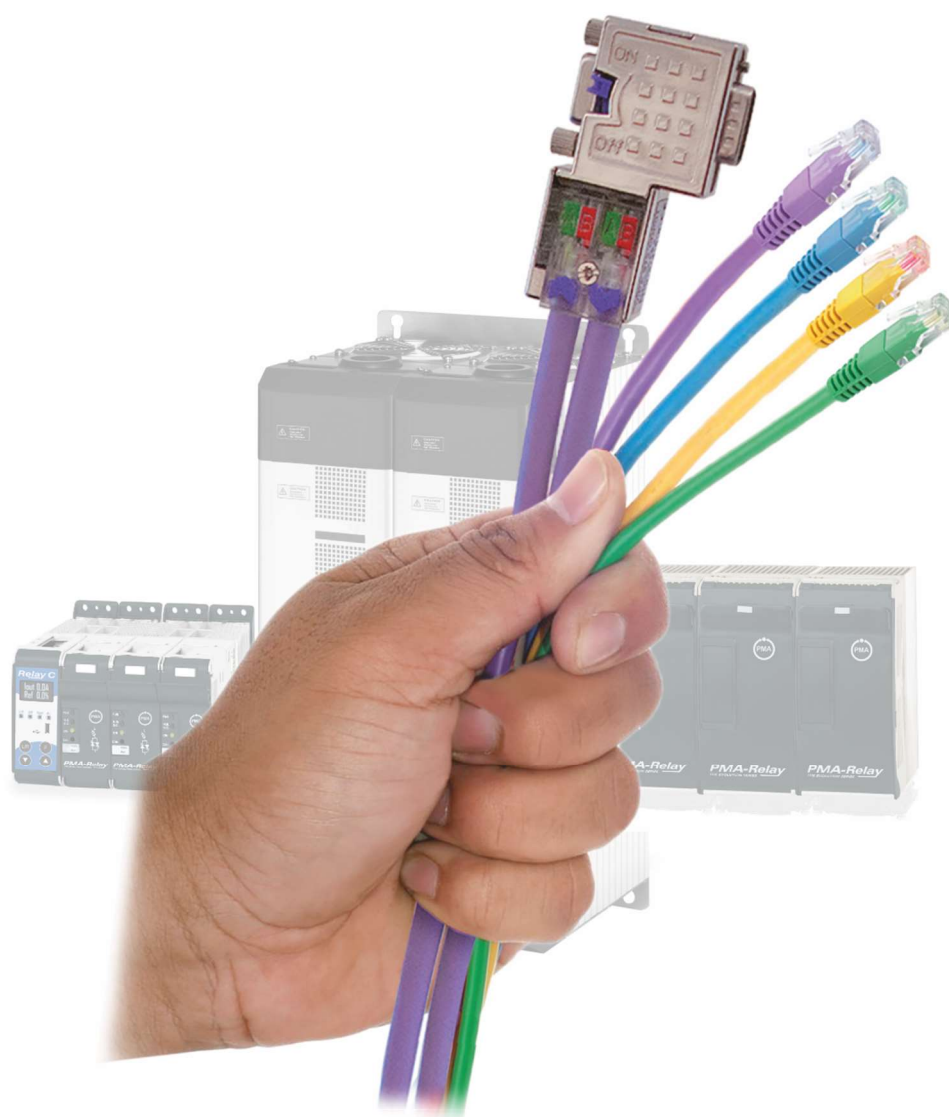


# Thyristor-Power Controller PMA-Relay C Serial Communication Manual



A publication of:



**PMA**  
**Prozeß- und Maschinen-Automation GmbH**  
**P.O.Box 310 229 • D-34058 Kassel • Germany**

All rights reserved.

No part of this document may be reproduced or published in any form or by any means without prior written permission from the copyright owner.

### Liability and warranty

Any information and notes in these operating instructions were composed under consideration of the applicable regulations, the present state of the art and our extensive know-how and experience.

With special versions, additional ordering options or due to the latest technical modifications, the actual scope of delivery may vary from the descriptions and drawings in this manual.

For questions, please, contact the manufacturer.



**Before starting to work with the instrument and before commissioning, in particular, these operating instructions must be read carefully! The manufacturer cannot be held responsible for damage and trouble resulting from failure to comply with the information given in this manual.**

**This product may be subject to change due to improvements of the product features in the course of further development.**

#### Copyright

**This operating manual should be considered as confidential information, intended only for persons who work with the instrument.**

**Contraventions are subject to payment of damages. Further claims reserved.**

## Inhalt

1.	MODBUS-RTU communication protocol .....	5
1.1.	Communication Terminals 30-40A (SR9-SR10-SR11) .....	5
1.1.1.	RS485 standard Serial Port .....	5
1.1.2.	Second Serial 485 Configuration Connectors .....	5
1.2.	Communication Terminals 60-210A (from SR12 to SR17) .....	6
1.2.1.	RS485 standard Serial Port .....	6
1.2.2.	Second Serial 485 Configuration Connectors .....	6
1.3.	Communication Terminals 300-800A (from S12 to S17) .....	7
1.3.1.	RS485 Serial Port .....	7
1.4.	Fieldbus communication option .....	7
1.5.	MODBUS communication .....	8
1.6.	MODBUS RTU Protocol .....	8
1.7.	Message Format .....	8
1.7.1.	C Language CRC 16 Example .....	10
1.8.	Read Holding Registers (function 03 /03Hex) - Read InputRegisters (function 04/04Hex) .....	10
1.9.	Preset Multiple Registers (function 16/10Hex) .....	11
1.10.	Preset single register (function 06/06Hex) .....	11
1.11.	Error and exception responses .....	12
1.12.	Address Configuration .....	12
1.13.	Parameter List .....	13
2.	Fieldbus .....	20
2.1.	MODBUS/TCP .....	20
2.1.1.	General description .....	20
2.1.2.	Modbus/TCP Connection .....	20
2.1.2.1.	Communication Terminals 30-40A (SR9-SR10-SR11) .....	20
2.1.2.2.	Communication Terminals 60-210A (from SR12 to SR17) .....	21
2.1.2.3.	Communication Terminals 300-800A (from S12 to S17) .....	21
2.1.3.	MODBUS/TCP Protocol .....	21
2.1.4.	PLC/Device Configuration .....	22
2.1.5.	Instrument IP Setting .....	22
2.1.5.1.	Set IP Address via web page .....	22
2.1.5.2.	set IP address desktop application .....	23
2.2.	PROFINET .....	24
2.2.1.	General description .....	24
2.2.2.	PROFINET Connection .....	24

2.2.2.1.	Communication Terminals 30-40A (SR9-SR10-SR11).....	24
2.2.2.2.	Communication Terminals 60-210A (from SR12 to SR17) .....	24
2.2.2.3.	Communication Terminals 300-800A (from S12 to S17) .....	25
2.2.3.	PLC Configuration.....	26
2.3.	PROFIBUS .....	29
2.3.1.	General description.....	29
2.3.2.	PROFIBUS Connection.....	29
2.3.2.1.	Communication Terminals 30-40A (SR9-SR10-SR11).....	29
2.3.2.2.	Communication Terminals 60-210A (from SR12 to SR17) .....	29
2.3.2.3.	Communication Terminals 300-800A (from S12 to S17) .....	30
2.3.3.	PLC Configuration.....	30
2.4.	Data Exchange Area .....	32
2.4.1.	Read area .....	32
2.4.2.	Write area .....	36

# 1. MODBUS-RTU communication protocol

## 1.1. Communication Terminals 30-40A (SR9-SR10-SR11)

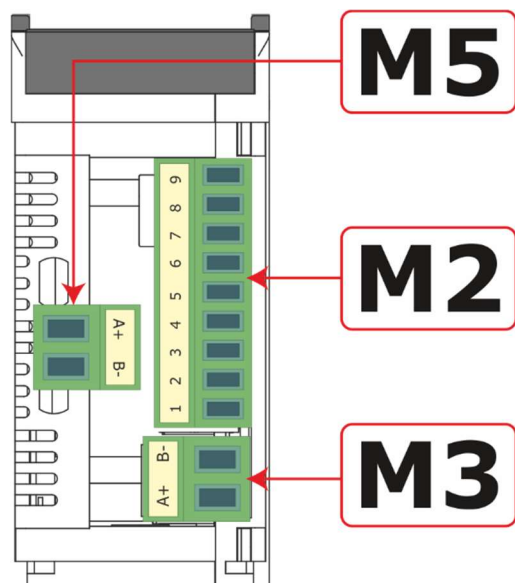
### 1.1.1. RS485 standard Serial Port

Terminal M1	Description
B-	RS485 B-
A+	RS485 A+

The serial communication port RS485 is available on the Command terminals.  
On this port may be done a network up to 127 Relay C.

### 1.1.2. Second Serial 485 Configuration Connectors

Terminal M5	Description
A+	RS485 A+
B-	RS485 B-

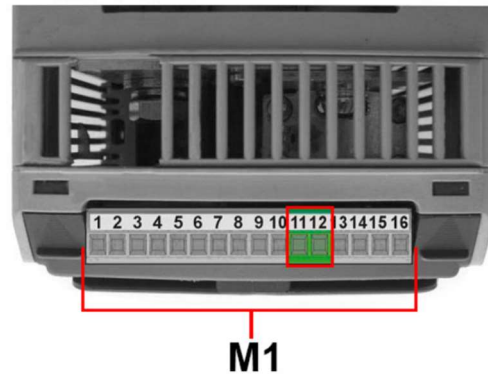


## 1.2. Communication Terminals 60-210A (from SR12 to SR17)

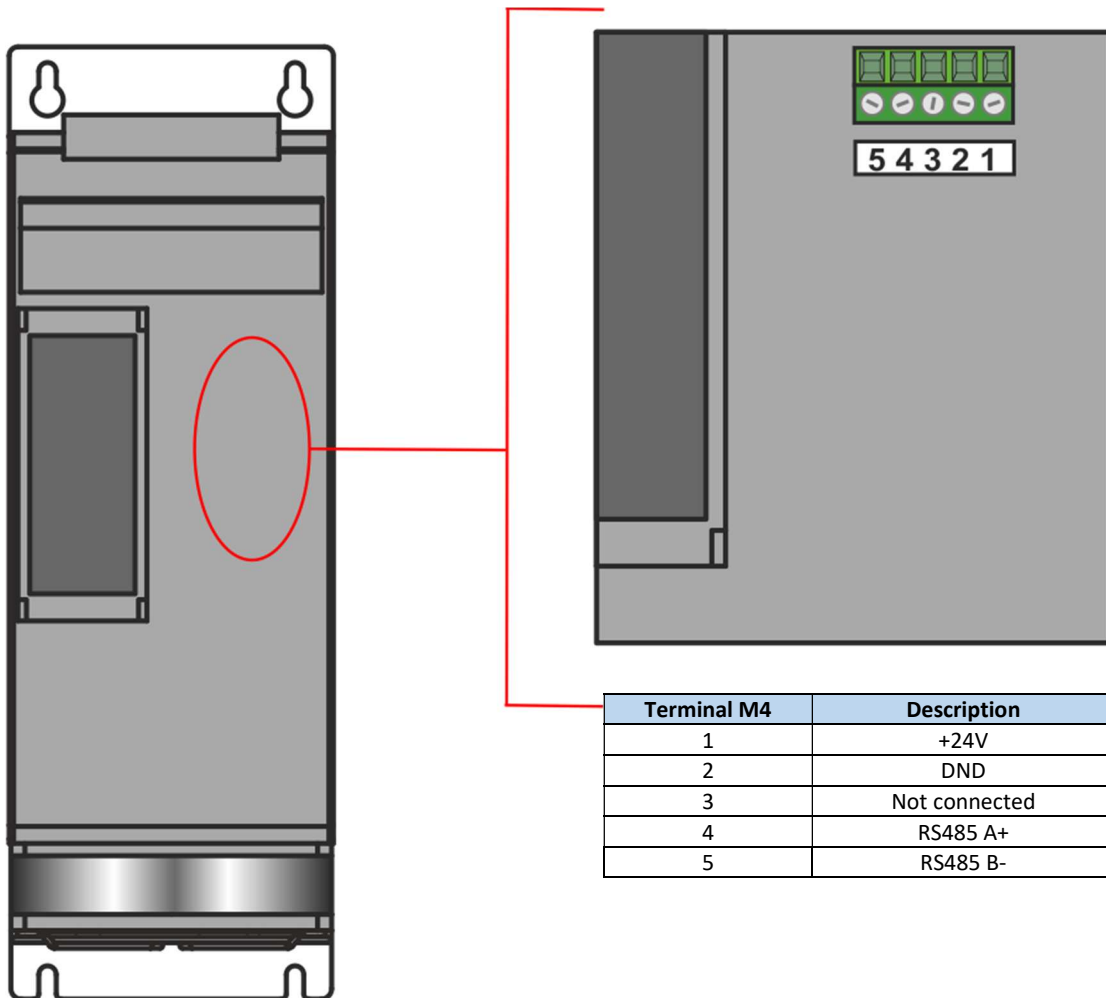
### 1.2.1. RS485 standard Serial Port

Terminal M1	Description
11	RS485 B-
12	RS485 A+

The serial communication port RS485 is available on the Command terminal.  
On this port may be done a network up to 127 Relay C.



### 1.2.2. Second Serial 485 Configuration Connectors



### 1.3. Communication Terminals 300-800A (from S12 to S17)

#### 1.3.1. RS485 Serial Port

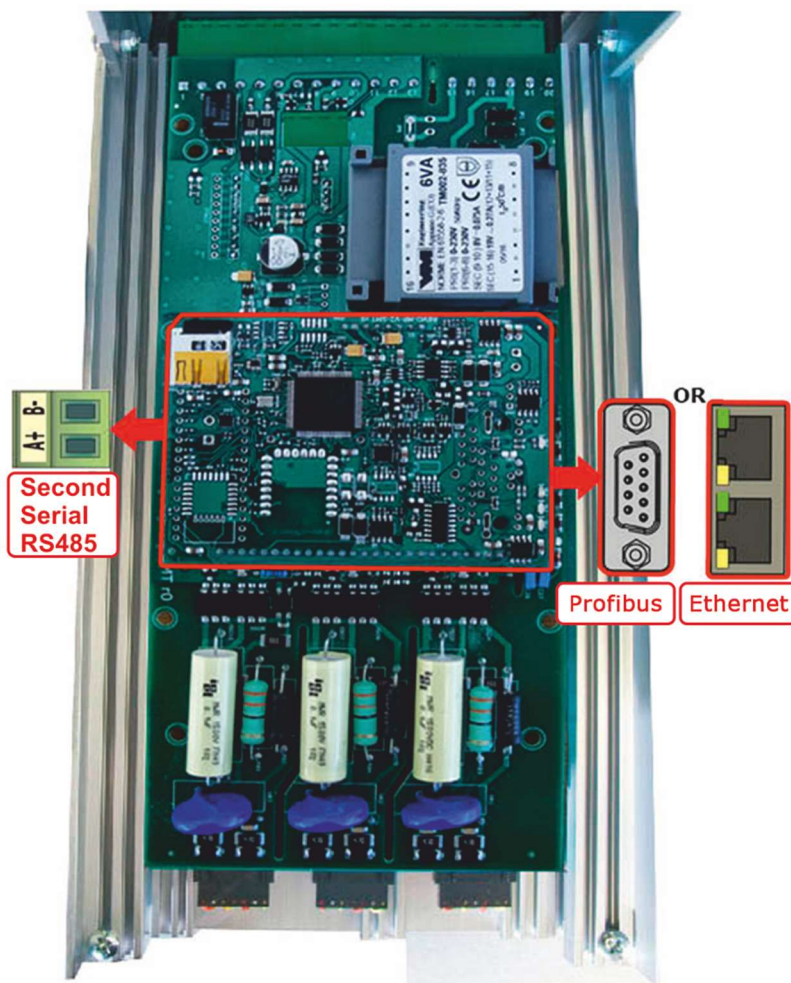
Terminal M1	Description
B-	RS485 B-
A+	RS485 A+

The serial communication port RS485 is available on the Command Terminals. On this port may be done a network up to 127 Relay C.



#### 1.4. Fieldbus communication option

Other serial communication port are available as option.



## 1.5. MODBUS communication

The serial communication port of the thyristor unit is two-wire RS485 type.

This port use an half-duplex system.

While a Unit is transmitting the transmission line is activated, otherwise the transmission line is in high impedance. The serial communication port allows to communicate between the thyristor units and a MASTER device (ex. A computer or a terminal). The cable must be rated for use to data transfer.

## 1.6. MODBUS RTU Protocol

The communication is based on the standard industrial MODBUS RTU with the following restrictions:



The Baud rate can be 9600-19200-38400-115200 Baud (Standard 19200).

The following MODBUS functions are supported:

Terminal M1	Description
03/04	Read Holding Registers (max 121 reg.)
06	Preset Single Registers
16	Preset Multiple Registers (max 25 reg.)



The unit support the Broadcast messages:

It's possible to send a Broadcast message using the address 0, all the units respond to the message without sending back any reply.

## 1.7. Message Format

The transmission format is a 1 bit start, 8 data bit, and 1 bit stop with no parity verification.

A message for either a Query or a Response is made up of an inter-message gap followed by a sequence of data characters. The inter-message gap is at least 3.5 character times.

The first Byte of each message is always the address of the unit that is a value from 1 to 255 or 0 for the broadcast messages, the second is always the function number, and the rest of the message depends of the function demand.



When a slave receives a message, the unit sends an answer with the same structure but with the information requested.

Each message is followed by CRC (Cyclic Redundancy Check) with two bytes. The CRC identifies the incongruity situations of the message, in this case the receiver ignores the message.

The CRC is calculated in accordance with a formula that implies a recursive division of the data by a polynomial.

The polynomial divisor is:

$2^{16} + 2^{15} + 2^2 + 1$  (Hex 18005)

but is modified in two ways:

- Since the bits order are reversed, then the binary pattern is also reversed, and the most significant bit (MSB) is the right-most bit.
- Since interest only the remainder, the right-most bit could be discarded.

Therefore, the polynomial divisor has value: Hex A001





**1.7.1. C Language CRC 16 Example**

```

static short CRC16 (unsigned char *p_first,unsigned char *p_last)
{
    unsigned int crc=0xffff;
    short j;
    for (;p_first<=p_last;p_first++)
    {
        crc ^= *p_first;
        for(j=8;j>0;j--)
        {
            if(crc & 0x0001)
            {
                crc = crc >> 1;
                crc ^= 0xA001;
            }
            else
            {
                crc = crc >> 1;
            }
        }
    }
    return (crc);
}
    
```

**1.8. Read Holding Registers (function 03 /03Hex) -  
Read InputRegisters (function 04/04Hex)**

This function reads the instantaneous values of a specified number of parameters from an address.  
The message is composed by 8 Byte:

- one Byte is for the address
- one Byte for the function (03/04Hex)
- two Byte for the address of the first parameter to read
- two Byte for the total number of parameters to read (max 121)
- two Byte for the CRC

Address Unit	Function 3/4 3/4Hex	Address of the First Parameter		N° of read Parameter		CRC 16	
		HI	LO	HI	LO	LO	HI

The answer is an echo of the first two Byte (address and function), one byte with the number of byte following (CRC excluded), the demanded values and finally two Byte for the CRC.

Address Unit	Function 3/4 3/4Hex	N° of Byte 2 - 32	First Parameter Value		Last Parameter Value		CRC 16	
			HI	LO	HI	LO	LO	HI

### 1.9. Preset Multiple Registers (function 16/10Hex)

This function could write maximum 25 parameters for each message.

The message is composed by:

- one Byte for the address
- one Byte for the function (10 Hex)
- two Byte for first parameter address to write
- two Bytes for the N° of parameters
- one Byte with the number of following Bytes
- values to write, two Byte for the CRC:

Address Unit	Function	Address of the First Parameter		N° of read Parameter		N° of Byte	Value to Write		→
	16 10Hex	HI	LO	HI	LO	2	HI	LO	→

→	First Value to Write		Last Value to Write		CRC 16	
→	HI	LO	HI	LO	LO	HI

The answer is an echo of the first two Byte (address and function), two Byte for first written parameter, two Byte with the N° of parameters, fixed to 1 (0001 Hex), two Byte for the CRC.

Address Unit	Function	Address of the First Parameter		N° of read Parameter		CRC 16	
	16 10Hex	HI	LO	0	1	LO	HI

### 1.10. Preset single register (function 06/06Hex)

This function writes a single Modbus paramter.

The message is composed by 8 Bytes:

- one Byte for the address,
- one Byte for the function (6 Hex),
- two Bytes for the parameter address to write
- two bytes for the value to write
- two Bytes for the CRC

Address Unit	Function	Address of the First Parameter		Value to Write		CRC 16	
	6 6Hex	HI	LO	HI	LO	LO	HI

The normal response is a complete echo of the received message.

### 1.11. Error and exception responses

If a message contains an altered character, if fails the CRC, or if the received message contains a syntax error (for example the number of the byte or of the words is not correct), then the unit will ignore the message.

If the received message is correct but contains a not valid value, the unit will send an answer of exception (5 byte):

Address Unit	Function	Error Code	CRC 16	
			LO	HI

The byte with the function number, represent the function number of the message that has caused the error with the first Bit set to 1 (ex. the function 3 becomes 0x83) The error code could be one of the followings:

Error Code	Name	Cause
1	ILLEGAL FUNCTION	Function not supported
2	ILLEGAL DATA ADDRESS	Address out of range
4	FAILURE IN ASSOCIATED DEVICE	Too Many parameter request

### 1.12. Address Configuration

The thyristor unit is assigned a unique device address by the user in the range 1 (default) to 247 using the parameter P115 *Addr* in the Hardware menu. This address is used to recognise Modbus Queries intended for this instrument.

The thyristor unit does not respond to modbus queries that don't have the same assigned address.

### 1.13. Parameter List

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
1	0	65535				X	0	X	X	Change User Access Level Level 0: Par 1 = 0 Level 1: Par 1 = 1111 (dec) Level 2: Par 1 = 2222 (dec) Level 3: Par 1 = 3333 (dec)
2	0	1					1	X	X	Used to temporarily disable Field Communications 0 = Enabled 1 = Disabled
3							0	X	X	Internal use
4							0	X	X	Internal use
5							0	X	X	Displays which bus module is populated
6						X	0	X	X	Used to specify if secondary port is used for WiFi, 2nd Modbus, bus or LOG
7	0	9999					-	X	X	Used for factory reset (wipes all EEPROM except serial number) of system or Wifi
8	0	65535				X	3	X	X	Used to save or restore default configuration
9	0	65535	0	655.35	Hz		0	X	X	Main network frequency
10	0	1023	0	1023	V		0	X	X	Rms Voltage or average Voltage of rms for multi-phase
11	0	1023	0.0	102.3	A		0	X	X	RMS Current or Average RMS Current (multi-phase)
12	0	1023	0	1023	%		0	X	X	RMS Power or Average RMS Power (multi-phase)
13	0	1023	0	1023	Sw		0	X	X	<b>Status bitmask</b> Bit 0 ShortCut Alarm Bit 1 Heat Break Alarm Bit 2 ON/OFF unit Bit 3 Thermal warning * Bit 4 Current Limit Alarm Bit 5 Thermal Alarm Bit 6 Communication Alarm (WD) Bit 7 Fuses alarm * Bit 8 Digital input 1 status Bit 9 Digital input 2 status Bit 10 Phase unbalanced Bit 11 Not used Bit 12 Anemometer * Bit 13 Not used Bit 14 Bakeout in function Bit 15 Thermal Alarm Active

\* Available only for Relay C Extended

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
14	0	255	0	1023	Sw	X	0	X	0	<b>Command bitmask</b> Bit 0 Not used Bit 1 Digital reference 0 = from analogue input 1 = from communication/keyb Bit 2 Unit enable 1= Enable 0= Disable Bit 3 Not used Bit 4 Current line switch 0 = from analogue input 1 = from communication/keyb Bit 5 Not used Bit 6 Save factory Bit 7 Load factory Bit 8 Not used Bit 9 Not used Bit 10 Not used Bit 11 Not used Bit 12 Not used Bit 13 Not used Bit 14 Not used Bit 15 Not used
15	0	1023	0.0	100.0	%	X	0	X	X	Remote set point for unit
16	0	255	0	100	%	X	0	X	X	How to scale the power set point
17	0	1023	0	100	%	X	0	X	No	Digital current limit value 0 = From analogue Input 1 = From communication/keyb
18	0	1023	0	1023	Sw	X	0	X	Only ZC BF	<b>Firing mode options</b> Zero cross 1 Single Cycle 2 Burst Firing 3 Phase Angle 4 Phase Angle + Soft Start 20 Half Cycle 10 Burst Cycle + Soft Start 19 Burst Firing + Delay Trigger 35 Burst Firing + Delay Trigger + Safety Ramp Peak 227 Burst Firing + Delay Trigger + Saftyramp 99 Half Cycle + Soft Start 74
19	0	1023	0	1023	Sw	X	0	X	X	<b>Control Mode (Feed-back)</b> VOLTAGE 32 VOLTAGE <sup>2</sup> 0 CURRENT 64 CURRENT <sup>2</sup> 2 POWER 128 NO_FEEDBACK 1
20	0	255	0	255	-	X	0	X		Number of cycles to fire in burst fire mode
21	0	255	0	255	-	X	0	X	No	Number of half cycles with a delay in burst fire mode
22	0	90	0	90	°	X	0	X	No	Degrees of delay from zero cross when the first cycle is triggered to on when in Delay Trigger Mode. (Delay for a transformer is 45 degrees)

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
23	0	255	0	255	X50ms	X	0	X	No	Number of 50 msec periods over which soft start is active
24	0	255	0	255	X50ms	X	0	X	No	Number of 50 msec periods that make up the fixed time base (Cycle time) calculation
25	0	1024	0	1024	HC	X	0	X	No	How many half cycles to use for soft start
26	0	255	0	255	-	X	1	X	No	Proportional term for the primary feedback loop
27	0	255	0	255	-	X	1	X	No	Integral term for the primary Feedback loop
28	0	255	0	255	X50ms	X	1	X	No	Number of 50 msec periods after the heater break is detected before the alarm is triggered
29	0	100	0	100	%	X	1	X	No	Threshold of resistance that activates the HB alarm as a percentage of the nominal load resistance
30	0	3	0	3	Sw	X	1	X	No	Baud rate for primary (RS485) Modbus port
31	0	255	0	255	Addr	X	1	X	No	Address for primary (RS485) Modbus port
32	0	5	0	5	Sw	X	1	X	No:4.7	Defines the function activated when: 0 = Enable thyristor 2 = Change to V feedback 3 = Change digital reference from AI/communication 4 = Force PA firing 5 = Select reference 1/2 6 = LOG: function enable 7 = Bakeout enable 8 = Fast enable thyristor Digital Input 1
33	0	5	0	5	Sw	X	1	X	No:4.7	Defines the function activated when: 0 = Enable thyristor 2 = Change to V feedback 3 = Change digital reference from AI/communication 4 = Force PA firing 5 = Select reference 1/2 6 = LOG: function enable 7 = Bakeout enable 8 = Fast enable thyristor Digital Input 2
34	0	65535	0	65535	Sw	X	1	X		Defines the function of the output relay Bit 0 HB alarm Bit 1 SC alarm Bit 2 LIM Alarm Bit 3 \ Bit 4 Modbus Watchdog
35	0	1023	0	1023	Sw	X	1	X	X	Analogue Input Calibration 0 = Normal operation 1 = Store low analogue input value 2 = Store high analogue input value

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
36	0	65535	0	65535	Sw		-	X	X	Unit type (1PH, 2PH, 3PH) 7 = Relay C 1PH 8 = Relay C 2PH 9 = Relay C 3PH 10 = Relay C 3PH PA
37	0	1023	0	1023	V	X	0	X	X	Nominal load voltage.
38	0	9999	0	999.9	A	X	0	X	X	Nominal load Current.
39	0	9999	0	999.9	A		-	X	X	Current transformer amperage rating
40	0	1	0	1	-		-	X	X	Used for current retransmission gain
41	0	1023	0	1023	V		-	X	X	Unit rating (max voltage rating for the product ex: 480, 600, 690)
42	0	1023	0	1023	V		-	X	X	Used to calibrate the aux voltage
43	0	1023	0	1023	V		0	X	X	Aux voltage
44	0	3	0	3	Sw	X	1	X		Analog input 1 type 1 = 0-10 V 2 = 4-20 mA 3 = 0-20 mA
45	0	255	0	255	Sw	X	1	X	X	Baud rate, secondary Modbus port (if mounted) 0 = 9600 baud 1 = 19200 baud 2 = 38400 baud 3 = 115200 baud
46	0	65535	0	655,35	ohm		0	X	X	Calculated resistance of the load. Based on a calculation of the Vrms load voltage divided by the Irms load current. (Average Irms in multi-phase unit)
47	0	65535	0	65535	V		0	X	X	AUX RMS input voltage
48	0	65535	0	65535	-		0	X	X	Version number (X.XX.X)
49	0	65535	0	65535	-		0	X	X	Year and week of release (YYWW)
50										Not used
51										Not used
52	0	1	0	1		X	0	X	X	Selector for the current limit type 0 = RMS 1 = PEAK
53										Not used
54	0	4096	0	4096	A		0	X	X	Measured RMS Current - phase 1
55	0	4096	0	4096	A		0	No	X	Measured RMS Current - phase 2
56	0	4096	0	4096	A		0	No	X	Measured RMS Current - phase 3
57	0	1023	0	1023	-		0	X	X	Internal use
58	0	1023	0	1023	-		0	X	X	Internal use
59	0	1023	0	1023	-		0	X	X	Internal use
60	0	1023	0	1023	SW	X	1	X	X	Output value displayed when the Thyristor unit starts up 0 = I current 1 = V voltage 2 = P power



Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
61	0	65535	0	65535	-	X	1	X	X	Selects which analogue input is used for the SP input 0 = Analogue Input 1 1 = Analogue Input 2
62	0	9999	0	9999	A	-	-	X	X	Thyristor unit Amperage Rating
63	0	255	0	255	-	X	1	X	No	Proportional term for the current limit loop
64	0	255	0	255	-	X	1	X	No	Integral term for the current limit loop
65	0	65635			x50mS	X	0	X	No	Once the output turns off, how much time must pass before safety ramp will be re-enabled
66	0	65535			x50mS	X	0	X	No	Time for the safety rmap
67	1	9999	0	99.99		-	-	X	X	Current transformer gain correction
68	0	1024	0	1024		X	1	X	X	Selects the parameter to retransmit 0 = No value 10 = Load Voltage 11 = Load Current 12 = Load Power 15 = Input Signal
69	0	1024	0	1024		X	1	X	X	Retransmission type 0 = 4-20 mA 1 = 0-10 V 2 = 0-20 mA
70	0	255	0	255	s	X	1	X	X	Data logging period
71	0	255	0	255		X	2	X	X	IP Address for Hilscher module
72	0	255	0	255		X	2	X	X	
73	0	255	0	255		X	2	X	X	
74	0	255	0	255		X	2	X	X	
75	0	255	0	255		X	2	X	X	Mask for the Hilscher module
76	0	255	0	255		X	2	X	X	
77	0	255	0	255		X	2	X	X	
78	0	255	0	255		X	2	X	X	
79	0	255	0	255		X	2	X	X	Gateway for the Hilscher module
80	0	255	0	255		X	2	X	X	
81	0	255	0	255		X	2	X	X	
82	0	255	0	255		X	2	X	X	
83	0	65535	0	65535		X	1	X	X	WiFi Machine Name (2 characters each, 16 characters total) PROFINET NAME: 120 WORDS IN EXTERNAL ADDRESS MAP (from address 300 to 420)
84	0	65535	0	65535		X	1	X	X	
85	0	65535	0	65535		X	1	X	X	
86	0	65535	0	65535		X	1	X	X	
87	0	65535	0	65535		X	1	X	X	
88	0	65535	0	65535		X	1	X	X	
89	0	65535	0	65535		X	1	X	X	
90	0	65535	0	65535		X	1	X	X	
91	0	65535	0	65535		X	0	X	X	DAY_MONTH High byte -> DAY Low byte -> MONTH
92	0	65535	0	65535		X	0	X	X	YEAR_HOUR High byte -> YEAR Low byte -> HOUR
93	0	65535	0	65535		X	0	X	X	MIN_SEC High byte -> MIN Low byte -> SEC

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
94	0	255					0	X	X	IP Address for WiFi module
95	0	255					0	X	X	
96	0	255					0	X	X	
97	0	255					0	X	X	
98	0	9995	0	9995	ms	X	2	No	X	Delay for zero cross of phase 1
99	0	9995	0	9995	ms	X	2	No	X	Delay for zero cross of phase 2
100	0	9995	0	9995	ms	X	2	No	X	Delay for zero cross of phase 3
101	0	1	0	1	Sw	X	1	X	No	Enable the current limit 0 = off 1 = on
102	0	1000	0	1000	ratio		0	X	X	Power Factor
103	0	1000	0	1000	ratio		0	No	X	Bus module version
104										Not used
105	0	3	0	3		X	1	X	X	Process signal type for analogue input 2 1 = 4-20 mA 2 = 0-10 V 3 = 0-20 mA
106	0	4096	0	4096			-	X	X	stored calibration value (internal use)
107	0	4096	0	4096			-	X	X	
108	0	4096	0	4096			-	X	X	
109	0	4096	0	4096			-	X	X	
110	0	4096	0	4096			-	X	X	
111	0	4096	0	4096			-	X	X	
112	0	4096	0	4096			-	X	X	
113	0	4096	0	4096			-	X	X	
114	0	4096	0	4096			-	X	X	
115	0	4096	0	4096			-	X	X	
116	0	2	0	2	Sw	X	1	X	No	Function associated with AN2 0 = Current Limit 1 = Feed-back 2 = External input
117	0	9999	0	9999			-	X	X	Gain for power set point
118	0	9999	0	9999			-	X	X	Gain for measured power rtx (Vxl)
119	0	2			Sw		-	X	X	Not used
120	0	1			Sw		2	X	X	Enable the WiFi 0 = off 1 = on
121	0	65535					0	X	X	Thyristor unit type
122	0	1024				X	1	X	X	If PROFIBUS is mounted, this is the external address that is used to communicate over PROFIBUS
123	0	65535			kVA	X	X	X	X	Real Time power consumption calculation (read only, ca1n set to 0 to reset total count)
124	0	65535				X	X	X	X	Retransmission gain
125	0	65535			kV/h			X	X	Total count in kW/h
126	0	65535						X	X	
127	0	1200	0	120	°C			X	X	Temperature of the SCR (if NTC, you will see the value, 0 = Okay 1 = Alarm

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
128	0	1200	0	120	°C	X	3	X	X	SCR Temp. alarm set (setting to 0 disables this alarm)
129	0	4096	0	4096			-	X	X	Calibration value for AI1
130	0	4096	0	4096			-	X	X	
131	0	65535			kw		0	X	X	Real time power consumption calculation
132	0	65535					-	X	X	Not used
133	0	65535					-	X	X	Not used
134	0	9999	0	9999			-	X	X	Gain for voltage rtx
135	0	9999	0	9999			-	X	X	Gain for current rtx
136										Not used
137	0	1000	0	100.0			0	X	X	Current value of analog input 2 in percent
138	0	1000	0	100.0			0	X	X	Current value of analog input 1 in percent
139	0	1				X	0	X	X	Start or stop data logging (0 - off / 1 - on)
140	0	1					0	X	No	Enable bakeout function (0 - off / 1 - on)
141	0	65535					-	X	X	Used to select PMA protocol for Data log file transfer, Live mode (bit0 - Live Mode / bit1 - file upload mode)
142	0	1				X	1	X	X	Enable to Modbus watchdog
143	0	255			s	X	1		X	Watch dog alarm time
144	0	9999			min	X	1	X	No	Bakeout total ramp time
145	0	9999			A	X	1	X	No	Bakeout current limit
146	0	9999			min	X	1	X	No	Time to wait while off before bakeout is needed again
147	0	1024					0	X	X	Scaled AN1 value (0-1024)
148	0	1024					0	X	X	Scaled AN2 value (0-1024)
149	0	9999					-	X	X	Serial Number
150	0	9999					-	X	X	
151	0	9999					-	X	X	
152	0	9999					-	X	X	
153	0	1000					0	X	X	Internal use
154										Not used
155										Not used
156										Not used
157										Not used
158	0	65535					0	X	X	CRC used for WiFi communication
159	0	65535					0	X	X	16 bit CRC of Modbus map

## 2. Fieldbus

The Relay C is available in these fieldbus types:

- MODBUS/TCP
- PROFINET
- PROFIBUS DP

**NOTE:** In order change the write parameters (see page 35) from Configuration Software (USB port) or from RS485 Modbus-RTU port, write from fieldbus must be disabled. If the connection is terminated/compromised, these parameters will be continuously set to 0 until parameter 2 is disabled or the connection is re-established and the parameters are set.

To disable write from bus use parameter 2

Parameter 2:

Par	Min	Max	Min UM	Max UM	UM	Write Enable	Access Level	1PH	2/3PH	Description
2	0	1					1	X	X	Used to temporarily disable Field Communications 0 = Enabled 1 = Disabled

### 2.1. MODBUS/TCP

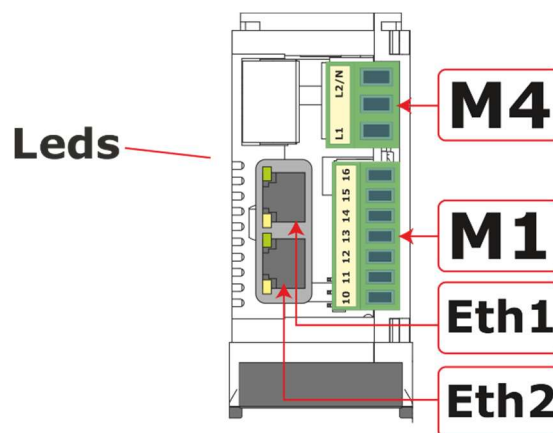
#### 2.1.1. General description

The thyristor unit permit a data exchange via Modbus/TCP to an external device (HMI or PLC).

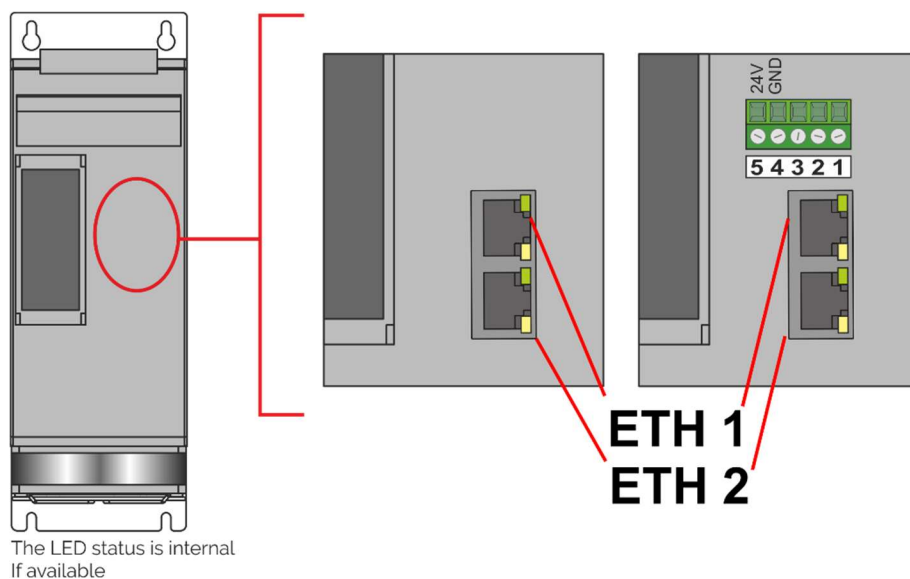
#### 2.1.2. Modbus/TCP Connection

##### 2.1.2.1. Communication Terminals 30-40A (SR9-SR10-SR11)

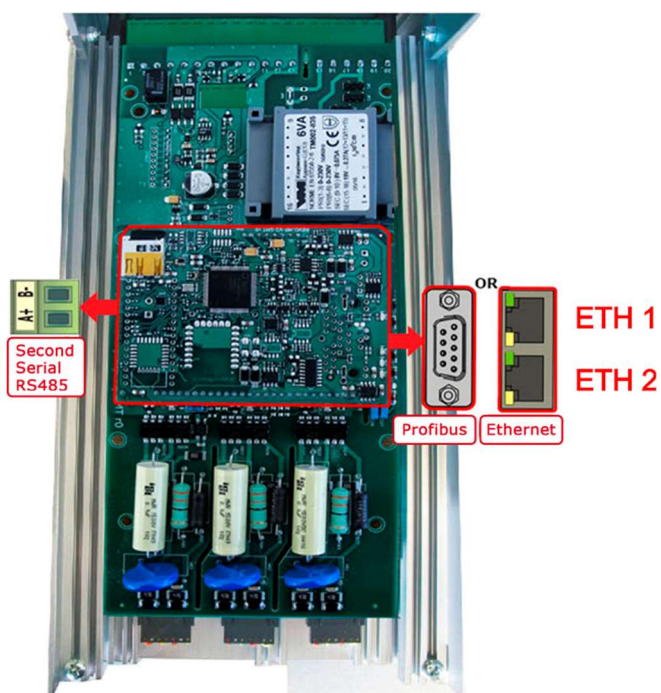
Ethernet Configuration Connectors



**2.1.2.2. Communication Terminals 60-210A (from SR12 to SR17)**



**2.1.2.3. Communication Terminals 300-800A (from S12 to S17)**



**2.1.3. MODBUS/TCP Protocol**

The communication is based on the standard industrial MODBUS TCP with the following restrictions:

The following MODBUS functions are supported:

Function	Description
04	Read Input Registers
06	Preset Single Registers
16	Preset Multiple Registers

### 2.1.4. PLC/Device Configuration

The device to connect to the unit need to set the correct IP address, the port and the unit ID

Default values are:

IP: 192.168.100.196

S.M.: 255.255.255.0

Gateway: 192.168.100.101

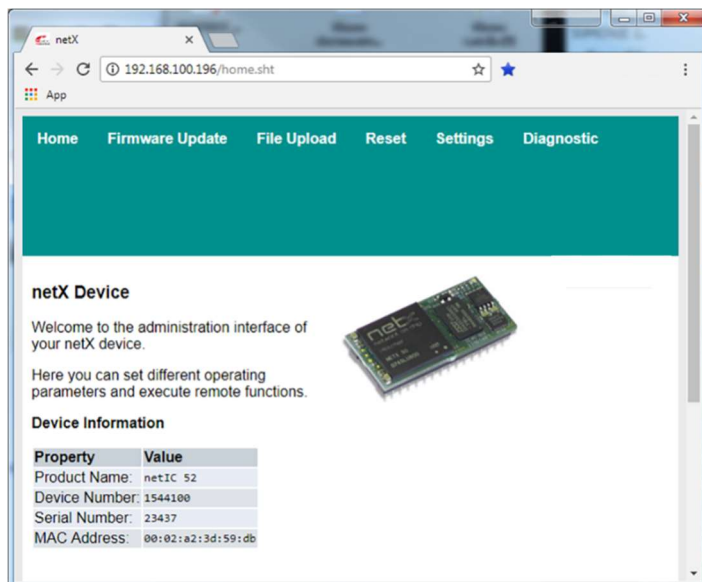
### 2.1.5. Instrument IP Setting

On Software configuration is not possible set IP address, but only see the value.

Is possible to set it via web page or via application software

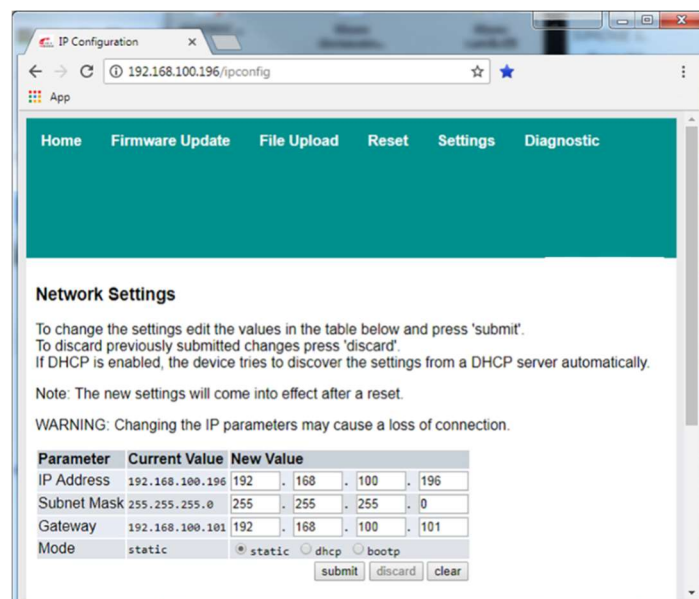
#### 2.1.5.1. Set IP Address via web page

Open a browser and set on URL the actual IP address (Ex: http://192.168.100.196 )



Click on settings and when credentials are required, set:  
User : ute1  
Password : ute1\_

Will appear a page with IP address, Subnet Mask, Gateway and Mode, set the configuration required and click on "submit" button to confirm.

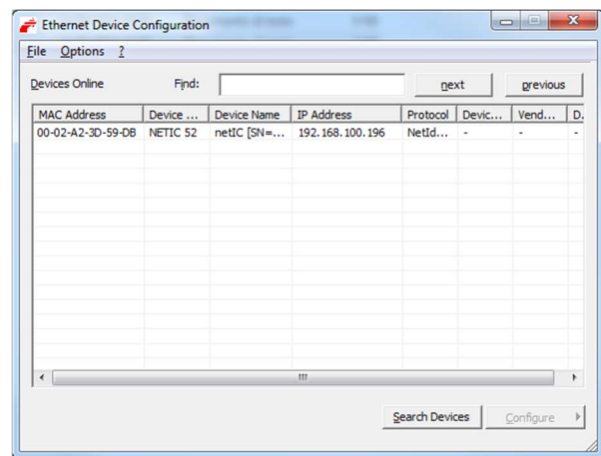


### 2.1.5.2. Set IP address desktop application

With a search tool on Ethernet

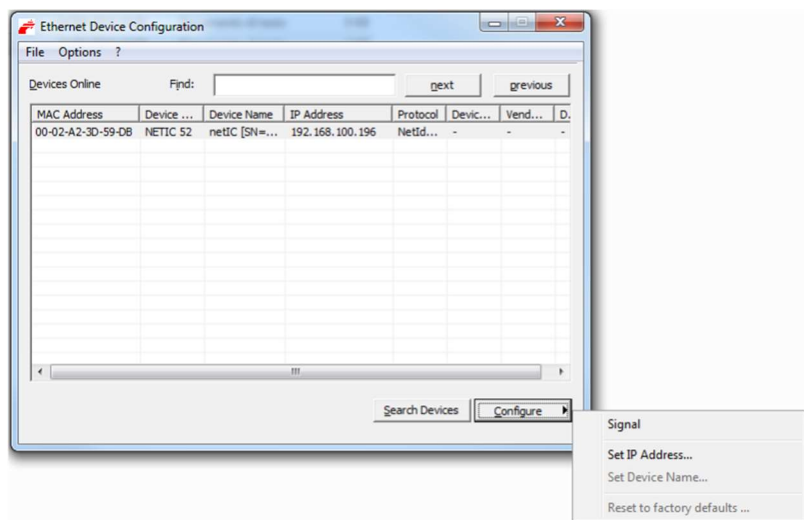
<https://kb.hilscher.com/display/ETHDEVCFG>

It's possible to search the units connected to the network, read the MAC address and set the correct IP address.

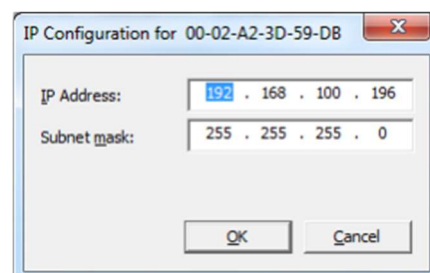


To set the IP address select the device with mouse left button then click on "Configure" button.

Click on "Set IP address".



Write the right IP and Subnet Mask and click OK to confirm.



## 2.2. PROFINET

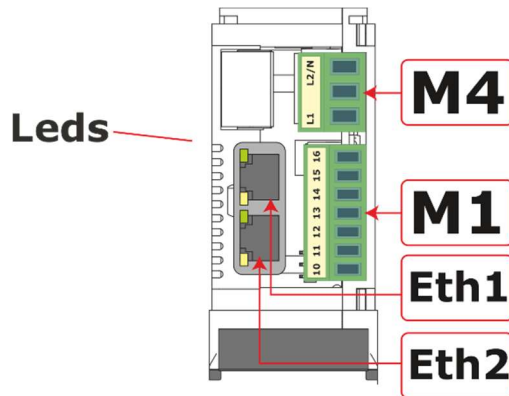
### 2.2.1. General description

The thyristor unit permit a data exchange via PROFINET-IO Siemens protocol.

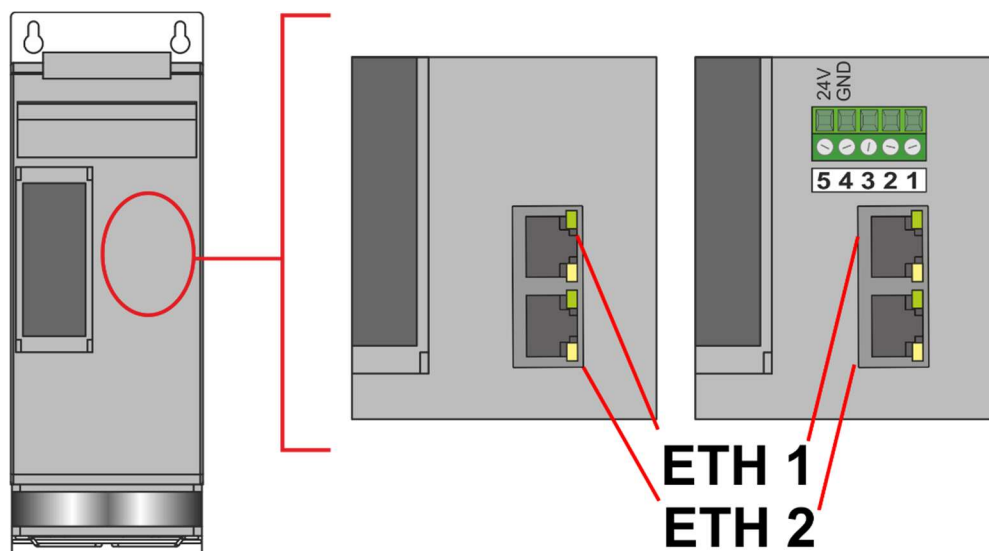
### 2.2.2. PROFINET Connection

#### 2.2.2.1. Communication Terminals 30-40A (SR9-SR10-SR11)

Ethernet Configuration Connectors



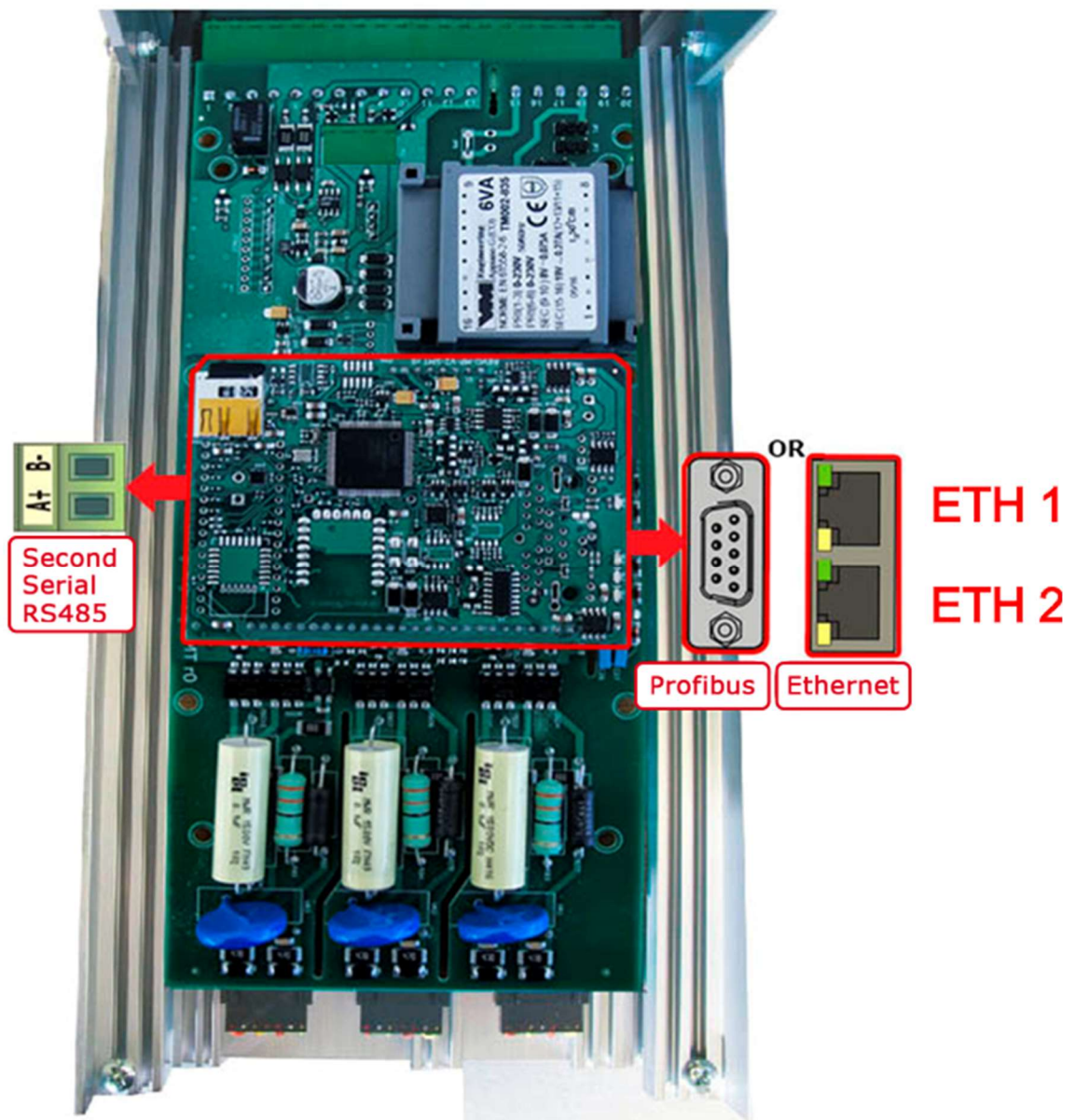
#### 2.2.2.2. Communication Terminals 60-210A (from SR12 to SR17)



The LED status is internal  
If available



### 2.2.2.3. Communication Terminals 300-800A (from S12 to S17)



### 2.2.3. PLC Configuration

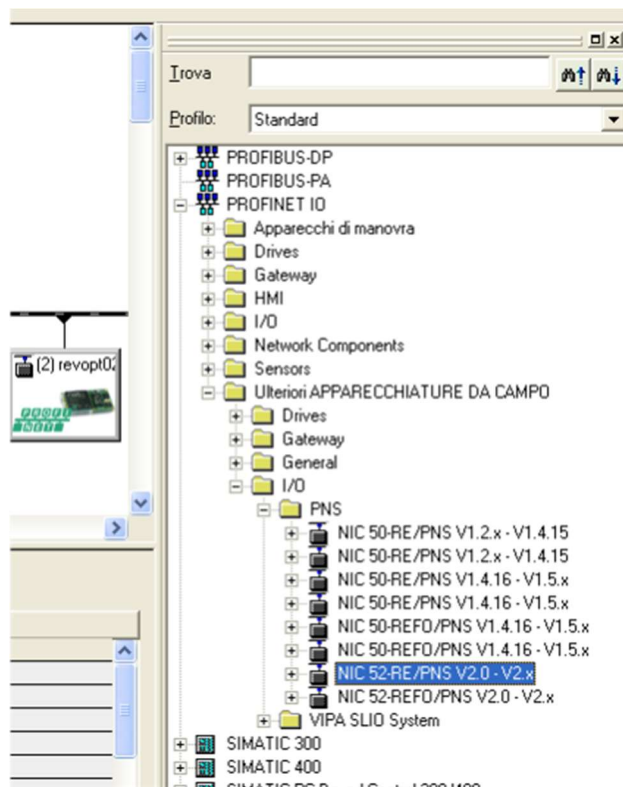
With PROFINET connection it's possible to read value in cyclic mode.

To do it you need to use the GSDML plc configuration file that describe the product, and install in PLC configuration software environment.

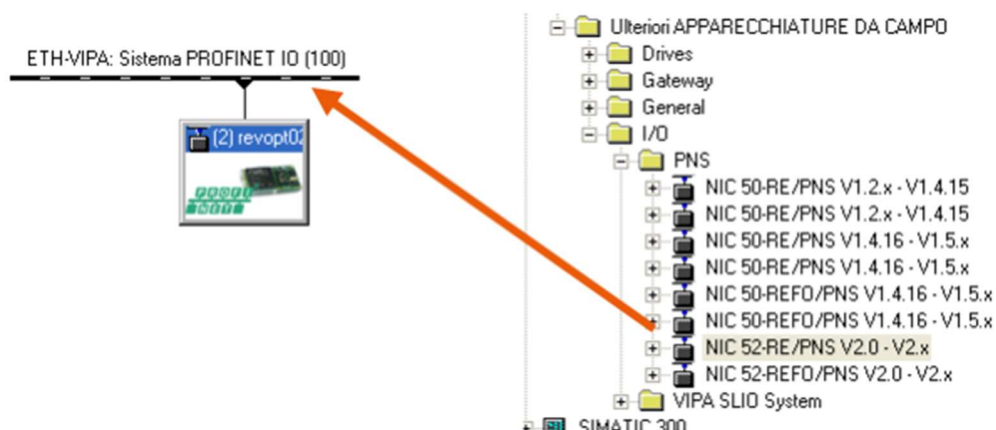
(GSDML-V2.32-HILSCHER-NIC 5X-RE PNS-20161102.xml)

If GSDML file is not installed, please install it

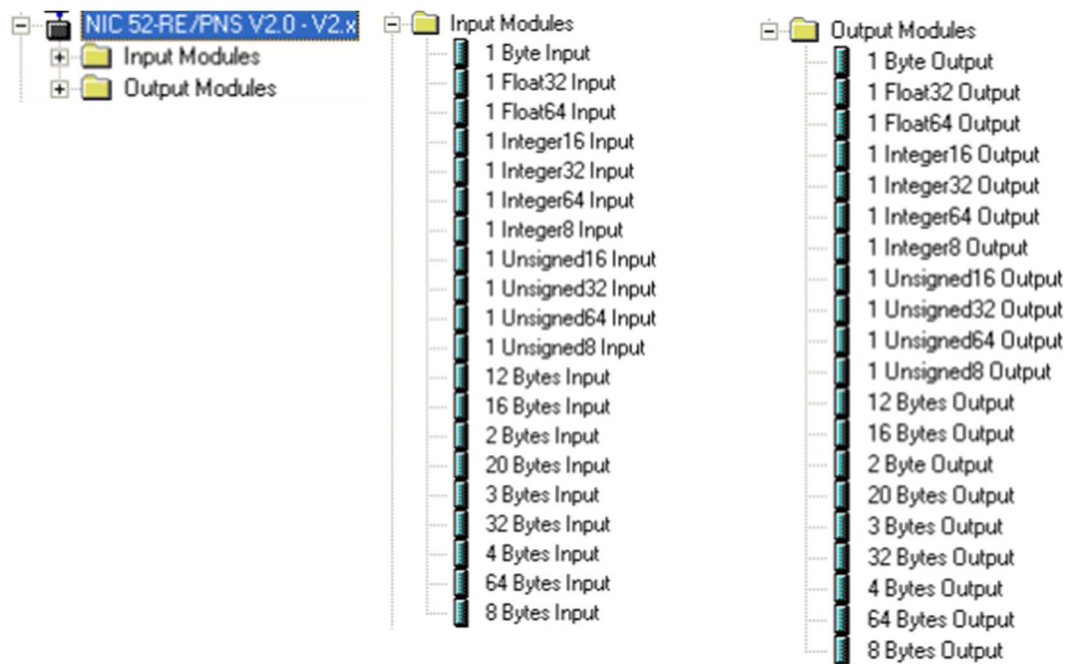
If installed or after installation will be present (NIC 52-RE/PNS V2.0-V2.x)



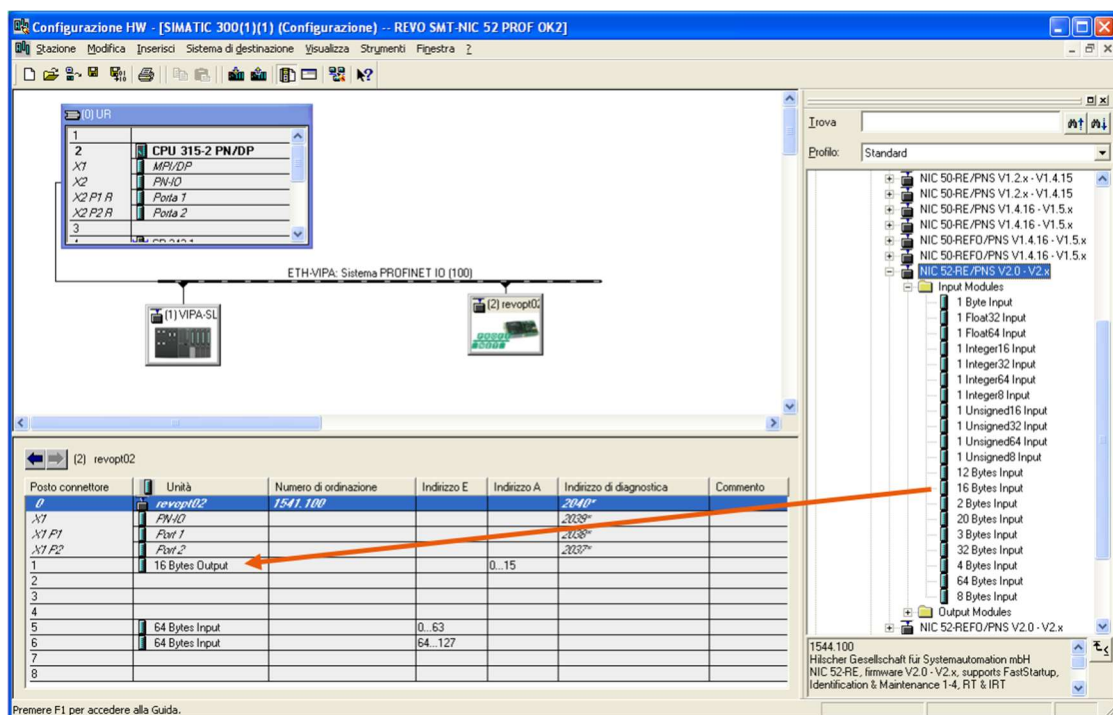
So it's possible to drag and drop it on the network



Then expand Input and output



And set Input and output with drag and drop



Set the configuration IP address and Name it with double-click on it



Fill the Device Name

N° di ord./firmware: 1541.100 / 1.2  
 Famiglia: PNS  
 Nome dispositivo: revopt02  
 File GSD: GSDML-V2.31-HILSCHER-NIC 5X-RE PNS-20150731.xml

Click on Ethernet

Proprietà - revopt02

Generale

Segla: nic50repns  
 NIC 50RE, firmware V1.2.x - V1.4.15, supports RT Communication.

N° di ord./firmware: 1541.100 / 1.2  
 Famiglia: PNS  
 Nome dispositivo: revopt02  
 File GSD: GSDML-V2.31-HILSCHER-NIC 5X-RE PNS-20150731.xml

Modifica versione...

Nodo del sistema PROFINET IO

Numero dispositivo: 2  
 Indirizzo IP: 192.168.100.199  
 Assegna indirizzo IP mediante IO Controller

Sistema PROFINET IO (100)  
 Ethernet...

Commento:

OK Annulla ?

Set the IP address

Proprietà - Interfaccia Ethernet nic50repns

Generale Parametri

Indirizzo IP: 192.168.100.199  
 Maschera sotto-rete: 255.255.255.0

Accoppiamento ad altra rete  
 senza router  
 con router  
 Indirizzo: \_\_\_\_\_

Sotto-rete:  
 --- non collegato/a in rete ---  
 ETHVIPA

Nuova...  
 Proprietà...  
 Cancella

OK Annulla ?

Then save and send the configuration to the PLC

Finally set the Name to the THYRISTOR unit with Siemens tools

Sistema di destinazione Visualizza Strumenti Finestra ?

- Carica nell'unità... Ctrl+L
- Carica nel PG...
- Carica identificazione unità...
- Carica identificazione unità nel PG...
- Unità guaste
- Stato dell'unità... Ctrl+D
- Stato di funzionamento... Ctrl+I
- Cancellazione totale...
- Imposta data e ora...
- Controlla/comanda
- Aggiorna firmware...
- Salva nome dispositivo nella memory card
- Ethernet
  - Modifica nodo Ethernet...
- PROFIBUS
  - Verifica nome dispositivo...
  - Assegna nome al dispositivo...
- Salva dati del service...

100)

[2] revopt02

## 2.3. PROFIBUS

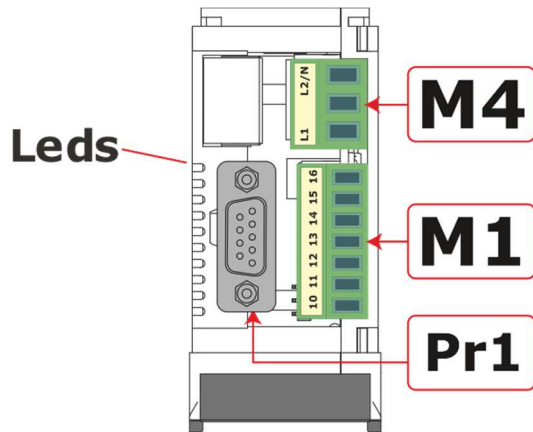
### 2.3.1. General description

The thyristor unit permit a data exchange via PROFIBUS-DP Siemens protocol.

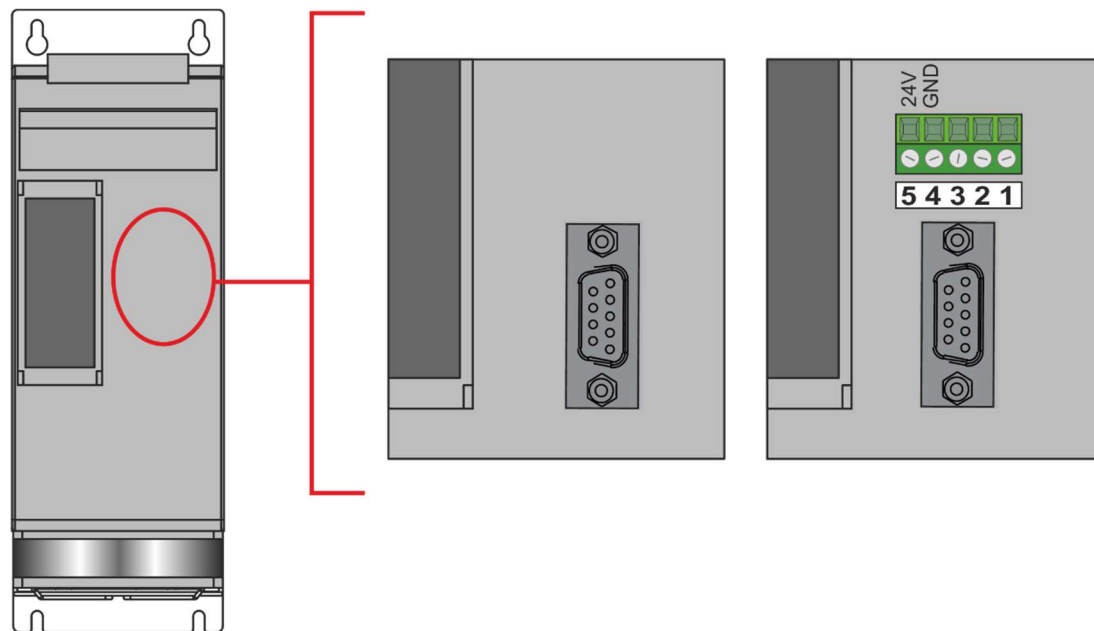
### 2.3.2. PROFIBUS Connection

#### 2.3.2.1. Communication Terminals 30-40A (SR9-SR10-SR11)

Ethernet Configuration Connectors

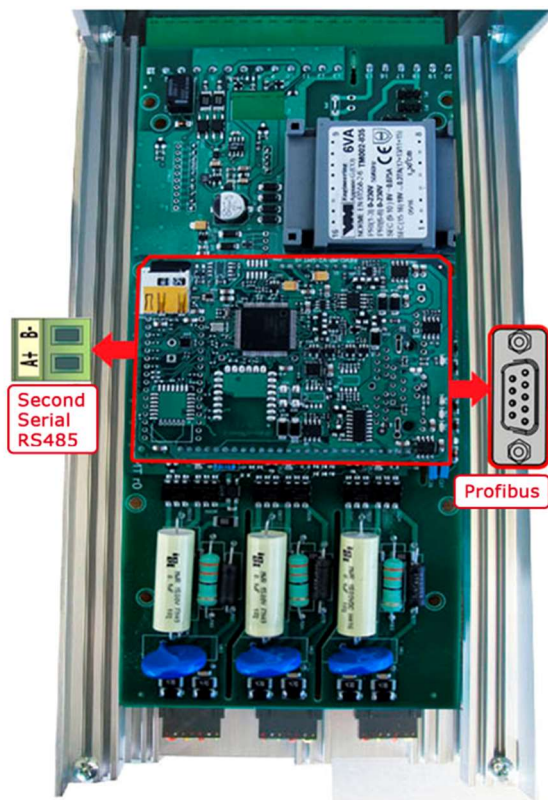


#### 2.3.2.2. Communication Terminals 60-210A (from SR12 to SR17)



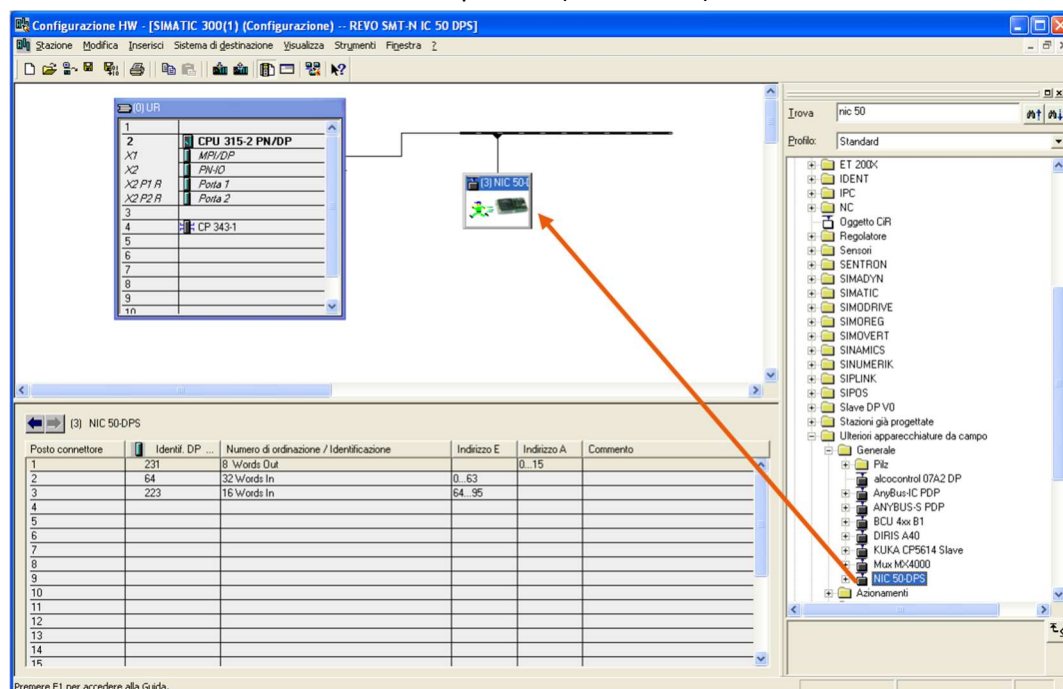
The LED status is internal

### 2.3.2.3. Communication Terminals 300-800A (from S12 to S17)

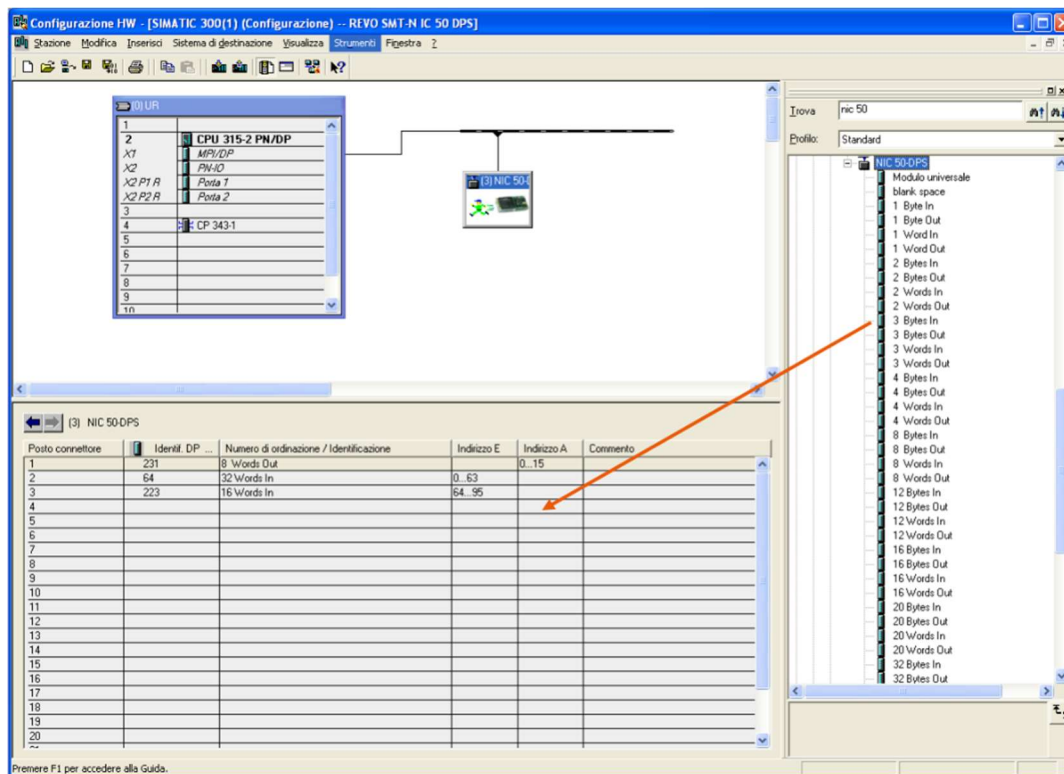


### 2.3.3. PLC Configuration

With PROFIBUS connection it's possible to read value in cyclic mode. To do it you need to use the GSD plc configuration file that describe the product, and install in PLC configuration software environment. If GSD file is not installed, please install it. If installed or after installation will be present (NIC 50-DPS)



And set Input and output with drag and drop



NOTE:

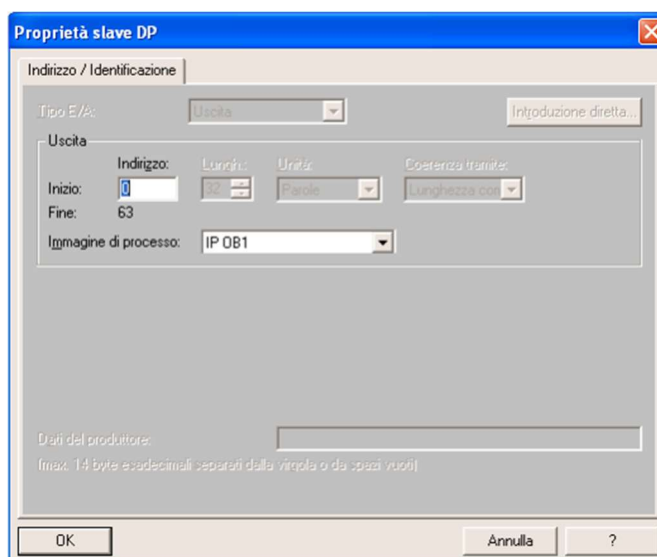
The module must have the right sequen

Posto connettore	Identif. DP ...	Numero di ordinazione / Identificazione	Indirizzo E	Indirizzo A	Comm
1	231	8 Words Out		0..15	
2	64	32 Words In	0..63		
3	223	16 Words In	64..95		
4					

The position is important, and:

- Position 1 must be 8 Word OUT
- Position 2 must be 32 Word IN
- Position 3 must be 16 Word IN

Then it's possible to assign the start address with a double click on it



## 2.4. Data Exchange Area

### 2.4.1. Read area

#### Columns

<b>Byte Bus Offset:</b>	The number of bytes from the "0" address to the parameter start address
<b>Word Bus Offset:</b>	The number of "Words" offset from the "0" address.
<b>Parameter Number:</b>	The Modbus parameter number (Is Input register, so to read the data you Must use function 4)
<b>Min:</b>	The minimum actual value of the parameter
<b>Max:</b>	The maximum actual value of the parameter
<b>Min UM:</b>	The minimum value translated to its unit of measurement
<b>Max UM:</b>	The maximum value translated to its unit of measurement
<b>UM:</b>	Unit of measurement
<b>1PH:</b>	Checked if available on a single phase unit
<b>2/3PH:</b>	Checked if available on a two/three phase unit

PROFIBUS PROFNET		MODBUS TCP	Min	Max	Min UM	Max UM	UM	1PH	2/3 PH	Description
Byte Bus Offset	Word Bus Offset	Parameter Number Func 4								
0	0	0 30001								Not used
2	1	1 30002								Not used
4	2	2 30003	0	65535	0	655.35	Hz	X	X	Main network frequency
6	3	3 30004	0	1023	0	1023	V	X	X	Rms Voltage or average Voltage of rms for multi- phase
8	4	4 30005	0	1023	0.0	102.3	A	X	X	RMS Current or Average RMS Current (multi-phase)
10	5	5 30006	0	1023	0	1023	%	X	X	RMS Power or Average RMS Power (multi-phase)
12	6	6 30007	0	1023	0	1023	Sw	X	X	<b>Status bitmask</b> See relative Tables Chapter Bit0 ShortCut Alarm Bit1 Heat Break Alam Bit2 ON/OFF unit Bit3 Not used Bit4 Current Limit Alarm Bit5 Thermal Alarm Bit6 Communication Alarm (WD) Bit7 Not used Bit8 Digital input 1 status Bit9 Digital input 2 status Bit10 Not used Bit11 Not used Bit12 Not used Bit13 Not used Bit14 Not used Bit15 Thermal Alarm Active



PROFIBUS PROFNET		MODBUS TCP									Description
Byte Bus Offset	Word Bus Offset	Parameter Number Func 4	Min	Max	Min UM	Max UM	UM	1PH	2/3PH		
14	7	7 30008	0	255	0	1023	Sw	X	0	<b>Command bitmask</b> Bit0 Not used Bit1 Digital Reference 0 = from analogue input 1 = from communication/ keyb. Bit2 unit enable 1 = Enable 0 = Disable Bit3 Not used Bit4 Current Limit Switch 0 = from analogue input 1 = from communication/ keyb. Bit5 Not used Bit6 Save Factory Bit7 Load Factory	
16	8	8 30009	0	1023	0.0	100.0	%	X	X	Remote setpoint for unit	
18	9	9 30010	0	255	0	100	%	X	X	How to scale the power set point	
20	10	10 30011	0	1023	0	100	%	X	No	Digital current limit value 0 = From analogue Input 1 = From communication/ keyb	
22	11	11 30012	0	1023	0	1023	V	X	X	Nominal load voltage.	
24	12	12 30013	0	9999	0	999.9	A	X	X	Nominal load Current.	
26	13	13 30014	0	4096	0	4096	A	X	X	Measured RMS Current - phase 1	
28	14	14 30015	0	4096	0	4096	A	No	X	Measured RMS Current - phase 2	
30	15	15 30016	0	4096	0	4096	A	No	X	Measured RMS Current - phase 3	
32	16	16 30017	0	65535	0	65535	V	X	X	AUX RMS input voltage	
34	17	17 30018	0	65535			kW	X	X	Real time power consumption calculation (includes power factor)	
36	18	18 30019	0	65535			kVA	X	X	Real Time power consumption calculation	
38	19	19 30020	0	65535			kW/h	X	X	Total count in kW/h	
40	20	20 30021	0	65535				X	X		
42	21	21 30022	0	1000	0	1000	ratio	X	X	Power Factor	
44	22	22 30023	0	1000	0	1000	ratio	No	X	(not used)	
46	23	23 30024	0	1000	0	1000	ratio	No	X	(not used)	
48	24	24 30025	0	1200	0	120	°C	X	X	Temperature of the SCR (if NTC, you will see the value) 0 = Okay 1 = Alarm	

PROFIBUS PROFNET		MODBUS TCP	Min	Max	Min UM	Max UM	UM	1PH	2/3PH	Description
Byte Bus Offset	Word Bus Offset	Parameter Number Func 4								
50	25	25 30026	0	65535	0	655.35	ohm	X	X	Calculated resistance of the load. Based on a calculation of the Vrms load voltage divided by the Irms load current. (Average Irms in multi-phase unit)
52	26	26 30027	0	65535	0	65535	ohm	X	X	Used for calibrating the calculation of resistance
54	27	27 30028	0	65535	0	65535	Sw	X	X	<b>Unit type (1PH, 2PH, 3PH)</b> 7 = Relay C 1PH 8 = Relay C 2PH 9 = Relay C 3PH 10 = Relay C 3PH
56	28	28 30029	0	1023	0	1023	V	X	X	Unit rating (max voltage rating for the product ex: 480, 600, 690)
58	29	29 30030	0	9999	0	9999	A	X	X	Thyristor Amperage Rating
60	30	30 30031	0	1023	0	1023	V	X	X	Calculated aux voltage
62	31	31 30032	0	1023	0	1023	Sw	X	Only ZC BF	<b>Firing mode options</b> Zero cross 1 Single Cycle 2 Burst Firing 3 Phase Angle 4 Phase Angle + Soft Start 20 Half Cycle 10 Burst Cycle + Soft Start 19 Burst Firing + Delay Trigger 35 Burst Firing + Delay Trigger + Safety Ramp Peak 227 Burst Firing + Delay Trigger + Saftyramp 99 Half Cycle + Soft Start 74
64	32	32 30033	0	1023	0	1023	Sw	X	X	<b>Control Mode (Feed-back)</b> See relative table Chapter VOLTAGE 32 VOLTAGE <sup>2</sup> 0 CURRENT 64 CURRENT <sup>2</sup> 2 POWER 128 NO_FEEDBACK 0
66	33	33 30034	0	1	0	1		X	No	Selector for the current limit 0 = RMS 1 = Peak
68	34	34 30035	0	65535	0	65535	-	X	X	Selects which analogue input is used for the SP input 0 = Analogue Input 1 1 = Analogue Input 2
70	35	35 30036	0	1000	0	100.0	%	X	X	Current value of analog input 1 in percent
72	36	36 30037	0	1000	0	100.0	%	X	X	Current value of analog input 2 in percent

PROFIBUS PROFNET		MODBUS TCP	Min	Max	Min UM	Max UM	UM	1PH	2/3PH	Description
Byte Bus Offset	Word Bus Offset	Parameter Number Func 4								
74	37	37 30038	0	5	0	5	Sw	X	No: 4.7	Defines the function activated when: 0 = Enable thyristor 2 = Change to V feedback 3 = Change digital reference from AI/communication 4 = Force PA firing 5 = Select reference 1/2 6 = LOG: function enable 7 = Bakeout enable 8 = Fast enable thyristor Digital Input 1
76	38	38 30039	0	5	0	5	Sw	X	No: 4.7	Defines the function activated when: 0 = Enable thyristor 2 = Change to V feedback 3 = Change digital reference from AI/communication 4 = Force PA firing 5 = Select reference 1/2 6 = LOG: function enable 7 = Bakeout enable 8 = Fast enable thyristor Digital Input 2
78	39	39 30040	0	65535	0	65535	Sw	X		Defines the function of the output relay Bit 0 HB alarm Bit 1 SC alarm Bit 2 LIM Alarm Bit 3 \\ Bit 4 Modbus Watchdog
80	40	40 30041	0	65535			X50 mS	X	No	Once the output turns off, how much time must pass before safety ramp will be reenabled
82	41	41 30042	0	65535			X50 mS	X	No	Time for the safety ramp
84	42	42 30043	0	1				X	No	Enable bakeout function 0 = off 1 = on
86	43	43 30043	0	9999			min	X	No	Bakeout total ramp time in minutes
88	44	44 30045	0	9999			A	X	No	Bakeout current limit
90	45	45 30046	0	9999			min	X	No	Time to wait while off before bakeout is needed again (time for the heater to cool)
92	46	46 30047	0	1				X	No	Start or stop data logging 0 = off 1 = on
94	47	47 30048	0	1			Sw	X	No	Enable the Wi-Fi 0 = off 1 = on

## 2.4.2. Write area

### Columns

<b>Byte Bus Offset:</b>	The number of bytes from the "0" address to the parameter start address
<b>Word Bus Offset:</b>	The number of "Words" offset from the "0" address.
<b>Parameter Number:</b>	The Modbus parameter number (Is Holding register, so to read the data you Must use function 4 so to write the data you Must use function 6 or 16)
<b>Min:</b>	The minimum actual value of the parameter
<b>Max:</b>	The maximum actual value of the parameter
<b>Min UM:</b>	The minimum value translated to its unit of measurement
<b>Max UM:</b>	The maximum value translated to its unit of measurement
<b>UM:</b>	Unit of measurement
<b>1PH:</b>	Checked if available on a single phase unit
<b>2/3PH:</b>	Checked if available on a two/three phase unit

PROFIBUS PROFNET		MODBUS TCP									Description
Byte Bus Offset	Word Bus Offset	Parameter Number Func 3/6/16	Min	Max	Min UM	Max UM	UM	1PH	2/3PH		
0	0	0 40001									Not used
2	1	1 40002									Not used
4	2	2 40003	0	255	0	1023	Sw	X	0	<b>Command bitmask</b> Bit0 Not used Bit1 Digital Reference 0 = from analogue input 1 = from communication/ keyb. Bit2 unit enable 1 = Enable 0 = Disable Bit3 Not used Bit4 Not used Bit5 Not used Bit6 Save Factory Bit7 Load Factory Bit8 Not used Bit9 Not used Bit10 Not used Bit11 Not used Bit12 Not used Bit13 Not used Bit14 Not used Bit15 Not used	
6	3	3 40004	0	1023	0.0	100.0	%	X	X	Remote set point for unit	
8	4	4 40005	0	255	0	100	%	X	X	How to scale the power set point	
10	5										



---

© PMA Prozeß- und Maschinen-Automation GmbH  
P.O.Box. 310 229, D-34058 Kassel, Germany  
Printed in Germany 9499-040-95911 (06/2019)