

• 15G9000B100 •

DCREG

DCREG interface via MODBUS-TCP

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English

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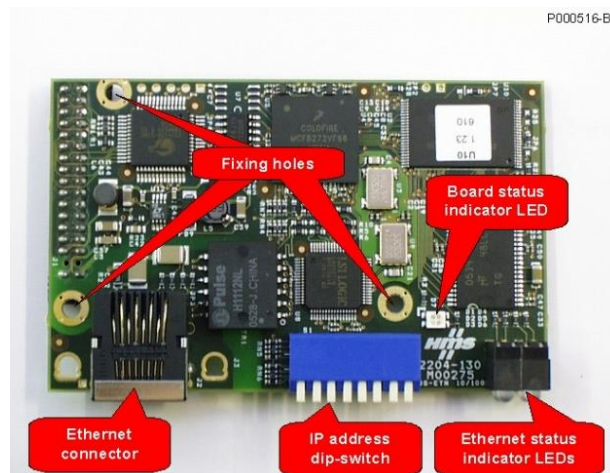
1 ETHERNET BOARD FOR MODBUS/TCP

Modbus/TCP communications board allows interfacing a drive to an external control unit with a communications interface operating with a Modbus/TCP Ethernet (IEEE 802) protocol complying with the Modbus-IDA V1.0 specifications. The IP rating for the communications board can be configured both through the on-board DIP-switches and automatically (network assignation through a DHCP protocol).

The communications board performs automatic negotiation with the mains if the baud rate is set to 10 or 100 Mbits/s.

The main features of the interface board are the following:

- Parameter configuration for Ethernet connection through DIP-switches, DHCP/BOOTP, ARP or internal Web server
- Modbus/TCP slave functions of class 0, class 1 and partially class 2
- Transparent socket interface for potential implementation of "over TCP/IP" dedicated protocols
- Ethernet interface galvanically isolated through a transformer



Via MODBUS TCP it is possible to

- read the parameters mentioned in the following 2.1 From master to DCREG.
- write the parameters mentioned in the following 2.2 From DCREG to master.

1.1 Ethernet Connector

The board is provided with a standard RJ-45 connector (IEEE 802) for Ethernet connection 10/100 (100Base-T, 10Base-T). The pin arrangement is the same as the one used for each network board computers are equipped with.

1.2 Connection to the Network

Ethernet interface board can be connected to an Ethernet control device with a Modbus/TCP master protocol (computer or PLC) through a LAN (Ethernet business network) or a direct point-to-point connection.

The board connection through a LAN is similar to a computer connection. Use a standard cable for a Switch or Hub connection or a Straight-Through Cable TIA/EIA-568-B of class 5 UTP (Patch cable for LAN).

1.3 Configuration of the Ethernet Board for Modbus/TCP

The first step in configuring the Ethernet interface board consists in communicating with the board through a computer in order to update the configuration file (etccfg.cfg) stored to the non-volatile memory of the board. The configuration procedure is different if you use a point-to-point connection to the computer, if the board is connected to a LAN that is not provided with a DHCP server and if the board is connected to a LAN that is provided with a DHCP server. The section below covers these types of connection:

- Point-to-point connection to the PC,
- A board connected to a LAN that does not require a DHCP server and
- A board connected to a LAN that requires the DHCP server.

Those connection modes are detailed below.

1.3.1 POINT-TO-POINT CONNECTION TO THE COMPUTER

If a point-to-point connection to the computer is used, first configure the network board of the computer by setting a static IP address as 192.168.0.nnn, where nnn is any number ranging from 1 to 254.

To set the static IP address with Windows 7, open the Network Properties folder (for example typing "LAN" in the quick search tab: see Figure 1); in the field for the properties of the TCP/IP protocol, set the address value, e.g. 192.168.0.1.

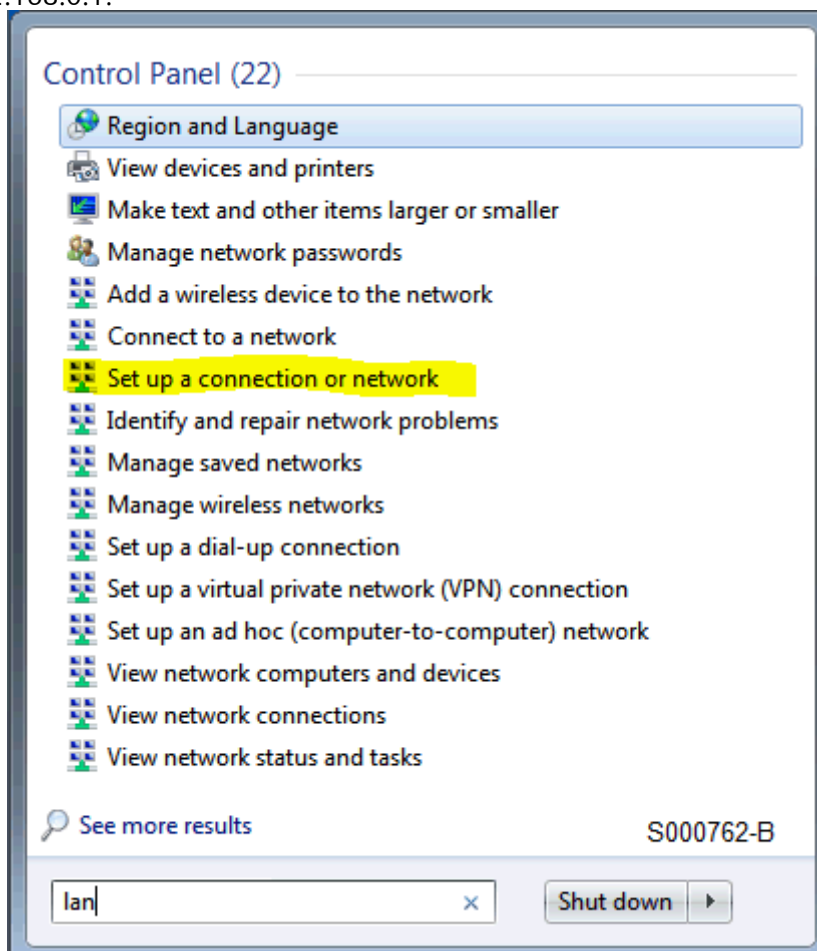


Figure 1: Windows 7 - Accessing directly to the network configuration folder

Figure 2 shows the correct setting of the TCP/IP v.4 on the PC when using Windows 7. Settings are very similar for computers running on other Windows versions.

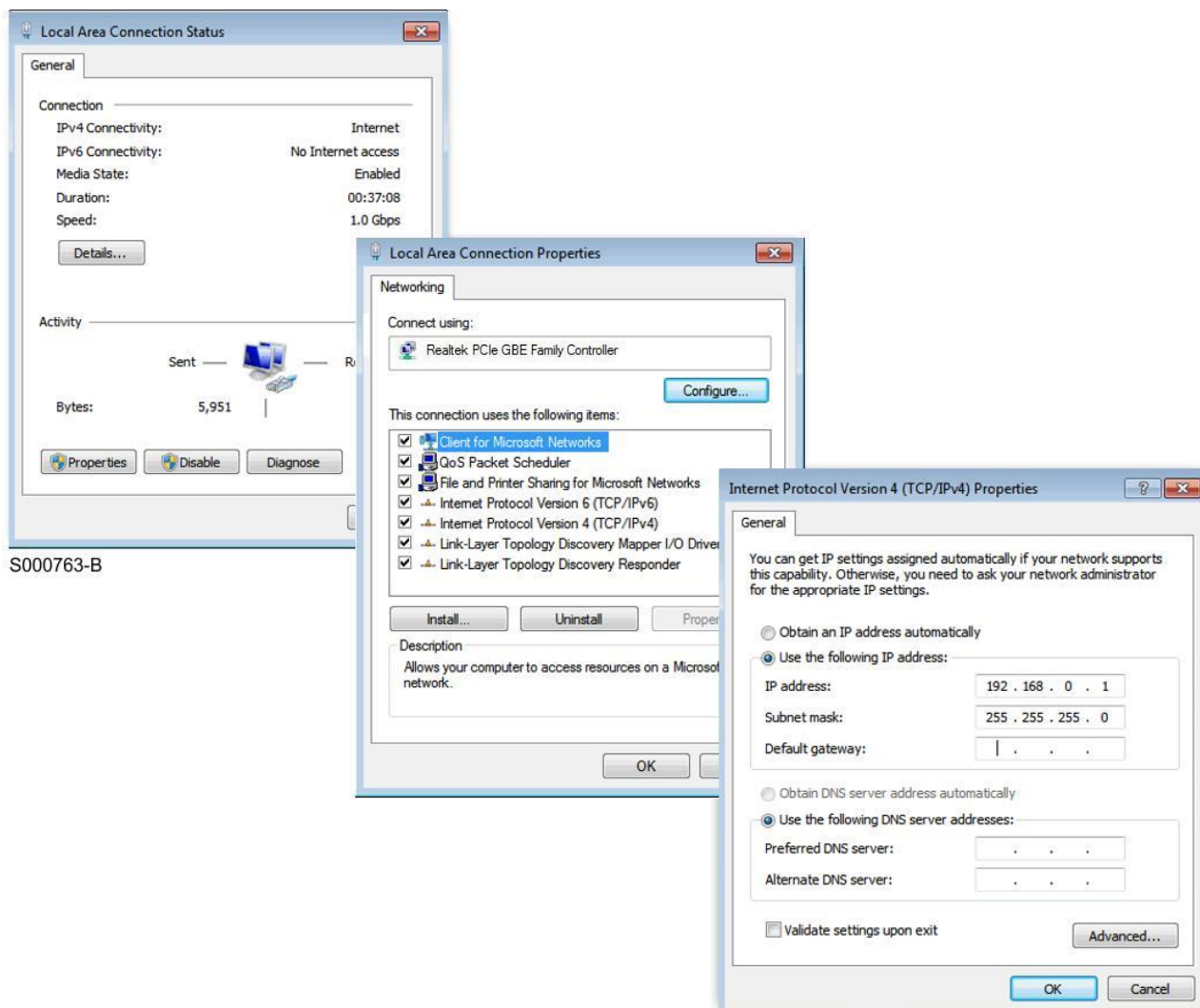


Figure 2: Setting a computer for a point-to-point connection to the inverter

After configuring your computer as described above, in the DIP-switches of the communications board set a binary number different from 0, different from 255 and different from the number set in the low portion of the IP address of the computer. For example, number 2 can be set by lowering (logic 1) only switch 7 as shown in the figure below.

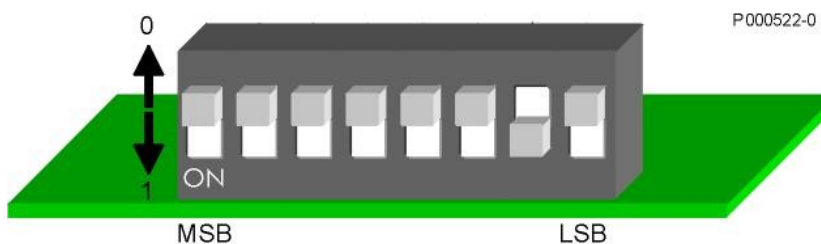


Figure 3: Setting the DIP-switches to set the IP address 192.168.0.2.

If the computer is connected to the inverter through a Cross-Over Cable, a local network is created, which is composed of two participant nodes (the computer and the inverter), with 192.168.0.1 and 192.168.0.2 as IP addresses respectively. When the inverter is powered on, the LINK LED (see below) in the interface board should turn on. The following command:

```
ping 192.168.0.2
```

launched by a command line window of the computer performs the correct connection to the board.

If the advanced configuration is required, the internal web server may be used. Enter the board IP address in the proper field from a popular browser. A configuration page opens, where different TCP/IP configuration parameters of the board can be set, as shown in Figure 4.

This procedure also allows setting other different IP addresses instead of the default addresses (the format is 192.168.0.nnn).

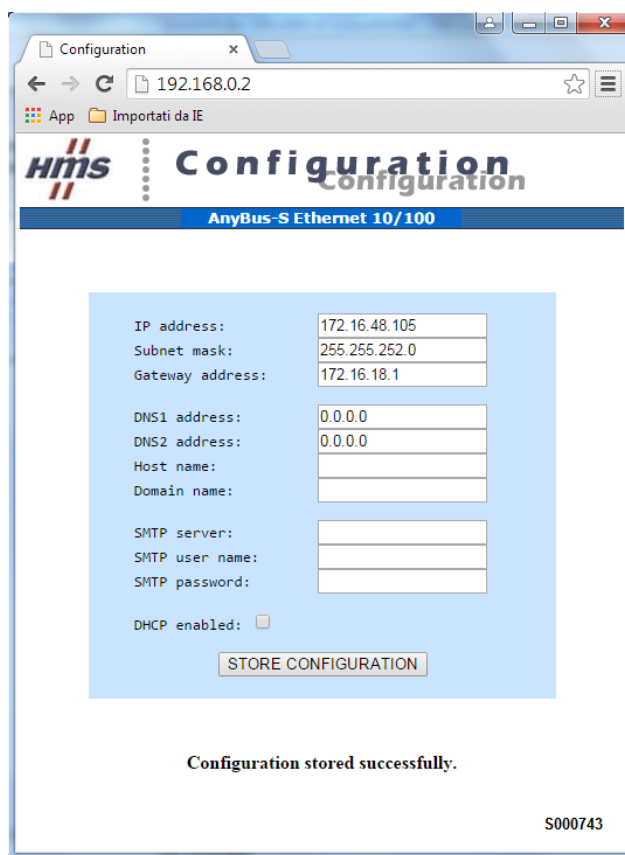


Figure 4: Internal webserver

1.3.2 CONNECTION WITH A COMPUTER THROUGH A LAN WITHOUT ANY DHCP SERVER

The network administrator will assign a static IP address for each inverter to be connected to the LAN.

Suppose that the IP address assigned from the administrator to an inverter is 10.0.254.177 and proceed as follows:

- Set all the DIP-switches in the Ethernet interface board to 0 ("up" position)
- Connect the board to a switch in the LAN using a Straight-Through cable and power on the inverter
- Make sure that the green light of the LINK LED (see below) comes on
- Note down the MAC address of the Ethernet board that is written on a label placed at the bottom of the printed circuit.

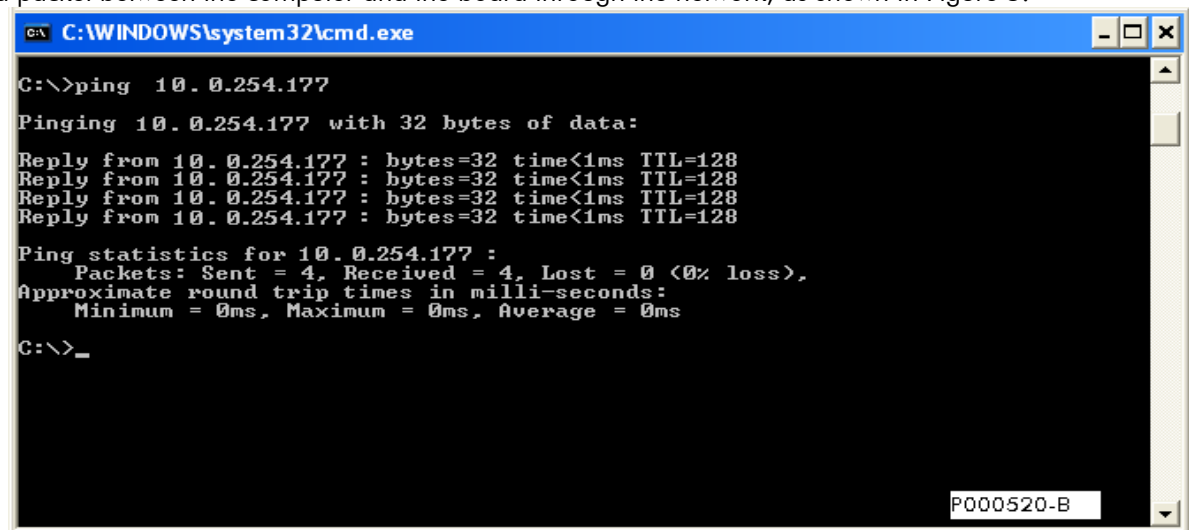
Suppose that the MAC address of the interface board is 00-30-11-02-2A-02

- In a computer connected to the same LAN (connected to the same sub-network, i.e. with an IP address equal to 10.0.254.xxx), open the command interpreter window and enter the following commands:

```
arp -s 10.0.254.177 00-30-11-02-2A-02
ping 10.0.254.177
arp -d 10.0.254.177
```

In the ARP table of the computer, the first command will create a static entry assigning the matching between the MAC address of the board and the static IP address.

The ping command queries the interface board to check the connection and returns the transit time of the data packet between the computer and the board through the network, as shown in Figure 5.



```
C:\WINDOWS\system32\cmd.exe
C:\>ping 10.0.254.177
Pinging 10.0.254.177 with 32 bytes of data:
Reply from 10.0.254.177 : bytes=32 time<1ms TTL=128
Reply from 10.0.254.177 : bytes=32 time<1ms TTL=128
Reply from 10.0.254.177 : bytes=32 time<1ms TTL=128
Reply from 10.0.254.177 : bytes=32 time<1ms TTL=128
Ping statistics for 10.0.254.177 :
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>_
```

Figure 5: Example of the ping command to the IP address of the inverter interface board

When the interface board is sent the data packet, it gets the MAC address-IP address match as a permanent match, then it compiles and saves an "ethcfg.cfg" file, where the IP address 10.0.254.177 is stored as its own address each time the inverter is turned on.

Command number 3 is optional and removes the static match IP-MAC related to the inverter Ethernet board from the ARP table of the inverter.

1.3.3 CONNECTION WITH A COMPUTER THROUGH A LAN EQUIPPED WITH A DHCP SERVER

If an inverter equipped with an Ethernet board is connected to the LAN and if all the DIP-switches are set to zero ("up" position), when the inverter is powered on, automatic negotiation with the DHCP server takes place and the inverter is assigned an IP address chosen among the available ones. This configuration is then stored to the "ethcfg.cfg" file.

The "Anybus IP config" utility, available for download from santerno.com, Software tab of the product sheet concerned, can be used to query all the inverters with an Ethernet interface in the LAN from the same computer and, if required, the network access parameters can be reconfigured. The figure below shows the page of the programme when an inverter is acknowledged. Multiple inverters can be identified from the same network through their own value of the MAC address.

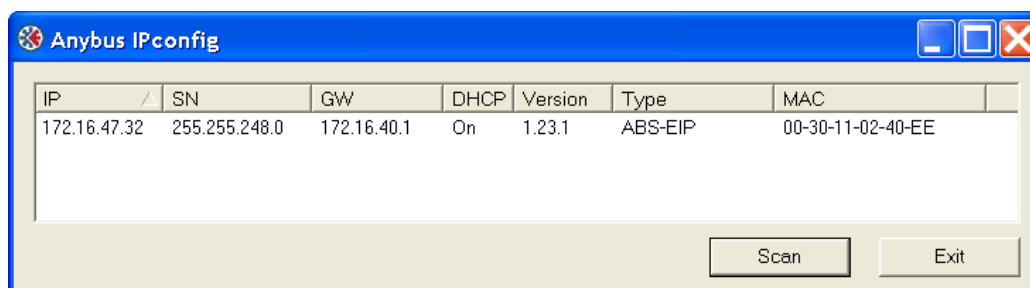


Figure 6: Anybus IP config utility

2 PARAMETER EXCHANGE

The following table shows the parameters of the DCREG exchanged through Modbus TCP

In each of the following are listed:

- 1) the number and the name of the parameter,
- 2) its meaning,
- 3) its range,
- 4) its unit of measure (shown on the display),
- 5) the ratio between the value inside the DCREG (exchanged via Profibus-DP) and the physical value represented (shown on the display).



NOTE

Unless otherwise specified, each parameter is exchanged as 16 bits signed integer (between -32768 and +32767).



NOTE

For further information on parameter configuration, refer to the "15P0059B3 OPERATION MANUAL DCREG2 DCREG4" R.07 Software Version D5.02.

2.1 From master to DCREG

1) Name	2) Configuration	3) Range	4) Unit of measure	5) Ratio
M016 FBRref	Speed / voltage reference from PROFIBUS	-100 ÷ +100	%	100 / 3FFFh
M019 AnOut1	Analog output 1 on terminal 8	-10 ÷ +10	V	10 / FFFh
M020 AnOut2	Analog output 2 on terminal 10	-10 ÷ +10	V	10 / FFFh
M022 MDO	Digital output state	00000xxxb ÷ 11111xxxb	Note A)	
P050 Ilim1A	First voltage limit bridge A	0 ÷ 300	%	1
P051 Ilim1B	First voltage limit bridge B	0 ÷ 300	%	1
not used				
M031 FBDigIn	Digital input state from PROFIBUS	00000000b ÷ 11111111b	Note B)	

2.2 From DCREG to master

1) Name	2) Meaning
temp	Note C)
M001 nFdbk	Speed / voltage feedback
M004 Iarm	Armature current
M006 Varm	Armature voltage
M010 AnIn1	Auxiliary analog input 1 at terminals 11 and 13
M011 AnIn2	Auxiliary analog input 2 at terminal 17
M012 AnIn3	Auxiliary analog input 3 at terminal 19
M026 EFreq	Encoder frequency

Note A)

Bit 3 → MDO5
Bit 4 → MDO1
Bit 5 → MDO2
Bit 6 → MDO3
Bit 7 → MDO4

Note B)

Bit 0 ENABLE
Bit 1 START
Bit 2 MDI1
Bit 3 MDI2
Bit 4 MDI3
Bit 5 MDI4
Bit 6 MDI5
Bit 7 MDI6

Note C)

The two 8-bit variables **AlarmNumber** and **Led** are mapped inside the variable **temp**. Its meaning is the following:

high part	low part
Led	Alarm Number

AlarmNumber has the following meaning:

Drive OK if **AlarmNumber** = 0;

Alarm = **AlarmNumber** if **AlarmNumber** ≤ 33;

Warning = **AlarmNumber**-33 if **AlarmNumber** > 33.

Led indicates the state of the LEDs on the remotable keyboard with the following map:

Bit 0 RUN
Bit 1 FORWARD
Bit 2 LOC SEQ
Bit 3 BRAKE
Bit 4 REF
Bit 5 REVERSE
Bit 6 LOC REM
Bit 7 I LIMIT

Note D)

DriveSize identifies the size of the armature circuit of DCREG within the range 10 ÷ 3500 A, as can be seen on the starting page of the remotable keyboard.

3 ALARM A028 COMMUNICATION INTERRUPTED

This alarm will come into action if the DCREG does not receive any valid message via PROFIBUS-DP within the timeout which can be set using parameter **C143 A028Delay**. This alarm can be inhibited using parameter **C159 A028Inhibit**.

4 DESCRIPTION OF THE MODBUS TCP MODULE

4.3 Indications

Each option fieldbus board of the Anybus-S series is equipped with a column provided with four LEDs installed on its front edge to monitor the bus status and with one LED (red/green) installed on the communications board for debugging, as shown in the figure below.

4.3.1 LEDs FRONTALLY MOUNTED

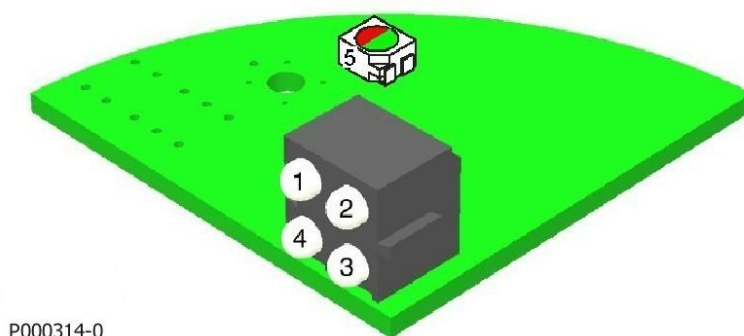


Figure 7: Position of indicator LEDs on the board

1. LINK
2. MODULE STATUS
3. NETWORK STATUS
4. ACTIVITY
5. BOARD DIAGNOSTICS

In the Modbus TCP board, the diagnostics LEDs indicate the status of the connection to the LAN:

Name	Function
1. LINK	Off – The module has not detected any legal carrier signal and is not in the LINK status On – The module has detected a legal carrier signal and is in the LINK status
2. MODULE STATUS	Off – The module is off Green – The module is properly operating Flashing green – The module was not configured and communication is in stand-by Flashing red – the module has detected a resettable event error Red – the module has detected an unresettable event error Flashing red/green – the module is performing a self-test at power on
3.NETWORK STATUS	Off – The IP address has not yet been assigned Green – At least one active Ethernet/IP connection is in progress Flashing green – No active Ethernet/IP connection is in progress Flashing red – “Timeout” of one or more links performed directly to the module Red – The module has detected that its IP is used by another device in the LAN Flashing red/green – The module is performing a self-test at power on
4. ACTIVITY	Flashing green – A data packet is being transmitted or received

4.3.2 LED ON THE BOARD

The LED located on the printed circuit of the Modbus TCP board indicates the status of the CPU dedicated to communication. The table below shows the possible type of signals:

Name	Function
5. BOARD DIAGNOSTICS	Red – Unknown internal error, or module operating in bootloader mode 1 Hz Red blinking – RAM fault 2 Hz Red blinking – ASIC or FLASH fault 4 Hz Red blinking – DPRAM fault 2 Hz Green blinking – Module not initialized 1 Hz Green blinking – Module initialized and operating.