

**R085**  
**R086**

## Converter P-Bus / Modbus RS485



### Summary

**R085 and R086 are microprocessor-controlled converters of Landis & Gyr P-Bus for I/O modules Landis & Gyr PTM..., PTK... to Modbus RTU over RS485. The converters provide galvanical separation of both interfaces and the power part, and they are able to supply 32 or 64 BE (P-Bus load units) respectively.**

### Application

- **integration of Landis & Gyr I/O modules into a SoftPLC or 3<sup>rd</sup> party environment – reconstruction and refurbishment of old plants using Landis & Gyr PRU., PRV., and RWP80 controllers.**

### Function

The converter links the I/O modules of total load of up to 64 BE to Merbon process stations, Domat MiniPLC, Domat IPLC500, IPLC510, IPCB.1, IPCT.1, to a SoftPLC or Merbon runtime or to any other client capable of Modbus RTU communication.

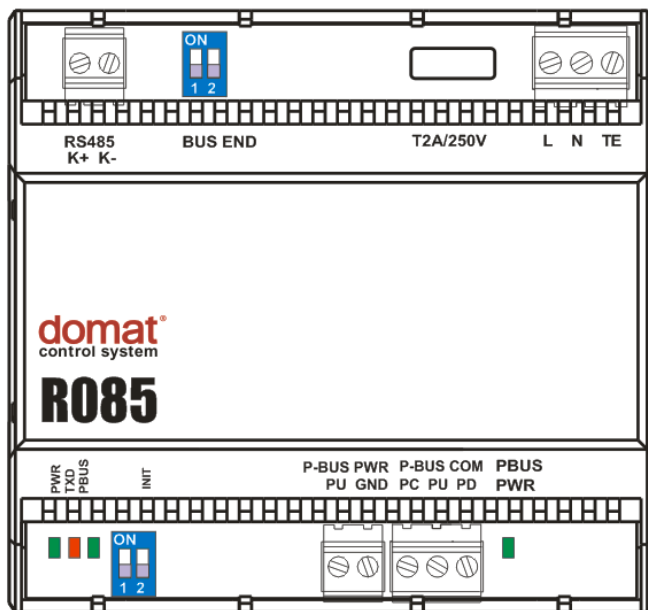
After powering on, the converter continuously scans the P-Bus and searches for the connected I/O modules which updates the internal I/O list. Using special commands (over ModComTool or according to the Modbus table) it is possible to save the actual configuration of the P-Bus (addresses and types of the I/O modules) into the memory of the converter, which speeds up the P-Bus communication. This is recommended especially at higher Modbus baudrates.

### Technical data

Power supply	universal 90...260 V AC, 120...370 V DC
Consumption	according to P-Bus load units, max. 30 VA
Fuse	replaceable fuse T2A / 250 V
Ambient temperature	0 ÷ 50°C
Ambient humidity	5 % ÷ 95 % non-condensing
Output P-Bus PWR	24 V AC
Max. current	<b>R085:</b> 0.6 A, <b>R086:</b> 1.0 A
Short-circuit protection	Automatic fuse against overload, short-circuit, overvoltage with automatic reset

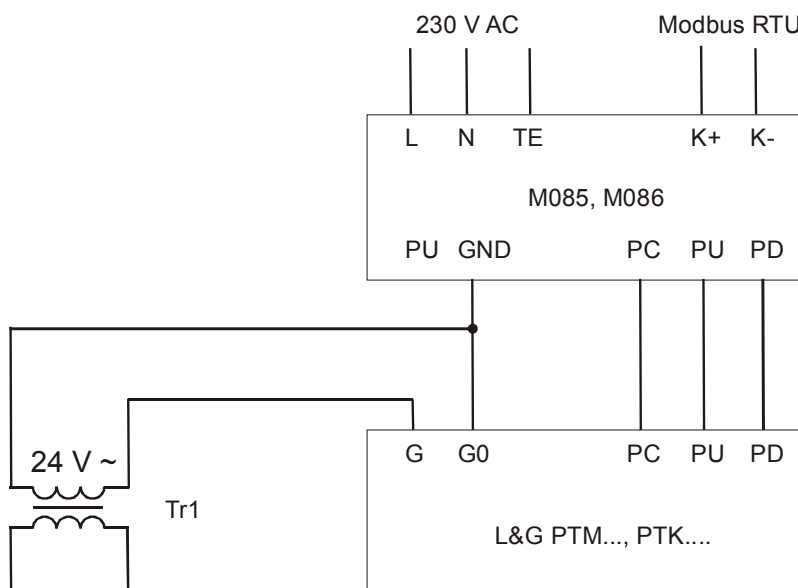
RS485 communication	
Maximum bus length	1200 m
Max. number of devices on the bus	256
Baud rate	1200...115200 bps
Protocol	Modbus RTU slave
Modbus addressing	with free software: ModComTool or SoftPLC IDE
P-Bus communication	Permanently short-circuit resistant
Load	<b>R085</b> : 32 BE, <b>R086</b> : 64 BE
Galvanical separation	power supply part, RS485, and P-Bus are optically separated from each other up to 1000 V DC
Dimensions	see below

## Terminals, LED



T2A/250V	fuse
L	power, 230 V phase
N	power, reference
TE	technical earth (optional)
BUS END	both switches at ON: RS485 termination
RS485 K+	communication, positive
RS485 K-	communication, negative
PWR	on: power OK
TXD	RS485 data transmit, red
PBUS	on: communication error
	flashes 1:1 : communication OK
	flashes 1:8 : communication off
INIT	if ON at power-up, RS485 default communication parameters (adr. 1, 9600 bps, N, 8, 1) are set
PU	P-Bus power, +
GND	P-Bus power ground
PC	P-Bus time sync
PU	reference voltage
PD	P-Bus data
PBUS PWR	on: P-Bus power OK

## Connection



Tr1... original transformer for powering of the I/O

The power supply 24 V of the R085, R086 (P-BUS PWR, terminals PU a GND) may be used e.g. as a power source for a process station (IPLC, mark) etc., but only up to the load limit of 0.6 A (R085) or 1 A (R086).

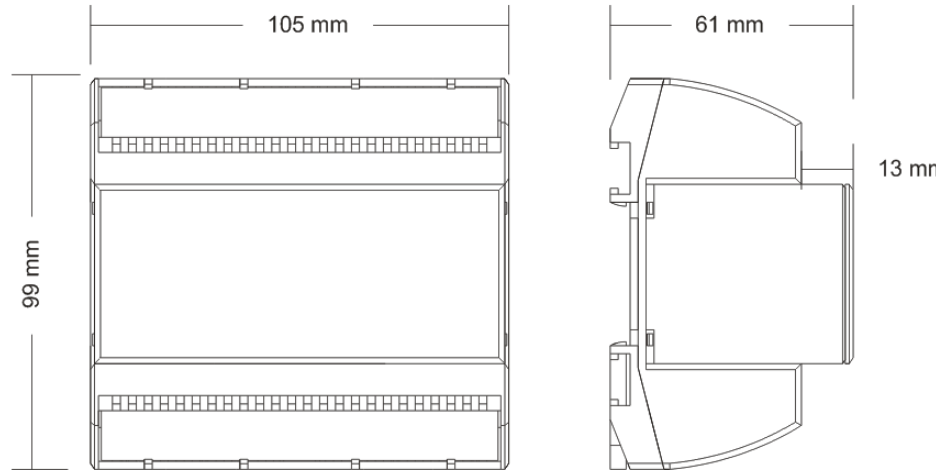
### Installation

The converter is snapped on a DIN rail. Remember to leave space enough around the device to allow heat dissipation.

### Maintenance

If the PWR LED is off, please check / replace the fuse. Use only fuse of the same type and rating!

### Dimensions



### Related products

<b>IPLC220</b>	Merbon process station
<b>IPLC320</b>	Merbon process station
<b>IPLC301</b>	MiniPLC process station
<b>IPLC510</b>	MiniPLC process station
<b>M012</b>	converter RS232-RS485
<b>M080</b>	converter USB-RS485
<b>M035</b>	Modbus RTU / TCP router
<b>RC-Vision</b>	SCADA software

### Changes in versions

10/2016 – new data sheet

## Attachment 1: The Modbus table

The following Modbus functions are supported:

**F01 Read Coil Status** – reading bits

**F03 Read Holding Registers** – reading words

**F15 Force Multiple Coils** – writing bits

**F16 Force Multiple Registers** – writing words.

Maximum number of registers to be read in a single Modbus request is 52.

Register name	Register number	Type	Description	Note
module ID	1 LSB 1 MSB	R	module identification at RS485	2-byte number, here 0x0091
firmware	2 LSB 2 MSB	R	firmware version	0x0100 = V1.00
status LSB	3 LSB 3 MSB	R, W RAM	module status lower byte <b>bit 0</b> – EEPROM write enabled <b>bit 1</b> – P-Bus comm. stop <b>bit 2</b> – P-Bus config reset <b>bit 3</b> – Pbus config save <b>bit 4</b> – EEPROM init (not used) <b>bit 5</b> – P-Bus module search stop  <b>EEPROM init</b> : init switch on, start module, init switch off, set bit 4 to 1 (indicated by bit 2 in status MSB)	<b>EEPROM init</b> Proceed as follows: - set the INIT switch to ON - power the module on - set the INIT switch to OFF - set bit 4 to 1 (indicated by bit 2 in status MSB)
status MSB	3 MSB	R RAM	<b>bit 1</b> – init mode active (INIT switch is ON) <b>bit 2</b> – EEPROM write enabled <b>bit 3</b> – EEPROM init (not used) <b>bit 5</b> – P-Bus comm error	
baud rate (communication speed)	4 LSB	R, W EEPROM	10 <sub>dec</sub> ... 1200 bps 11 <sub>dec</sub> ... 2400 bps 12 <sub>dec</sub> ... 4800 bps 13 <sub>dec</sub> ... 9600 bps (výchozí hodnota) 14 <sub>dec</sub> ... 19200 bps 15 <sub>dec</sub> ... 38400 bps 16 <sub>dec</sub> ... 57600 bps 17 <sub>dec</sub> ... 115200 bps	New baudrate setting is active only after restart. The register is written immediately.
Modbus address	4 MSB	R, W EEPROM	1...250	default address: 1
reserved	5 LSB			
serial RS485 port settings	5 MSB	R, W EEPROM	parameters of the RS485 communication  (default = no parity, one stop bit: 0x00)	bit 0-1 ... parity (00 – no parity, 01 – even, 10 – odd) bit 2 ... stop bits (0 – one, 1 – two)  New settings is active only after restart. The register is written immediately.

number of found modules	6 LSB 6 MSB	R	number of I/O modules found on the P-Bus	for diagnostics only
number of definitions of known modules	7 LSB 7 MSB	R	number of I/O module types in the internal library (may differ with firmware versions)	for diagnostics only
uptime	8 LSB 8 MSB	R	uptime in ticks	for diagnostics only
module data	1001 LSB 1001 MSB	R, W RAM	Data of the P-Bus module with address 0, register 0	To be interpreted according to the I/O module type, see tables below
module data	1002 LSB 1002 MSB	R, W RAM	Data of the P-Bus module with address 0, register 1	
module data	1003 LSB 1003 MSB	R, W RAM	Data of the P-Bus module with address 0, register 2	
module data	1004 LSB 1004 MSB	R, W RAM	Data of the P-Bus module with address 0, register 3	
module data	1005 LSB 1005 MSB	R, W RAM	Data of the P-Bus module with address 1, register 0	
...				
module data	1008 LSB 1008 MSB	R, W RAM	Data of the P-Bus module with address 1, register 3	
...			(other modules and their registers)	
module data	1512 LSB 1512 MSB	R, W RAM	Data of the P-Bus module with address 127, register 3	
module info	2001 LSB 2001 MSB	R RAM	P-Bus module address 0, P-Bus address	
module info	2002 LSB 2002 MSB	R RAM	P-Bus module address 0, module status	bit 0: comm error bit 15: read from Flash
module info	2003 LSB 2003 MSB	R RAM	P-Bus module address 0, module type (code see below)	
module info	2004 LSB 2004 MSB	R RAM	P-Bus module address 0, detected module type (code see below)	
module info	2005 LSB 2005 MSB	R RAM	P-Bus module address 1, P-Bus address	
...			(other modules and their states)	
module info	2512 LSB 2512 MSB	R RAM	P-Bus module address 127, detected module type (code see below)	

For commissioning, SoftPLC IDE or Merbon IDE and a converter RS232 or USB to RS485 are used. Define a serial channel in the SoftPLC / Merbon IDE, and insert the Landis & Gyr P-Bus I/O modules into the channel according to the module types and address pegs. The R085 or R086 is to be addressed in the menu or over ModComTool (it may be connected on the RS485 bus together with more Modbus/RS485 modules if the data throughput is OK) and after the communication from the SoftPLC is started, the module starts to communicate with the P-Bus I/O modules. It is not necessary to use the Modbus table.

When communicating with other / 3<sup>rd</sup> Party clients, use Modbus registers 1001 and higher for communication with the converter. In the registers of 2001 and higher, there are diagnostic data: types and states of the P-Bus modules which

were auto-detected by the converter. The address and other communication parameters can be set over the ModComTool software.

The PTK... compact modules are composed of the following PTM... modules:

**PTK1.23V02** addressed 0:

2	2R1K
3	2R1K
4	2R1K
5	2R1K
6	2U10
7	2U10
8	11Q250

**PTK1.30V01** addressed 0:

1	4Y10S
2	2R1K
3	2R1K
4	2U10
5	12D20
6	8Q250

## Attachment 2: Variable maps for P-Bus I/O modules

The address of the first register (Register 0) with the module data is  $1000 + 4 * \text{P-Bus address (peg)}$ , see Modbus table. The module is represented by maximum 4 registers.

Example: Input 2 (Register 1, see below) of the module PTM1.2R1K (2x passive AI) with the address peg No. 3 is to be read in the register with address of

$$1000 + 4 * 3 + 1 = 1013.$$

### PTM1.2C

#### 2x pulse counter

Module code 0x0000

Register 0 (read)

Bit	Description
0	Pulse input 2 bit 0
1	Pulse input 2 bit 1
2	Pulse input 2 bit 2
3	Pulse input 2 bit 3
4	Pulse input 2 bit 4
5	Pulse input 2 bit 5
6	Pulse input 2 bit 6
7	No function
8	Pulse input 1 bit 0
9	Pulse input 1 bit 1
10	Pulse input 1 bit 2
11	Pulse input 1 bit 3
12	Pulse input 1 bit 4
13	Pulse input 1 bit 5
14	Pulse input 1 bit 6
15	No function

### PTM1.2D20

#### 2x potential-free digital input

Module code 0x0101

Register 0 (read)

Bit	Description
0	Input 1 (0 – off, 1 – on)
1	Input 2 (0 – off, 1 – on)
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	Input 1 (0 – off, 1 – on)
9	Input 2 (0 – off, 1 – on)
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

Module code 0x0202

Register 0 (read, Input 1), Register 1 (read, Input 2)

Bit	Description
0	No function
1	No function
2	No function
3	A/D converter, bit 0
4	A/D converter, bit 1
5	A/D converter, bit 2
6	A/D converter, bit 3
7	A/D converter, bit 4
8	A/D converter, bit 5
9	A/D converter, bit 6
10	A/D converter, bit 7
11	A/D converter, bit 8
12	A/D converter, bit 9
13	A/D converter, bit 10
14	A/D converter, bit 11
15	Broken or short-circuit

The converter has 12 bit resolution (0...4095). The curve is linearised in the module. The temperature is calculated from the read value X :

$$t = 0.05 * X - 52.4$$

so e.g. for the read value of 1448 the temperature is  $t = 0.05 * 1448 - 52.4 = 20 \text{ }^{\circ}\text{C}$ .

Bit 15 in true indicates a broken or short-circuited sensor. The measured value range is  $-50...150 \text{ }^{\circ}\text{C}$  (read value 48...4048). Broken sensor: the read value is 4095, short circuited sensor: 0.

Module code 0x0303

Register 0 (write, Output 1), Register 1 (write, Output 2)

Bit	Description
0	Back-up value, bit 0
1	Back-up value, bit 1
2	Back-up value, bit 2
3	Back-up value, bit 3
4	Back-up value, bit 4
5	No function
6	No function
7	D/A converter, bit 0
8	D/A converter, bit 1
9	D/A converter, bit 2
10	D/A converter, bit 3
11	D/A converter, bit 4
12	D/A converter, bit 5
13	D/A converter, bit 6
14	D/A converter, bit 7
15	No function

The converter has 8 bit resolution (0...240 dec), which corresponds to the output of 0..10 V (0...100 %).

The back-up value has 5 bit resolution, 0...31 dec, which corresponds to the output of 0..10 V (0...100 %). If the P-Bus is not communicating, i.e. the I/O module does not receive a valid telegram at least each 4 s, the output is set to the backup value.



**PTM1.2U10****2x analog input 0...10 V**

Module code 0x0606

Register 0 (read, Input 1), Register 1 (read, Input 2)

Bit	Description
0	No function
1	No function
2	A/D converter, bit 0
3	A/D converter, bit 1
4	A/D converter, bit 2
5	A/D converter, bit 3
6	A/D converter, bit 4
7	A/D converter, bit 5
8	A/D converter, bit 6
9	A/D converter, bit 7
10	A/D converter, bit 8
11	A/D converter, bit 9
12	A/D converter, bit 10
13	A/D converter, bit 11
14	A/D converter, bit 12
15	No function

The converter has 13 bit resolution (0...8191). The measured value Y is calculated from the read value X:

$$Y = 0.03125 * (X / 2) - 14.0$$

so e.g. for a humidity sensor and the read value of 7296  
the rH =  $0.03125 * (7296 / 2) - 14.0 = 100\%rH$ .

The measured value range is 0...10 V (read value 896...7296). A value < 64 means underflow, a value > 8126 is overflow.

**PTM1.2Y10S-M****2x analog output 0...10 V with manual override**

Module code 0x0707

Register 0 (write, Output 1), Register 1 (write, Output 2)

Bit	Description
0	Back-up value, bit 0
1	Back-up value, bit 1
2	Back-up value, bit 2
3	Back-up value, bit 3
4	Back-up value, bit 4
5	No function
6	No function
7	D/A converter, bit 0
8	D/A converter, bit 1
9	D/A converter, bit 2
10	D/A converter, bit 3
11	D/A converter, bit 4
12	D/A converter, bit 5
13	D/A converter, bit 6
14	D/A converter, bit 7
15	No function

Register 3 (read)

Bit	Description
0	Output 1 in manual mode (1 = active)
1	Output 2 in manual mode (1 = active)
2	No function

3	No function
4	No function
5	No function
6	No function
7	No function
8	Manual override status Output 1 (1 = on, 0 = off)
9	Manual override status Output 2 (1 = on, 0 = off)
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

The converter has 8 bit resolution (0...240 dec), which corresponds to the output of 0..10 V (0...100 %).

The back-up value has 5 bit resolution, 0...31 dec, which corresponds to the output of 0..10 V (0...100 %). If the P-Bus is not communicating, i.e. the I/O module does not receive a valid telegram at least each 4 s, the output is set to the backup value.

## PTM1.2QD

### Relay output 250 V AC with operation feedback

Module code 0x0909

#### Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	No function
15	Relay command (0 = off, 1 = on)

#### Register 1 (read)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	Operation (feedback)
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	No function
15	Relay status from Register 0 (Write), bit 15

Module code 0x0A0A

Register 0 (read, Input 1), Register 1 (read, Input 2)

Bit	Description
0	No function
1	No function
2	A/D converter, bit 0
3	A/D converter, bit 1
4	A/D converter, bit 2
5	A/D converter, bit 3
6	A/D converter, bit 4
7	A/D converter, bit 5
8	A/D converter, bit 6
9	A/D converter, bit 7
10	A/D converter, bit 8
11	A/D converter, bit 9
12	A/D converter, bit 10
13	A/D converter, bit 11
14	A/D converter, bit 12
15	Broken or short-circuit

The converter has 13 bit resolution (0...8191). The A/D converter output is linear. This means that for the Pt100 sensors the value must be linearized: either by an approximation of part of the curve which is considered linear, or in the PLC. With SoftPLC it is recommended to perform the interpolation in the variable properties.

The measured value Y is calculated from the read value X:

$$Y = S * (X/2) + O$$

so e.g. for a Pt100 ranged 10...40 °C, where it is considered linear, and read value of 3580, the temperature is  $t = 0.1718213 * (3580/2) - 287.5085 = 20$  °C.

The measuring range is 0...250 Ohm (read value of 346...7846). The read value when overflow is > 7920, when underflow it is < 100. If bit 15 is set, the sensor is broken or short-circuited. Broken sensor returns the read value of 8191, short-circuited sensor returns the read value of 346.

Module code 0x0B0B

Register 0 (write, Output 1), Register 1 (write, Output 2)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	D/A converter, bit 0
8	D/A converter, bit 1
9	D/A converter, bit 2
10	D/A converter, bit 3
11	D/A converter, bit 4
12	D/A converter, bit 5
13	D/A converter, bit 6
14	D/A converter, bit 7
15	No function

The converter has 8 bit resolution (0...240 dec), which corresponds to the output of 4...20 mA (0...100 %).

## PTM1.2I25

### 2x analog input 0...25 mA

Module code 0x0E0E

Register 0 (read, Input 1), Register 1 (read, Input 2)

Bit	Description
0	No function
1	No function
2	A/D converter, bit 0
3	A/D converter, bit 1
4	A/D converter, bit 2
5	A/D converter, bit 3
6	A/D converter, bit 4
7	A/D converter, bit 5
8	A/D converter, bit 6
9	A/D converter, bit 7
10	A/D converter, bit 8
11	A/D converter, bit 9
12	A/D converter, bit 10
13	A/D converter, bit 11
14	A/D converter, bit 12
15	No function

Using shunts, following ranges may be selected:

1 .. 5mA (200Ω); 0 .. 10mA (100Ω); 0(4) .. 20mA (50Ω) a 0 .. 25mA (40Ω). With no shunt the measuring range is voltage, 0...1 V DC.

The converter has 13 bit resolution (0...8191). The measured value Y is calculated from the read value X:

$$Y = S * (X/2) + O$$

where X = read value, S = slope, O = offset, Y = measured value.

Example: for a 0...20 mA sensor measuring 0...100 % rH, a 50 Ohm shunt and read value of 7296, the rH is

$$rH = 0.03125 * (7296 / 2) - 14.0 = 100 \%rH.$$

The measured range is 0...25 mA (read value 896...7296). A value < 64 means underflow, a value > 8126 means overflow.

**PTM1.4D20****4x potential free digital input**

Module code 0x0111

**Register 0 (read)**

Bit	Description
0	Input 1 (0 – off, 1 – on)
1	Input 2 (0 – off, 1 – on)
2	Input 3 (0 – off, 1 – on)
3	Input 4 (0 – off, 1 – on)
4	No function
5	No function
6	No function
7	No function
8	Input 1 (0 – off, 1 – on)
9	Input 2 (0 – off, 1 – on)
10	Input 3 (0 – off, 1 – on)
11	Input 4 (0 – off, 1 – on)
12	No function
13	No function
14	No function
15	No function

**PTM1.4Y10S****4x analogue output 0...10 V**

Module code 0x1313

Register 0 (write, Output 1), Register 1 (write, Output 2), Register 2 (write, Output 3), Register 3 (write, Output 4)

Bit	Description
0	Back-up value, bit 0
1	Back-up value, bit 1
2	Back-up value, bit 2
3	Back-up value, bit 3
4	Back-up value, bit 4
5	No function
6	No function
7	D/A converter, bit 0
8	D/A converter, bit 1
9	D/A converter, bit 2
10	D/A converter, bit 3
11	D/A converter, bit 4
12	D/A converter, bit 5
13	D/A converter, bit 6
14	D/A converter, bit 7
15	No function

The converter has 8 bit resolution (0...240 dec), which corresponds to the output of 0..10 V (0...100 %).

The back-up value has 5 bit resolution, 0...31 dec, which corresponds to the output of 0..10 V (0...100 %). If the P-Bus is not communicating, i.e. the I/O module does not receive a valid telegram at least each 4 s, the output is set to the backup value.

Module code 0x1616

Register 0 (read, Input 1), Register 1 (read, Input 2)

Bit	Description
0	No function
1	No function
2	A/D converter, bit 0
3	A/D converter, bit 1
4	A/D converter, bit 2
5	A/D converter, bit 3
6	A/D converter, bit 4
7	A/D converter, bit 5
8	A/D converter, bit 6
9	A/D converter, bit 7
10	A/D converter, bit 8
11	A/D converter, bit 9
12	A/D converter, bit 10
13	A/D converter, bit 11
14	A/D converter, bit 12
15	Broken or short-circuit

The converter has 13 bit resolution (0...8191). The A/D converter output is linear. This means that for the Pt1000 sensors the value must be linearized: either by an approximation of part of the curve which is considered linear, or in the PLC. With SoftPLC it is recommended to perform the interpolation in the variable properties.

The measured value Y is calculated from the read value X:

$$Y = S * (X/2) + O$$

so e.g. for a Pt1000 ranged 10...40 °C, where it is considered linear, and read value of 3580, the temperature is  $t = 0.1718213 * (3580/2) - 287.5085 = 20$  °C.

The measuring range is 0...2500 Ohm (read value of 346...7846). The read value when overflow is > 7920, when underflow it is < 100. If bit 15 is set, the sensor is broken or short-circuited. Broken sensor returns the read value of 8191, short-circuited sensor returns the read value of 346.

Module code 0x1919

Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	Relay command Stage 2 (0 = Off, 1 = On)
15	Relay command Stage 1 (0 = Off, 1 = On)

### Register 1 (read)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	Operation (feedback) 1
5	Operation (feedback) 2
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	Relay status Stage 2 from Register 0 (Write, bit 14)
15	Relay status Stage 1 from Register 0 (Write, bit 15)

## PTM1.2I420

### 2x analogue input 4...20 mA

Module code 0x1A1A

Register 0 (read, Input 1), Register 1 (read, Input 2)

Bit	Description
0	No function
1	No function
2	A/D converter, bit 0
3	A/D converter, bit 1
4	A/D converter, bit 2
5	A/D converter, bit 3
6	A/D converter, bit 4
7	A/D converter, bit 5
8	A/D converter, bit 6
9	A/D converter, bit 7
10	A/D converter, bit 8
11	A/D converter, bit 9
12	A/D converter, bit 10
13	A/D converter, bit 11
14	A/D converter, bit 12
15	No function

The converter has 13 bit resolution (0...8191). The measured value Y is calculated from the read value X:

$$Y = S * (X/2) + O$$

where X = read value, S = slope, O = offset, Y = measured value.

Example: for a 0...20 mA sensor measuring 0...100 % rH, a 50 Ohm shunt and read value of 7296, the rH is

$$rH = 0.03125 * (7296 / 2) - 14.0 = 100 \%rH.$$

The measured range is 4...20 mA (read value 896...7296). A value < 64 means underflow, a value > 8126 means overflow.

## PTM1.2Q250

### 2x relay output 24...250 V st

Module code 0x1D1D

Register 0 (write)

Bit	Description
0	Relay command 1 (0 = Off, 1 = On)
1	Relay command 2 (0 = Off, 1 = On)
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

## PTM1.4R1K

### 4x analog passive input for sensors Ni1000 L&G

Module code 0x1E1E

Register 0 (read, Input 1), Register 1 (read, Input 2), Register 2 (read, Input 3), Register 3 (read, Input 4)

Bit	Description
0	No function
1	No function
2	A/D converter, bit 0
3	A/D converter, bit 1
4	A/D converter, bit 2
5	A/D converter, bit 3
6	A/D converter, bit 4
7	A/D converter, bit 5
8	A/D converter, bit 6
9	A/D converter, bit 7
10	A/D converter, bit 8
11	A/D converter, bit 9
12	A/D converter, bit 10
13	A/D converter, bit 11
14	A/D converter, bit 12
15	Broken or short-circuit

The converter has 13 bit resolution (0...8191). The curve is linearised in the module. The temperature is calculated from the read value X :

$$t = 0.05 * X - 52.4$$

so e.g. for the read value of 2896 the temperature is  $t = 0.05 * 2896 / 2 - 52.4 = 20$  °C.

Bit 15 in true indicates a broken or short-circuited sensor. The measured value range is -50...150 °C (read value 96...8096). Broken sensor: the read value is 8091, short circuited sensor: 0.

## PTM1.2Q250-M

### 2x relay output 24...250 V AC with manual override

Module code 0x2020

Register 0 (write)

Bit	Description
0	No function
1	No function



2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	Relay command 2 (0 = Off, 1 = On)
15	Relay command 1 (0 = Off, 1 = On)

#### Register 1 (read)

Bit	Description
0	Manual override of Output 1 active (1 = active)
1	Manual override of Output 2 active (1 = active)
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	Status of manual override Output 1 (inverted, 0=on, 1=off)
9	Status of manual override Output 2 (inverted, 0=on, 1=off)
10	No function
11	No function
12	No function
13	No function
14	Status of Relay 2 from Register 0 (Write), bit 14
15	Status of Relay 1 from Register 0 (Write), bit 15

### PTM1.2D42

#### 2x low voltage digital input 24 V AC or 10...42 V DC

Module code 0x2121

#### Register 0 (read)

Bit	Description
0	Input 1 (0 – no voltage, 1 – voltage applied)
1	Input 2 (0 – no voltage, 1 – voltage applied)
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	Input 1 (0 – no voltage, 1 – voltage applied)
9	Input 2 (0 – no voltage, 1 – voltage applied)
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

### PTM1.3Q-M3

#### Three-stage relay output with manual override

Module code 0x2828

#### Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function

3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	Relay command 3 (0 = Off, 1 = On)
14	Relay command 2 (0 = Off, 1 = On)
15	Relay command 1 (0 = Off, 1 = On)

#### Register 1 (read)

Bit	Description
0	Manual override of the output active (1 = active)
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	Status of manual override Output 1 (inverted, 0=on, 1=off)
9	Status of manual override Output 2 (inverted, 0=on, 1=off)
10	Status of manual override Output 3 (inverted, 0=on, 1=off)
11	No function
12	No function
13	Status of Relay 3 from Register 0 (Write), bit 13
14	Status of Relay 2 from Register 0 (Write), bit 14
15	Status of Relay 1 from Register 0 (Write), bit 15

## PTM1.2D20S

### 2x digital potential-free digital input with memory function

Module code 0x2929

#### Register 0 (read)

Bit	Description
0	Input 1 (0 – pulse not detected, 1 – pulse detected)
1	Input 2 (0 – pulse not detected, 1 – pulse detected)
2	Stav ukládání – Input 1 (0 = reset, 1 = aktivní) – kopie reg. pro write 0 bit 2
3	Stav ukládání – Input 2 (0 = reset, 1 = aktivní) – kopie reg. pro write 0 bit 3
4	No function
5	No function
6	No function
7	No function
8	Input 1 (0 – pulse not detected, 1 – pulse detected)
9	Input 2 (0 – pulse not detected, 1 – pulse detected)
10	Status storage function input 1 (Actual value write register 0 bit 2)
11	Status storage function input 2 (Actual value write register 0 bit 3)
12	No function
13	No function
14	No function
15	No function

#### Register 1 (write)

Bit	Description
0	No function
1	No function
2	Storage function – Input 1 (0 = reset, 1 = active)
3	Storage function – Input 2 (0 = reset, 1 = active)
4	No function
5	No function
6	No function
7	No function
8	No function

9	No function
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

The storage function is activated by setting the write register 1 bit 2 for input 1 or write register 1 bit 3 for input 2. After detection of a puls on the input read register 0 bit 0 (input 1) or read register 0 bit 1 (input 2) is set. The input can now be processed by the automation controller.

The read register 0 bit 0 or bit 1 remains set until the automation controller has reset the input by setting write register 1 bit 2 or 3 back to 0.

The contact input can either be used for the detection of make or break contact pulses. However, detection of a puls is always indicated by a 1 in the corresponding read register 0 (bit 0 or 1).

## PTM1.2Q250-B

### 2x bi-stable output with changeover contact 24...250 V AC

Module code 0x2D2D

#### Register 0 (write)

Bit	Description
0	Relay 1 On command (1 = activation)
1	Relay 1 Off command (1 = activation)
2	Relay 2 On command (1 = activation)
3	Relay 2 Off command (1 = activation)
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

#### Relay 1 states

Command	Bit 0	Bit 1
No function	0	0
On	1	0
Off	0	1
No function	1	1

#### Relay 2 states

Command	Bit 2	Bit 3
No function	0	0
On	1	0
Off	0	1
No function	1	1

Module code 0x3030

## Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	Relay 4 command (0 = Off, 1 = On) – make contacts Q23 and Q24
13	Relay 3 command (0 = Off, 1 = On) – break contacts Q21 and Q22
14	Relay 2 command (0 = Off, 1 = On) – make contacts Q13 and Q14
15	Relay 1 command (0 = Off, 1 = On) – break contacts Q11 and Q12

## Register 1 (read)

Bit	Description
0	Manual override channel 1 (relay 1 and 2) active (1 = active)
1	Manual override channel 2 (relay 3 relay 4) active (1 = active)
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	Relay 4, value from Register 0, bit 12
13	Relay 3, value from Register 0, bit 13
14	Relay 2, value from Register 0, bit 14
15	Relay 1, value from Register 0, bit 15

Module code 0x3131

## Register 0 (read)

Bit	Description
0	Input 1 (0 – voltage-free, 1 – voltage applied, LED on)
1	Input 2 (0 – voltage-free, 1 – voltage applied, LED on)
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	Input 1 (0 – voltage-free, 1 – voltage applied, LED on)
9	Input 2 (0 – voltage-free, 1 – voltage applied, LED on)
10	No function
11	No function
12	No function
13	No function
14	No function
15	No function

Module code 0x3838

## Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	Preset positioning time range bit 0
5	Preset positioning time range bit 1
6	Preset positioning time range bit 2
7	Preset positioning time range bit 3
8	Output value bit 0
9	Output value bit 1
10	Output value bit 2
11	Output value bit 3
12	Output value bit 4
13	Output value bit 5
14	Output value bit 6
15	Output value bit 7

## Register 1 (read)

Bit	Description
0	Manual override active (1 = active)
1	No function
2	No function
3	1 = Positioning in progress
4	Preset positioning time range bit 0, actual value write register 0 bit 4
5	Preset positioning time range bit 1, actual value write register 0 bit 5
6	Preset positioning time range bit 2, actual value write register 0 bit 6
7	Preset positioning time range bit 3, actual value write register 0 bit 7
8	Output value status bit 0
9	Output value status bit 1
10	Output value status bit 2
11	Output value status bit 3
12	Output value status bit 4
13	Output value status bit 5
14	Output value status bit 6
15	Output value status bit 7

The output value has 8 bit resolution (0...255). The range 1...240 corresponds to the actuator value 0...100 %. The conversion of valve position (X) to the write value (Y) is calculated as follows:

$$Y = (2.39 * X) + 1$$

Calibration to Close = Write value 0

Calibration to Open = Write value 255

If the calibration is activated (by writing 0 or 255), the output is commanded for a longer time than the preset time range to make sure that the output had reached its end position and was synchronised with the internal controller. It is recommended to check the positioning time at the installation.

*Preset positioning ranges*

Preset value	Time range (s)	Preset value	Time range (s)
0	--	8	96 ... 138
1	8.5 ... 13	9	138 ... 192
2	13 ... 18	10	192 ... 270
3	18 ... 25	11	270 ... 378

4	25 ... 35	12	378 ... 540
5	35 ... 48	13	540 ... 660
6	48 ... 66	14	--
7	66 ... 96	15	--

## PTM1.4D20R

### 4x digital input inverted, potential-free

Module code 0x4141

#### Register 0 (read)

Bit	Description
0	Input 1 (0 – off, LED active; 1 – on)
1	Input 2 (0 – off, LED active; 1 – on)
2	Input 3 (0 – off, LED active; 1 – on)
3	Input 4 (0 – off, LED active; 1 – on)
4	No function
5	No function
6	No function
7	No function
8	Input 1 (0 – off, LED active; 1 – on)
9	Input 2 (0 – off, LED active; 1 – on)
10	Input 3 (0 – off, LED active; 1 – on)
11	Input 4 (0 – off, LED active; 1 – on)
12	No function
13	No function
14	No function
15	No function

## PTM1.2QD-M

### Relay output 250 V AC with feedback and manual override

Module code 0x6060

#### Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	No function
15	Relay command (0 = Off, 1 = On)

#### Register 1 (read)

Bit	Description
0	Manual override active (1 = active)
1	No function
2	No function
3	No function
4	Operation (feedback)
5	No function
6	No function
7	No function
8	Manual output override status (inverted, 0 = on, 1 = off)
9	No function
10	No function
11	No function

12	No function
13	No function
14	No function
15	Relay status from Register 0 (Write), bit 15

## PTM1.8D20E

### 8x potential-free digital input

Module code 0x8080

#### Register 0 (read)

Bit	Description
0	Input 1 (0 – off; 1 – on, LED active)
1	Input 2 (0 – off; 1 – on, LED active)
2	Input 3 (0 – off; 1 – on, LED active)
3	Input 4 (0 – off; 1 – on, LED active)
4	Input 5 (0 – off; 1 – on, LED active)
5	Input 6 (0 – off; 1 – on, LED active)
6	Input 7 (0 – off; 1 – on, LED active)
7	Input 8 (0 – off; 1 – on, LED active)
8	Input 1 (0 – off; 1 – on, LED active)
9	Input 2 (0 – off; 1 – on, LED active)
10	Input 3 (0 – off; 1 – on, LED active)
11	Input 4 (0 – off; 1 – on, LED active)
12	Input 5 (0 – off; 1 – on, LED active)
13	Input 6 (0 – off; 1 – on, LED active)
14	Input 7 (0 – off; 1 – on, LED active)
15	Input 8 (0 – off; 1 – on, LED active)

## PTM1.4QD-M2

### 2-stage 250 V AC relay output with feedback and manual intervention

Module code 0xA0A0

#### Register 0 (write)

Bit	Description
0	No function
1	No function
2	No function
3	No function
4	No function
5	No function
6	No function
7	No function
8	No function
9	No function
10	No function
11	No function
12	No function
13	No function
14	Relay command 2 (0 = Off, 1 = On)
15	Relay command 1 (0 = Off, 1 = On)

#### Register 1 (read)

Bit	Description
0	Manual override active (1 = active)
1	No function
2	No function
3	No function
4	Operation (feedback) Stage 1
5	Operation (feedback) Stage 2
6	No function
7	No function
8	Manual output override Stage 1 status (inverted, 0 = on, 1 = off)
9	Manual output override Stage 2 status (inverted, 0 = on, 1 = off)
10	No function
11	No function

12	No function
13	No function
14	Relay 2 status from Register 0 (Write), bit 14
15	Relay 1 status from Register 0 (Write), bit 15