1200..115200 configurable
ENVIRONMENTAL CONDITIONS	
Temperature	-20 °C.. +70 °C
Humidity	30 ..90% a 40 °C no condensing
Storage temperature	-25..+85 °C
BOX	
Dimensions	100 x 17,5 x 111 mm
Box; protection degree	Black, PA6, IP20
CONNECTORS	
	IDC 10 for PDM-DIN bus Removable terminals, pitch 5,08 mm Mini-B USB Ethernet RJ45
STANDARDS	
EN 61000-6-4/ 2007	Emission, industrial environmental
EN 61000-6-2/ 2005	Immunity, industrial environmental
EN 61010-1/ 2001	Safety

21.3. Electrical Connections

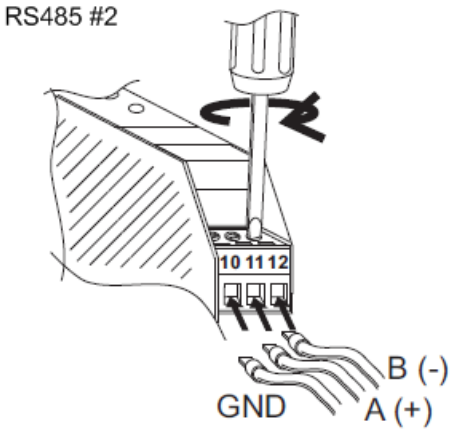
For power ON the PDM-ETH connect the screw terminal 2-3 or use the PDM-DIN BUS for connect the IDC10 connector:



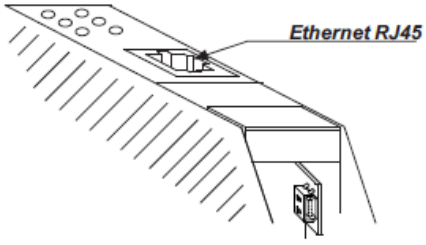




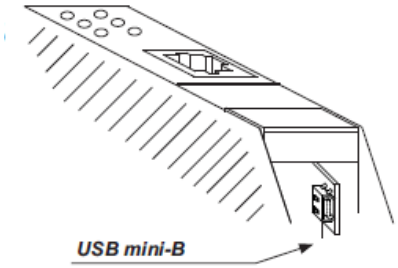
The RS485#1 is available from the IDC10 connector
The RS485#2 is available from the screw terminals 10-11-12:



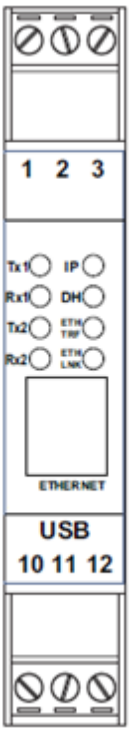
Note: before to insert the cable into RJ45 connector, remove the protection rubber:



USB port with mini-B plug-in for a PC connection:



21.4. Debug LEDs



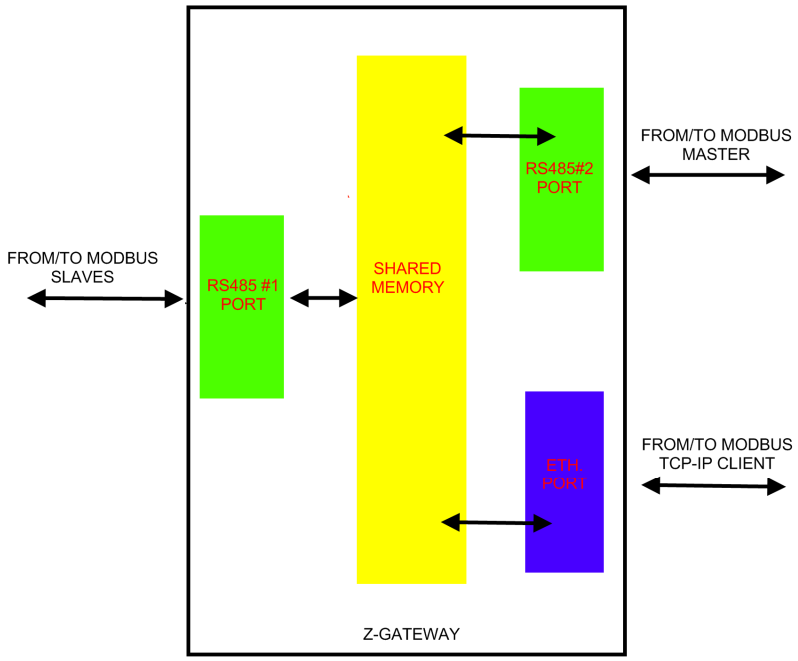
LED	STATE	MEANING
TX1	FLASHING	Data transmission on RS485#1
RX1	FLASHING	Data reception on RS485#1
TX2	FLASHING	Data transmission on RS485#2
RX2	FLASHING	Data reception on RS485#1
IP	FLASHING	Ethernet port not connect
IP	ON	Valid static IP address
DH	ON	DHCP activated
ETH TRF	FLASHING	Data traffic on Ethernet port
ETH LINK	ON	Ethernet port connected

21.5. How it works

Into a Modbus RTU bus it's essential to read as fast as possible the registers from the various Modbus Slave devices.

The PDM-ETH can be configured with up to 100 modbus tag (1 tag = 1 variable that can be composed by one or two Modbus registers) on the RS485 buses, this values are stored into a shared memory that can be accessed from Ethernet or by the other RS485 port.

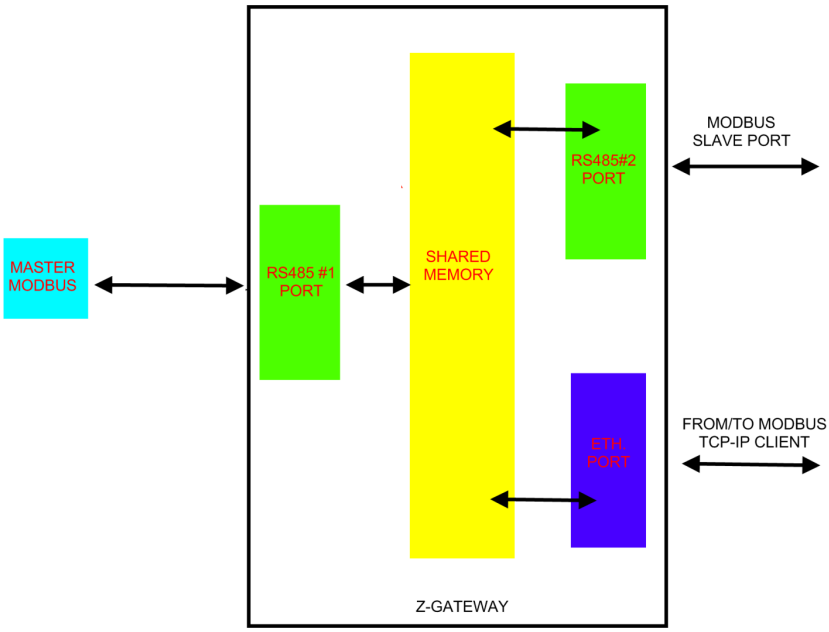
When a register is required from the Ethernet port or from the other RS485 port the values is read directly from the Shared memory without the needed of waiting the Slave response time:



In this way the shared memory is always refreshed at maximum speed from the "slaves side" and the values are read from the "masters side" without waiting a slave response.

Another benefit is that the Shared memory can be accessed also from the web using the PDM-ETH embedded webserver.

Another way to use the PDM-ETH is with the two RS485 ports as Modbus slave, in this way it's possible to use the Shared memory for writing the registers for example from a PLC that doesn't support the Modbus RTU Slave protocol:



CAUTION!

PDM-ETH SUPPORTS ONLY THE MODBUS RTU SLAVE, MODBUS RTU MASTER AND MODBUS TCP-IP SERVER PROTOCOLS.

21.6. Modbus RTU to Modbus TCP-IP or Modbus RTU

The PDM-ETH can be configured as gateway Modbus RTU to Modbus RTU:
Setting for example the RS485#1 as Modbus Master and RS485#2 as Modbus Slave the PDM-ETH act as Modbus RTU to Modbus RTU Gateway.
Setting for example the RS485#1 and RS485#2 as Modbus Master the PDM-ETH act as Modbus RTU to Modbus TCP-IP Gateway.
From the RS485 the maximum number of TAGs that can be configured is 100, a TAG is a variable that can be associated to more than one register:
For example if a Modbus slave device has the register 40005 contains the counter1 value (from 0 to 65535) this variable is a TAG, but if the register 40006 contains the counter2 HIGH VALUE and the 40007 contains the counter2 LOW VALUE the register 40006-40007 is one variable and then a single TAG.

NOTE
In every configuration the Ethernet port always support the Modbus TCP-IP server protocol and the Web server too.

CAUTION!
The maximum number of configurable TAGs is 100

CAUTION!
Modbus" Multiple write registers" is supported only on a single TAG, so it's not possible to write more than 1 TAG with the write multiple registers Modbus function.

21.7. "Shared memory mode"

There are a lot of devices that don't support the Modbus RTU slave protocol but only the Modbus RTU master.
In this case it's not possible to log through the RS485 port the process values, to do that PDM-ETH can be used for obtain a Modbus RTU Slave port.
Configuring the RS485#1 and RS485#2 ports as slave Modbus the Modbus RTU master device can write registers from 40001 to 40200, for example from port RS485#1, this registers can be read from port RS485#2 or from Ethernet.

CAUTION!
The shared memory can be freely read and written from Modbus register 40001 (holding register 0) to 40200 (holding register 199).

21.8. USB Serial Communication

PDM-ETH has two RS485 ports, but also the USB port can be used for a supplementary Modbus RTU Slave port by using a Windows PC.
The RS485 ports and USB port can work all at the same time and are independent.
The protocol supported from the USB port is the Modbus RTU Slave.
By installing the software Easy Setup a virtual com driver can be installed on a windows™ PC (see chapter **Erreur ! Source du renvoi introuvable.** for more info).
The configuration for USB port is fixed and not configurable:

- Modbus station address: 1
- baud rate: 115200 baud
- parity: none
- data bit: 8
- stop bit: 1

21.9. Ethernet communication

The PDM-ETH includes a fast Ethernet port (10-100Mbit), the TCP-IP integrated protocol supports:
-Static IP address or DHCP
-Gateway support
-Modbus TCP-IP server protocol (support up to 8 Modbus TCP-IP clients at the same time)
-Webserver (with user / password protection)
The default configuration for the Ethernet port is:

- Static Ip address 192.168.90.101
- Modbus TCP-IP client 1 port 502
- Modbus TCP-IP client 2 port 503
- Modbus TCP-IP client 3 port 504
- Modbus TCP-IP client 4 port 505
- Modbus TCP-IP client 5 port 506
- Modbus TCP-IP client 6 port 507
- Modbus TCP-IP client 7 port 508
- Modbus TCP-IP client 8 port 509

WARNING!
BEFORE CONNECT PDM-ETH ON THE NETWORK BE SURE THAT THE IP ADDRESS 192.168.90.101 IS NOT USED BY ANOTHER ETHERNET DEVICE.

21.9.1. Static IP address and DHCP

The default IP address is the static 192.168.90.101, it's also possible to obtain an IP and a Gateway address from a DHCP server. Typically a DHCP server is always active into a Router (a range of addresses are reserved for the internal DHCP server).
Using a DHCP can create problem for a connection with PDM-ETH module because the IP can change without notice (after a timeout).

21.10. Modbus RTU and Modbus TCP-IP protocol

The Modbus protocols supported by the PDM-ETH are:
Modbus RTU Master (By RS485#1 or RS485#2)
Modbus RTU Slave (By RS485#1 or RS485#2 or USB)
Modbus TCP-IP Server (By Ethernet)
For more information about this protocols please refer to Modbus specification website:
http://www.modbus.org/specs.php
For using the USB Port you must install the USB driver first

21.11. Modbus RTU and Modbus TCP-IP registers map

All registers are "Holding register" (Read Modbus function 3) with the convention that the first register is the 40001 address.
The following Modbus functions are supported:
Read Coils (function 1)
Read Discrete Inputs (function 2)
Read Holding Register (function 3)
Read Input Registers (function 4)
Write Single Coil (function 5)
Write Single Register (function 6)
Write Multiple registers (function 16) (ONLY FOR THE SAME TAG)

All 32 bits values are stored into 2 consecutive registers, for example:
Totalizer 1 in unsigned 32 bits is stored into registers 40016 and 40017, the Most significant word is the register 40016, the less significant word is the 40017.
So the 32bits value is obtained by the following relation:

$$Totalizer1 = Reg(40017) + (Reg(40016) \times 2^{16}) = Reg(40017) + (Reg(40016) \times 65536)$$

21.12. The webserver

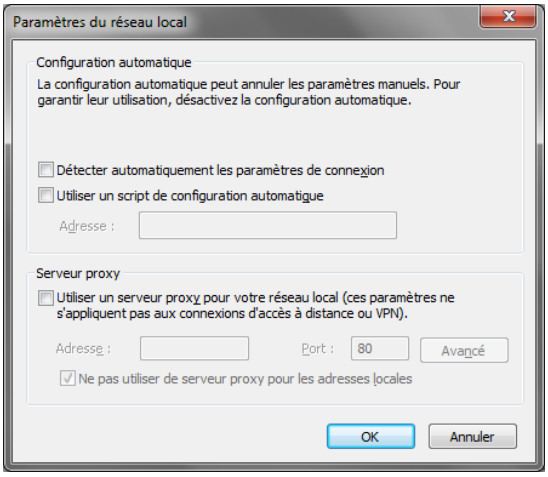
The PDM-ETH include a Webserver for setup or for view the real time values.
The Webserver works with the following browser:
-Internet explorer
-Firefox
-Chrome
-Android
-Iphone/Ipad

The webserver can be protected by a user name and a password.

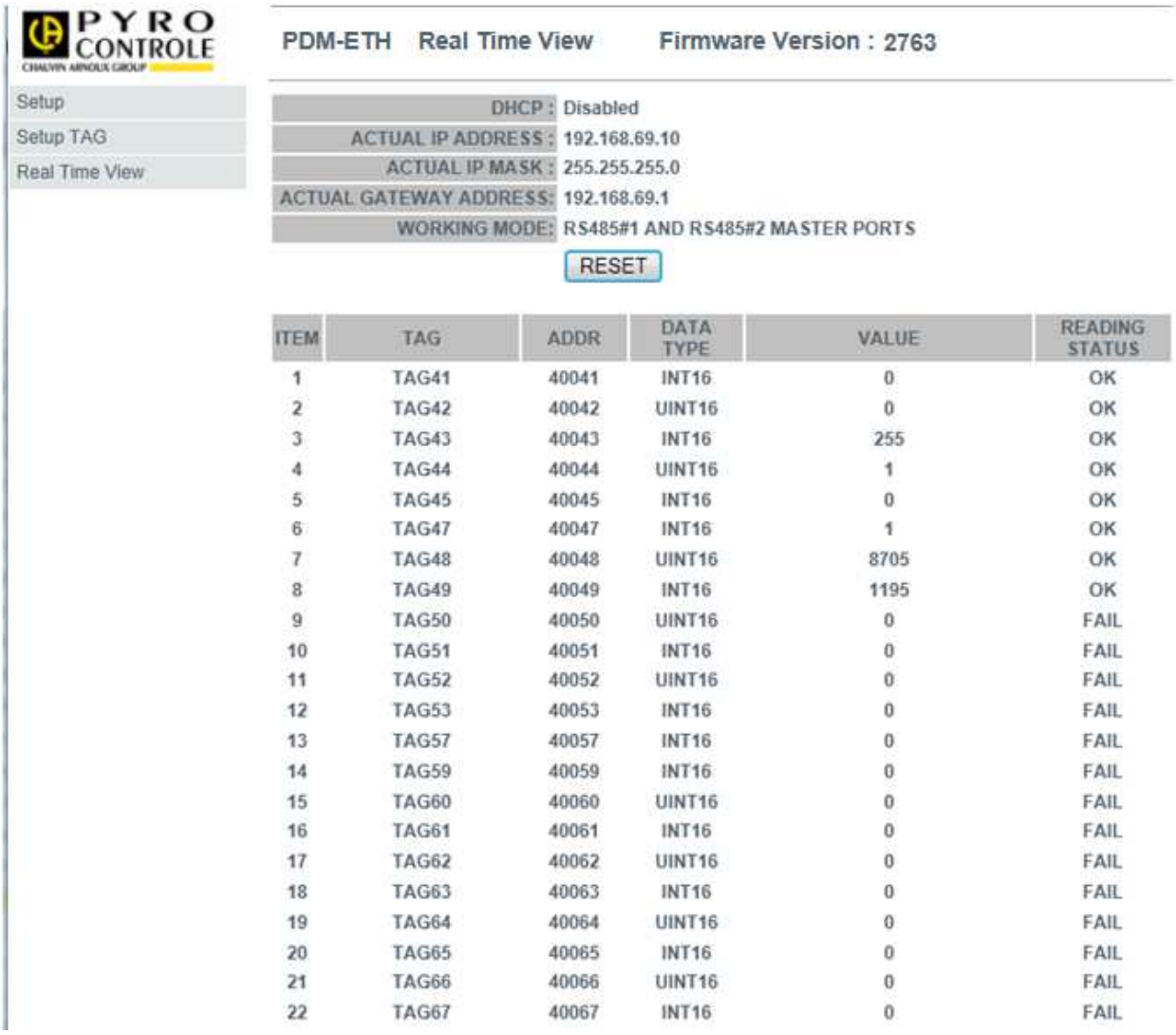
If you are using Internet explorer 9 (or newer) you must enable the compatibility mode (see the arrow below):

21.12.1. Local connection to the webserver

To connect an Ethernet device to the PDM-ETH Webserver you must have two compatible IP addresses.
Also you must disable the flag on the proxy server configuration into the browser:



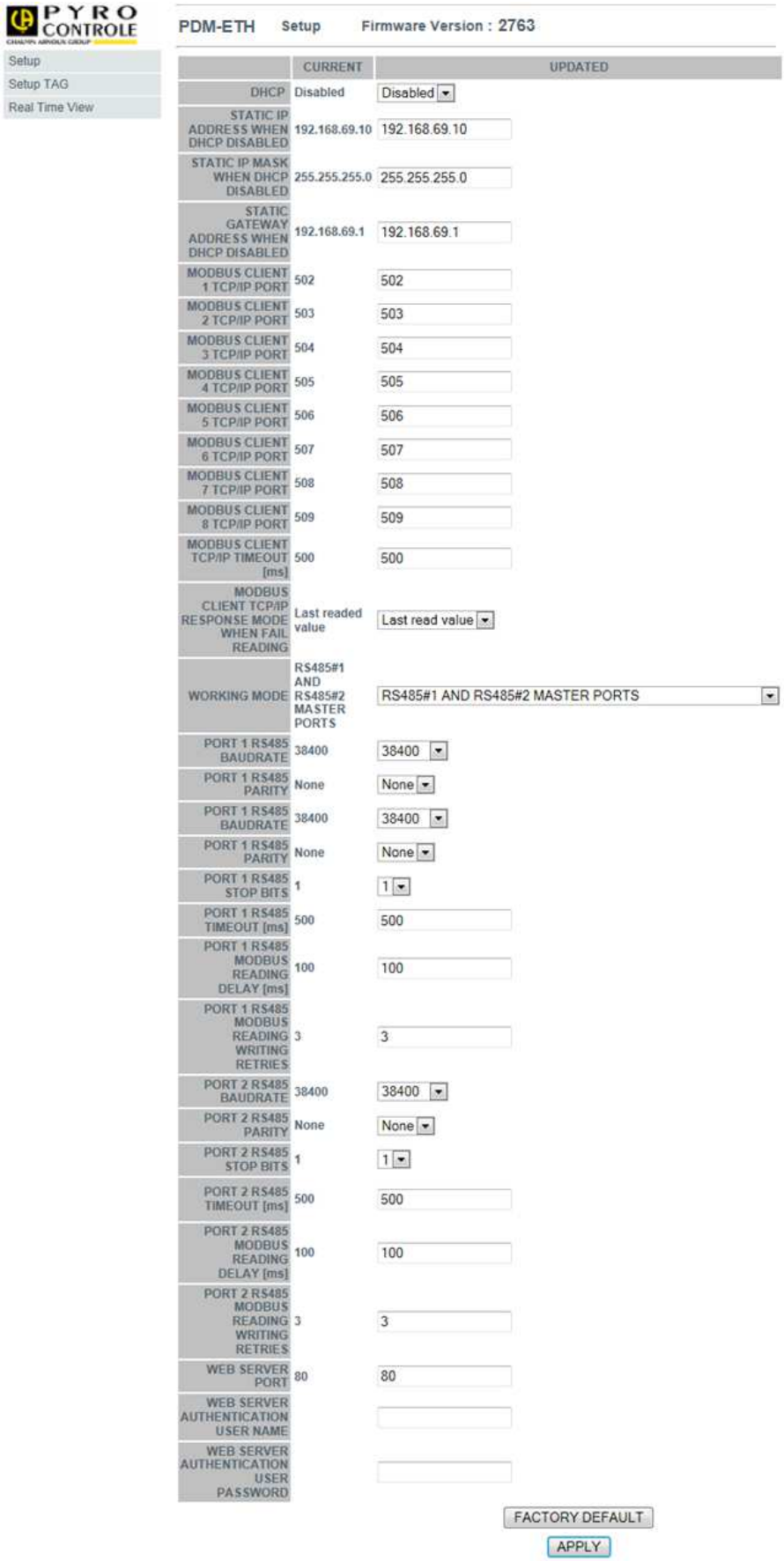
For example if the PDM-ETH address is 192.168.90.101 with subnet mask 255.255.255.0 the other device must have the ip starting with 192.168.90, so for example 192.168.90.102 can works.
The PDM-ETH ethernet device supports the auto-switching mode so it's possible to connect an Ethernet device point to point without the need of a Router or Switch.
After that, open a browser and type:
http://192.168.90.101:port
where port it's the port configured for the webserver (default 80), so the default is:
http://192.168.90.101:80
For connect a WiFi device to the PDM-ETH Webserver you need a Wifi access point or a WiFi router, in the case of a WiFi Router into the PDM-ETH configuration set the Gateway IP equals to the Router IP.
If the ip configuration is made correctly the webserver appear:



ITEM	TAG	ADDR	DATA TYPE	VALUE	READING STATUS
1	TAG41	40041	INT16	0	OK
2	TAG42	40042	UINT16	0	OK
3	TAG43	40043	INT16	255	OK
4	TAG44	40044	UINT16	1	OK
5	TAG45	40045	INT16	0	OK
6	TAG47	40047	INT16	1	OK
7	TAG48	40048	UINT16	8705	OK
8	TAG49	40049	INT16	1195	OK
9	TAG50	40050	UINT16	0	FAIL
10	TAG51	40051	INT16	0	FAIL
11	TAG52	40052	UINT16	0	FAIL
12	TAG53	40053	INT16	0	FAIL
13	TAG57	40057	INT16	0	FAIL
14	TAG59	40059	INT16	0	FAIL
15	TAG60	40060	UINT16	0	FAIL
16	TAG61	40061	INT16	0	FAIL
17	TAG62	40062	UINT16	0	FAIL
18	TAG63	40063	INT16	0	FAIL
19	TAG64	40064	UINT16	0	FAIL
20	TAG65	40065	INT16	0	FAIL
21	TAG66	40066	UINT16	0	FAIL
22	TAG67	40067	INT16	0	FAIL

21.12.2. Configuring the PDM-ETH with the Webserver

The Webserver can be also used for configuring the PDM-ETH module, all parameters are visible clicking on “Setup” button to the left of the screen:



On the first column represents the parameter name, the second column (current) it's the current parameter value. The last column (updated) can be used for changing the current configuration. When a configuration it's made you must confirm with "APPLY", then the new configuration became operative.
The parameters are explained below:

DHCP

Disable: A static Ip address is used
Enable: The IP address, the IP-Mask and the Gateway address are obtained by a DHCP server. If DHCP mode is enabled the PDM-ETH IP address can be read from the USB port By the test configuration on the Easy Setup software

STATIC IP ADDRESS WHEN DHCP DISABLED

IP address when DHCP is Disable

STATIC IP MASK WHEN DHCP DISABLED

IP mask when DHCP is Disable

STATIC GATEWAY ADDRESS WHEN DHCP DISABLED

Gateway mask when DHCP is Disable

MODBUS CLIENT 1 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 1)

MODBUS CLIENT 2 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 2)

MODBUS CLIENT 3 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 3)

MODBUS CLIENT 4 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 4)

MODBUS CLIENT 5 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 5)

MODBUS CLIENT 6 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 6)

MODBUS CLIENT 7 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 7)

MODBUS CLIENT 8 TCP/IP PORT

TCP-IP port for Modbus TCP-IP Server protocol (Client Number 8)

MODBUS CLIENT TCP/IP TIMEOUT

Modbus TCP-IP protocol timeout time

MODBUS CLIENT TCP/IP RESPONSE MODE WHEN FAIL READING

No response: when the slave TAG doesn't respond PDM-ETH doesn't respond too
Last read value: when the slave TAG doesn't respond PDM-ETH respond with last read value

WORKING MODE

RS485#1 and #2 MASTER PORTS: The two RS485 ports are connected to the slaves, the registers can be accessed by the Ethernet port (Modbus TCP-IP or Webserver)
RS485#1 SLAVEPORT and RS485#2 MASTER PORT: The RS485#2 port is connected to the slaves, the registers can be accessed by the Ethernet port (Modbus TCP-IP or Webserver) or by the RS485#1 port (Modbus RTU).
RS485#1 MASTER PORT and RS485#2 SLAVE PORT: The RS485#1 port is connected to the slaves, the registers can be accessed by the Ethernet port (Modbus TCP-IP or Webserver) or by the RS485#2 port (Modbus RTU).
RS485#1 and #2 SLAVE PORTS SHARED MEMORY: The RS485#1 and RS485#2 port are connected to Master Modbus RTU that can write the shared memory from holding register 40001 to 40200 (from address 0 to 199), the registers can be accessed by the Ethernet port (Modbus

TCP-IP). In this working mode the Webserver TAG cannot be configured (are showed only the first 100 Modbus register in Unsigned 16bits) .

PORT 1 RS485 BAUDRATE

Used to Set the port baudrate

PORT 1 RS485 PARITY

Used to Set the port parity (None, Odd or even)

PORT 1 RS485 STOP BITS

Used to Set the port parity (1 or 2; note that if the parity is set, only 1 bit can be used)

PORT 1 RS485 TIMEOUT

Used to Set the timeout on Modbus Master mode before making a new call

PORT 1 RS485 MODBUS READING DELAY

Used to Set the delay between two Modbus Master request

PORT 1 RS485 MODBUS READING WRITING RETRIES

Used to Set the retries to write a Modbus register into Modbus Master mode

PORT 2 RS485 BAUDRATE

Used to Set the port baudrate

PORT 2 RS485 PARITY

Used to Set the port parity (None, Odd or even)

PORT 2 RS485 STOP BITS

Used to Set the port parity (1 or 2; note that if the parity is set, only 1 bit can be used)

PORT 2 RS485 TIMEOUT

Used to Set the timeout on Modbus Master mode before making a new call

PORT 2 RS485 MODBUS READING DELAY

Used to Set the delay between two Modbus Master request

PORT 2 RS485 MODBUS READING WRITING RETRIES

Used to Set the retries to write a Modbus register into Modbus Master mode

WEB SERVER PORT

Used to Set the TCP-IP port for the Webserver

WEB SERVER AUTHENTICATION USER NAME

Used to Set the User Name for accessing the Webserver (if User Name and Password are leave empty no authentication is require for webserver access)

WEB SERVER AUTHENTICATION USER PASSWORD

Used to Set the Password for accessing the Webserver (if User Name and Password are leave empty no authentication is require for webserver access)

WARNING!

REMEMBER ALWAYS TO CONFIGURE THE WEBSERVER AUTHENTICATION USER NAME AND PASSWORD FOR RESTRICT THE ACCESS TO THE WEBSERVER. IF YOU LEAVE THE TWO PARAMETERS TEXT BOXES BLANK NO AUTHENTICATION IT'S REQUIRED FOR WEBSERVER ACCESS.

CAUTION!

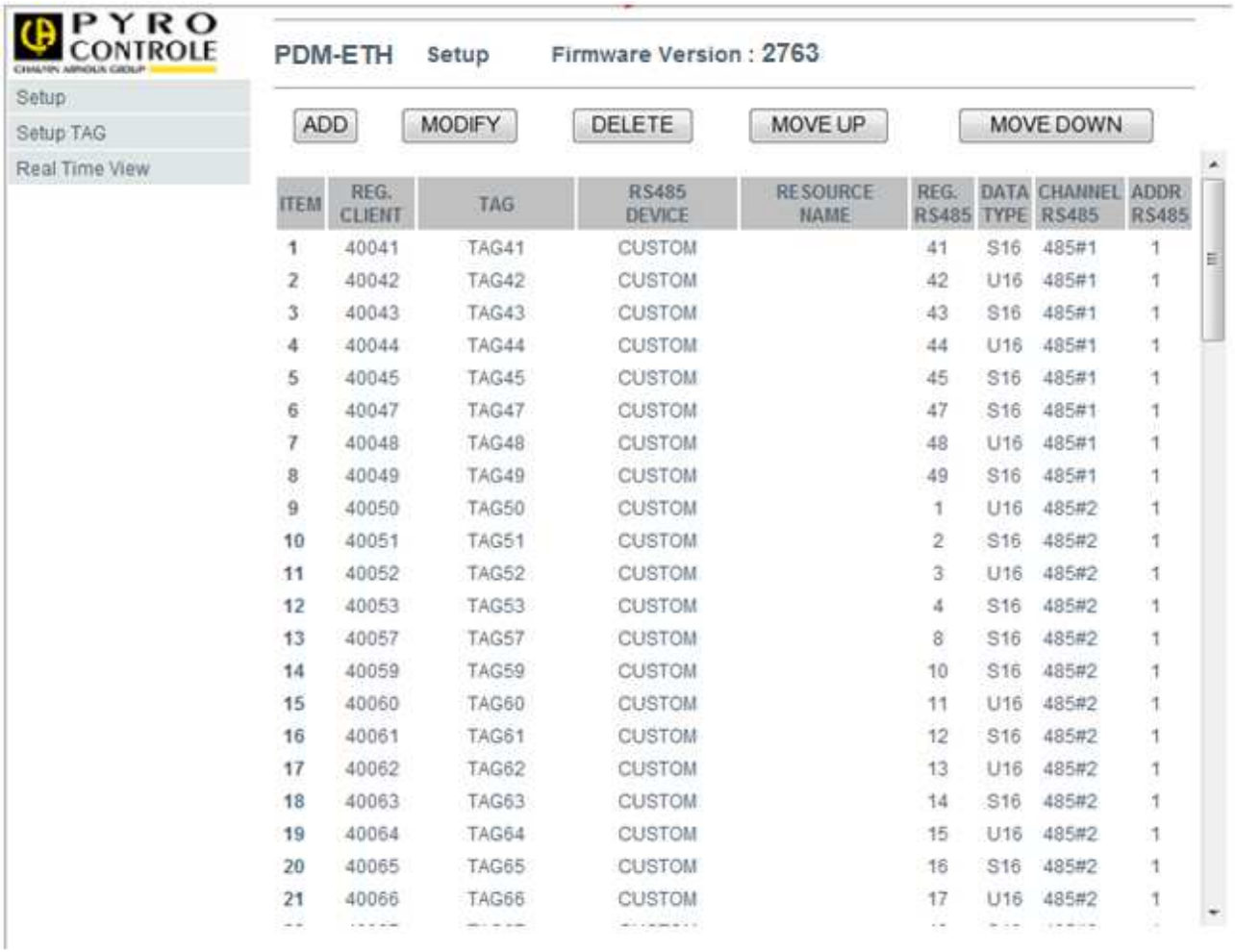
If you are using Internet explorer 9 (or newer) you must enable the compatibility mode (see the arrow below):

21.12.3. Configuring the PDM-ETH Tags with the Webserver (Not for shared memory mode)

The Webserver can also be used for configuring the PDM-ETH TAGs, all parameters are visible clicking on “Setup TAG” button to the left of the screen.

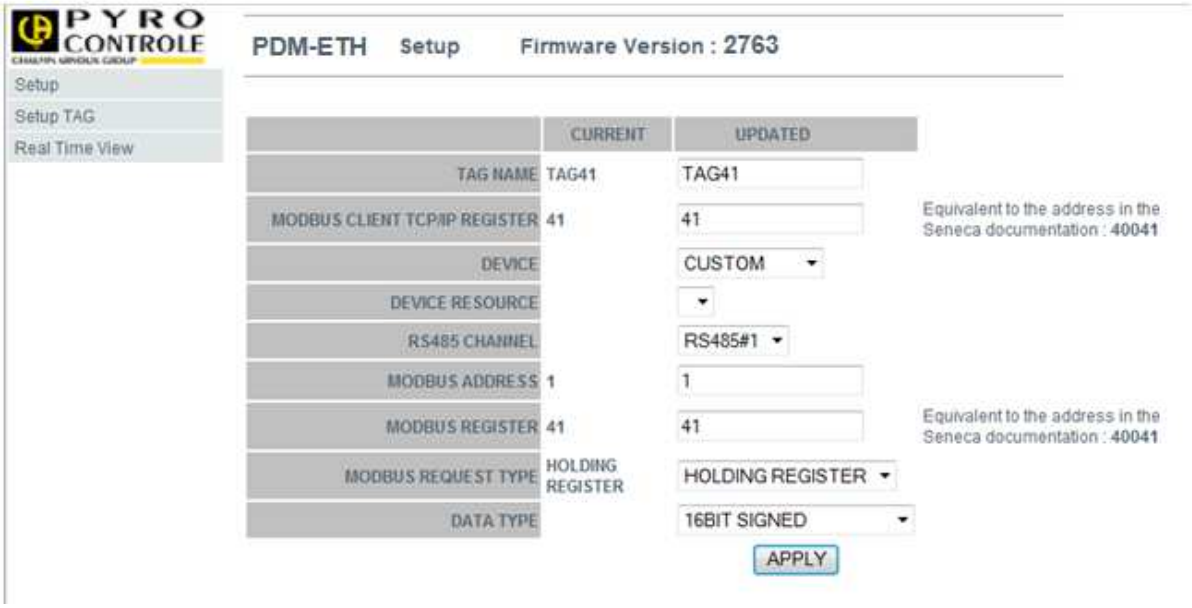
CAUTION!

If you are using Internet explorer 9 (or newer) you must enable the compatibility mode (see the arrow below):



ITEM	REG. CLIENT	TAG	RS485 DEVICE	RESOURCE NAME	REG. RS485	DATA TYPE	CHANNEL RS485	ADDR RS485
1	40041	TAG41	CUSTOM		41	S16	485#1	1
2	40042	TAG42	CUSTOM		42	U16	485#1	1
3	40043	TAG43	CUSTOM		43	S16	485#1	1
4	40044	TAG44	CUSTOM		44	U16	485#1	1
5	40045	TAG45	CUSTOM		45	S16	485#1	1
6	40047	TAG47	CUSTOM		47	S16	485#1	1
7	40048	TAG48	CUSTOM		48	U16	485#1	1
8	40049	TAG49	CUSTOM		49	S16	485#1	1
9	40050	TAG50	CUSTOM		1	U16	485#2	1
10	40051	TAG51	CUSTOM		2	S16	485#2	1
11	40052	TAG52	CUSTOM		3	U16	485#2	1
12	40053	TAG53	CUSTOM		4	S16	485#2	1
13	40057	TAG57	CUSTOM		8	S16	485#2	1
14	40059	TAG59	CUSTOM		10	S16	485#2	1
15	40060	TAG60	CUSTOM		11	U16	485#2	1
16	40061	TAG61	CUSTOM		12	S16	485#2	1
17	40062	TAG62	CUSTOM		13	U16	485#2	1
18	40063	TAG63	CUSTOM		14	S16	485#2	1
19	40064	TAG64	CUSTOM		15	U16	485#2	1
20	40065	TAG65	CUSTOM		16	S16	485#2	1
21	40066	TAG66	CUSTOM		17	U16	485#2	1

Now select the TAG that you want to edit than click on “Modify”, a new page show the TAG configuration:



TAG NAME

Used for sets the name that it's shown in the realtime view page

MODBUS CLIENT TCP/IP REGISTER

Used for sets the TAG start register address for accessing the register (from Modbus TCP-IP or Modbus RTU Slave).

Only Holding Register Values are available from the Modbus TCP-IP protocol and Modbus RTU Slave protocol.

Register 1 means 40001 on PDM documentation, Register 2 means 40002 etc…

DEVICE

Use "custom" for create a TAG from a custom Modbus RTU Slave device or select the PDM Slave device from the database.

DEVICE RESOURCE

If you have selected a PDM device on "Device" field here the desired resource register(s) can be selected.

In this way all the fields:

-Modbus register

-Modbus Request Type

-Data Type

are automatically filled.

RS485 CHANNEL

Used for sets the RS485 number connected to the slave device

MODBUS ADDRESS

Used for sets the Modbus Slave node Address

MODBUS REGISTER

Used for sets the Modbus Register address, this field is automatically filled if you have selected a PDM Device into the "Device" field.

MODBUS REQUEST TYPE

Used for sets the Modbus Register type, can be selected from:

Holding register, Input register, Discrete input or Coil.

This field is automatically filled if you have selected a PDM Device into the "Device" field.

DATA TYPE

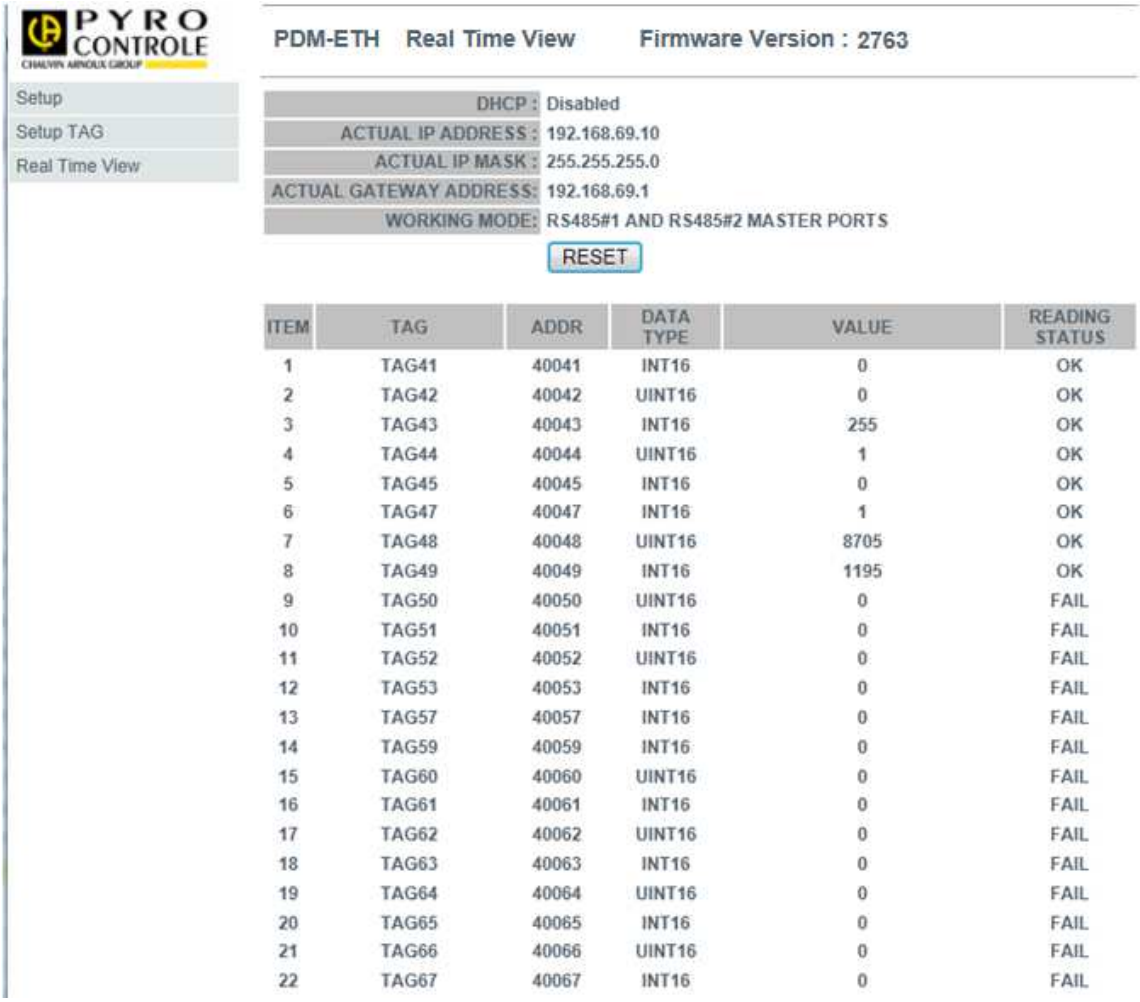
Used for sets the TAG Data type, from:

16 BITS UNSIGNED: 1 modbus register, from 0 to 65535

16 BITS SIGNED: 1 modbus register, from -32768 to +32767
32 BITS UNSIGNED MSW : 2 modbus registers with the lower address Modbus register that hold the Most Significant Word, from 0 to 4294967295
32 BITS UNSIGNED LSW : 2 modbus registers with the lower address Modbus register that hold the Less Significant Word, from 0 to 4294967295
32 BITS SIGNED MSW : 2 modbus registers with the lower address Modbus register that hold the Most Significant Word, from -2147483648 to +2147483647
32 BITS SIGNED LSW : 2 modbus registers with the lower address Modbus register that hold the Less Significant Word, from -2147483648 to +2147483647
FLOAT MSW : 2 modbus registers with the lower address Modbus register that hold the Most Significant Word, Floating point single precision (IEEE 758-2008)
FLOAT LSW : 2 modbus registers with the lower address Modbus register that hold the Less Significant Word, Floating point single precision (IEEE 758-2008)
BIT : 1 Boolean coil or Discrete input register
This field is automatically filled if you have selected a PDM Device into the "Device" field.

21.12.4. Real time measures on the webserver

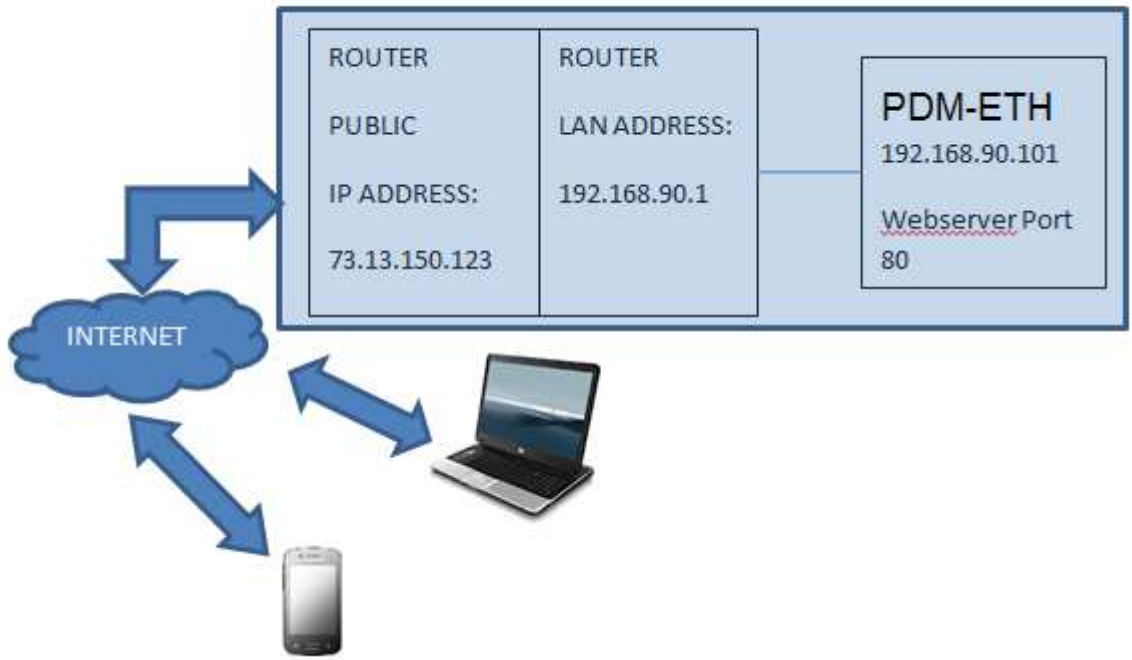
The Webserver can be used also for view the real time register values.
The "ITEM" column represent the variable TAG number from 1 to 100.
The "TAG" column represent the TAG NAME
The "ADDR" column represent the TAG Modbus Address
The "DATA TYPE" column represent the TAG data type (see chapter 21.12.3)
The "VALUE" column represent the actual TAG value
The "READING STATUS" column represent if the slave is responding (OK) or not (FAIL)



ITEM	TAG	ADDR	DATA TYPE	VALUE	READING STATUS
1	TAG41	40041	INT16	0	OK
2	TAG42	40042	UINT16	0	OK
3	TAG43	40043	INT16	255	OK
4	TAG44	40044	UINT16	1	OK
5	TAG45	40045	INT16	0	OK
6	TAG47	40047	INT16	1	OK
7	TAG48	40048	UINT16	8705	OK
8	TAG49	40049	INT16	1195	OK
9	TAG50	40050	UINT16	0	FAIL
10	TAG51	40051	INT16	0	FAIL
11	TAG52	40052	UINT16	0	FAIL
12	TAG53	40053	INT16	0	FAIL
13	TAG57	40057	INT16	0	FAIL
14	TAG59	40059	INT16	0	FAIL
15	TAG60	40060	UINT16	0	FAIL
16	TAG61	40061	INT16	0	FAIL
17	TAG62	40062	UINT16	0	FAIL
18	TAG63	40063	INT16	0	FAIL
19	TAG64	40064	UINT16	0	FAIL
20	TAG65	40065	INT16	0	FAIL
21	TAG66	40066	UINT16	0	FAIL
22	TAG67	40067	INT16	0	FAIL

21.13. Accessing the PDM-ETH from Internet

Using a static ip address it's possible to configure the router for accessing PDM-ETH from internet. This operation is known as "Virtual server " or "Port forwarding" refers to your Router documentation for more info.
The IP address of your internet connection must have a static public ip address, if your public ip address isn't static you can obtain-it by using a Dynamic DNS like Dyndns (http://dyn.com/).
Take a look to this example:
The Router IP address is 192.168.90.1 and the PDM-ETH device address is 192.168.90.101 with the Webserver on port 80.
For example the Router Public address is 73.13.150.123.



Now we must open the port 80 on the router and forwarding it to the IP 192.168.90.101:
So the configuration on the router must be:

IP ADDRESS	PRIVATE PORT	PUBLIC PORT	PROTOCOL
192.168.90.101	80	8080	UDP/TCP

With this Virtual Server entry, all Internet traffic on Port 8080 with ip address 73.13.150.123 will be redirected to PDM-ETH webserver on port 80 at IP Address 192.168.90.101.
So for accessing to the PDM-ETH Webserver using a browser you must enter http://73.13.150.123:8080
A similar configuration can be used for Modbus TCP-IP access:

IP ADDRESS	PRIVATE PORT	PUBLIC PORT	PROTOCOL
192.168.90.101	502	502	UDP/TCP

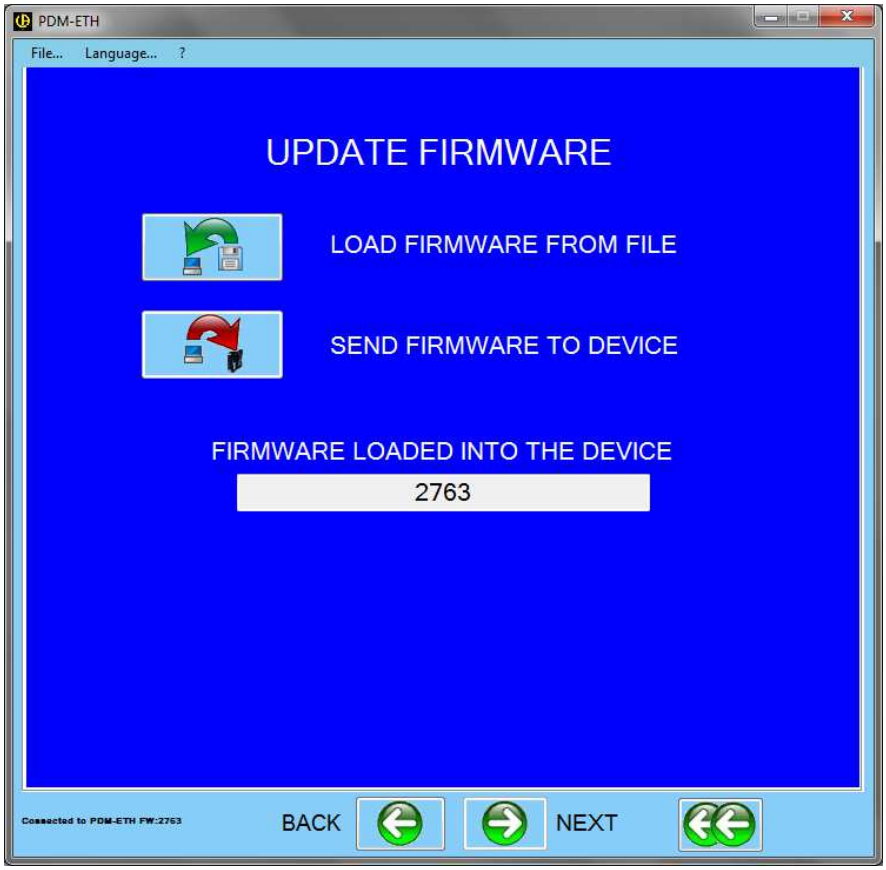
21.14. Firmware Update

With a new revision of Easy PDM-ETH, Pyrocontrole can include a new device firmware.
A new firmware update can include new features or bugfix.

WARNING!

When the firmware update it's started don't power down the device until all the procedure it's finished.

Power ON the device and connect it to the PC
On the configuration menu click on "Software update"



Press the "Load software from file", the software will open directly the firmware directory.
If the "new software" revision is newer the "software in the device" revision click on "Send software to the device"
The firmware update takes about 6 minutes.

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