LARTET

TECHNICAL MANUAL

DC Range (V2)

DC-10TH
DC-10R / DR'S-1X9

DC-41RTH
DC-22RT

DC-41RTHO
DC-23

DC-20TH
DC-23+D

1 Introduction

Our new DC range features a wide selection of environmental measurement displays, clocks with advanced functions and accident-free day displays.

In environmental measurement equipment, we have models that allow the simultaneous visualization of multiple variables; temperature, humidity and CO2, as well as models with a more compact design that display environmental variables alternately, oriented for those environments where space is limited.

Our clocks allow synchronization with time servers. Even in cases where it is not possible to connect to the network, we offer the option of GPS synchronization. With these functionalities, you can rest assured that your clocks will always display the correct time. We also have models that combine the watch with environmental measurements to cover all your needs.

Another area in which we focus our devices is; safety in the work environment. Accidents at work can be costly for companies in terms of medical care, compensation, and lost productivity, so any measures that help prevent them are crucial.

Within the DC range we will find accident-free days indicator models. These de are extremely important as they promote a culture of safety. By keeping a visible record of accident-free days, employees become more aware of their surroundings and potential risk situations, resulting in a safer, healthier, and more productive work environment.

From the point of view of versatility, our equipment not only offers a wide variety of communication interfaces; Ethernet, RS232, RS485, Wifi and communication protocols; TCP, UDP, MODBUS, ASCII, but they also feature a built-in web server that makes them extremely easy to set up and manage.

Find out how our devices can take connectivity and configuration to a new level in your work environment!

2 Models and Features

2.1 Features by Model

DC10TH

POWER SUPPLY

Supply voltage: 100 – 240 V AC (50/60 Hz)

Max Power: 15 W | **Power Minimum brightness:** 10.2 W

DISPLAY

3 digits of 7 segments of 100 mm height + symbol unit of measure

Visibility: 50 m

ENVIRONMENTAL CONDITIONS

Working temperature: -10 to 50 ºC

Storage temperature: -20 to 60 ºC

Humidity: 5 to 95% non-condensing

Maximum ambient lighting: 1000 lux

Degree of protection: IP 41

SENSOR (Temperature and Humidity)

Temperature measurement range: -10 to 90 ºC | Accuracy ≤ ±0.3 ºC

Humidity measurement range: 0 to 100 % | Accuracy ≤ ±2.5%

Temperature Resolution: 0.1 ºC | **Temperature Resolution:** 1%

DIMENSIONS AND WEIGHT

Width x Height x Depth: 440x240x60 mm

Approximate weight: 4.5 Kg

DC41RTH

POWER SUPPLY

Supply voltage: 100 – 240 V AC (50/60 Hz)

Max Power: 22.7 W | **Power Minimum brightness:** 10.9 W

DISPLAY

Time: 4 digits of 7 segments of 100 mm height + colon

Temperature: 3 digits of 7 segments of 100 mm height

Humidity: 2 digits of 7 segments of 100 mm height

Visibility: 50 m

ENVIRONMENTAL CONDITIONS

Working temperature: -10 to 50 ºC

Storage temperature: -20 to 60 ºC

Humidity: 5 to 95% non-condensing

Maximum ambient lighting: 1000 lux

Degree of protection: IP 41

SENSOR (Temperature and Humidity)

Temperature measurement range: -10 to 90 ºC | Accuracy ≤ ±0.3 ºC

Humidity measurement range: 0 to 100 % | Accuracy ≤ ±2.5%

Temperature Resolution: 0.1 ºC | **Temperature Resolution:** 1%

DIMENSIONS AND WEIGHT

Width x Height x Depth: 440x720x60 mm

Approximate weight: 8 Kg

DC41RTHO

POWER SUPPLY
Supply voltage: 100 – 240 V AC (50/60 Hz)
Max Power: 27 W | **Power Minimum brightness:** 11.1 W
DISPLAY
Time: 4 digits of 7 segments of 100 mm height + colon
Temperature: 3 digits of 7 segments of 100 mm height
Humidity: 2 digits of 7 segments of 100 mm height
CO2: 4 digits of 7 segments of 57 mm height
Visibility: 50 m
ENVIRONMENTAL CONDITIONS
Working temperature: -10 to 50 ºC
Storage temperature: -20 to 60 ºC
Humidity: 5 to 95% non-condensing
Maximum ambient lighting: 1000 lux
Degree of protection: IP 41
SENSOR (Temperature, Humidity and CO2)
Temperature measurement range: -10 to 70 ºC | Accuracy = ±0.4 ºC
Humidity measurement range: 0 to 95 % | Accuracy ≤ ±3%
CO2 Measurement Range: 0 to 10000 ppm | Accuracy = ±30ppm + 3% MV
Res. temperature: 0.1 ºC | **Res. moisture:** 1% | **CO2 Res.**: 1 ppm
DIMENSIONS AND WEIGHT
Width x Height x Depth: 440x720x60 mm
Approximate weight: 8 Kg

DC20TH

POWER SUPPLY
Supply voltage: 100 – 240 V AC (50/60 Hz)
Max Power: 17.4 W | **Power Minimum brightness:** 10.3 W
DISPLAY
Temperature: 3 digits of 7 segments of 100 mm height
Humidity: 2 digits of 7 segments of 100 mm height
Visibility: 50 m
ENVIRONMENTAL CONDITIONS
Working temperature: -10 to 50 ºC
Storage temperature: -20 to 60 ºC
Humidity: 5 to 95% non-condensing
Maximum ambient lighting: 1000 lux
Degree of protection: IP 41
SENSOR (Temperature and Humidity)
Temperature measurement range: -10 to 90 ºC | Accuracy ≤ ±0.3 ºC
Humidity measurement range: 0 to 100 % | Accuracy ≤ ±2.5%
Temperature Resolution: 0.1 ºC | **Temperature Resolution:** 1%
No. of measuring channels: 1 to 4 sensors
DIMENSIONS AND WEIGHT
Width x Height x Depth: 518x320x60 mm
Approximate weight: 8 Kg

DC10R

POWER SUPPLY

Supply voltage: 100 – 240 V AC (50/60 Hz)

Max Power: 15.6 W | **Power Minimum brightness:** 10.3 W

DISPLAY

Time: 4 digits of 7 segments of 100 mm height + two dots

Visibility: 50 m

ENVIRONMENTAL CONDITIONS

Working temperature: -10 to 50 ºC

Storage temperature: -20 to 60 ºC

Humidity: 5 to 95% non-condensing

Maximum ambient lighting: 1000 lux

Degree of protection: IP 41

DIMENSIONS AND WEIGHT

Width x Height x Depth: 440x240x60 mm

Approximate weight: 4.5 Kg

DR-1X9

POWER SUPPLY

Supply voltage: 100 – 240 V AC (50/60 Hz)

Max Power:
- **DR-109:** 13.2 W
- **DR-119:** 15.6 W
- **DR-189:** 34.2 W

Power Minimum brightness:
- **DR-109:** 8.7 W
- **DR-119:** 10.3 W
- **DR-189:** 22.7 W

DISPLAY

Time: 4 digits of 7 segments of 100 mm height + colon

Visibility:
- **DR-109:** 25 m
- **DR-119:** 50 m
- **DR-189:** 90 m

ENVIRONMENTAL CONDITIONS

Working temperature: -10 to 50 ºC

Storage temperature: -20 to 60 ºC

Humidity: 5 to 95% non-condensing

Maximum ambient lighting: 1000 lux

Degree of protection: IP 41, **IP65 Optional.**

DIMENSIONS AND WEIGHT

Width x Height x Depth:
- **DR-109:** 288x122x120 mm
- **DR-119:** 504x177x120 mm
- **DR-189:** 820x251x120 mm

Approximate weight:
- **DR-109:** 3 Kg
- **DR-119:** 5.1Kg
- **DR-189:** 7.7Kg

DC22RT

POWER SUPPLY
Supply voltage: 100 – 240 V AC (50/60 Hz)
Max Power: 20 W | **Power Minimum brightness:** 10.7 W
DISPLAY
Time: 4 digits of 7 segments of 100 mm height + colon
Temperature: 3 digits of 7 segments of 100 mm height
Humidity: 2 digits of 7 segments of 100 mm height
Visibility: 50 m
ENVIRONMENTAL CONDITIONS
Working temperature: -10 to 50 ºC
Storage temperature: -20 to 60 ºC
Humidity: 5 to 95% non-condensing
Maximum ambient lighting: 1000 lux
Degree of protection: IP 41
SENSOR (Temperature and Humidity)
Temperature measurement range: -10 to 90 ºC | Accuracy ≤ ±0.3 ºC
Humidity measurement range: 0 to 100 % | Accuracy ≤ ±2.5%
Temperature Resolution: 0.1 ºC | **Temperature Resolution:** 1%
No. of measuring channels: 1 to 4 sensors
DIMENSIONS AND WEIGHT
Width x Height x Depth: 518x320x60 mm
Approximate weight: 4.5 Kg

DC23

POWER SUPPLY
Supply voltage: 100 – 240 V AC (50/60 Hz)
Max Power: 10.3 W | **Power Minimum brightness:** 15.6 W
DISPLAY
4 digits of 7 segments of 100 mm height
Visibility: 50 m
ENVIRONMENTAL CONDITIONS
Working temperature: -10 to 50 ºC
Storage temperature: -20 to 60 ºC
Humidity: 5 to 95% non-condensing
Maximum ambient lighting: 1000 lux
Degree of protection: IP 41
DIMENSIONS AND WEIGHT
Width x Height x Depth: 518x320x60 mm
Approximate weight: 4.5 Kg

DC23D

POWER SUPPLY
Supply voltage: 100 – 240 V AC (50/60 Hz)
Max Power: 26 W | **Power Minimum brightness:** 13.5 W
DISPLAY
Date/Record days: 6 digits of 7 segments of 57 mm height
Accident-free days: 4 digits of 7 segments of 57 mm height
Visibility: 50 m
ENVIRONMENTAL CONDITIONS
Working temperature: -10 to 50 ºC
Storage temperature: -20 to 60 ºC
Humidity: 5 to 95% non-condensing
Maximum ambient lighting: 1000 lux
Degree of protection: IP 41
DIMENSIONS AND WEIGHT
Width x Height x Depth: 518x320x60 mm
Approximate weight: 4.5 Kg

2.2 Relay output features

The following features are common to all models

Relay Type:	Switched Contact (SPDT)
Number of relays per device:	2
Maximum voltage:	250 VAC, 30 VDC
Maximum Current (Resistive Load):	Normally Open Contact (NO) : 5 A Normally Closed Contact (NC): 3 A

3 Equipment Installation

3.1 Fixing the equipment to the wall

The displays of the DC range can be fixed to the wall in two ways:

1) **Hanged**: Identify the display model in the Fig. 3.1 and place 2 of those supplied at the distance W indicated on the Board 3.1, allowing the screw head to protrude by about 4 mm. Hang the display through the top slot following the zig-zag.
2) **Screwed:** Remove the front cover from the methacrylate. Place the 4 dowels according to the measurements indicated on the Board 3.1. Place the 2 screws on the top letting the head come out about 4 mm. Hang the display through the top slot following the zig-zag. Place the screws at the bottom and screw in the 4 screws. Replace the front cover.

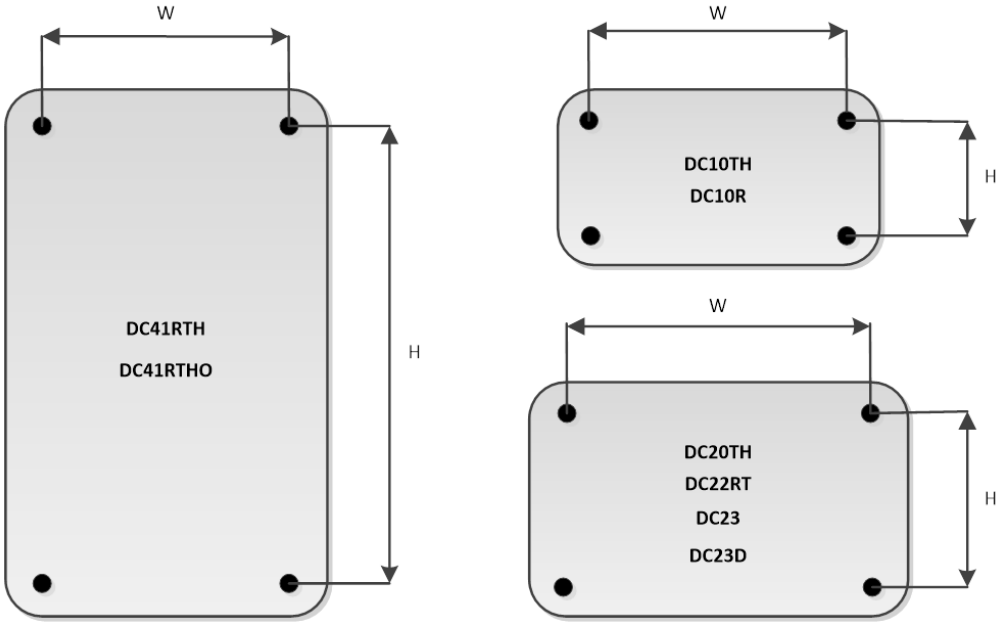


Fig. 3.1 Formats by diplay Model

Models	W	H
DC41RTH, DC41RTHO	314 mm	695 mm
DC10TH, DC10R	314 mm	215 mm
DC20TH, DC22RT, DC23, DC23D	410 mm	289 mm

Board 3.1 Clamping dimensions per model

3.2 Equipment power

The equipment must be powered in the range of 100 to 240 VAC, 50/60 Hz. A Schuko type plug with an earth connection must be used.

If the power cable needs to be extended, the device has an internal power strip for connecting the new extended cable.

3.3 Internal connections

The display's controller card is equipped with a series of connectors that simplify connections.

Through these connectors, communication cables with external devices, environmental measurement sensors, etc., will be connected.

The factory equipment already comes with all the elements connected. The user will only need access to these connectors if they want to make some kind of connection with the internal relays or want to connect a serial communication cable with the visualizer.

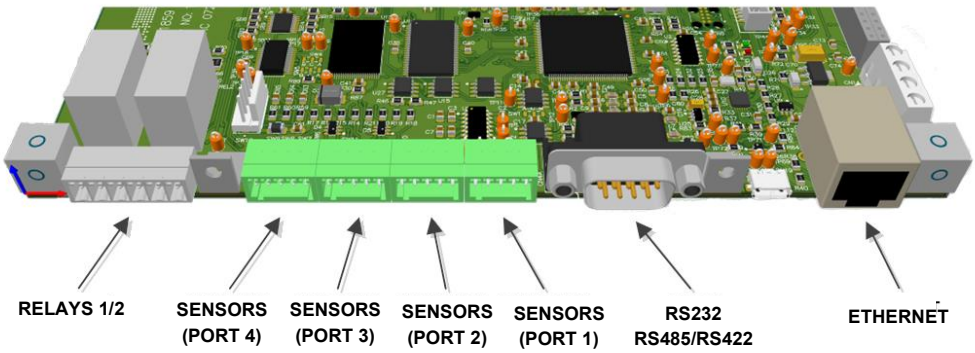


Fig. 3.2 Connections to the controller board

3.3.1 Ethernet

Ethernet connection port to connect the equipment to the company's wired network.

Equipment is usually supplied with a small Ethernet cable extension, so it is not necessary to open the equipment to access this connector.

The Ethernet connection is necessary to access the web server of the display and configure its operating parameters (especially on the first connection with the equipment).

3.3.2 Serial Line (RS232/RS485 [RS422])

The displays in the DC range allow connection to external devices via the RS-232 and RS-485 interfaces, or RS-232 and RS-422 if the device with this option has been ordered to replace the RS-485 interface.

The selection between interfaces will be made through the web server of the display.

In the Fig. 3.3 The signal mapping is displayed on the connector.

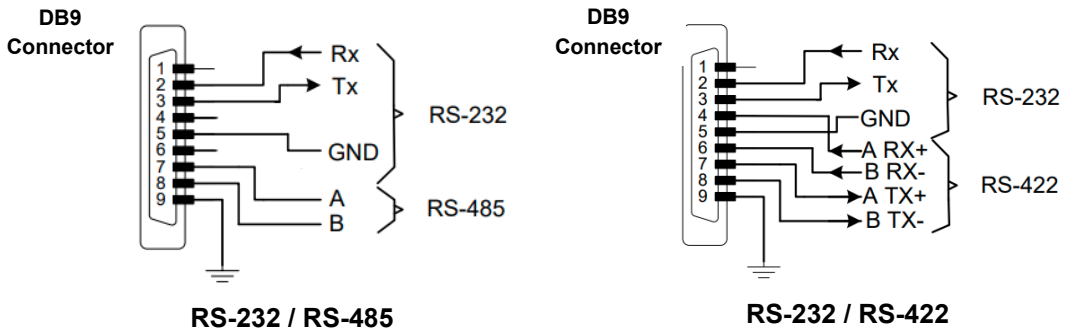


Fig. 3.3 Assigning signals on the connector

3.3.2.1 RS-232 connection between a PC and a DC range display

Use a cable of appropriate length for this type of communication. For a communication speed of 9600 bps this length should not exceed 15 m. If the communication speed is higher, this length should still be lower.

Keep the data cable away from sources of electrical noise such as frequency converters or welding machines that may cause interference in communication and use shielded cable whenever possible, connecting the screen mesh to pin 9 of the connector.

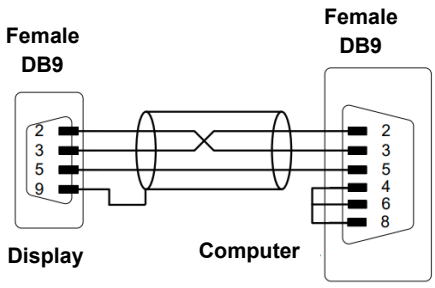


Fig. 3.4 RS-232 communication between devices

3.3.2.2 RS-485 connection between a PC and a DC range display

RS-485 communication allows greater distances to be covered than RS-232 communication. Under no circumstances should a length of 1000 m be exceeded if repeaters are not available.

It is recommended to use braided and shielded cable, connecting the screen mesh to pin 9 of the DB9 connector, to have greater immunity to external interference.

In this type of communication, it is advisable to terminate the ends of the communication line with termination resistors of a value equivalent to the characteristic impedance of the transmission line (R=120 Ω for braided cable), since in this way reflections are attenuated and the distortion of the transmitted data is minimized, allowing greater speed in communication and line length.

Networks or communication lines of short length (up to 100 m) operating at low speed (up to 19200 bps) will function properly without the need for termination resistors.

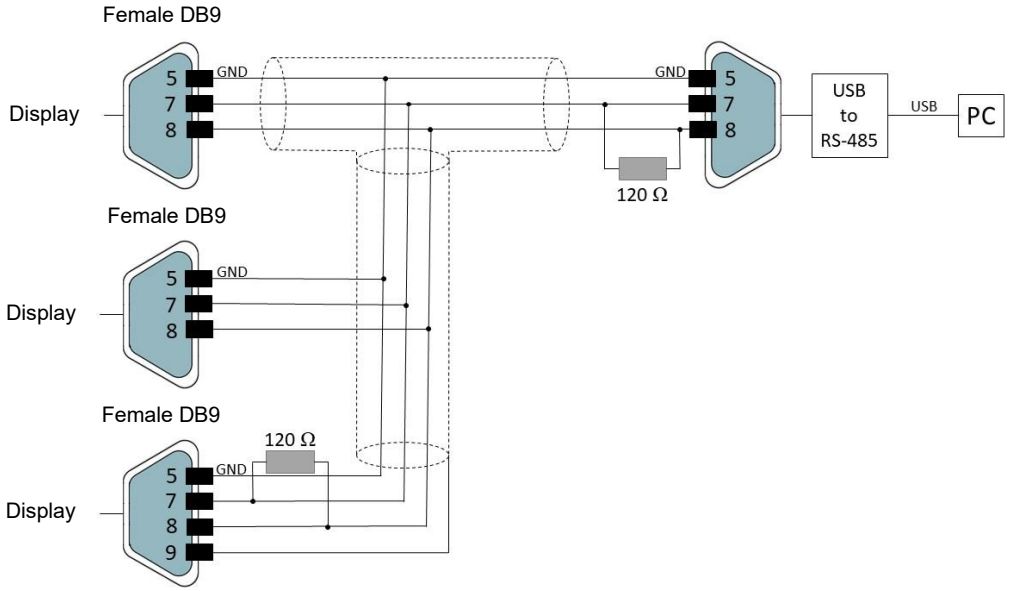


Fig. 3.5 RS-485 communication between a PC and 3 displays

3.3.3 Sensors

The DC20TH is the only model that supports up to 4 temperature and humidity sensors that can be connected interchangeably into any of the dedicated sensor ports. This model also allows individual calibration of each sensor, so if there is more than one sensor connected it is especially useful to identify the port of the sensor being calibrated in order to adjust the compensation parameter on the correct sensor (see section 4.3.4.2).

The remaining models only support one sensor and it must be plugged into **PORT 1**. If connected to another port, the sensor will not be recognized.

3.3.4 Relays

All models in the DC range have 2 relays (SPDT) to connect/disconnect devices. It is important to comply with the power characteristic indicated in the 3.3.4 to avoid damaging them. The NO (Normally Open), C (Common), and NC (Normally Closed) contacts are listed below:

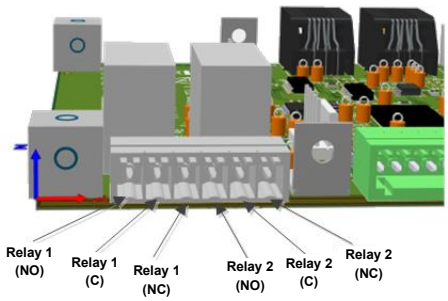


Fig. 3.6 Identification of internal relay terminals

3.3.5 GPS

GPS is only available if the equipment has been ordered with this option. GPS equipment is supplied with an antenna and a 5 m extension cable connected to the antenna input of the controller board.

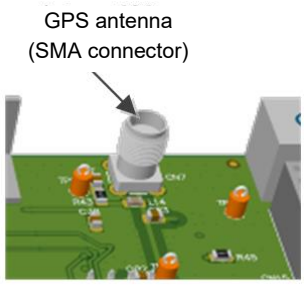


Fig. 3.7 GPS antenna connector

Whenever possible, the GPS antenna should be placed outside, in a high and clear place, avoiding obstacles and sources of electromagnetic interference. The clearer the view towards the horizon, the better the signal reception, so it is very important to avoid the presence of nearby obstacles, such as tall buildings, dense trees or metal structures, which can block or interfere with GPS signals.

The GPS antenna includes a magnet, so it is easy to attach to ferromagnetic materials such as window grilles and the outside of metal roofs (roofs or facades) made of galvanized steel.

3.4 Start-up

Before connecting the display to the mains, we must make sure that all connections have been made correctly and that the display is firmly in place.

During the boot process, the following sequence will be observed:

(1) **"bP0" message**: Each time the device is powered and before starting the main program, an access time is established to the Bootloader (update load manager) that will allow a failed FW update process to be retried. This functionality allows you to solve situations where a FW update has not completed correctly or an erroneous FW has been loaded that can cause the display to become inoperative. The time interval in which the message "**bP0**" is displayed, indicates the time at which the update can be repeated by the emergency IP address **192.168.1.100** (not by the IP address that was previously defined on the computer).
(2) **Frontal test sequence:** In this stage, all the segments of the digits are activated one by one. They are then deactivated in reverse order. This sequence is used to detect segments that stop working over the years.
(3) **hXX:** Shows the hardware ID (XX) of the display.
(4) **uX.X**: Shows the firmware version of the device. On devices that have fronts with rows of digits, stages (3) and (4) are displayed in a single step.
(5) **Display Started**: Shows the display information. On those models that have sensors, if the sensor is not properly connected or there is some type of anomaly in the sensor, an error message will be indicated. The DC20 model has a repeater mode (see section 4.3.4.3), if it is in this mode, until the display receives the first piece of data, the device will indicate "---".

The displays are factory configured with IP 10.30.90.11 for the wired network. If you connect the display directly to a PC and configure the computer's network settings with an IP that is within the same range as the display's IP (e.g. 10.30.90.100). When you open the browser and type the factory IP of the visualizer, you will access the webserver to make the first configuration. It is also possible to configure it by WIFI, although in this case the IP is different (see section 4.1.4)

To make the setup process easier and more flexible, we recommend downloading our "Display Discoverer" app (https://www.lartet.com/en/download-center/). Through "Display Discoverer" we will be able to detect any display that is on the network (as long as the PC where the application is running is connected to the same network). In the current version of the app, it will only detect displays that are connected via wired network.

3.5 Setup with Display Discoverer

When you open the application, if one or more displays are connected to the network, they will be detected and displayed in the application.

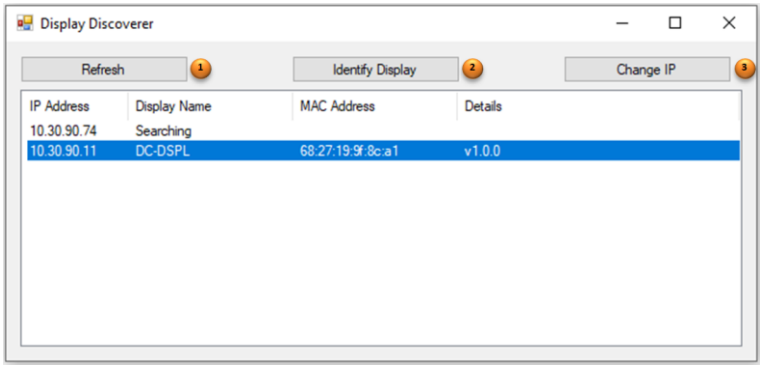


Fig. 3.8 Displays detected with "Display Discoverer"

1. Clicking on "Refresh" re-scans the network for new displays. If we add a new device or change the IP of any of the connected devices, clicking on this button will update the information
2. If we have several displays connected to the network and we select one of the rows of detected displays, when we press "Identify Display", the information that is showing the display will blink three times. In this way, it will be possible to verify that the webserver we are going to access corresponds to the physical unit that we want to configure.
3. Clicking on "Change IP" will access the submenu to assign a new IP to the device or press the "Auto-Assign IP" button to obtain it automatically.

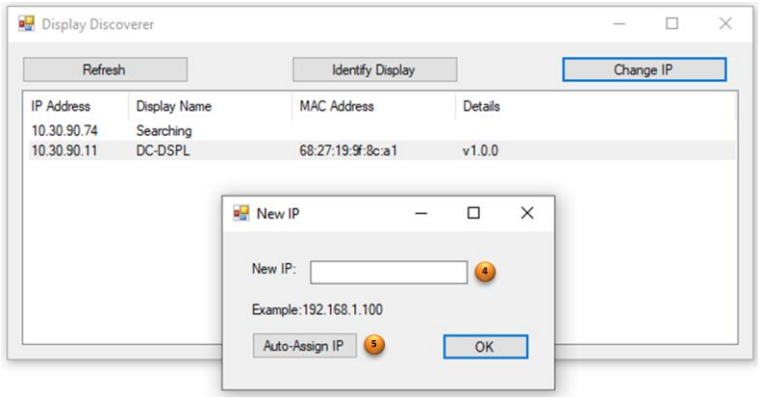


Fig. 3.9 Assigning a new IP

4. Field to enter the new IP. Pressing the "OK" button will update the device with the new IP. It is necessary to press the "Refresh" button again, to see the new changes reflected in the list of detected displays.

5. Pressing this button will automatically set the "DHCP" mode on the display and get an automatic IP from the server. It is necessary to press the "Refresh" button again, so that the application detects the display with the new IP assigned.

Double-clicking on any row of the detected displays will open the default browser and you will be taken directly to the main page of the webserver.

IMPORTANT:

If several new devices are received for installation, it must be taken into account that they will all be configured with the same IP address, so prior to their configuration, the IP of some devices must be changed individually to avoid duplicate addresses.

4 Display Settings

To configure the equipment, it is only necessary to access the internal web server of the device and customize the different parameters according to the specific needs of the user.

To do this, it is necessary to connect the display to the company's Ethernet network and configure it from any computer connected to the network. The IP access to the web server will be obtained with the application *Display Discoverer* (see section 3.5) that will locate the different connected equipment, easily accessed with a *Double click* to the web server of the selected device.

It is also possible to configure and use the display via WIFI connection. The WIFI connection has its own IP address (which to avoid duplication of equipment on the network, must be different from the Ethernet address). The current version of the *Display Discoverer app* only locates devices connected via wired network, not those connected via WIFI. Therefore, if the IP address defined for the WIFI connection is unknown, it will be necessary to connect the equipment via a wired network and see the IP address defined in the WIFI settings.

The device internal web server provides an intuitive and easy-to-use environment to customize the different configuration parameters; network settings, operation, communication interfaces, etc. At the same time, it also allows you to remotely view data represented in the display.

Below, we detail the different sections in which the internal server is structured and where to locate the different configuration parameters.

4.1 Web server configuration and localization parameters

All the displays in the DC range have the same web server structure, that is, sections and parameters that are common to all the models in the range and which we will call static *structure* and a *dynamic* part that corresponds to specific sections and parameters that are only available to certain models and that we will refer to in specific sections in this manual.

Broadly speaking, the static structure of the web server is composed of the following sections:

- **Overview:** A web server entry page that displays information about the model and the values represented by the display
- **Global Settings:** Global settings of the device.
- **Network Settings:** Network settings for wired connection.
- **WIFI Settings:** Network Settings for Wireless Connection
- **Communication:** Specific settings of the communication interface defined on the Global Settings page. The information displayed on this page is different depending on the communication interface selected.

The following sections describe the configuration settings in each of these sections.

4.1.1 Overview

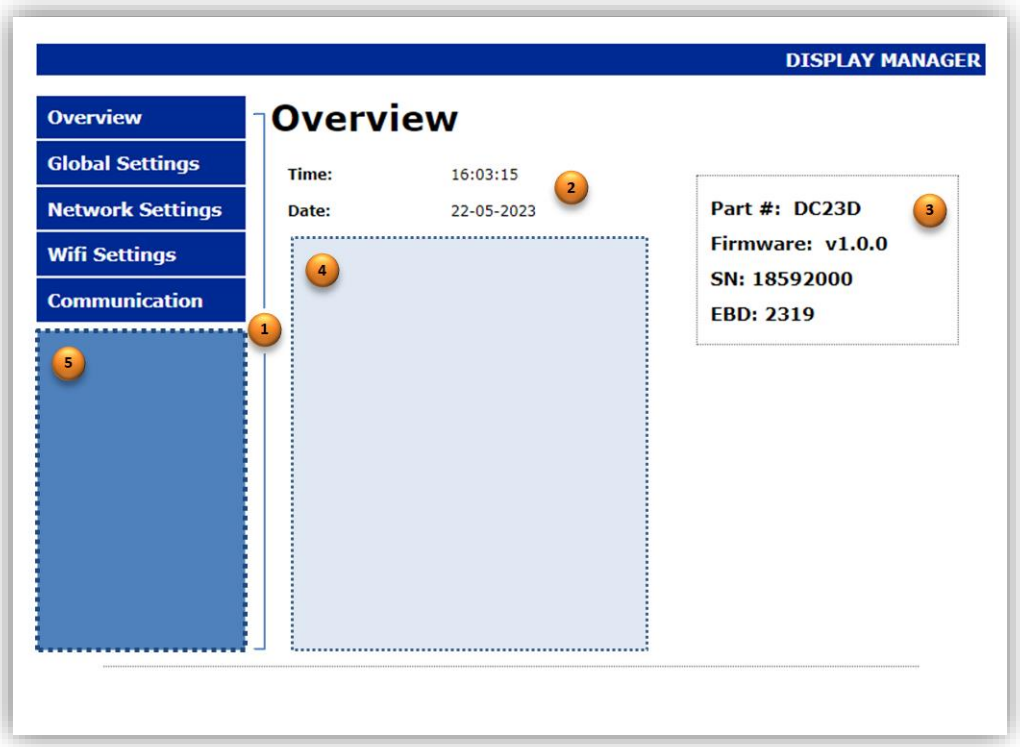


Fig. 4.1 Web server login page. Overview

1. Navigation menu to access the different sections on the web server
2. Shows time information from the device's internal clock
3. Equipment identification record, especially useful when contacting the technical assistance service for the resolution of incidents.
4. Dynamic information area; The information represented by the display will be displayed. Depending on the characteristics of the equipment, there will be a greater or lesser number of variables represented. (see the section where the specific model is described for more details)
5. Dynamic Links Area; Some models have additional sections for the parameterization of the device. (see the section where the specific model is described for more details)

4.1.2 Global Settings

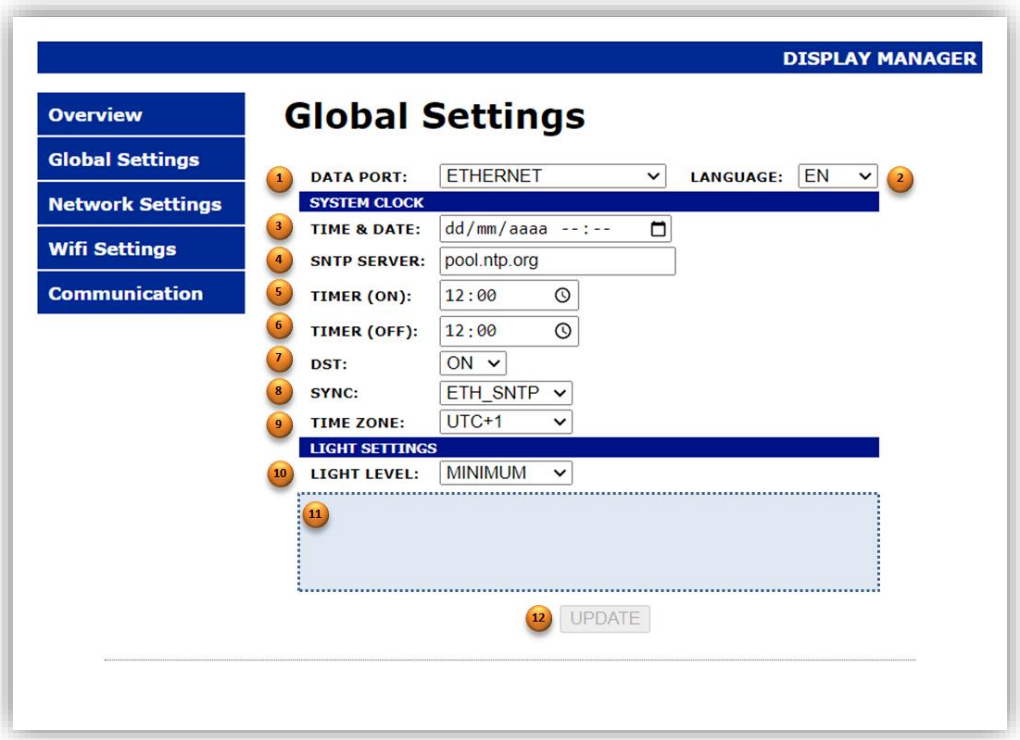


Fig. 4.2 Global equipment settings

1. The display has the communication interfaces; Serial, Ethernet and Wi-Fi for command-based communication with an external PC/PLC (see section 4.3 where the different models in the DC range are described for more details). This selector allows you to select the desired interface
2. Select the language of the web server. It is currently only available in English.
3. Set the date and time of the device's internal clock. If you press the *calendar icon* located on the far right of the control, a calendar and contextual clock opens that facilitates time adjustment, even allowing you to update the date and time based on the time information of the device from which you are accessing the web server.
4. Time server SNTP address/domain to have the device's internal clock permanently set to time.
5. The display has an internal on/off timer. This control allows you to set the daily power-on time of the display. Pressing the clock icon on the far right of the controller opens a contextual clock that makes it easier to adjust the clock.
6. This control sets the daily shutdown time of the display. If you want to disable the device's internal on/off timer, simply set the same time for both the device's on/off control.
7. Selector to enable/disable automatic time change in winter/summer time periods.
8. Allows you to select the desired method of synchronizing the device's internal clock.
    - **NONE:** Won't sync the watch
    - **ETH_SNTP:** Wired Network Synchronization (will use the server defined in 4)
    - **WIFI_SNTP:** WIFI synchronization (will use the server defined in 4)
    - **GPS:** This option will only appear on devices that have the GPS option

9. A selector that sets the time zone in which the display is located. It is important to set this value correctly so that the local time is displayed correctly, especially if your device is synchronized with a time server or by GPS.
10. Sets the light intensity level on the display. All models that incorporate a clock on the front of the device also have the possibility of adjusting the light intensity of the device according to the ambient light (AUTO option).
11. Dynamic information area. Depending on the model of the equipment, specific configuration controls will appear in this area. (see the section where the specific model is described for more details).
12. This button is activated if any changes have been made to the parameters and pressing it will update the new settings.

4.1.3 Network Settings

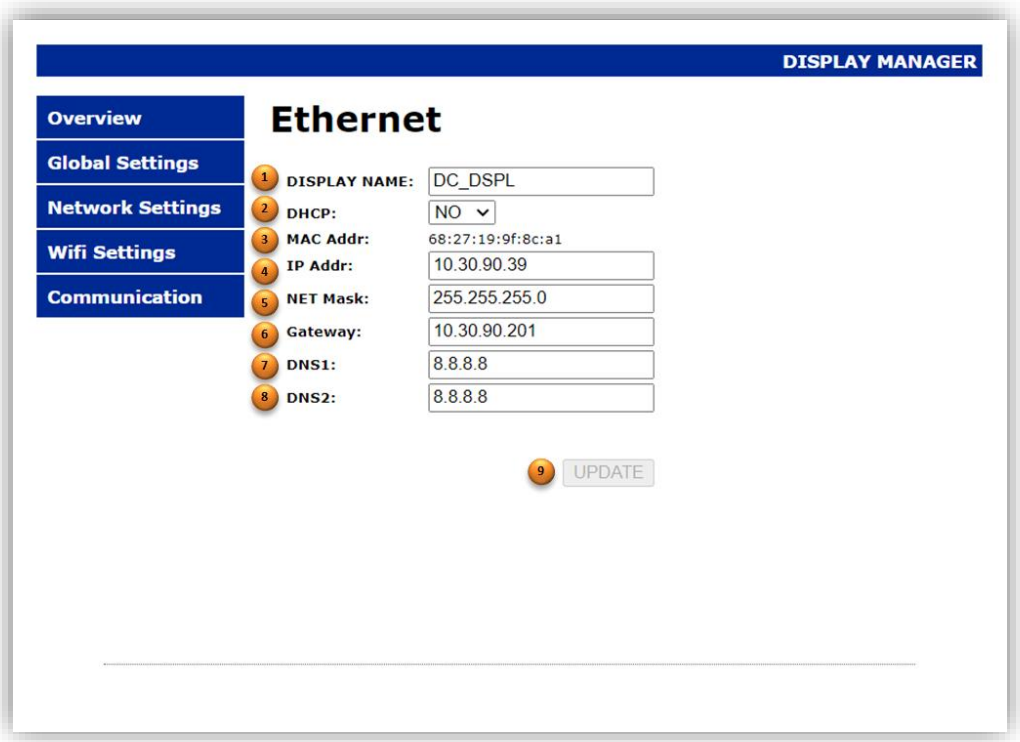


Fig. 4.3 Network Settings

1. In a local network with NetBios support, each device is assigned a unique name for its knowledge and identification, allowing each device to be perfectly distinguishable. This parameter allows us to define the name with which we will identify the equipment within the network.
   Therefore, if the local network uses NetBios, we can also access the device's web server by simply entering the name of the display in the browser; **DC_DSPL/** or **dc_dspl/**, for the example in the figure.
   The name assigned in this field is the one that will appear in the *Display Discoverer* app when you list the found devices.
2. The DHCP protocol is enabled/disabled. If you want the IP of the device to be automatically assigned from the server, you must set this control to ON. If, on the other hand, you want the device to have the fixed IP defined in the fields of this form, this control must be set to OFF.
3. Displays the MAC address of the display.
4. Modify the device IP address.
5. Modify the netmask.
6. Modifies the address of the Gateway. It is important that this address is well defined to communicate with external networks such as the internet and have access to public time servers.
7. Sets the primary DNS address. If the DNS is not set correctly and the SNTP server field in the global settings section has a domain name (e.g., "pool.ntp.com") and not an IP, the display will not be able to resolve this name and will not be able to update from that time server.
8. Sets the secondary DNS address.
9. This button is activated if any changes have been made to the parameters and pressing it will update the new settings.

IMPORTANT:

A) The network settings defined in this section only apply to the wired network. WIFI settings are defined in another section. It should be considered not to repeat IPs to avoid conflicts of duplication of addresses, since the display does not generate any warning in case this happens.

B) Since the only possible way to configure the display is through the web server. The device is equipped with an IP detection mechanism that in case of detecting during startup, that the IP address of the display is corrupted due to power interruptions during the saving process or other causes, the system will automatically activate the default emergency IP: 192.168.1.100, thus allowing access to the web server to solve the problem. By searching for connected devices using the *Display Discoverer* application, we will know at any time the IPs assigned to the equipment.

4.1.4 Wifi Settings

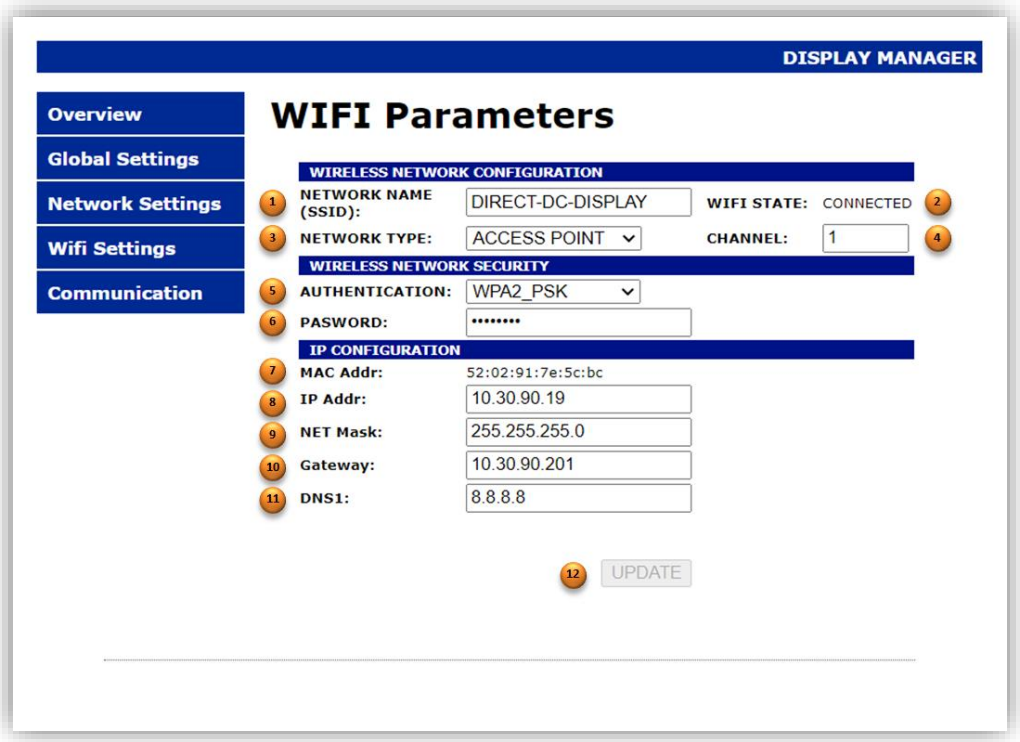


Fig. 4.4 WiFi Settings

1. Set the name of the WIFI network to which we want to connect or the name of the WIFI network that the display will generate, depending on the network mode that is configured with parameter 3.
2. Indicates the status of the connection.
   If you want to connect to a WIFI network and you cannot establish the connection either because the station name is not correct or the password is incorrect, "ERROR" will be shown in this field.
3. Configure the device to connect to an external WIFI network with the name indicated in 1 (**STATION** Mode) or convert the device into a WIFI access point, generating a network with the name indicated in 1 (**ACCESS POINT** Mode). This last mode will allow us to make point-to-point connections wirelessly.
4. In ACCESS POINT mode, it defines the channel within the 2.4 GHz frequency band that the network will use for data transmission. Selecting the right WIFI channel is important to avoid interference with other nearby networks. If multiple WIFI networks operate in the same frequency range in each area, congestion can occur that negatively affects connection performance and quality. By choosing a less busy channel, it is possible to minimize interference and improve signal stability.
   For configurations in **STATION mode** this field does not apply and is disabled.
5. Set the security type for the WIFI network. In **STATION mode**, it will be the one required for the WIFI network to which you want to connect. In **ACCESS POINT mode** it will be the one we want to assign to our WIFI access point.

6. Set the password for the WIFI network. In **STATION mode** it will correspond to that of the network to which we want to connect. In **ACCESS POINT** mode it will be the one we want our access point to have so that other devices can connect to the display.
7. Shows the MAC address of the WIFI network. There are two different directions, depending on whether the device is configured in **STATION** or **ACCESS POINT mode**.
8. Set the IP address of the WIFI network. In **STATION mode** it will correspond to the IP address that the device will have within the network to which we connect, while in **ACCESS POINT** mode it will correspond to the IP that we must connect to access the web server wirelessly.
9. Set up the netmask.
10. Set up the gateway. It is important that this address is well defined to communicate with external networks such as the internet and have access to public time servers.
11. Set up DNS. If the DNS address is not properly defined, IPs for domain names of time servers, such as "pool.ntp.com", cannot be resolved.
12. This button is activated if any changes have been made to the parameters and pressing it will update the new settings.

Being connected to the web server by WIFI it is possible to change the network settings as it will automatically redirect us to the new IP, or change the type of network (Station or Access Point), network name, password that in this case we will see in the web server an informative message with a progress bar while the display is restarting the WIFI module with the new parameters.

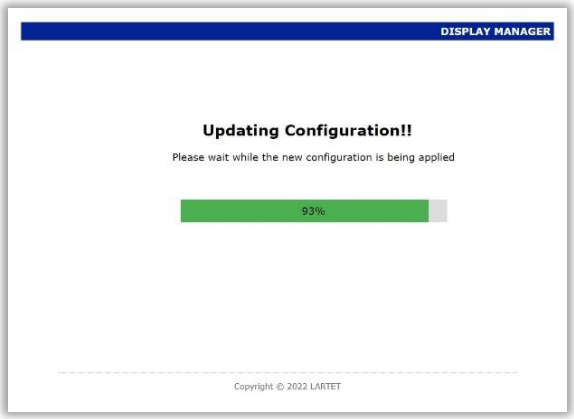


Fig. 4.5 WIFI module reset process with the new configuration

The displays are factory configured in "STATION" mode, so when connected to power you will see that "DIRECT-DC-DISPLAY" will appear in the list of WIFI networks available on the user's PC/Laptop.

The factory settings for accessing the display via WIFI are as follows:

PASSWORD: 12345678
Web Server Access IP: 10.30.90.16

Remember to set an IP on the user's PC/Laptop that is in range of IP of access to the web server.

Particularities of WIFI communication:

Wireless communication is not identical in functionality to that which can be obtained through a wired network. Below are some aspects to take into account.

- You cannot modify wired network settings from a wireless web server access.
- During a WIFI session, if the network settings are changed and any parameters have been incorrectly defined, when the new WIFI settings are reset, wireless communication may not be established. In this case, it will be necessary to connect via a wired network to enter the correct WIFI parameters.
- The ETHERNET and WIFI network IP addresses are independent. Make sure that the two are different and that they are not duplicated with other equipment if the displsay is integrated into a network.
- When initiating a point-to-point connection in Windows operating systems, if the list of WIFI networks is refreshed (close and open again the option to show "Available Wifi networks"), we will observe that we get the "Connected" status faster than if we wait for the system to notify us automatically.

4.1.5 Configuration of communication protocols (Comunication)

As a complement to the web server, the displays of the DC range have a set of commands that allow you to read/write information on the device, using the different communication interfaces and communication protocols that are available.

Thus, depending on the selection of the communication interface (parameter 1 in the global settings section of the web server), we will notice a different content in the communication configuration parameters.

4.1.5.1 Ethernet interface (DATA PORT = ETHERNET)

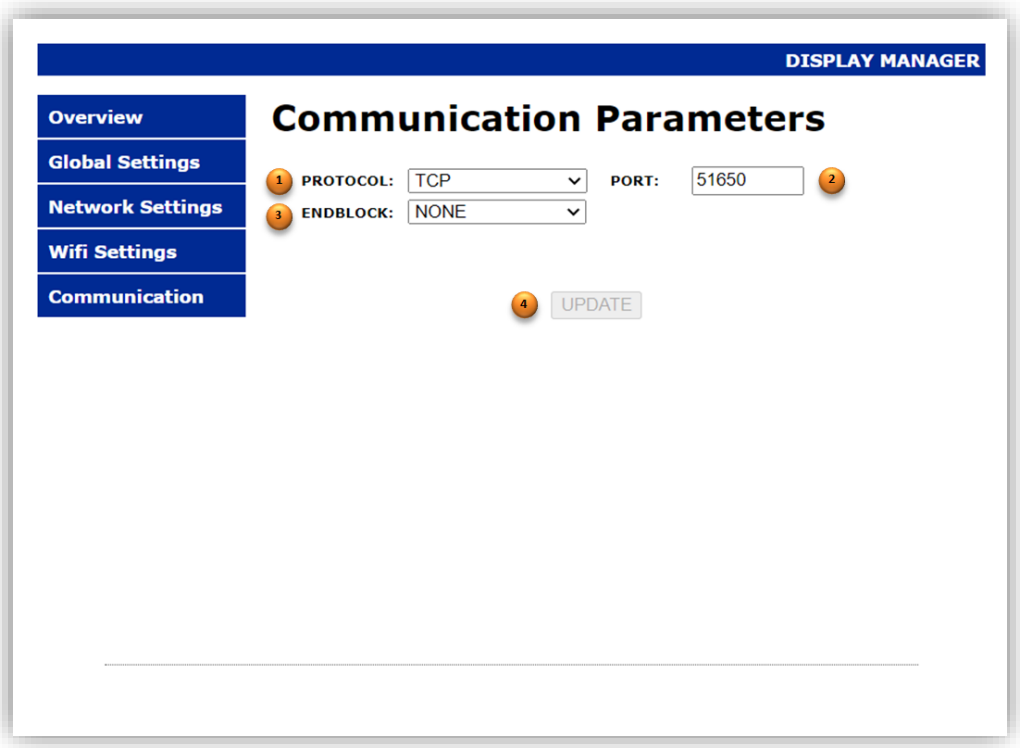


Fig. 4.6 Settings Communication (Ethernet)

1. The type of protocol to be used in the Ethernet configuration (TCP, UDP, and MODBUS TCP/IP) is configured.
2. Configure the communication port to use. It only affects the TCP and UDP protocols, since for the MODBUS TCP/IP protocol it uses the default port 502. The port to choose must be in the ephemeral port range (49152 – 65535).

3. Allows you to select the end of the frame that will accompany the command.

Endblock	
NONE	No frame ending
02h	STX (02h)
03h	ETX (03h)
04h	EOT (04h)
<CR> 0Dh	Carriage Return (0Dh)
<LF> 0Ah	Line Break (0Ah)
<CR LF> 0Dh 0Ah	Return + Line Break (0Dh 0Ah)
<LF CR> 0Ah 0Dh	Line Break + Return (0Ah 0Dh)
< * CR> 2Ah 0Dh	Omron 2Ah 0Dh Host-Link

Board 4.1 Frame Ends (Ethernet)

It is important to note that if an end of frame has been configured for communication and a command is sent without the corresponding end of frame, that command will not be interpreted by the display.

4. This button is activated if any changes have been made to the parameters and pressing it will update the new settings.

4.1.5.2 Serial Interface (DATA PORT = SERIAL)

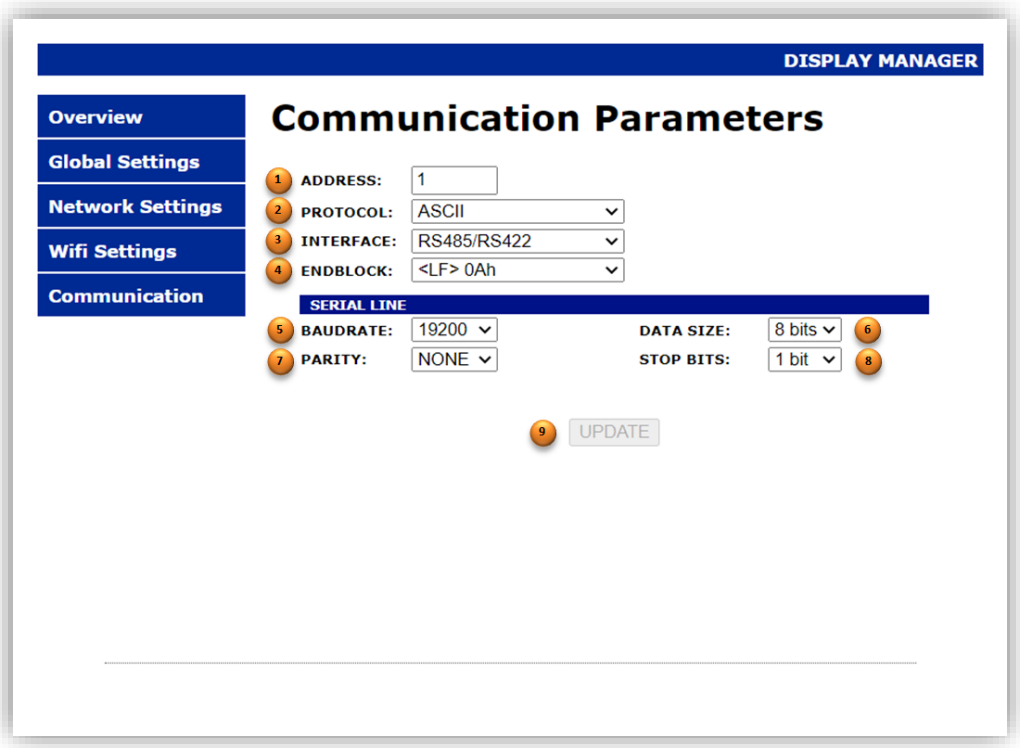


Fig. 4.7 Communication Settings (Series)

1. Sets the direction that the device will have on the serial communication bus. Valid values must be within the range 1 to 99.
2. Configure the communication protocol to use. The possible options are; ASCII and MODBUS RTU.
3. Set up the communication interface. You can choose an RS232 or RS485 serial line (RS422 if this manufacturing option has been ordered).
4. Define the end of frame to be used in serial communication.

Endblock	
<CR> 0Dh	Carriage return (0Dh).
<LF> 0Ah	Line break (0Ah).
<CR LF> 0Dh 0Ah	Return + Line Break (0Dh 0Ah).
<LF CR> 0Ah 0Dh	Line Break + Return (0Ah 0Dh).
03h	ETX (03h)
< * CR> 2Ah 0Dh	Omron Host-Link (2Ah 0Dh).

Board 4.2 Frame endings (Series)

5. Set the speed of communication.
6. Set the number of bits per character (7 or 8 bits). If the MODBUS RTU protocol cannot be modified, the default value of 8 bits is set.
7. Sets the parity bit option for error handling.
8. Defines the number of stop bits (1 or 2 bits) for information synchronization.
9. This button is activated if any changes have been made to the parameters and pressing it will update the new settings.

4.1.5.3 WIFI interface (DATA PORT = WIFI)

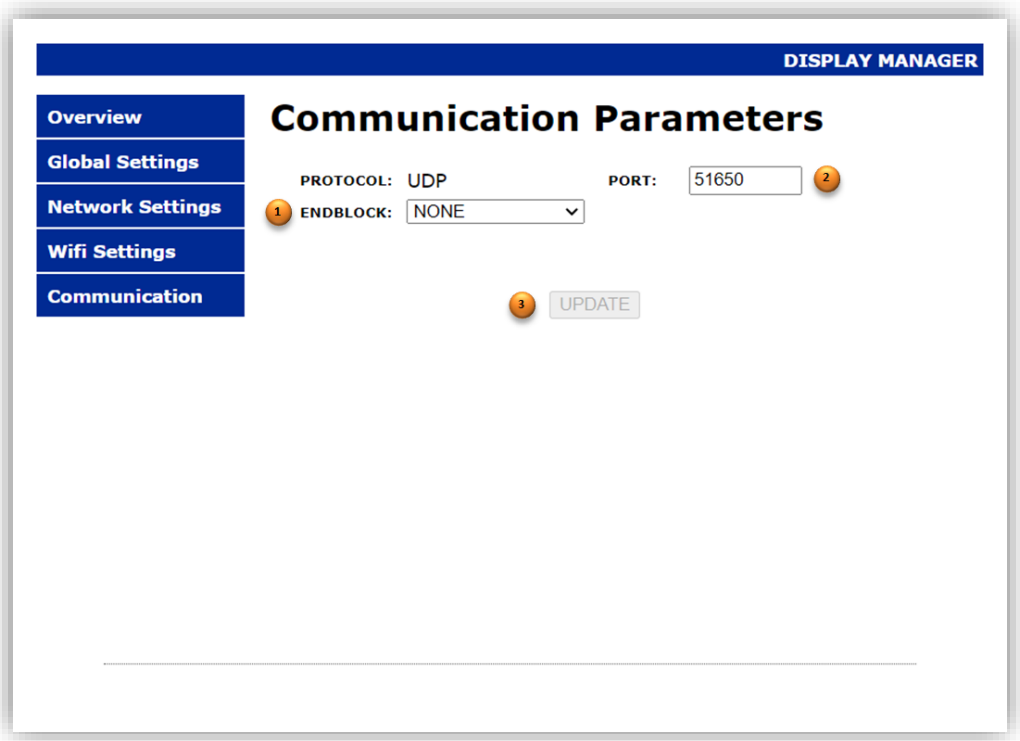
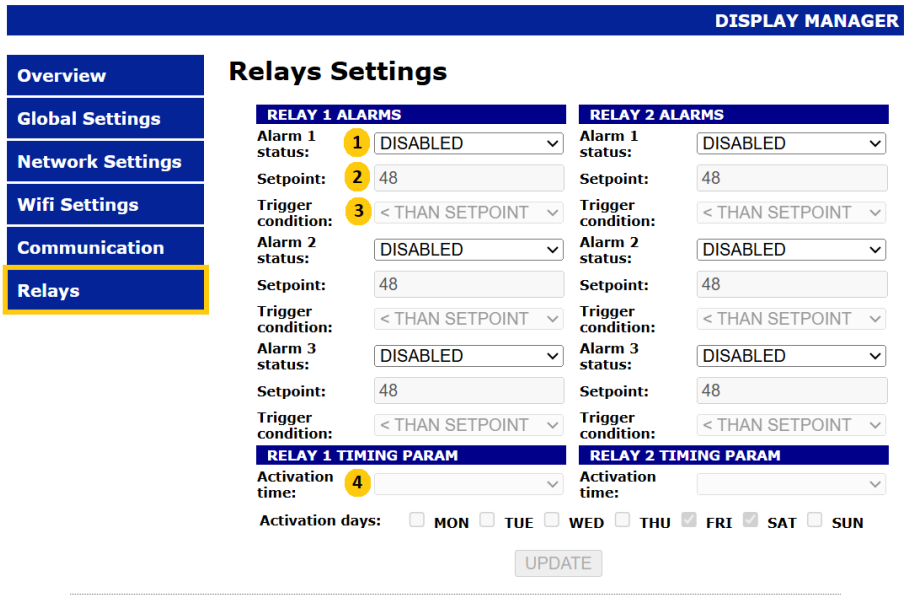


Fig. 4.8 Communication Settings (WIFI)

When using communication over WIFI, it is important to note that the default protocol is UDP and there are no options to select other protocols.

1. It allows you to select the end of the frame that will accompany the command. The possible options are the same as those indicated for the Ethernet interface (see Board 4.1). Note that if you have set up an end frame for communication, you have to send the command with the corresponding end frame to be interpreted by the display.
2. Configure the communication port to use. The port to choose must be in the ephemeral port range (49152 – 65535).
3. This button is activated if any changes have been made to the parameters and pressing it will update the new settings.

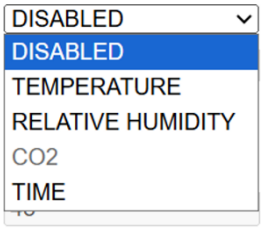
4.1.6 Relays

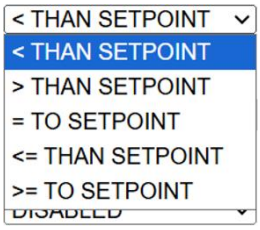


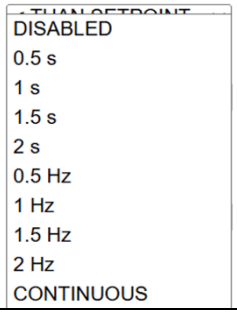
The displays in the DC and DR range allow the device to take actions based on the data read from the display. For example, if a high concentration of CO2 is detected, the master device can act on one of the relays to activate a fan that circulates clean air from outside. They have 3 alarms for each relay, making a total of 6 alarms.

The connection of the relays can be found in section 3.3.4 Relays

Each alarm allows you to configure the following fields:

<table>
<tr>
<td>1. Alarm status:
 

It allows you to define what type of value you want the relay to be activated.</td>
<td>2. Setpoint:
 

Defines the set point of the relay excitation.</td>
</tr>
<tr>
<td>3. Trigger condition:
 

Defines relay trip condition, in seconds, hertz, or continuously.</td>
<td>4. Activation time:

It allows you to define the days of the week on which the alarms are activated if the parameters configured in the previous points are met.</td>
</tr>
</table>

4.2 Communicating the display with other devices

The DC range of displays offers a variety of communication interfaces and protocols to meet your connection needs and allow you to easily communicate with a PC or PLC for information exchange.

It will be possible to obtain information on values from measurement sensors, hourly information or tracking variables such as records or accident-free days, as well as establishing values in those variables that allow writing.

This exchange of information will be carried out through specific commands in the case of the TCP, UDP and ASCII protocols and through registers in the MODBUS protocol.

Since the variants of the DC range are diverse, displays that have sensors for environmental measurements (with different numbers of variables represented), time displays, displays of environmental measurements combined with time information, displays of accident-free days, etc. Each device accepts only the commands that its functionality applies in the characteristics of the model. Therefore, models that display only hourly information will not recognize environmental information commands.

To structure the commands by their scope of application, this manual will include specific sections by model, where, apart from describing the specific configuration characteristics, the list of commands that their scope of application corresponds to that model will be included, as well as some application examples.

4.2.1 Communication via commands (TCP, UDP, and ASCII)

There are two types of commands; read commands where we exclusively obtain information from the display and other write commands, which accept arguments to send values to the dispaly.

Command frame format for Ethernet and WIFI interfaces, using TCP or UDP protocols

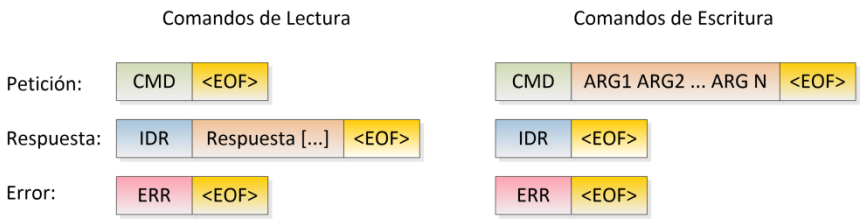


Fig. 4.9 Command Frame Structure for Ethernet and WIFI Interfaces

Where:

CMD: Command
ARG1 ARG2 ... ARGN: List of arguments separated by the character "space" (ASCII 32d)
IDR: Response ID. A 2-byte alphanumeric code (specific to each command) that is located just before the field containing the response information of the display.
<EOF1>: Optional frame ending.
Answer[...]: A string of characters containing the response of the device.
ERR: Error description message, the error messages that can be obtained are:

UNDEFINED	The display does not recognize the command
ARG_ERR	Error in the arguments

Format of the commands for the serial interface, using the ASCII protocol

Fig. 4.10 Command Structure for Serial Interfaces

Where:

@: Header code, frame start indicator.
AHAL: Address of the destination equipment on the serial bus. The digit addresses are made up of 2 digits corresponding to the address range 01 to 99. The descriptor AH would correspond to the digit of the tens and AL to the digit of the units.
CMD: Command
ARG1 ARG2 ... ARGN: List of arguments separated by the character "space" (ASCII 32d)
IDR: Response ID. A 2-byte alphanumeric code (specific to each command) that is located just before the field containing the response information of the display.
EOF1: End of frame. It must correspond to the one that has been defined in the device.
Answer[...]: A string of characters containing the response of the device.
ERR: Error description message, the error messages that can be obtained are:

UNDEFINED	The display does not recognize the command
ARG_ERR	Error in the arguments

[1] The commands do not have a specific frame ending, you can choose from any of the available ones.

The commands for the DC display range are summarized in the following table.

CMD	DESCRIPTION	PROPERTY	IDR
PH	Get Date and Time from the device's internal clock	READING	RH
PT	**Ethernet and WIFI interface:** Obtains the temperature value displayed by the display (unit ^{o}C) **Serial Interface:** Obtains the temperature and humidity value displayed by the display (unit ^{o}C and % respectively)	READING	RT
PU	**Ethernet and WIFI interface:** Obtains the humidity value displayed by the visualizer **Serial Interface:** *Command Not Available*	READING	RU
PC	Obtains CO2 concentration (ppm unit)	READING	RC
PD	Get accident-free days	READING	RD
DR	Obtains the record of accident-free days	READING	RD
FR	Get the date of the last accident	READING	RF
VT	Enter the average temperature and humidity value for ambient measurement displays in "Repeater" mode **Arguments:** *tt,t hh* (value of temperature and humidity in the indicated format, separated by the space character)	WRITING	VT
FD	Performs a preset of the accident-free days to be displayed by the visualizer **Arguments:** *dddd* (accident-free days with a maximum of 4 digits)	WRITING	FD
VD	Write the record of accident-free days **Arguments:** *dddd* (record of accident-free days with a maximum of 4 digits)	WRITING	VD
VF	Enter the date of the last accident **Plots:** *DD-MM-YYYY* (Date with the indicated format, separating the days, month and year fields by hyphens)	WRITING	VF

Board 4.3 DC Command List

	Commands										
MODEL	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF
DC10 TH	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
DC-10R / DR-1X9	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
DC41STH	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
DC41STHO	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
DC20/21TH	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗
DC23	✓	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗
DC23D	✓	✗	✗	✗	✓	✗	✓	✗	✓	✓	✓

Board 4.4 Scope of Commands by Model

Application examples:

Request for the internal time of the display, being 8:30:00 on 05/30/2023

1) **Interface: Ethernet | Protocol: TCP | End of frame: None**
   a. Request: PH
   b. Answer: RH30-05-23<SP>08:30:00
2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII | End of frame: <*CR*>**
   a. Petition: @01PH<CR>
   b. Answer: @01RH30-05-23<SP>08:30:00<CR>

Characters in oblique square brackets < > indicate special ASCII characters. The following symbols must therefore be replaced by the numerical value of the corresponding symbol

<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<SP> (space) ASCII value: 20h or 32d

4.2.2 Communication via the MODBUS protocol[2]

Information can be exchanged with this protocol, both through the Ethernet interface and the serial interface.

For this purpose, a read-only record set is enabled for unalterable information and a read/write record set for those variables that can be modified by the user.

Address	No. of Registers	Type	Variable	UNITS	FORMAT	ACCESS
0000h	1	INPUT REGISTER	Day		Unsigned 16 bit INT	Reading
0001h	1	INPUT REGISTER	Month		Unsigned 16 bit INT	Reading
0002h	1	INPUT REGISTER	Year		Unsigned 16 bit INT	Reading
0003h	1	INPUT REGISTER	Day of the week (Monday [1] ... Sunday [7])		Unsigned 16 bit INT	Reading
0004h	1	INPUT REGISTER	Hour		Unsigned 16 bit INT	Reading
0005h	1	INPUT REGISTER	Minute		Unsigned 16 bit INT	Reading
0006h	1	INPUT REGISTER	Seconds		Unsigned 16 bit INT	Reading
0007h	1	INPUT REGISTER	Temperature	°C x 10	Unsigned 16 bit INT	Reading
0008h	1	INPUT REGISTER	Humidity	%	Unsigned 16 bit INT	Reading
0009h	1	INPUT REGISTER	CO2	ppm	Unsigned 16 bit INT	Reading
000Ah	1	INPUT REGISTER	Accident-free days		Unsigned 16 bit INT	Reading
000Bh	1	INPUT REGISTER	Record number of accident-free days		Unsigned 16 bit INT	Reading
000Ch	1	INPUT REGISTER	Date of last accident (Day)		Unsigned 16 bit INT	Reading
000Dh	1	INPUT REGISTER	Date of last accident (Month)		Unsigned 16 bit INT	Reading
000Eh	1	INPUT REGISTER	Date of last accident (Year)		Unsigned 16 bit INT	Reading

Board 4.5 Read-only Modbus registers, accessible with the 04h function

Address	No. of Registers	Type	Variable	UNITS	FORMAT	ACCESO[1]
0000h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0001h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0002h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0003h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0004h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0005h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0006h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
0007h	1	HOLDING REGISTER	Temperature (Repeater Mode)	°C x 10	Unsigned 16 bit INT	L/E
0008h	1	HOLDING REGISTER	Humidity (Repeater Mode)	%	Unsigned 16 bit INT	L/E
0009h	*1*	*HOLDING REGISTER*	*Reserved*			*L/E*
000Ah	1	HOLDING REGISTER	Accident-free days (Preset)		Unsigned 16 bit INT	L/E
000Bh	1	HOLDING REGISTER	Record number of accident-free days		Unsigned 16 bit INT	L/E
000Ch	1	HOLDING REGISTER	Date of Last Accident (Day)		Unsigned 16 bit INT	L/E
000Dh	1	HOLDING REGISTER	Date of last accident (Month)		Unsigned 16 bit INT	L/E
000Eh	1	HOLDING REGISTER	Date of last accident (Year)		Unsigned 16 bit INT	L/E

1) R/W: Reading and Writing

Board 4.6 Modbus read/write registers, accessible with the functions: 03h, 06h, 10h

[2] Modbus Protocol: https://modbus.org/specs.php

Application example:

Request for the internal time of the display, being 8:30:00 on 05/30/2023

1) **Function 04h (Read Input Registers) | Address Start Registration: 00h| Number of Registers: 7**
   a. Answer:

REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h
30	5	2023	2	8	30	0

The content of the records shown in the response is in decimal format

The combination of the Modbus protocol and actuator elements provides our displays with a more versatile integration into home automation or industrial automation systems.

For this purpose, a pair of "Coils" are enabled for the control of these relays.

Address	No. of Coil	Type	Variable	UNITS	FORMAT	ACCESO[1]
0001h	1	COIL	Relay 1		Unsigned 16 bit INT	L/E
0002h	2	COIL	Relay 2		Unsigned 16 bit INT	L/E

1) R/W: Reading and Writing

Board 4.7 Modbus read/write registers, accessible with the functions: 01h and 0Fh

Application example:

Reading the "Coils" when Relay 1 is on and Relay 2 is off

1) **Function 01h (Read Coil) | Dir. Check-in: 01h| No. of Coils: 2**
   a. Answer:

DIR 01h	DIR 02h
1	0

Deactivating Relay 1 and Activating Relay 2

2) **Function 01h (Force Multiple Coils) | Dir. Check-in: 01h| No. of Coils: 2**
   a. Value to write on the coils :

DIR 01h	DIR 02h
0	1

4.3 Detailed information by model

This section provides detailed information on model-specific functionality and configuration, as well as examples for exchanging information with the display.

4.3.1 DC10TH

This equipment is intended for users who want to represent environmental variables in a large digit format and want to keep the display size as small as possible. That is why this type of display only allows you to visualize a single variable simultaneously. To cover the customization needs as much as possible, it offers configuration options to display either *Temperature* or *Humidity*, or also the option to display both variables alternately with a user-defined alternation time.

4.3.1.1 Dynamic content in the Overview section

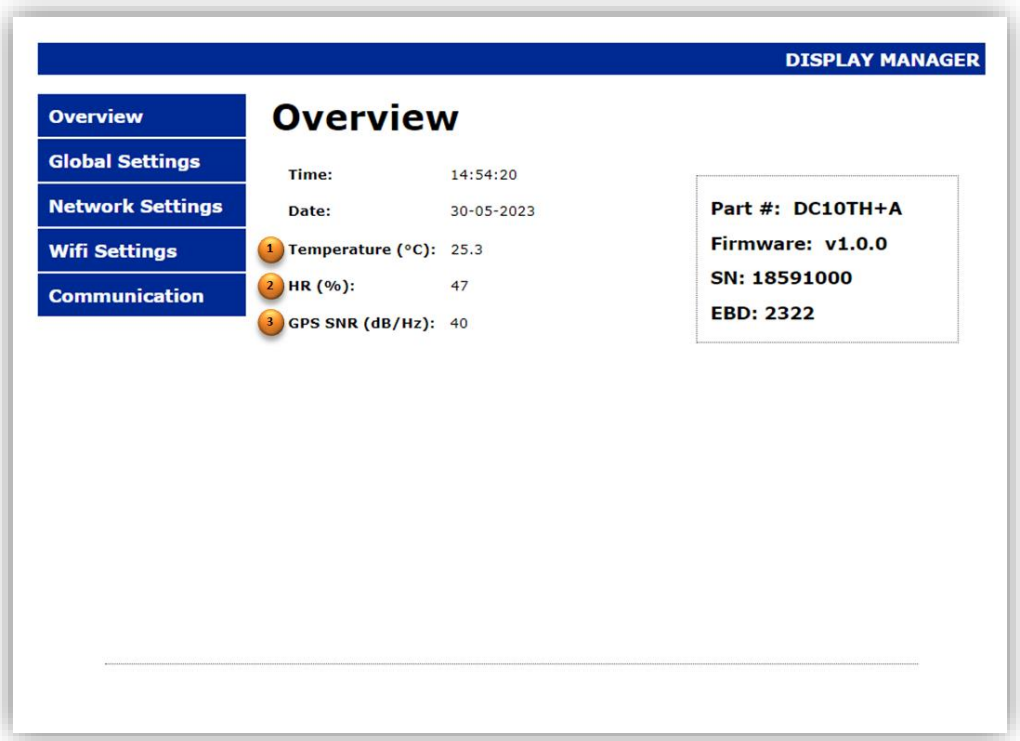


Fig. 4.11 Information shown in the DC10TH dynamic section

1. Temperature value obtained from the sensor. If the acquired temperature value is outside the measurement range (-20 ºC < T ≤ 90 ºC) it will show; "OuH" if the temperature is higher than the maximum allowed or "OuL" if it is lower. If, on the other hand, the sensor is disconnected, or defective, it will display the message "FAIL".
2. Relative humidity value obtained from the sensor. If the acquired moisture value is outside the measurement range (0% ≤ H ≤ 99%), it will show; "OuH" if the temperature is higher than the maximum allowed or "OuL" if it is lower. If, on the other hand, the sensor is disconnected, or defective, it will display the message "FAIL".

3. **[OPTIONAL]** If the equipment has been purchased with the GPS time synchronization option (+A option), it will indicate the GPS signal-to-noise ratio (SNR). The higher the SNR, the better the strength of the received signal and the less likely it is that changing atmospheric conditions will over-attenuate the received signal and lose synchronism with the satellite.
    - If the received signal level is too low, the message "LOW" will be displayed.
    - If GPS time synchronism is not activated (SYNC = GPS, see section 4.1.2) the message "OFF" will be displayed

4.3.1.2 Dynamic content in the Global Settings section

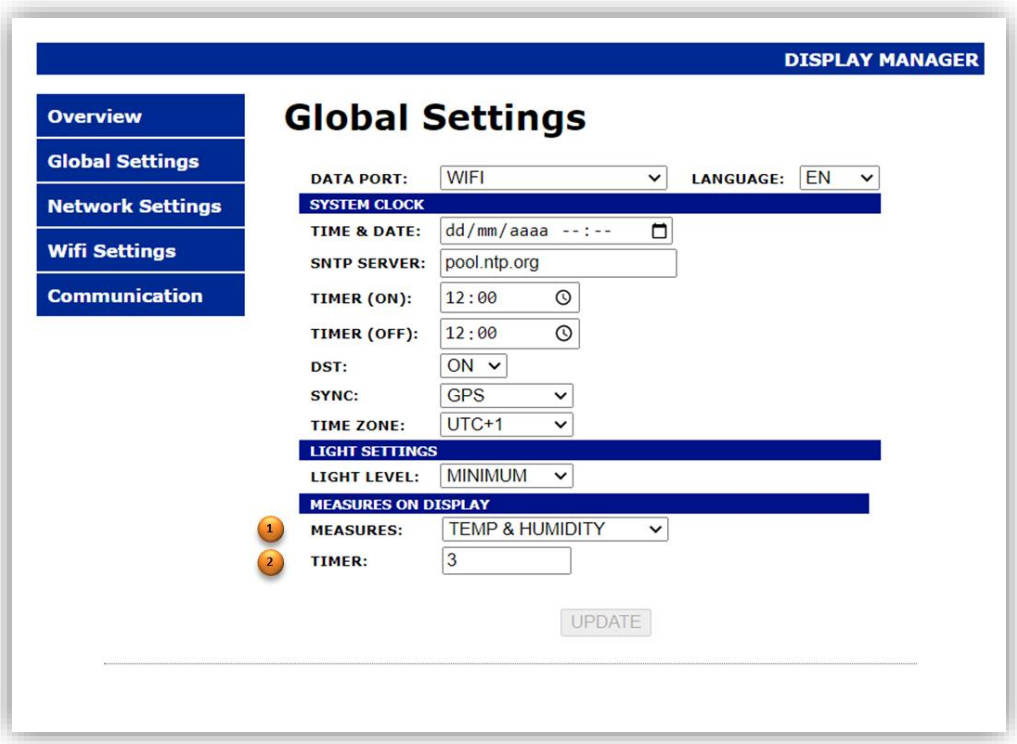


Fig. 4.12 Particular settings for the DC10TH model

1. Display Options
    - "TEMPERATURE" Display temperature only.
    - "HUMIDITY" Display humidity only
    - "TEMP & HUMIDITY" Display temperature and humidity alternately
2. Applies only if the "TEMP & HUMIDITY" option is selected and defines the time in which the temperature and humidity values will alternate in the display. The timing range ranges from 1 to 255 seconds.

4.3.1.3 Flagging alerts and errors

If there is an alert or error on your device, the following descriptive messages will be displayed in the display.

Error	Causa
Err 1	The temperature and humidity sensor is not detected/recognized. Check that the sensor is properly connected and that there are no breaks in the wiring.
OuH	Temperature measurement above the maximum allowed (t_{max} = 90 ºC) Humidity measurement above the maximum allowed (h_{max} = 99%)
OuL	Temperature measurement below the minimum permissible (t_{max} = -19.9 ºC) Humidity measurement below the minimum allowed (h_{max} = 0%)

4.3.1.4 Communications with external devices

This model enables the following Modbus commands and registers

DC10TH	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh	
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh	

Fig. 4.13 DC10TH Modbus Commands and Registers

Application examples:

Temperature request, for a device that is showing 24.3 ^{o}C

1) **Interface: Ethernet | Protocol: TCP | End of frame: None**
   a. Request: PT
   b. Answer: RT24.3

2) **RS232 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
   a. Petition: @01PT<CR>
   b. Answer: @01RT24.3<SP>60<CR>

Note: The PT command on a serial interface also responds with the humidity value to maintain compatibility with our previous range

Temperature and humidity reading for a device that is alternately displaying 24.3 ^{o}C and 60%

3) **RS232 Serial Interface | Protocol: MODBUS RTU | Function 04h | Address Start Check-in: 07h| Number of Registers: 2**
   a. Answer

REG 07h	REG 08h
243	60

Note: The temperature value is multiplied by 10 to convert the value to an integer.

Characters in oblique square brackets < > indicate special ASCII characters.

<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<SP> (space) ASCII value: 20h or 32d

4.3.2 DC41RTH

In those locations where a small size of the display is not required, this model allows the simultaneous display of relevant information such as time, temperature and humidity, of interest to the public.

4.3.2.1 Dynamic content in the Overview section

It is identical to that of the DC10TH model (see section 4.3.1.1)

4.3.2.2 Dynamic content in the Global Settings section

It doesn't add dynamic content.

4.3.2.3 Signaling alerts and errors

Generates the same alerts and errors as the DC10TH model (see section 4.3.1.3)

4.3.2.4 Communications with external devices

This model enables the following Modbus commands and registers

DC41RTH	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh	
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh	

Board 4.8 Modbus commands and registers in the DC41RTH

Application examples:

Humidity request, for a device that is displaying a value of 60%

1) **Interface: Ethernet | Protocol: TCP | End of frame:** <LF> (ASCII: 0Ah or 10d)
   a. Request: PU<LF>
   b. Answer: RU60<LF>
2) **RS232 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
   a. Petition: @01PT<CR>
   b. Answer: @01RT24.3<SP>60<CR>

Note: There is no PU command on the serial interface, the PT command must be used which returns both temperature and humidity.

Characters in oblique square brackets < > indicate special ASCII characters.

<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<SP> (space) ASCII value: 20h or 32d

4.3.3 DC41RTHO

This model provides the most complete solution in our range in the representation of environmental variables, allowing the simultaneous visualization of; temperature, humidity, and CO2, as well as providing hourly information.

4.3.3.1 Dynamic content in the Overview section

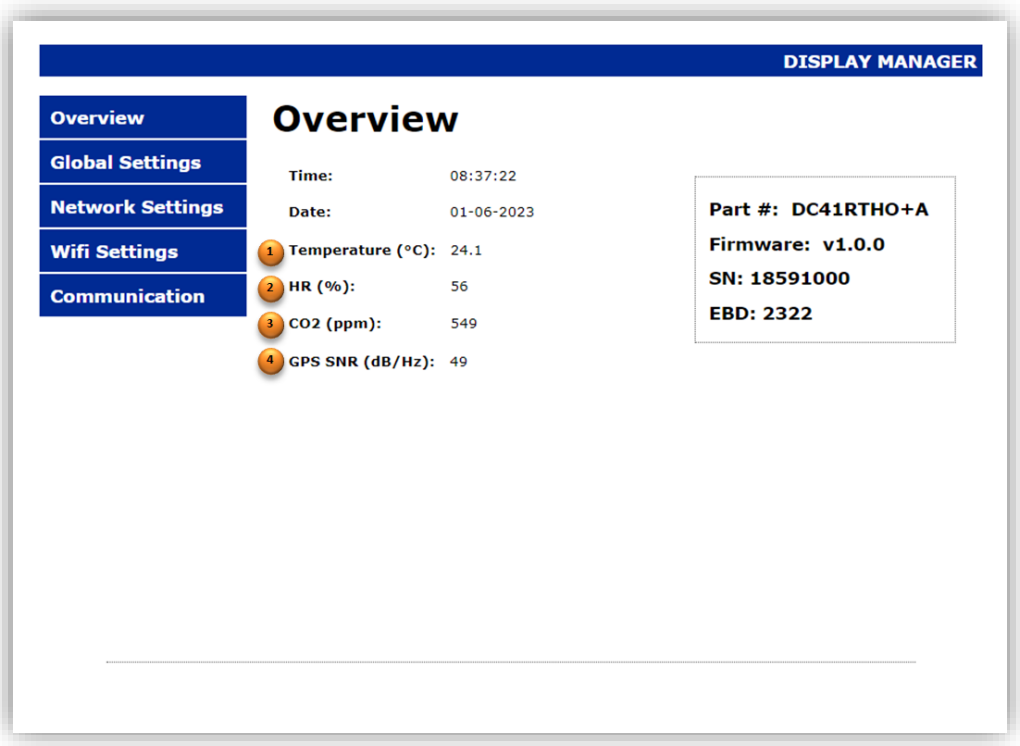


Fig. 4.14 Information displayed in the dynamic section of the DC41SRTHO model

1. Temperature value obtained from the sensor. If the acquired temperature value is outside the measurement range (-20 ºC < T ≤ 90 ºC) it will show; "OuH" if the temperature is higher than the maximum allowed temperature or "OuL" if it is lower. If, on the other hand, the sensor is disconnected or defective, it will display the message "FAIL".
2. Relative humidity value obtained from the sensor. If the acquired moisture value is outside the measurement range (0% ≤ H ≤ 99%), it will show; "OuH" if the temperature is higher than the maximum allowed temperature or "OuL" if it is lower. If, on the other hand, the sensor is disconnected or defective, it will display the message "FAIL".
3. Value of CO2 concentration. If the concentration value is outside the measurement range (10 ppm < CO2 ≤ 9999 ppm), it will display: "OuH" if the temperature is higher than the maximum permissible temperature or "OuL" if it is lower. If, on the other hand, the sensor is disconnected or defective, it will display the message "FAIL".

4. **[OPTIONAL]** If the equipment has been purchased with the GPS time synchronization option (+A option), it will indicate the GPS signal-to-noise ratio (SNR). The higher the SNR, the better the strength of the received signal and the less likely it is that changing atmospheric conditions will over-attenuate the received signal and lose synchronism with the satellite.

   - If the received signal level is too low, the message "LOW" will be displayed.
   - If GPS time synchronism is not activated (SYNC = GPS, see section 4.1.2) the message "OFF" will be displayed

4.3.3.2 Dynamic content in the Global Settings section

It doesn't add dynamic content.

4.3.3.3 Signaling alerts and errors

If there is an alert or error on your device, the following descriptive messages will be displayed in the display.

Error	Causa
Err 1	The temperature/humidity and CO2 sensor is not detected/recognized. Check that the sensor is properly connected and that there are no breaks in the wiring.
OuH	Temperature measurement above the maximum allowed (t_{max} = 90 ºC) Humidity measurement above the maximum allowed (h_{max} = 99%) CO2 concentration higher than the maximum allowed ($CO2_{max}$ = 9999 ppm)
OuL	Temperature measurement below the minimum allowed (t_{min} = -19.9 ºC) Humidity measurement below the minimum allowed (h_{min} = 0%) CO2 concentration below the minimum allowed ($CO2_{min}$ = 10 ppm)

4.3.3.4 Communications with external devices

This model enables the following Modbus commands and registers

DC41RTHO	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh

Board 4.9 Modbus commands and registers of the DC41RTHO

Application examples:

CO2 request, for a device that is displaying a concentration of 755 ppm

1) **Interface: Ethernet | Protocol: UDP| End of frame:** <CR><LF>
   a. Request: PC<CR><LF>
   b. Answer: RC755<CR><LF>

2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |Frame End: *<CR>** (Host Link Frame End)
   a. Request: @01PC*<CR>
   b. Answer: @01RC755*<CR>

Reading all the information available on the DC40SRTHO model:
Time: 10:57:35, Date: 6/1/2023, Temperature = 25.6 °C, Humidity = 55%, CO2 = 761 ppm

1) **Ethernet Interface | Protocol: MODBUS TCP/IP| Function 04h | Dir. Check-in: 00h| Number of Registers: 10**
   a. Answer

REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h
1	6	2023	4	10	57	35	256	55	761

Note: The temperature value (REG07) is multiplied by 10 to convert decimal values to the integer type of the register.

Characters in oblique square brackets < > indicate special ASCII characters.

<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<LF> (Line Break) ASCII Value: 0Ah or 10d
<SP> (space) ASCII value: 20h or 32d

4.3.4 DC20/21TH

This model simultaneously displays temperature and humidity values visible over long distances, while maintaining a compact and small equipment size. It also offers additional functionalities such as the averaging of up to 4 temperature and humidity sensors, to homogenize spaces where there may be temperature gradients and offers the possibility of making a specific calibration to each of the sensors from a reference standard.

4.3.4.1 Dynamic content in the Overview section

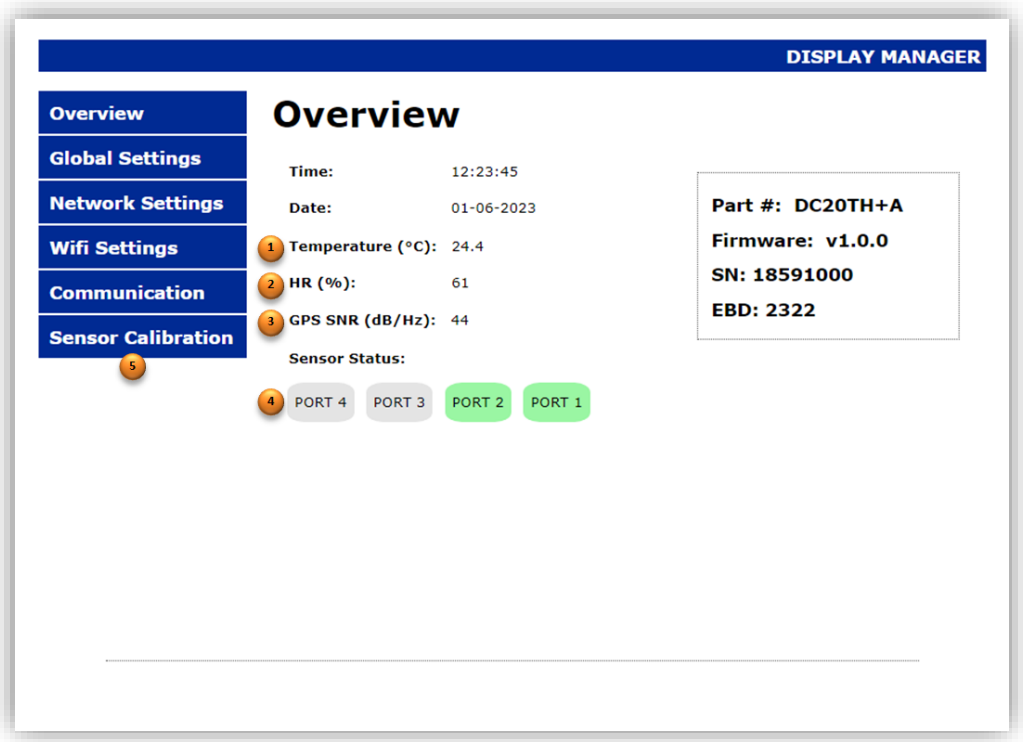


Fig. 4.15 Information shown in the DC20/21TH model dynamic section

1. Average temperature value obtained from connected sensors. If the average temperature value is outside the measurement range (-20 ºC < T ≤ 90 ºC) it will show; "OuH" if the average temperature is higher than the maximum allowed or "OuL" if it is lower. In case all sensors are disconnected, or there is not at least one sensor that obtains a temperature value within the measurement range, the message "FAIL" will be displayed.
2. Value of the average relative humidity obtained from the connected sensors. If the average humidity value is outside the measurement range (0% ≤ H ≤ 99%), it will show; "OuH" if the average humidity is higher than the maximum allowed or "OuL" if it is lower. In case all sensors are disconnected, or there is not at least one sensor that obtains a humidity value within the measurement range, the message "FAIL" will be displayed.

3. **[OPTIONAL]** If the equipment has been purchased with the GPS time synchronization option (+A option), it will indicate the GPS signal-to-noise ratio (SNR). The higher the SNR, the better the strength of the received signal and the less likely it is that changing atmospheric conditions will over-attenuate the received signal and lose synchronism with the satellite.
   - If the received signal level is too low, the message "LOW" will be displayed.
   - If GPS time synchronization is not activated (SYNC= GPS, see section 1.1.2) the message "OFF" will be displayed

4. Active port indicator. These ports are displayed in a certain color depending on their status:
   - **Grey:** No sensor connected or not recognised by the equipment.
   - **Green:** The port is active and acquiring measurements within its valid range.
   - **Red:** The sensor has been detected, but measurements are being obtained outside its valid range.

   The device automatically averages the temperature based on the active ports. If any of the connected sensors obtain values outside the measurement range, they are automatically discarded in the calculation of the average.
   The Active Ports Indicator provides a useful monitoring tool, as it can be quickly identified if any sensors are faulty or disconnected, allowing you to check that the average is always performed with the number of sensors provided.
5. Link to the sensor calibration section (see section 4.3.4.2)

4.3.4.2 Calibrating the sensors

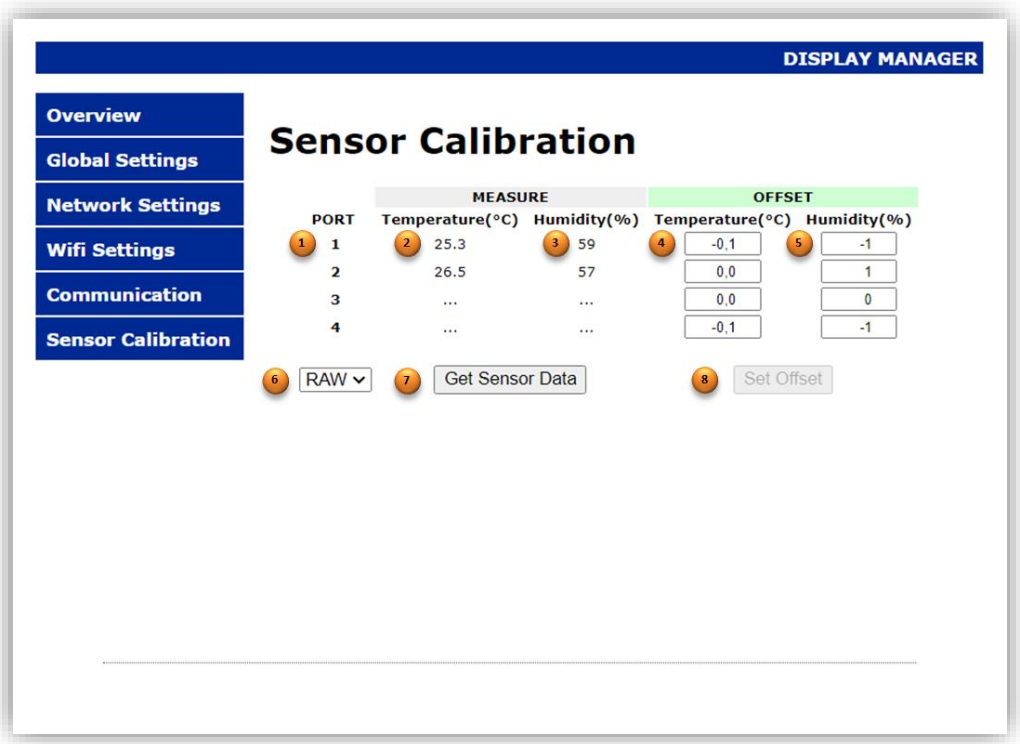


Fig. 4.16 Calibrating the DC20/21TH sensors

1. Sensor port identifier. All settings made in this row affect the sensor connected to that port.
2. Temperature measurement for the sensor connected to the reference port (1). Depending on the selector (6), it will offer the temperature value as obtained from the sensor, or compensated with the compensation values defined by the user.
3. Humidity measurement for the sensor connected to the reference port (1). Like the temperature measurement, depending on the selector (6), it will offer the raw value of the sensor or compensated.
4. Compensation value that will be added to the sensor's temperature measurement to correct small deviations for an accurate and reliable measurement. This value can be positive or negative to compensate for biases of any sign.
5. Compensation value that will be added to the humidity measurement to compensate for small deviations in the sensor. As with temperature, this value can be positive or negative.
6. Selector to configure whether to display the measurements of the sensor in raw "RAW", or calibrated "CAL". The "CAL" mode is especially useful for comparing the readings of the calibrated sensor with those of the equipment used as the calibration standard.
7. Button to acquire/refresh the measurements of the active ports of the equipment. Each time this button is pressed, a new set of measurements is obtained according to the mode selected in (6). If a port does not have a sensor connected or is not obtaining values within its valid measurement range, "..." in the temperature and humidity measurements of said port. Likewise, when accessing the calibration section, as long as this button is not pressed, "..." in the temperature and humidity measurements of all ports. In the same

way, we will observe this indication in all measurements when we change the mode selected in (6), being necessary to press this button again, to acquire a new set of measures according to the selection in (6).

8. Button to set the new calibration parameter settings. It will be disabled by default and will be activated when a value change is made in any field of the compensation parameters.

4.3.4.3 Dynamic content in the Global Settings section

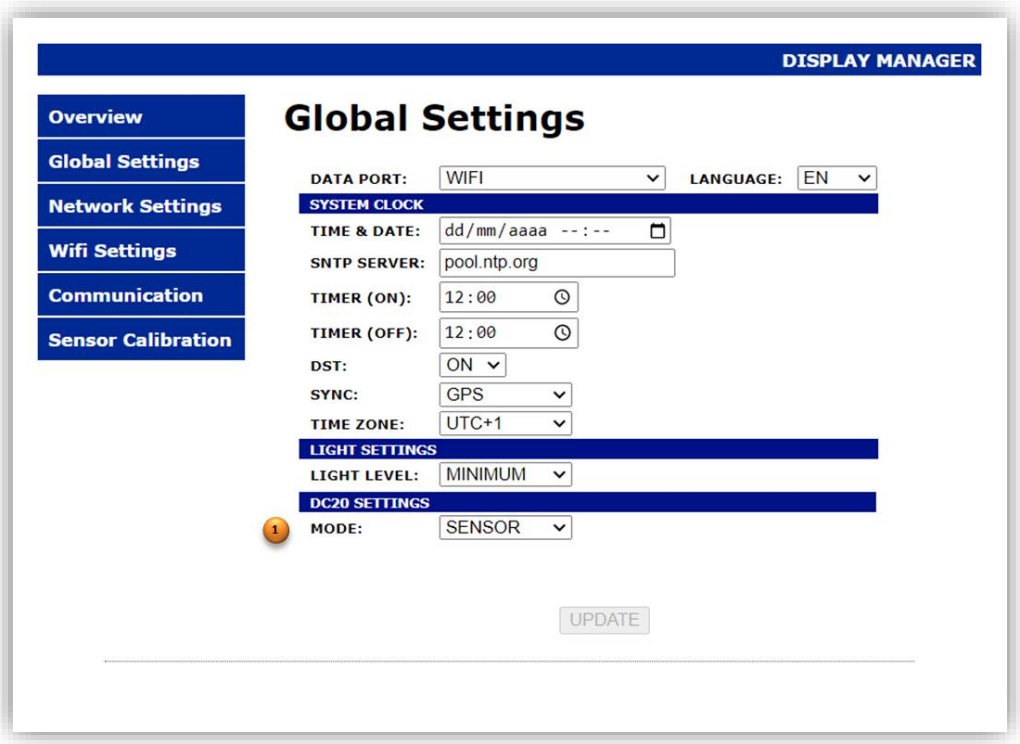


Fig. 4.17 Particular settings for the DC20/21TH model

1. Mode of operation; "Sensor" or "Repeater".
   - **Sensor Mode**: The display shows the average temperature and humidity value of all the sensors connected to your ports.
   - **Repeater Mode**: The display receives the average temperature and humidity values sent by the user through the interface and protocol configured on the equipment. In this mode, as long as no data is sent, it will be displayed "---" in the display, and in the temperature and humidity fields in the "Overview" section of the web server.

4.3.4.4 Signaling alerts and errors

Generates the same alerts and errors as the DC10TH model (see section 4.3.1.3)

4.3.4.5 Communications with external devices

This model enables the following Modbus commands and registers.

DC20TH	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh

Board 4.10 DC20TH Modbus Commands and Registers

Application examples:

Temperature Request, for a device that is displaying 23.4 ^{o}C

1) **Interface: Ethernet | Protocol: UDP| End of frame: None**
   a. Request: PT
   b. Answer: RT234

Writing average temperature and humidity in "Repeater" mode
Temperature = 23.6 ^{o}C, Humidity = 65%

1) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
   a. Values to write: @01VT23.6<SP>65<CR>
   b. Answer: @01VT<CR>

2) **RS485 Serial Interface | Protocol: MODBUS RTU| Function 10h | Slave Address: 01 | Dir. Check-in: 07h| Number of Registers: 2**
   a. Values to write in the *Holding Registers*:

REG 07h	REG 08h
236	65

Note: The temperature value (REG07) is multiplied by 10 to convert decimal values to the integer type of the register.

Once the registers have been updated, we will display these values in the display (as long as we have the "Repeater" mode selected in the display).

Characters in oblique square brackets < > indicate special ASCII characters.

<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<SP> (space) ASCII value: 20h or 32d

4.3.5 DC10R / DR-1X9

The DC-10R model offers a simple, highly accurate clock in HH:MM format, which combines an elegant and minimalist design with synchronization options such as GPS and connection to time servers to continuously display the correct time. The DR-1X9 model meets the same characteristics manufactured in an aluminum box for industrial environment, having a higher degree of protection.

4.3.5.1 Dynamic content in the Overview section

It doesn't add dynamic content.

4.3.5.2 Dynamic content in the Global Settings section

It doesn't add dynamic content.

4.3.5.3 Signaling alerts and errors

No alerts or errors are generated, as it has no sensors attached.

4.3.5.4 Communications with external devices

This model enables the following Modbus commands and registers

DC10TH	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh

Board 4.11 DC10R Modbus Commands and Registers

Application examples:

Humidity request, for a device that is showing 14:05 (with the internal clock of the display having the following date and time information; 02/06/2023 14:05:30)

1) **Interface: Ethernet | Protocol: TCP | End of frame: <LF>**
   a. Request: PH<LF>
   b. Answer: RH02-06-2023<SP>14:05:30<LF>
2) **RS232 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
   a. Petition: @01PH<CR>
   b. Answer: @01RT24.3<SP>60<CR>
3) **Ethernet Interface | Function 04h (Read Input Registers) |Protocol: Modbus TCP/IP Dir. Check-in: 00h| Number of Registers: 7**
   a. Answer:

REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h
2	6	2023	5	14	5	30

Characters in oblique square brackets < > indicate special ASCII characters.
<LF> (Line Break) ASCII Value: 0Ah or 10d
<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<SP> (space) ASCII value: 20h or 32d

4.3.6 DC22RT

This model integrates a simple clock of great precision in HH:MM format, with a thermometer with a resolution of tenth of a degree. This combination makes it ideal equipment for offices or production areas, since having synchronized time information allows an organized production schedule. Similarly, in offices it guarantees that meetings between companies or their own are held on time. Having an adequate working temperature has an impact on productivity, hence the importance of monitoring it and checking that it is in its optimal range.

4.3.6.1 Dynamic content in the Overview section

It is identical to that of the DC10TH model (see section 4.3.1.1).

4.3.6.2 Dynamic content in the Global Settings section

It doesn't add dynamic content.

4.3.6.3 Signaling alerts and errors

Same as the DC10TH model (see section 4.3.1.3)

4.3.6.4 Communications with external devices

This model enables the following Modbus commands and registers

DC22RT	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh	
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh	

Board 4.12 DC10TH Modbus Commands and Registers

Application examples:

Temperature request, for a device that is showing 24.9 % (the relative humidity is not represented in the display , but it is shown in the web server and the one observed is: 63%)

1) **Interface: Ethernet | Protocol: TCP | Frame End: *<CR>** (Host Link)
   a. Petition: PT*<CR>
   b. Answer: RT24.9*<CR>
2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: <LF> <CR>**
   a. Petition: @01PT<LF><CR>
   b. Answer: @01RT24.9<SP>63<LF><CR>

Note: The PT command on a serial interface also responds with the humidity value to maintain compatibility with our previous range

Characters in oblique square brackets < > indicate special ASCII characters

<CR> (Carriage Return) ASCII Value: 0Dh or 13d
<LF> (Line Break) ASCII Value: 0Ah or 10d
<SP> (space) ASCII value: 20h or 32d

Application examples:

Temperature and humidity reading via MODBUS for a device whose sensor is measuring a temperature of 24.9 ^{o}C and a relative humidity of 63%

1) **Ethernet Interface | Protocol: MODBUS TCP/IP| Function 04h | Address Start Check-in: 07h| Number of Registers: 2**
   a. Answer

REG 07h	REG 08h
249	63

Note: The temperature value is multiplied by 10 to convert the value to an integer.

4.3.7 DC23

This model implements a basic accident-free days display. These teams foster a culture of safety in the workplace. By showing the number of days that have passed without incidents or injuries, awareness is created and a safe work environment is promoted. This generates a collective commitment to adopt preventive measures, follow safe practices and keep safety as a priority.

4.3.7.1 Dynamic content in the Overview section

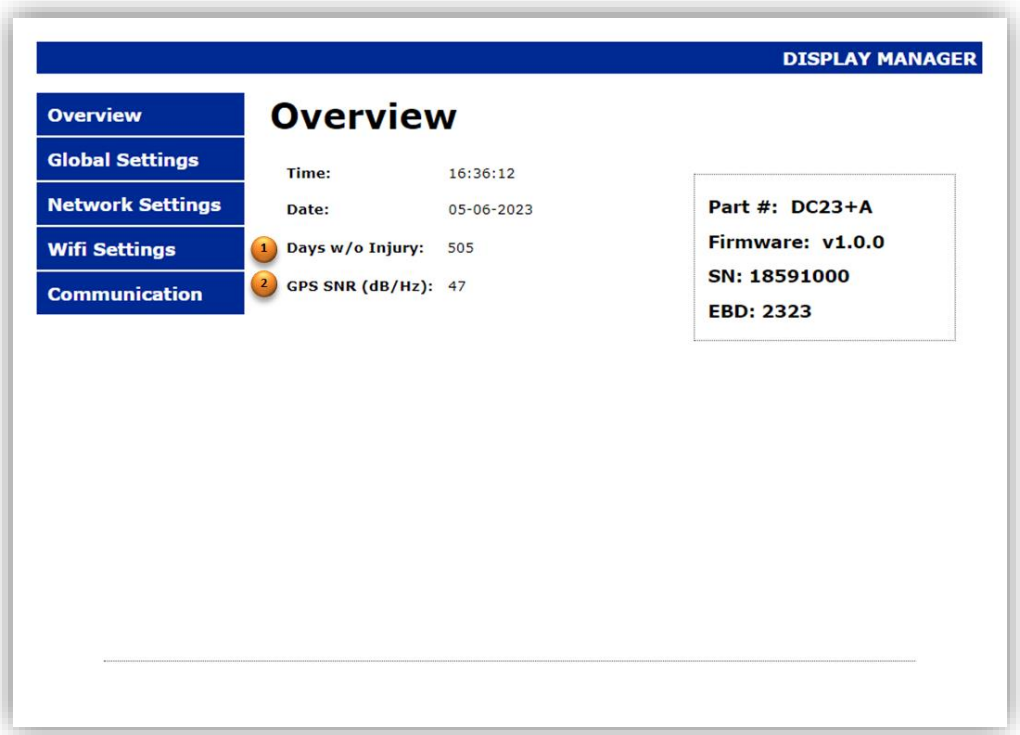


Fig. 4.18 Information shown in the dynamic section of the DC23 model

1. Value of the days without accidents counter. If the adjustments made (see the 4.3.7.2) cause the information to be displayed to be inconsistent (e.g. negative days) the message "----" will be displayed.
2. **[OPTIONAL]** If the equipment has been purchased with the GPS time synchronization option (+A option), it will indicate the GPS signal-to-noise ratio (SNR). The higher the SNR, the better the strength of the received signal and the less likely it is that changing atmospheric conditions will over-attenuate the received signal and lose synchronism with the satellite.

   - If the received signal level is too low, the message "LOW" will be displayed.
   - If GPS time synchronism is not activated (SYNC= GPS, see section 4.1.2) will display the message "OFF".

4.3.7.2 Dynamic content in the Global Settings section

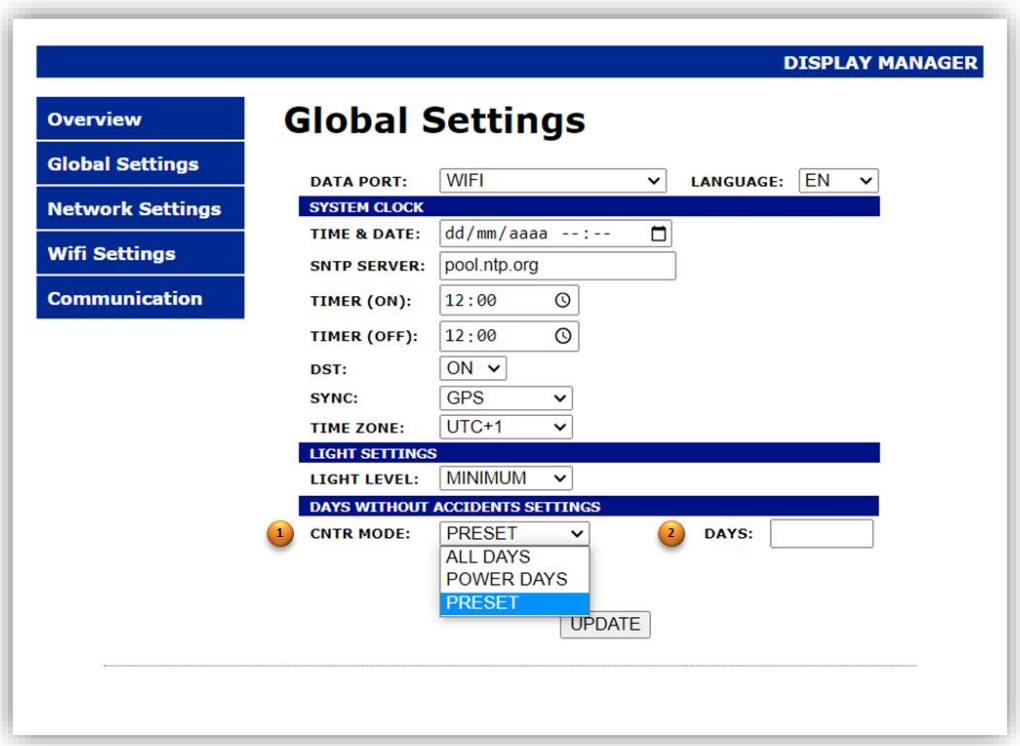


Fig. 4.19 Adjustments to the dynamic section of the DC23 model

1. Accident-free day counting mdoe. The following options are available:
   - **PRESET:** Allows you to set the value of accident-free days to be displayed in the display. Internally the display also records the date with which this adjustment has been made, so it is very important that the display has the correct date and time before setting the accident-free days.
   - **ALL DAYS:** In this mode, all the days elapsed from the date on which the *Preset was made will be counted* and the pre-established value of accident-free days will be increased.
     This type of display bases their operation on the information of their internal clock, so it is extremely important that date and time are correctly set. Therefore, it is recommended whenever possible to synchronize the display with a time server; either your own on an internal network or a public one if you also have an internet connection.
   - **POWER DAYS:** In this mode, only the days on which the display has been powered will be counted. This option is useful in those situations where you want to count only working days, discarding holidays. So, if this displayr is installed on the same power line as the electrical or lighting machines in the work room and assuming that this line will only have power if it is a working day, you can have a good discriminator for the days not worked.

It is possible at any time to change the **ALL DAYS** and **POWER DAYS** modes to display the value of the *total days elapsed* and those *exclusively worked*, since the equipment simultaneously records these values.

It is worth noting those situations in which certain settings may cause inconsistent information in the display.

Case 1) The internal clock of the display is dated 5/6/2023 and we perform a 10-day Preset. If after this adjustment, we change the date of the internal clock to an earlier date, for example 2/3/2023, negative days will occur that will be marked with the message "----".

Case 2) In ***Power Days mode*** it is assumed that from the date of the ***Preset*** the days will always increase progressively. With this criterion, the display when detecting power checks the date of the day and compares it with the last recorded date to determine if a one-day interval has elapsed to increase the counter and update the recording date. Therefore, if in this mode we set the internal clock of the display to a date before the last power date, the message "----" will be displayed (This situation will only affect this mode and not the ***ALL DAYS*** mode, as long as the new setting date is not earlier than the one when the ***Preset*** was made)

IMPORTANT: To avoid these situations, it is advisable to make a new preset with the value of days without accidents that the display must show, if for some reason it is necessary to set the internal clock of the device to a date earlier than the current one. It should also be considered that when performing a ***Preset***, the value of the accumulated in Power Days mode ***is lost***, since the internal counters are reset with the date of the ***Preset***.

2. Value of the accident-free days that you want to set the display. This field only appears if the ***Preset option is selected***. Once this information has been updated with the "Update" button, the selector (1) will automatically switch to **ALL DAYS** or **POWER DAYS** mode (whichever was predefined before the preset).

4.3.7.3 Signaling alerts and errors

No alerts or errors are generated, as it has no sensors attached.

4.3.7.4 Communications with external devices

This model enables the following Modbus commands and registers.

DC23	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh

Board 4.13 DC23 Modbus Commands and Registers

Application examples:

Request for accident-free days for a device that is displaying the value 506.

1) **Interface: Ethernet | Protocol: TCP | End of frame: None**
    a. Request: P.S.
    b. Answer: RD506
2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
    a. Petition: @01PD<CR>
    b. Answer: @01RD506<CR>
3) **Ethernet Interface | Function 04h (Read Input Registers) |Protocol: Modbus TCP/IP Dir. Start Log: 0Ah| Number of Registers: 1**
    a. Answer:

REG 0Ah
506

Set the Accident-Free Days Value to 10

1) **Interface: Ethernet | Protocol: TCP | End of frame: None**
    a. Request: VT10
    b. Answer: VT

2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
    a. Petition: @01VT10<CR>
    b. Answer: @01VT<CR>

3) **Ethernet Interface | Protocol: Modbus TCP/IP**
    a. 10h Function (Preset Multiple Registers) | Start Log: 0Ah| Number of Registers: 1
    b. Function 06h (Preset Single Register) | Register: 0Ah
        i. Value to write to the log for cases (a) and (b)

REG 0Ah
10

Characters in oblique square brackets < > indicate special ASCII characters.

<CR> (Carriage Return) ASCII Value: 0Dh or 13d

4.3.8 DC23D

This equipment expands the DC23 model with additional information such as the record of days without accidents or the date of the last accident. Having these record records is a motivating stimulus for employees, since exceeding them is a collective achievement and demonstrates everyone's commitment and effort to maintain a safe environment.

4.3.8.1 Dynamic content in the Overview section

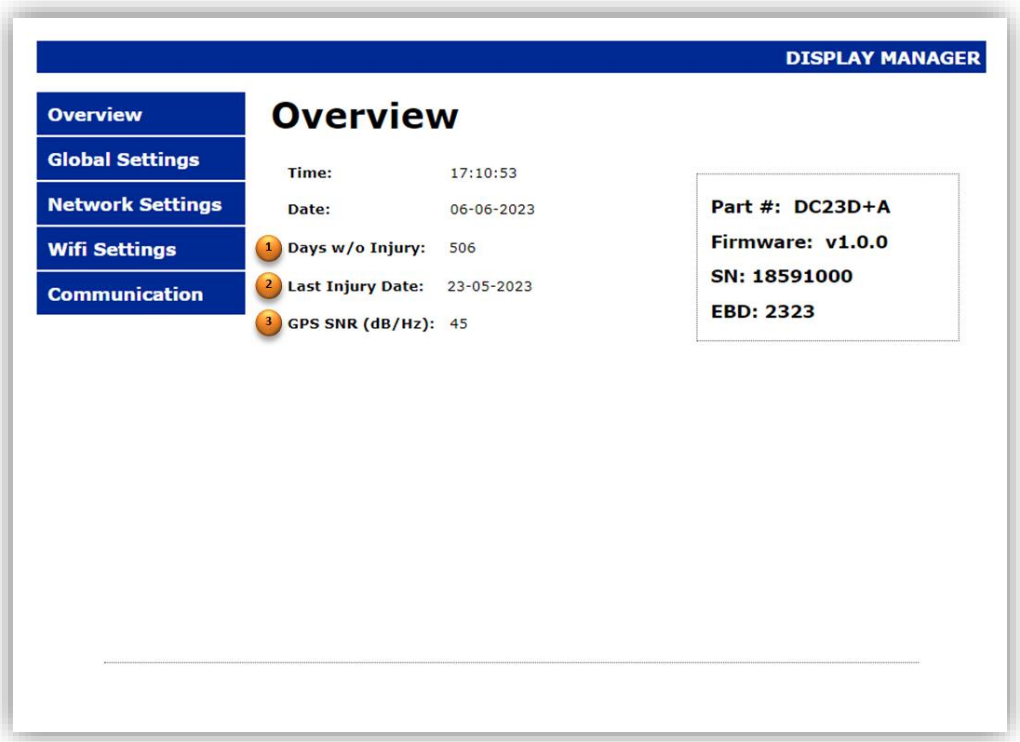


Fig. 4.20 Information displayed in the dynamic section of the DC23D model

1. Value of the days without accidents counter. In the event that the adjustments made (see the 4.3.7.2) cause the information to be displayed to be inconsistent (e.g. negative days) the message "----" will be displayed.
2. Depending on the settings made in the global settings section (see section 4.3.8.2) will show either the date of the last accident or the record of accident-free days.
3. **[OPTIONAL]** If the device has been purchased with the GPS time synchronization option (+A option), it will indicate the GPS signal-to-noise ratio (SNR). The higher the SNR, the better the strength of the received signal and the less likely it is that changing atmospheric conditions will over-attenuate the received signal and lose synchronism with the satellite.

   - If the received signal level is too low, the message "LOW" will be displayed.
   - If GPS time synchronism is not activated (SYNC = GPS, see section 4.1.2) will display the message "OFF".

4.3.8.2 Dynamic content in the Global Settings section

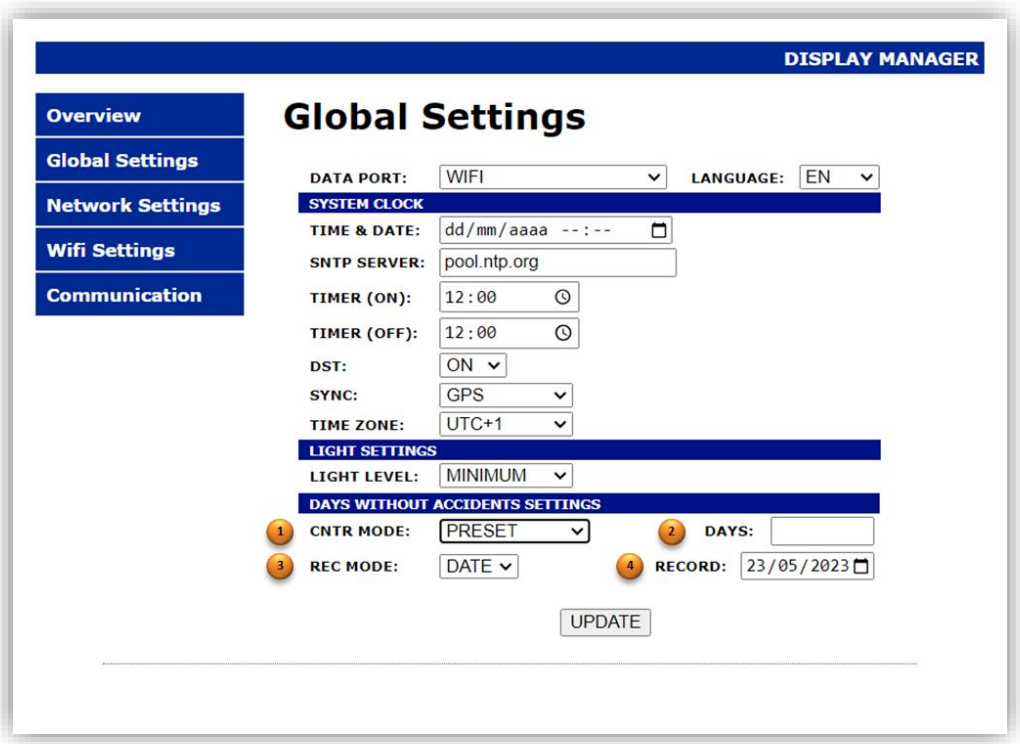


Fig. 4.21 Information displayed in the dynamic section of the DC23D model

1. How to count the days without accidents, see section 4.3.7.2 for the different options.
2. Value of the accident-free days that you want to set in the display, this control appears only when you select the ***Preset*** in (1), see the section 4.3.7.2 for more information.
3. Selector of the record information to be displayed; Allows you to select whether the display will show the date of the last accident or the record of accident-free days
4. Depending on the selection in (3), the appropriate control will appear in this field to enter either the record of days without accidents or the date of the last accident. In the date type controls, clicking on the icon located on the far right of the control opens a calendar that facilitates the entry of dates, there is even an option that directly updates this control to the date of the current day.

It should be noted that both the date of the last accident and the record of days without accidents are values that are controlled exclusively by the user. The display in no case modifies the date of the last accident or the record of accident-free days depending on whether the counter has been reset or whether the accident-free days exceed the previously established record. In this way, the user has all the flexibility to update these values when they see fit.

4.3.8.3 Signaling alerts and errors

No alerts or errors are generated, as it has no sensors attached.

4.3.8.4 Communications with external devices

This model enables the following Modbus commands and registers.

DC23D	COMMANDS															
TCP | UDP| ASCII	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	VF					
	MODBUS															
Function: 04h (Input Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
Function: 03h, 06h 10h (Holding Registers)	REG 00h	REG 01h	REG 02h	REG 03h	REG 04h	REG 05h	REG 06h	REG 07h	REG 08h	REG 09h	REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh

Board 4.14 DC23D Modbus Commands and Registers

Application examples (I):

Asking a display who has this parameter configured for the date of the last accident with the date 25/2/2023

1) **Interface: Ethernet | Protocol: TCP | End of frame: None**
   a. Request: FR
   b. Answer: RF25-03-2023

Asking for the record of days without accidents to a display that has this parameter configured with the value 244

2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
   a. Petition: @01DR<LF>
   b. Answer: @01RD244<LF>

Obtain the information related to the days without accidents from the display (counter value=74, record days=244 and date of the last accident=25-03-2023)

3) **Ethernet Interface | Function 04h (Read Input Registers) |Protocol: Modbus TCP/IP Dir. Start Log: 0Ah| Number of Registers: 5**
   a. Answer:

REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
74	244	25	3	2023

Characters in oblique square brackets < > indicate special ASCII characters.

<LF> (Line Break) ASCII Value: 0Ah or 10d

Application examples (II):

Enter the parameter of the date of the last accident with the date 7/6/2023

1) **Interface: WIFI | Protocol: UDP | End of frame: None**
   a. Request: VF1-3-23 (VF01-03-2023 format is also valid)
   b. Answer: VF

Write the record parameter of days without accidents with the value 675

2) **RS485 Serial Interface |Destination display address: 01| Protocol: ASCII |End of frame: *<CR>***
   a. Petition: @01VD675<CR>
   b. Answer: @01VD<CR>

Write down all the information related to the display's accident-free days (counter value=0, record days=675 and date of last accident=7-6-2023)

3) **Ethernet Interface | 10h Function (Preset Multiple Registers) |Protocol: Modbus TCP/IP | Dir. Start Log: 0Ah| Number of Registers: 5**
   a. Values to write to the logs :

REG 0Ah	REG 0Bh	REG 0Ch	REG 0Dh	REG 0Eh
0	675	7	6	2023

Characters in oblique square brackets < > indicate special ASCII characters.

<LF> (Line Break) ASCII Value: 0Ah or 10d

5 FIRMWARE UPDATE

Firmware updates fix detected bugs, including improvements in computer performance and optimizations to increase the overall stability of the system. Also, in some cases they can add new features and capabilities to the device. The equipment in the DC range has this functionality and allows the user to update the equipment to always have it in optimal operating conditions.

For greater ease, the user will be able to update the equipment through the company's local network, without the need to be in the physical location where the display or displays to be updated are installed.

To be able to update the equipment, it is necessary to download the **MicroBoot application** (https://www.lartet.com/en/download-center/) and follow the following steps:

5.1 Configuring the MicroBoot Application

The current version of the computers only allows updating via wired network connection, and the configuration is as follows.

When opening the application, go to the "Settings" option to configure the communication

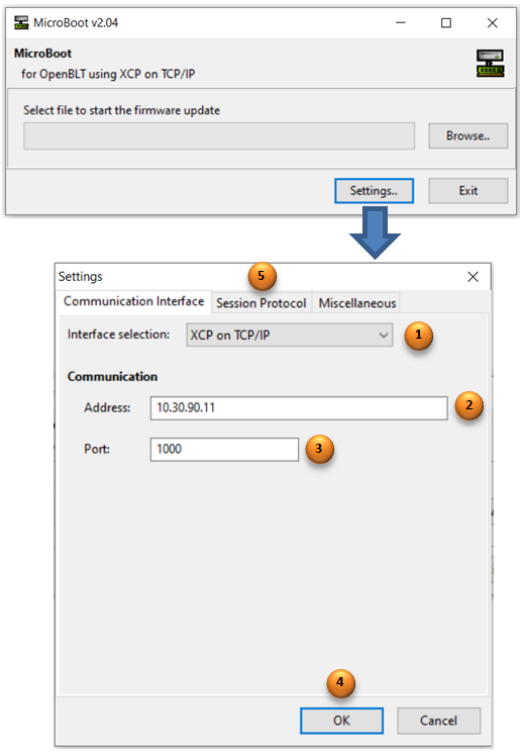


Fig. 5.1 MicroBoot Configuration

1. Interface Selection. Select "*XCP on TCP/IP*" for the update over Ethernet.
2. Field to enter the IP of the equipment to be updated
3. Update port. The value to be defined in this field is 1000
4. Button to accept the settings.
5. Update protocol parameters, set the timers with the values in the "Timeouts" section indicated in the Fig. 5.2

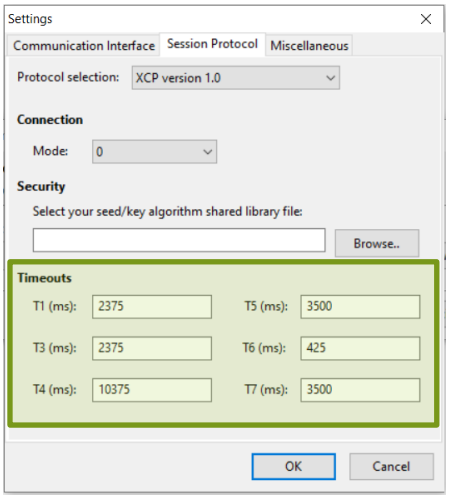


Fig. 5.2 Update Protocol Timeouts

5.2 Equipment Upgrade

Once the application is configured, click on the "Browse" button on the main screen and locate the directory where the file with the update firmware (.srec extension) is located.

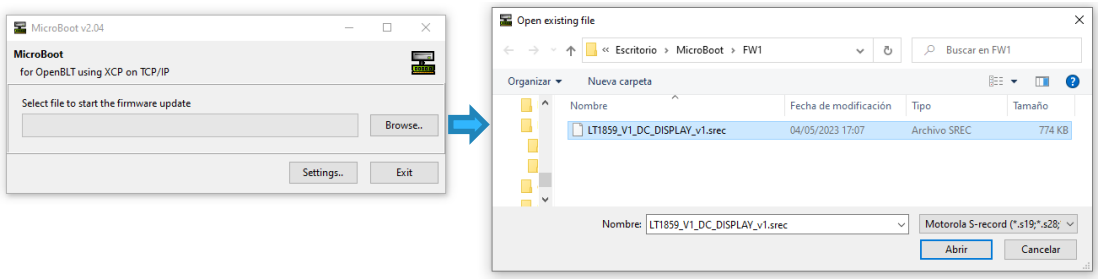


Fig. 5.3 Selecting the Update File

Selecting the file and pressing the "Open" button will start the update process. On the main screen of the application, the progress of the progress bar will be observed until the update process is completed.

During the update, the display will display the message "**bP1**". It is important to pay attention to the message that the display indicates when you start the update process, especially if the update process does not start.

If the display shows "**bP1**" when starting the update process indicates that the computer is waiting for communication over the IP that the display has configured and therefore MicroBoot should be configured with this IP (see 5.1). If, on the other hand, the message displayed is "**bP0**", MicroBoot should be configured with the emergency IP (192.168.1.100) for the update.

Generally, we will always update the display by the IP that the equipment has defined. In cases where a problem has arisen during the update through your IP (failure in the power supply of the equipment, disconnecting the cable, etc.) the update will be incomplete and the display will not

have a valid program to run and will not know how to interpret its own IP. For these cases, if the power supply equipment is disconnected and reconnected, it will be observed that for a period "bP0" is displayed. During this time interval, the update process can be attempted by the emergency IP. Once the display is successfully restored, the configuration of parameters, IP addresses, etc. will be the same as the display had previously configured, and the computer configuration will not be lost if unfortunately an update has been corrupted.

If when updating a display the update process does not start or takes longer than usual, cancel the process with "EXIT", check the IP configured in the MicroBoot application, the Ethernet cable and check that the rules defined in the Firewall are not blocking communication. Once possible problems have been identified and fixed, repeat the update process.

DECLARATION OF CONFORMITY

Tetralec Electronica Industrial S.L.
c/ Severo Ochoa, 80
Font del Radium Industrial Estate
08403 Granollers

As a brand device builder **LARTET:**

Model: DC-10TH (V2) in all its versions.
Model No.: DC-41RTH (V2) in all its versions.
Model No.: DC-41RTHO (V2) in all its versions.
Model: DC-20TH (V2) in all its versions.
Model: DC-10R (V2) in all its versions.
Model: DC-22RT (V2) in all its versions.
Model: DC-23 (V2) in all its versions.
Model: DC-23D (V2) in all its versions.
Model: DR-109 (V2) in all its versions.
Model: DR-119 (V2) in all its versions.
Model: DR-189 (V2) in all its versions.

We declare under our sole responsibility that the aforementioned product complies with the following European directives:

Directive: 2014/35/EU	Low voltage directive.
Standard UNE-EN 60204-1:2019	Machine safety. Electrical equipment of the machines.
Directive: EMC 2014/30 EU	Electromagnetic Compatibility Directive.
UNE-EN 61000-6-2:2019	Generic norms. Immunity in industrial environments
UNE-EN 61000-4-4:2013	Tests of immunity to fast electrical transients in bursts.
UNE-EN 61000-4-2:2010	Electrostatic discharge immunity test.
Directive 2011/65/EU:	Restrictions on the use of certain substances in electrical and electronic equipment.

Granollers, June 22, 2023