



TECHNICAL MANUAL

DC Range (V2)

DC10TH
DC10R

DC41RTH
DC22RT

DC41RTHO
DC23

DC20TH
DC23D





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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 show 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 features, you can have peace of mind that your watches will always show the correct time. We also have models that combine the watch with environmental measures to cover all your needs.

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


Within the DC range we will find models indicating accident-free days. These teams 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 risky 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, Wi-Fi 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 teams can take connectivity and configuration to a new level in your work environment


2 Models & Features


2.1 Features by Model


DC10TH	
	POWER SUPPLY
	Supply voltage: 100 – 240 V AC (50/60 Hz)
	Max Power: 15 W Power Minimum Luminosity: 10,2 W
	DISPLAY
	3 digits of 7 segments. 100 mm digit height + unit of measure symbol
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
	Maximum ambient lighting: 1000 lux
	Degree of protection: IP 41
	SENSOR (Temperature & Humidity)
	Temperature Measurement Range: -10 to 90 °C Accuracy $\leq \pm 0.3$ °C
Humidity Measurement Range: 0 to 100 % Accuracy $\leq \pm 2.5$ %	
Temperature resolution: 0.1 °C Humidity resolution: 1%	
DIMENSIONS & 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 Luminosity: 10.9 W
	DISPLAY
	Time: 4 digits of 7 segments. 100 mm digit height + two dots
	Temperature: 3 digits of 7 segments. 100 mm digit height
	Humidity: 2 digits of 7 segments. 100 mm digit height
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
	Maximum ambient lighting: 1000 lux
	Degree of protection: IP 41
SENSOR (Temperature & Humidity)	
Temperature Measurement Range: -10 to 90 °C Accuracy $\leq \pm 0.3$ °C	
Humidity Measurement Range: 0 to 100 % Accuracy $\leq \pm 2.5$ %	
Temperature resolution: 0.1 °C Humidity Resolution: 1%	
DIMENSIONS & 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 Luminosity: 11.1 W
	DISPLAY
	Time: 4 digits of 7 segments. 100 mm digit height + two dots
	Temperature: 3 digits of 7 segments. 100 mm digit height
	Humidity: 2 digits of 7 segments. 100 mm digit height
	CO ₂ : 4 digits of 7 segments. 57 mm digit height
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
Maximum ambient lighting: 1000 lux	
Degree of protection: IP 41	
SENSOR (Temperature, Humidity & CO₂)	
Temperature Measurement Range: -10 to 70 °C Accuracy = ±0.4 °C	
Humidity Measurement Range: 0 to 95 % Accuracy ≤ ±3 %	
CO ₂ Measurement Range: 0 to 10000 ppm Accuracy = ±30ppm + 3% VM	
Temperature Res.: 0.1 °C Humidity Res.: 1% CO ₂ Res.: 1 ppm	
DIMENSIONS & 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 Luminosity: 10.3 W
	DISPLAY
	Temperature: 3 digits of 7 segments. 100 mm digit height
	Humidity: 2 digits of 7 segments. 100 mm digit height
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
	Maximum ambient lighting: 1000 lux
	Degree of protection: IP 41
SENSOR (Temperature & Humidity)	
Temperature Measurement Range: -10 to 90 °C Accuracy ≤ ±0.3 °C	
Humidity Measurement Range: 0 to 100 % Accuracy ≤ ±2.5 %	
Temperature resolution: 0.1 °C Humidity resolution: 1%	
No. of Measurement Channels: 1 to 4 sensors	
DIMENSIONS & 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 Luminosity: 10.3 W
	DISPLAY
	Time: 4 digits of 7 segments. 100 mm digit height + two dots
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
Maximum ambient lighting: 1000 lux	
Degree of protection: IP 41	
DIMENSIONS & WEIGHT	
Width x Height x Depth: 440x240x60 mm	
Approximate Weight: 4.5 Kg	

DC22RT	
	POWER SUPPLY
	Supply voltage: 100 – 240 V AC (50/60 Hz)
	Max Power: 20 W Power Minimum Luminosity: 10,7 W
	DISPLAY
	Time: 4 digits of 7 segments. 100 mm digit height + two dots
	Temperature: 3 digits of 7 segments. 100 mm digit height
	Humidity: 2 digits of 7 segments. 100 mm digit height
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 a 50 °C
Storage Temperature: -20 a 60 °C	
Humidity: 5 to 95 % non-condensing	
Maximum ambient lighting: 1000 lux	
Degree of protection: IP 41	
SENSOR (Temperature & Humidity)	
Temperature Measurement Range: -10 to 90 °C Accuracy $\leq \pm 0.3$ °C	
Humidity Measurement Range: 0 to 100 % Accuracy $\leq \pm 2.5$ %	
Temperature Resolution: 0.1 °C Humidity Resolution: 1%	
No. of measurement channels: 1 to 4 sensors	
DIMENSIONS & 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 Luminosity: 15.6 W
	DISPLAY
	4 digits of 7 segments. 100 mm digit height
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
Maximum ambient lighting: 1000 lux	
Degree of protection: IP 41	
DIMENSIONS & 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 Luminosity: 13,5 W
	DISPLAY
	Date/Record Days: 6 digits of 7 segments. 57 mm digit height
	Days without accidents: 4 digits of 7 segments. 57 mm digit height
	Visibility: 50 m
	ENVIRONMENTAL CONDITIONS
	Working Temperature: -10 to 50 °C
	Storage Temperature: -20 to 60 °C
	Humidity: 5 to 95 % non-condensing
	Maximum ambient lighting: 1000 lux
	Degree of protection: IP 41
DIMENSIONS & 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 display:	2
Maximum Voltage:	250 VAC, 30 VDC
Maximum Current (Resistive Load):	Normally Open Contact (NO) : 5 A Normally Closed Contact (NC): 3 A



3 Installation of the Displays

3.1 Attaching the equipment to the wall

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

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

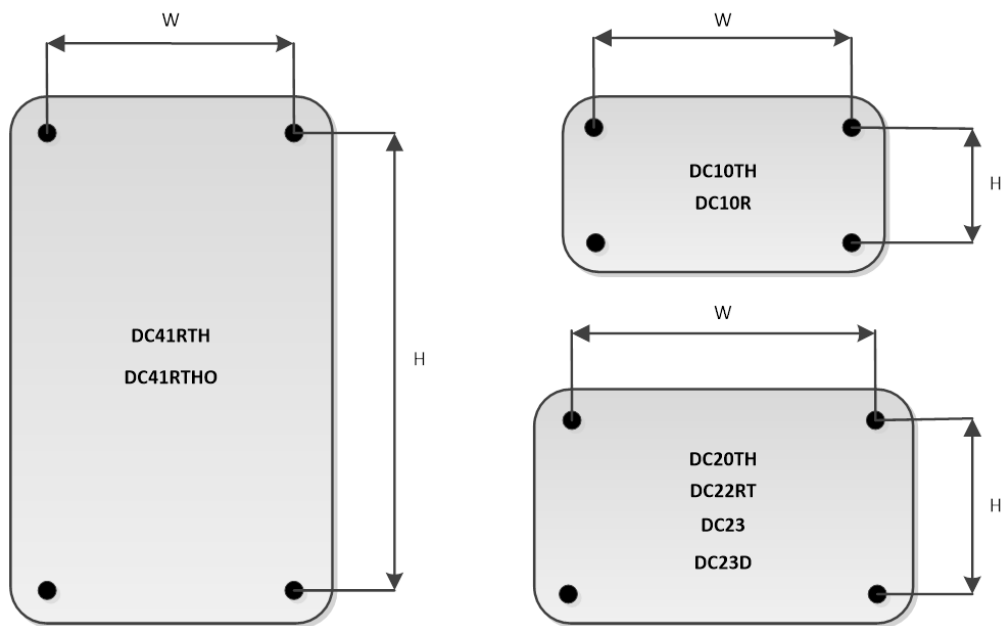


Fig. 3.1 Formats by Display Model

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

Tabla 3.1 Attachment dimensions per model



3.2 Powering the equipment

The equipment must be supplied in the range of 100 to 240 VAC, 50/60 Hz. A grounded Shuko-type plug must be used.

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

3.3 Internal Connections

The controller board of the visualizer is equipped with a series of connectors that simplify connections.

These connectors will be used to connect communication cables to external devices, environmental measurement sensors, etc.

The factory equipment already comes with all the elements connected. The user will only need to access 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 display.

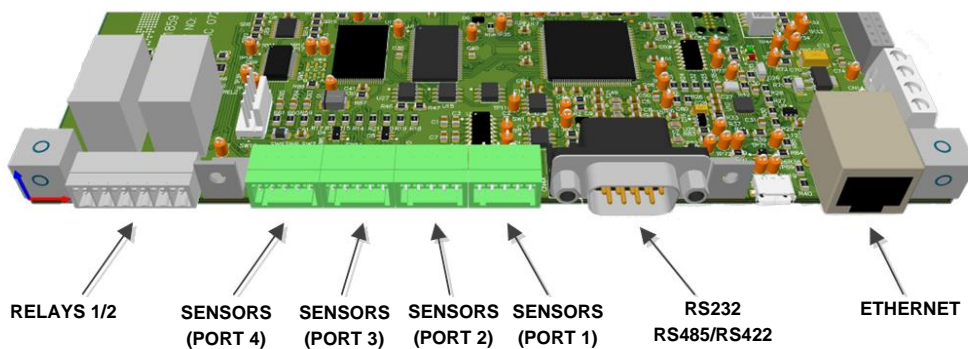


Fig. 3.2 Connections to the Controller Board

3.3.1 Ethernet

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

Computers are usually supplied with a small Ethernet cable extension so that you do not need to open the device to access this connector.

The Ethernet connection is required to access the display's web server and configure its operating parameters (especially on the first connection to the device).

3.3.2 Serial line (RS232/RS485 [RS422])

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

The selection between interfaces will be done through the display's web server.

In Fig. 3.3 shows the signal assignment on the connector.

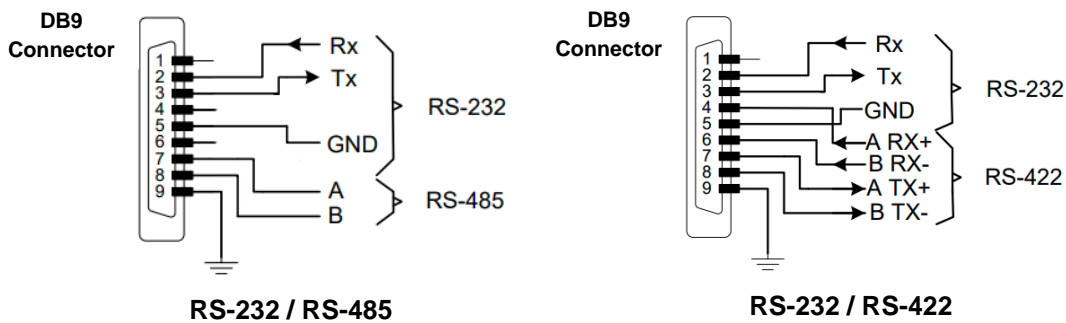


Fig. 3.3 Assigning Signals on the Connector

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 less.

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

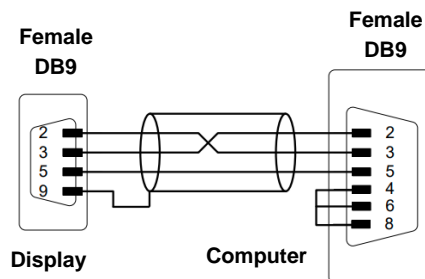


Fig. 3.4 RS-232 communication between devices

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

RS-485 communication allows you to cover greater distances than RS-232 communication. In no case 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 ($R=120\ \Omega$ for stranded cable), since in this way the reflections are attenuated and the distortion of the transmitted data is minimized, allowing greater speed in communication and length of the line.

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

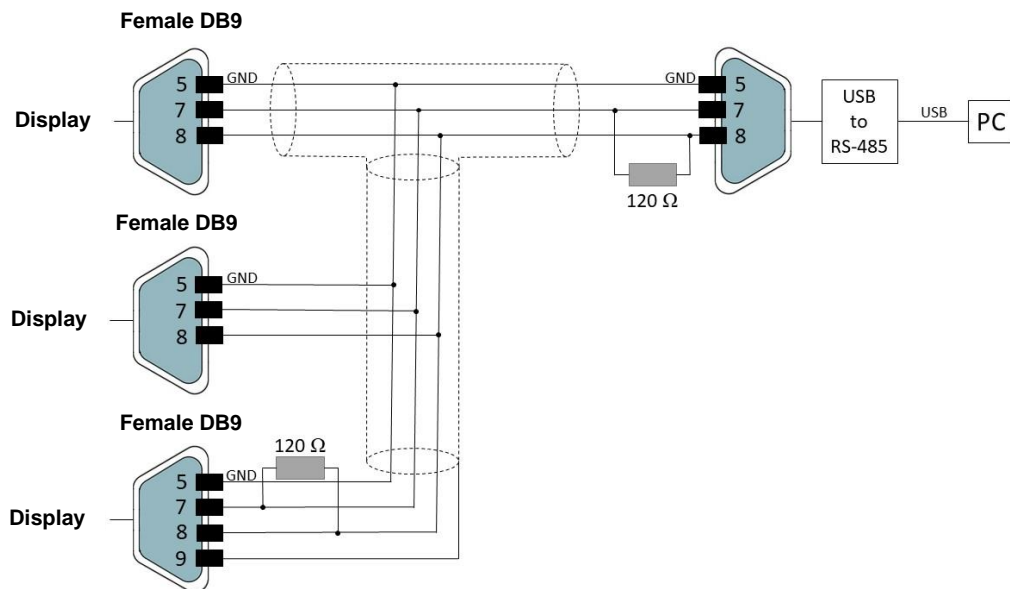


Fig. 3.5 RS-485 communication between one PC and 3 displays

3.3.3 Sensors

The DC20TH is the only model that supports up to 4 temperature and humidity sensors that can be connected interchangeably on any of the dedicated sensor ports. This model also allows individual calibration of each sensor, so if more than one sensor is connected it is especially useful to identify the sensor port being calibrated to set the compensation parameter to 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 you plug it into another port, the sensor will not be recognized.

3.3.4 Relays

All models in the DC range have 2 relays (SPDT) for connecting/disconnecting devices. It is important to comply with the potency characteristic indicated in 3.3.3 to avoid damaging them. The NO (Normally Open), C (Common) and NC (Normally Closed) contacts are listed below:

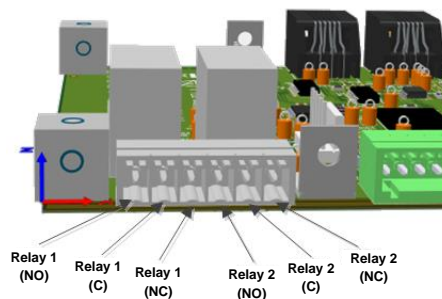


Fig. 3.6 Identification of internal relay terminals

3.3.5 GPS

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

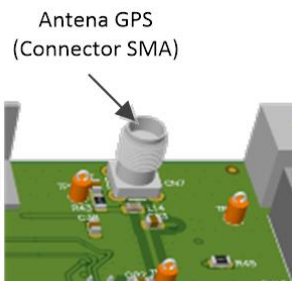


Fig. 3.7 GPS antenna connector

Whenever possible, the GPS antenna should be placed outside, in an elevated and clear place, avoiding obstacles and sources of electromagnetic interference. The clearer the view to 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 to the outside of galvanized steel metal roofs (roofs or facades).

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) **Message "bP0"**: Each time the device is powered, and before the main program starts, an access time is set to the Bootloader that will allow you to retry a failed FW update process. This functionality allows you to resolve situations where an FW update has not completed successfully, or an erroneous FW has been loaded that may cause the display to become inoperable. The time interval in which the "bP0" message 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 previously defined on the computer).
- (2) **Test sequence**: At this stage, all 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**: Displays the hardware ID (XX) of the display.
- (4) **uX.X**: Displays the firmware version of your computer. On computers that have fronts with rows of digits, stages (3) and (4) are displayed in a single step.
- (5) **Display Started**: It will show the display information. For models that have sensors, if the sensor is not properly connected or there is some kind of abnormality 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 does not receive the first data, the equipment will indicate "---".

The displays are configured at the factory with IP 10.30.90.11 for the wired network. If you connect the display directly to a PC and set the computer's network settings to an IP that is within the same range as the display's IP (for example 10.30.90.100). When you open the browser and type in the factory IP of the display, you will access the webserver to perform the first configuration. It is also possible to configure it via 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/>). By means of "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 a wired network.

3.5 Configuration with "Display Discoverer"

When you open the app, if one or more displays are connected to the network, it will detect them and display them in the app.

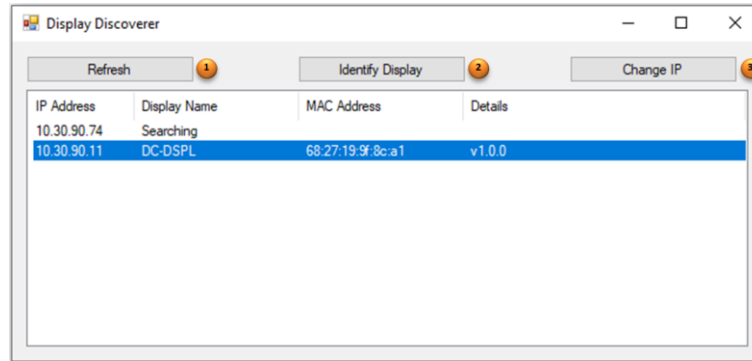


Fig. 3.8 Displays detected with "Display Discoverer"

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 visualizers connected to the network and we select one of the rows of the detected displays, when we press "Identify Display", the information that is showing that display will flash three times. In this way, you will be able to verify that the webserver you are going to access corresponds to the physical unit you want to configure.
3. Clicking on "Change IP" will take you to the submenu to assign a new IP to the device or click on the "Auto-Assign IP" button to obtain it automatically.

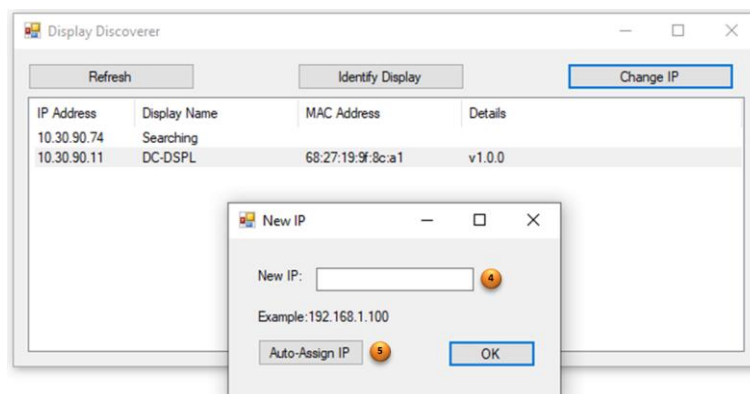


Fig. 3.9 Assigning a new IP

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



5. Pressing this button will automatically set the "DHCP" mode on the device and you will 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 take you directly to the main page of the webserver.

IMPORTANT:

If several new equipments are received for installation, it must be considered that they will all be configured with the same IP address, so prior to their configuration, the IP of some computers must be changed individually to avoid duplication of address

4 Configuring the display

To configure the equipment, you only need to access the internal web server of the computer 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 to access the web server will be obtained with the *Display Discoverer* application (see section 3.5) that will locate the different connected computers, easily accessing the *web server of the selected device* with a double click.

It is also possible to configure and use the display via WIFI connection. The WIFI connection has its own IP address (which must be different from the Ethernet address to avoid duplication of equipment on the network). The current version of the *Display Discoverer app* only locates devices connected via a 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 device via a wired network and view the defined IP address in the WIFI settings.

The display's internal web server provides an intuitive, easy-to-use environment for customizing different configuration parameters, network settings, modes of operation, communication interfaces, etc. At the same time, it also allows you to remotely visualize 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 Configuration and localization parameters on the web server

All the displays in the DC range have the same web server structure, i.e. 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 only certain models have available 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:** An entry page to the web server that displays information about the model and the values represented by the display
- **Global Settings:** Global equipment settings.
- **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

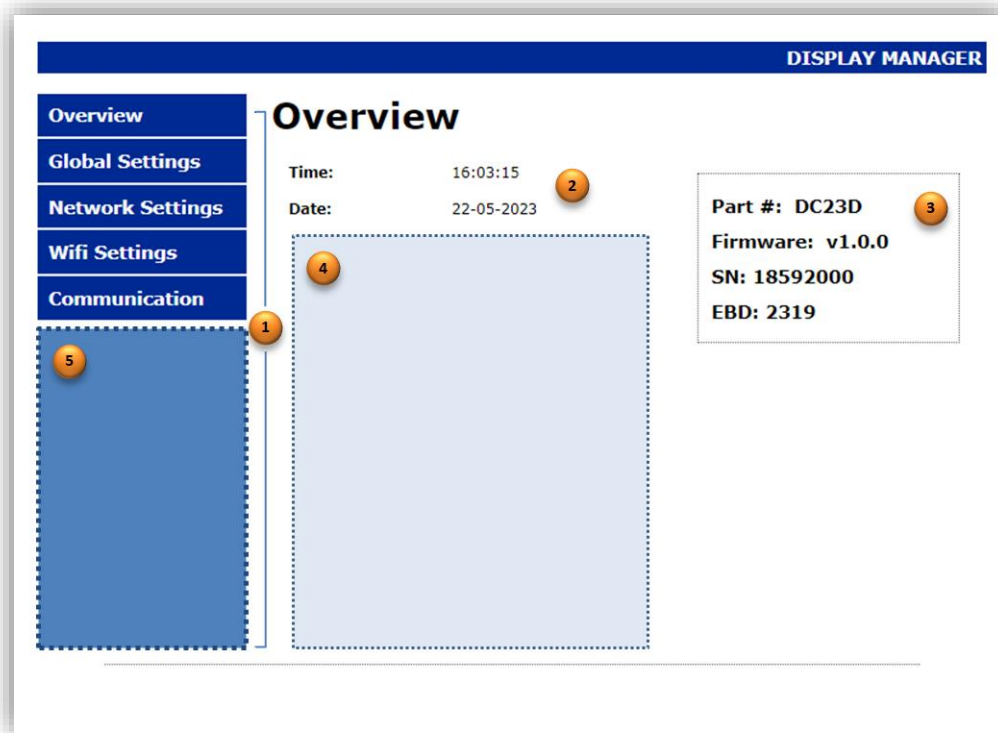


Fig. 4.1 Web server entry page. Overview

1. Navigation menu to access the different sections on the web server.
2. Displays time information from the device's internal clock.
3. Identification record of the equipment, especially useful when contacting the technical support 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 team, there will be a greater or lesser number of variables represented. (see the section describing the specific model for more details)
5. Dynamic Links Area: Some models have additional sections for parameterization of the equipment. (see the section describing the specific model for more details)

4.1.2 Global Settings

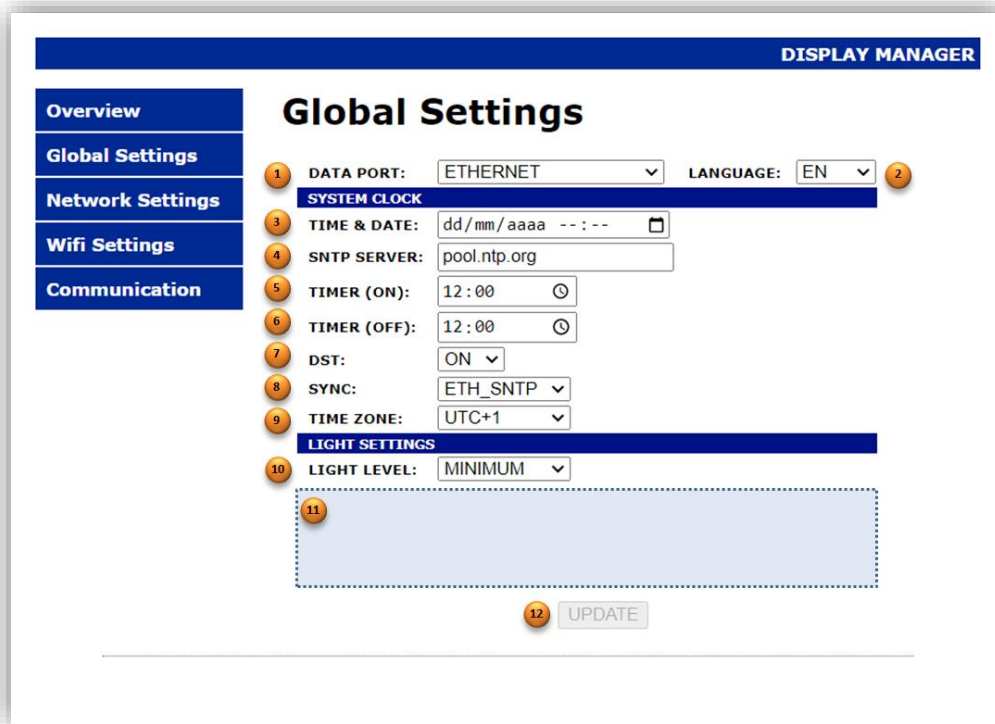


Fig. 4.2 Global Team Settings

1. The display has the communication interfaces; Serial, Ethernet and Wifi to communicate via commands 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. Sets the date and time for your computer's internal clock. If you click on the *calendar icon* located at 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 computer from which you are accessing the web server.
4. SNTP address/domain of the time server to permanently have the device's internal clock 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. Tapping the clock icon on the far right of the control 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 for synchronizing the device's internal clock.
 - **NONE:** It will not sync the watch
 - **ETH_SNTP:** Wired network synchronization (will use the server defined in 4)
 - **WIFI_SNTP:** Synchronization by WIFI (you will use the server defined in 4)
 - **GPS:** This option will only appear on computers 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 the device is synchronized with a time server or by GPS.
10. Set 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 depending on the ambient light (AUTO option).
11. Dynamic information area. Depending on the model of the device, specific configuration controls will appear in this area. (See the section describing the specific model 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

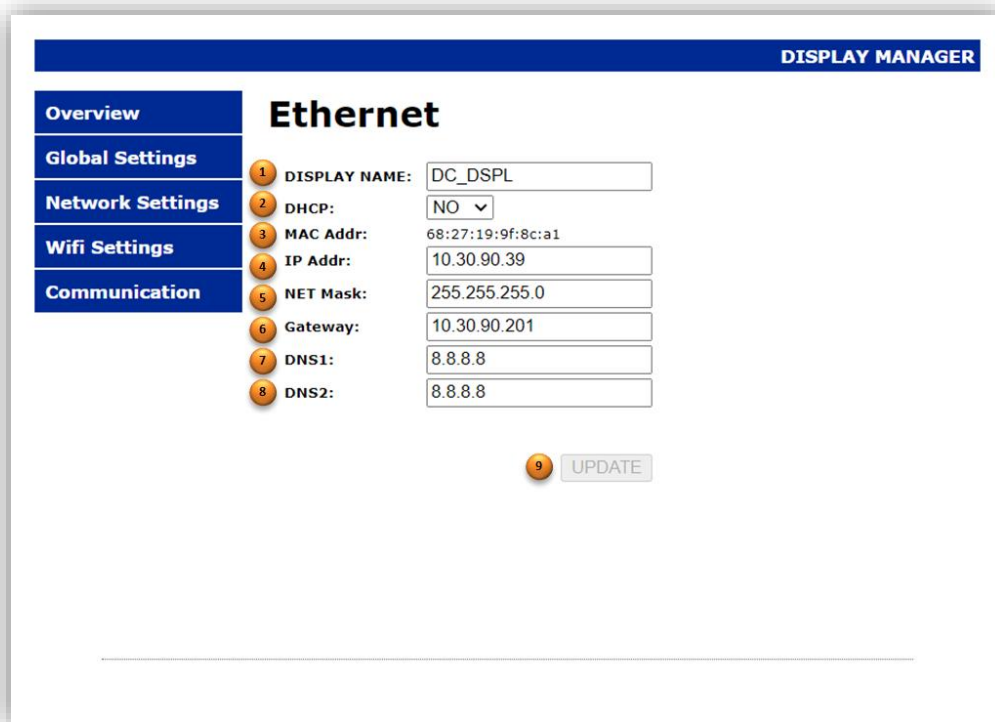


Fig. 4.3 Network Settings

1. In a local network with NetBios support, each computer is assigned a unique name for its knowledge and identification, allowing each computer to be perfectly distinguishable. This parameter allows us to define the name with which we will identify the computer 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 name that will appear in the *Display Discoverer* app when it lists the devices found.
2. The DHCP protocol is enabled/disabled. If you want the device's IP 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, you must set this control to OFF.
3. Displays the MAC address of the display.
4. Modify the IP address of the display.
5. Modify the netmask.
6. Modify the address of the gateway. It is important that this address is well defined to be able to communicate with external networks such as the internet and have access to public time servers.
7. Sets the primary address of the DNS. If the DNS is not defined 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. Set the secondary address of the DNS.
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 duplicate address conflicts, since the display does not generate any warnings in case this happens.
- B)** Since the only viable way to configure the display is through the web server. The device is equipped with an IP detection mechanism that if it detects 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 performing a search for connected devices using the *Display Discoverer* application, we will know at any time the IPs assigned to the devices.

4.1.4 Wifi Settings

The screenshot shows the 'DISPLAY MANAGER' interface for 'WIFI Parameters'. On the left is a navigation menu with 'Wifi Settings' selected. The main area is divided into three sections:

- WIRELESS NETWORK CONFIGURATION:**
 - 1. NETWORK NAME (SSID): DIRECT-DC-DISPLAY
 - 2. WIFI STATE: CONNECTED
 - 3. NETWORK TYPE: ACCESS POINT
 - 4. CHANNEL: 1
- WIRELESS NETWORK SECURITY:**
 - 5. AUTHENTICATION: WPA2_PSK
 - 6. PASSWORD: [REDACTED]
- IP CONFIGURATION:**
 - 7. MAC Addr: 52:02:91:7e:5c:bc
 - 8. IP Addr: 10.30.90.19
 - 9. NET Mask: 255.255.255.0
 - 10. Gateway: 10.30.90.201
 - 11. DNS1: 8.8.8.8

At the bottom right, there is a 12. UPDATE button.

Fig. 4.4 WiFi Settings

1. Set the name of the WIFI network you want to connect to 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 name of the station is not correct or the password is incorrect, "ERROR" will be displayed in this field.
3. Configure the display to connect to an external WIFI network with the name indicated in 1 (**Station Mode**) or convert the display to 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 the performance and quality of the connection. 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 you want to assign to your 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 that we want our access point to have so that other devices connect to the display.
7. Displays the MAC address of the WIFI network. There are two different directions, depending on whether the device is configured in **STATION** or **ACCESS POM 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 will have to 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 be able to communicate with external networks such as the internet and have access to public time servers.
11. Configure the DNS. If the DNS address is not well defined, IPs for time server domain names, 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 since 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.

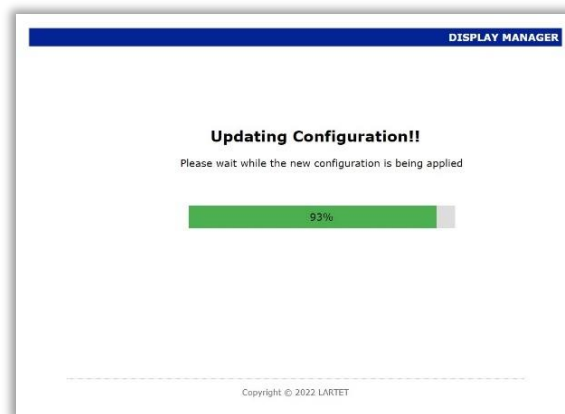


Fig. 4.5 WIFI module reboot process with the new configuration

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

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

PASSWORD: 12345678

Web Server Access IP: 10.30.90.16

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

Particularities of WIFI communication:

Wireless communication is not identical in functionality to that of a wired network. Here are some things to keep in mind.

- 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 set incorrectly, when the new WIFI settings are reset, wireless communication may not be able to 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 separate. Make sure that both are different and that they are not duplicated with other equipment if the display is integrated into a network.
- When starting a point-to-point connection in Windows operating systems, if the list of WIFI networks is refreshed (closing and reopening the option to show "Available Wifi networks"), we will see that we get the status of "Connected" faster than if we wait for the system to notify us automatically.

4.1.5 Configuring Communication Protocols (Communication)

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

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

4.1.5.1 Ethernet Interface (DATA PORT = ETHERNET)

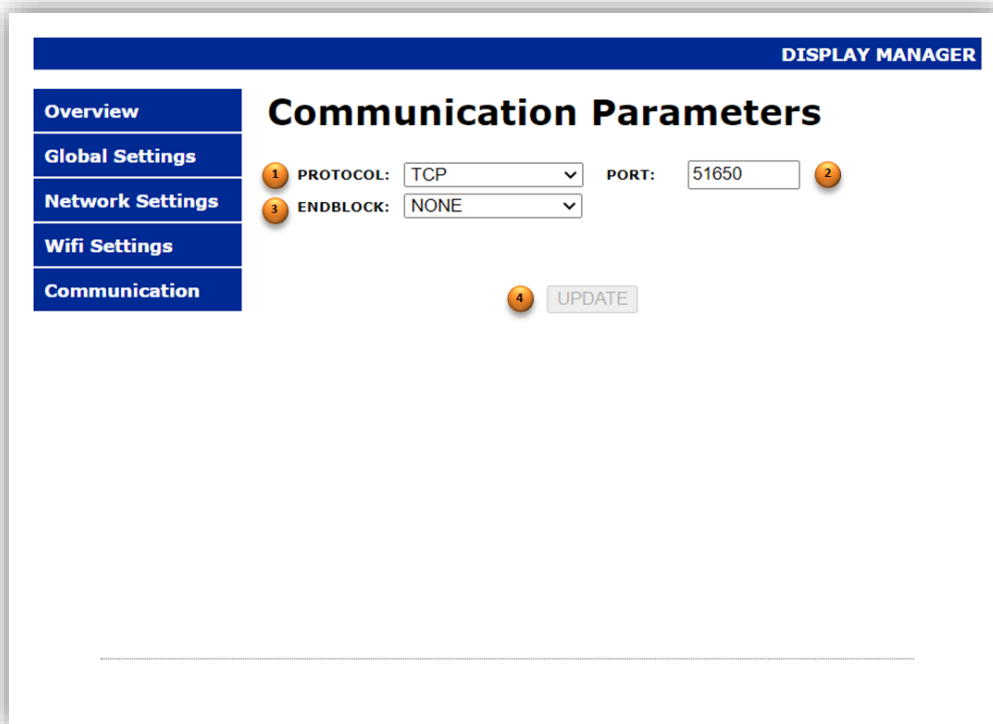


Fig. 4.6 Communication settings (Ethernet)

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 TCP and UDP protocols, as 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).

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

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

Table 4.1 End of block (Ethernet)

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

- 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)

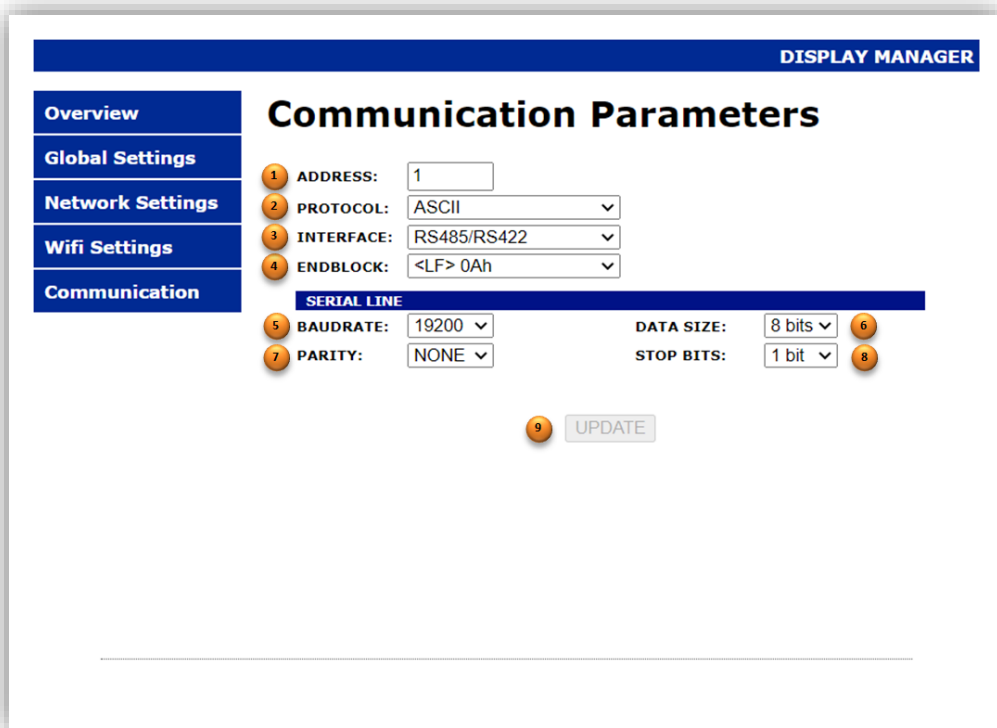


Fig. 4.7 Communication Settings (Serial)

1. Sets the address that the device will have on the communication serial bus. Valid values must be within the range 1 to 99.
2. Configure the communication protocol to be used. 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. Defines the end of the frame to be used in serial communication.

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

Table 4.2 End of block (Serial)

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 is set to 8 bits.
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)

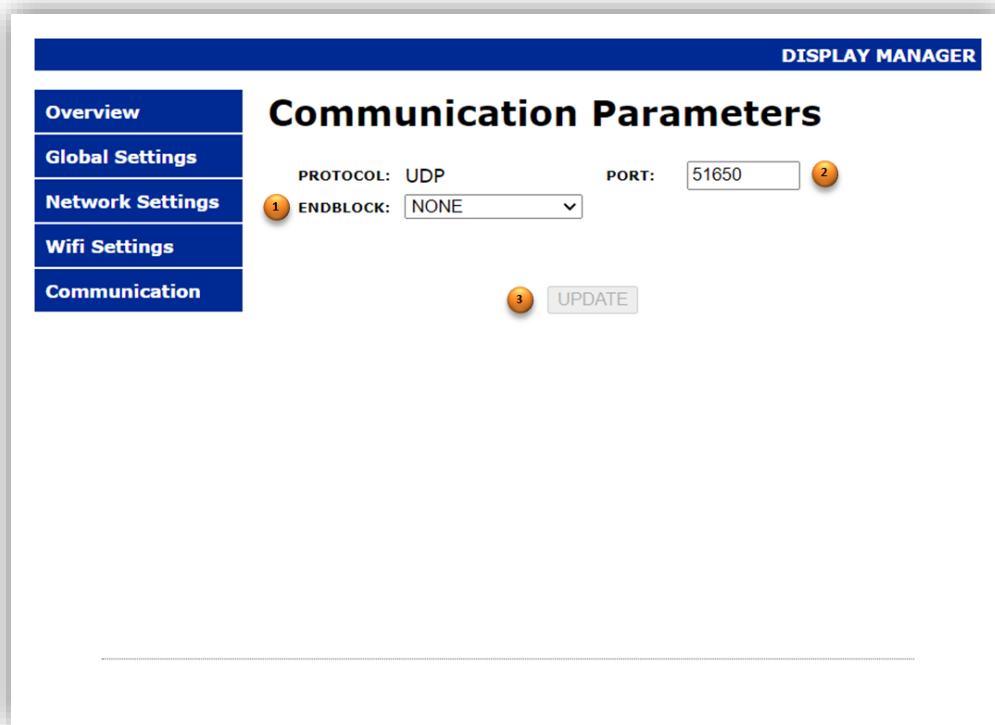


Fig. 4.8 Communication Settings (WIFI)

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. Allows you to select the end of the frame that will accompany the command. The viable options are the same as those given for the Ethernet interface (see Table 4.1). Note that if a frame end has been configured for communication, the command with the corresponding frame end must be sent 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.

4.2 Display communication with other devices.

The DC range of displays offers various 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 measured sensor values, hourly information or tracking variables such as records or accident-free days, as well as establish values in those variables that allow writing.

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

Since the variants of the DC range is diverse; Displays that have sensors for environmental measurements (with different number of variables represented), time displays, environmental measurement displays combined with time information, accident-free day displays, etc. Each display accepts only the commands that its functionality applies to the model's characteristics. 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 in addition to describing the specific configuration characteristics, the list of commands that correspond to the scope of application for that model will be included, as well as some application examples.

4.2.1 Communication via commands (TCP, UDP y ASCII)

There are two types of commands; read commands where we exclusively get information from the display and other write commands, which accept arguments to send values to the display. Script format for Ethernet and WIFI interfaces, using TCP or UDP protocols:

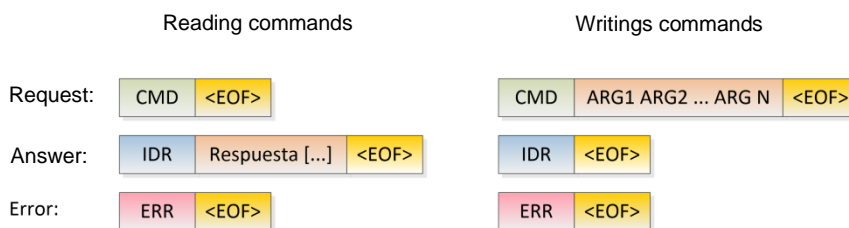


Fig. 4.9 Command Frame Structure for Ethernet and WIFI Interfaces

Where:

CMD: Command
ARG1 ARG2 ... ARGN: List of arguments separated by the character "space" (ASCII 32d)
IDR: Response ID. A 2-byte alphanumeric code (unique to each command) just before the field containing the viewer's response information.
<EOF¹>: End of block optional.
Answer [...]: String containing the team's response.
ERR: Error descriptive message, the error messages that can be obtained are:
 UNDEFINED The display does not recognize the command.
 ARG_ERR Error in arguments

Formatting commands for the serial interface, using the ASCII protocol.

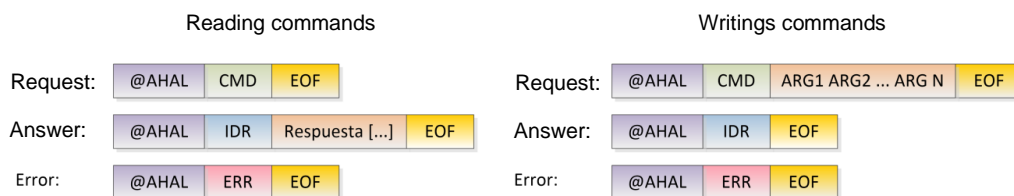


Fig. 4.10 Command Structure for Serial Interfaces

Where:

@: Header code, indicative of the start of the frame.
AHAL: Address of the target computer on the serial bus. 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 ones.
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 viewer's response information.
EOF¹: End of block. It must correspond to the one defined in the display.
Answer [...]: String containing the team's response.
ERR: Error descriptive message, the error messages that can be obtained are:
 UNDEFINED The display does not recognize the command
 ARG_ERR Error in arguments

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

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

CMD	DESCRIPTION	PROPERTY	IDR
PH	Get Date & Time from your computer's internal clock	READING	RH
PT	Ethernet & WIFI Interface: Obtains the temperature value displayed by the display (unit °C) Serial Interface: Obtains the temperature and humidity value displayed by the display (unit °C and % respectively)	READING	RT
PU	Ethernet & WIFI Interface: Obtains the humidity value displayed by the display Serial Interface: <i>Command not available</i>	READING	RU
PC	Obtain the CO2 concentration (unit ppm)	READING	RC
PD	Get the days without accidents	READING	RD
DR	Get the record for days without accidents	READING	RD
FR	Get the date of the last accident	READING	RF
VT	Enter the average temperature and humidity value for environmental measurement displays in "Repeater" mode Arguments: <i>tt, t hh</i> (temperature and humidity value in the specified format, separated by the space character)	WRITING	VT
FD	Make a preset of the days without accidents that the display has to show Arguments: <i>dddd</i> (days without accidents with a maximum of 4 digits)	WRITING	FD
VD	Record the number days without accidents Arguments: <i>dddd</i> (record number of accident-free days with a maximum of 4 digits)	WRITING	VD
VF	Write down the date of the last accident Arguments: <i>DD-MM-YYYY</i> (Date formatted, separating the days, month, and year fields by hyphens)	WRITING	VF

Board 4.3 List of DC Range Commands

MODEL	Commands										
	PH	PT	PU	PC	PD	DR	FR	VT	FD	VD	V F
DC10 TH	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
DC41STH	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
DC41STHO	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
DC20/21TH	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗
DC23	✓	✗	✗	✗	✓	✗	✗	✗	✓	✗	✗
DC23D	✓	✗	✗	✗	✓	✗	✓	✗	✓	✓	✓

Table 4.4 Scope of Commands by Model

Application examples:

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

Interface: Ethernet | Protocol: TCP | End of block: None

- a. Request: PH
- b. Answer: RH30-05-23<SP>08:30:00

2) Serial interface RS485 | Destination Display Address: 01 | Protocol: ASCII | End of block: <CR>

- a. Request: @01PH<CR>
- b. Answer: @01RH30-05-23<SP>08:30:00<CR>

Characters in oblique square brackets < > indicate ASCII special characters. Therefore, the following symbols are to 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 protocol²

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

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

Address	Nº 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 days without accidents		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

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

Address	Nº Registers	Type	Variable	UNITS	FORMAT	ACCESS ¹
0000h	1	HOLDING REGISTER	Reservado			R/W
0001h	1	HOLDING REGISTER	Reservado			R/W
0002h	1	HOLDING REGISTER	Reservado			R/W
0003h	1	HOLDING REGISTER	Reservado			R/W
0004h	1	HOLDING REGISTER	Reservado			R/W
0005h	1	HOLDING REGISTER	Reservado			R/W
0006h	1	HOLDING REGISTER	Reservado			R/W
0007h	1	HOLDING REGISTER	Temperature (Repeater Mode)	°C x 10	Unsigned 16 bit INT	R/W
0008h	1	HOLDING REGISTER	Humidity (Repeater Mode)	%	Unsigned 16 bit INT	R/W
0009h	1	HOLDING REGISTER	Reservado			R/W
000Ah	1	HOLDING REGISTER	Days without accidents (Preset)		Unsigned 16 bit INT	R/W
000Bh	1	HOLDING REGISTER	Record number of days without accident		Unsigned 16 bit INT	R/W
000Ch	1	HOLDING REGISTER	Date of Last Accident (Day)		Unsigned 16 bit INT	R/W
000Dh	1	HOLDING REGISTER	Date of Last Accident (Month)		Unsigned 16 bit INT	R/W
000Eh	1	HOLDING REGISTER	Date of Last Accident (Year)		Unsigned 16 bit INT	R/W

1) R/W: Reading & Writing

Table 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 viewer, being 8:30:00 on 30/05/2023

1) Function 04h (Read Input Registers) | Dir. Startup Registration: 00h | N° 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 contents of the records displayed in the response are in decimal format.

The displays in the DC range are equipped with two built-in relays that allow the Modbus master 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.

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 to control these relays.

Address	Coil No.	Type	Variable	UNITS	FORMAT	ACCESS ¹⁾
0001h	1	COIL	Relay 1		Unsigned 16 bit INT	R/W
0002h	2	COIL	Relay 2		Unsigned 16 bit INT	R/W

1) R/W: Reading & Writing

Table 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 | N° of Coils: 2

a. Answer:

DIR 01h	DIR 02h
1	0

Deactivating Relay 1 and Activating the Relay 2

2) Function 01h (Force Multiple Coils) | Dir. Check-in: 01h | N° of Coils: 2

a. Value to write in 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 at the same time. To make the most of your customization needs, it offers configuration options to display either *Temperature* or *Humidity*, or the option to alternately display both variables with a user-defined alternation time.

4.3.1.1 Overview

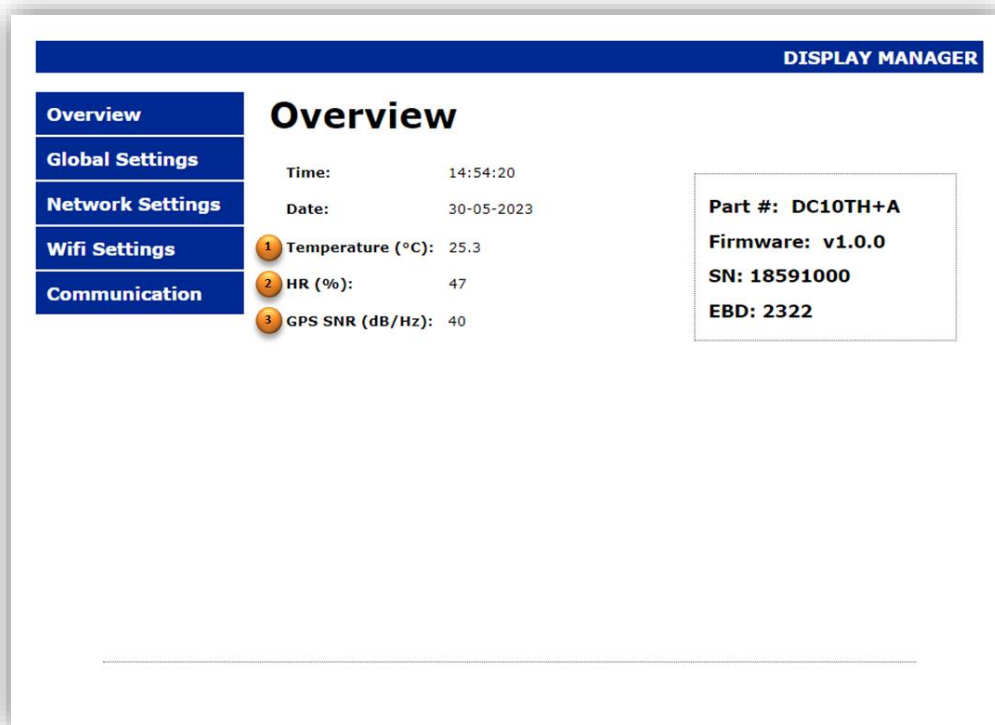


Fig. 4.11 Information shown in the DC10TH Dynamics section.

1. Temperature value obtained from the sensor. If the acquired temperature value is outside the measurement range ($-20\text{ °C} < T \leq 90\text{ °C}$) 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 ($0\% \leq H \leq 99\%$), 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. **[OPTIONAL]** If the device has been purchased with the GPS time synchronization option (+A option), it will indicate the signal-to-noise ratio (SNR) of the GPS. The higher the SNR,

the better the received signal strength and the less likely it is that changing atmospheric conditions will excessively 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 enabled (SYNC= GPS, see section 4.1.2) the message "OFF" will be displayed.

4.3.1.2 Global Settings

Fig. 4.12 Particular settings for the DC10TH model

1. Display Options
 - "TEMPERATURE" Display temperature only.
 - "HUMIDITY" Display only humidity
 - "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 be alternated in the display. Timing ranges from 1 to 255 seconds.

4.3.1.3 Flagging Alerts and Errors

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

Alerta Error	Causa
Err I	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 ($t_{\max} = 90\text{ }^{\circ}\text{C}$) Humidity measurement above the maximum allowed ($h_{\max} = 99\%$)
OUL	Temperature measurement below the minimum permissible ($t_{\max} = -19.9\text{ }^{\circ}\text{C}$) 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 computer that is showing 24.3 °C

1) Interface: Ethernet | Protocol: TCP | Plot Ending: None

- a. Request: PT
- b. Answer: RT24.3

2) RS232 Serial Interface | Destination display address: 01 | Protocol: ASCII | Plot Ending: <CR>

- a. Request: @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 computer that is showing alternately 24.3 °C and 60%

3) RS232 Serial Interface | Protocol: MODBUS RTU | Function 04h | Dir. Check-in: 07h | No. of Records: 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 ASCII special 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 (Overview)

It is identical to the DC10TH model (see section 0)

4.3.2.2 Dynamic content in the Global Settings section

It does not add dynamic content.

4.3.2.3 Flagging 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

Table 4.8 Modbus Commands and Registers from the DC41RTH

Application examples:

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

- 1) **Interface: Ethernet | Protocol: TCP | End of block: <LF> (ASCII: 0Ah or 10d)**
 - a. Request: PU<LF>
 - b. Answer: RU60<LF>
- 2) **RS232 Serial Interface | Destination display address: 01 | Protocol: ASCII | Plot Ending: <CR>**
 - a. Request: @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 ASCII special 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

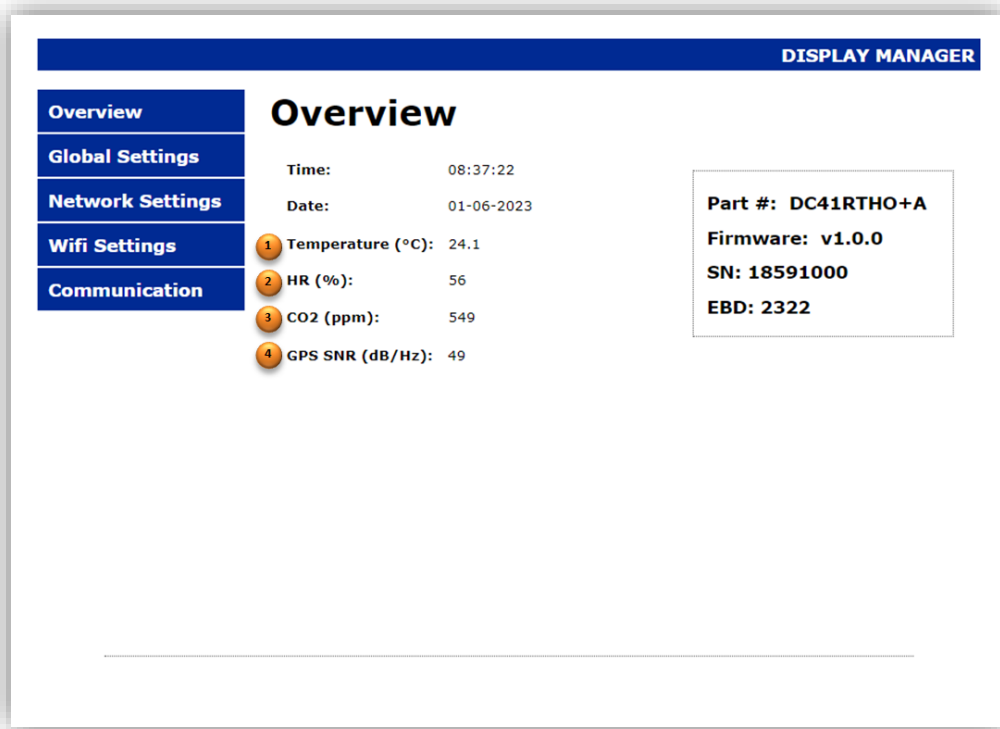


Fig. 4.14 Information displayed in the dynamic section of the model DC41STHO

1. Temperature value obtained from the sensor. If the acquired temperature value is outside the measurement range ($-20\text{ °C} < T \leq 90\text{ °C}$) 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 ($0\% \leq H \leq 99\%$), 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 ($10\text{ ppm} < \text{CO}_2 \leq 9999\text{ ppm}$), 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 device has been purchased with the GPS time synchronization option (+A option), it will indicate the signal-to-noise ratio (SNR) of the GPS. The higher the SNR, the better the received signal strength and the less likely it is that changing atmospheric conditions will excessively 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 enabled (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 does not add dynamic content.

4.3.3.3 Flagging Alerts and Errors

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

Alert Error	
Err I	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 ($t_{max} = 90\text{ }^{\circ}\text{C}$) Humidity measurement above the maximum allowed ($h_{max} = 99\%$) CO2 concentration higher than the maximum allowed ($\text{CO2}_{max} = 9999\text{ ppm}$)
OUL	Temperature measurement below the minimum allowed ($t_{min} = -19.9\text{ }^{\circ}\text{C}$) Humidity measurement below the minimum allowed ($h_{min} = 0\%$) CO2 concentration below the minimum allowed ($\text{CO2}_{min} = 10\text{ ppm}$)

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

Table 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 block: <CR><LF>**
 - a. Request: `PC<CR><LF>`
 - b. Answer: `RC755<CR><LF>`

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

Lectura de toda la información que tiene disponible el modelo DC40STHO:

Hora: 10:57:35, Fecha: 1/6/2023, Temperatura = 25.6 °C, Humedad = 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 record.

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

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

<LF> (Line feed) 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. In addition, it 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 based on a reference standard.

4.3.4.1 Dynamic content in the Overview section

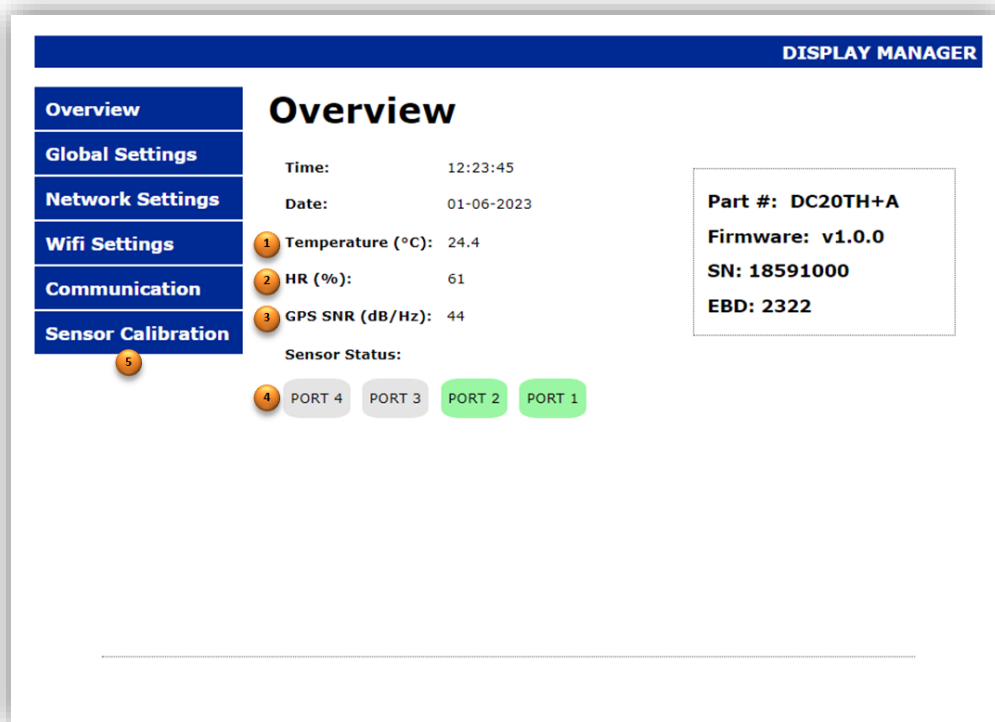


Fig. 4.15 Information shown in the DC20/21TH Dynamic Section

1. Average temperature value obtained from connected sensors. If the average temperature value is outside the measurement range ($-20\text{ °C} < T \leq 90\text{ °C}$) it will show; "OuH" if the average temperature is higher than the maximum allowable temperature or "OuL" if it is lower. If all sensors are switched off, or if there is not at least one sensor that obtains a temperature value within the measurement range, the message "FAIL" is displayed.
2. Value of the average relative humidity obtained from the connected sensors. If the average humidity value is outside the measurement range ($0\% \leq H \leq 99\%$), it will show; "OuH" if the average humidity is higher than the maximum allowable humidity or "OuL" if it is lower. If all sensors are switched off, or if there is not at least one sensor that obtains a humidity value within the measurement range, the message "FAIL" is displayed.

3. **[OPTIONAL]** If the device has been purchased with the GPS time synchronization option (+A option), it will indicate the signal-to-noise ratio (SNR) of the GPS. The higher the SNR, the better the received signal strength and the less likely it is that changing atmospheric conditions will excessively 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 enabled (SYNC= GPS, see section 1.1.2) the message "OFF" will be displayed.

4. Active ports indicator. These ports are displayed in a certain color depending on their status:
 - **Grey:** There is no sensor connected or it is not recognized 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 of its valid range.

The device automatically averages the temperature based on the active ports. If any of the connected sensors obtains values outside the measurement range, they are automatically discarded in the calculation of the average.

The active ports indicator provides an especially useful monitoring tool, as it can quickly identify if there is a sensor at fault or disconnected, allowing you to check that the average is always done with the number of sensors provided.

5. Link to the calibration section of the sensors (see section 4.3.4.2).

4.3.4.2 Calibrating the sensors

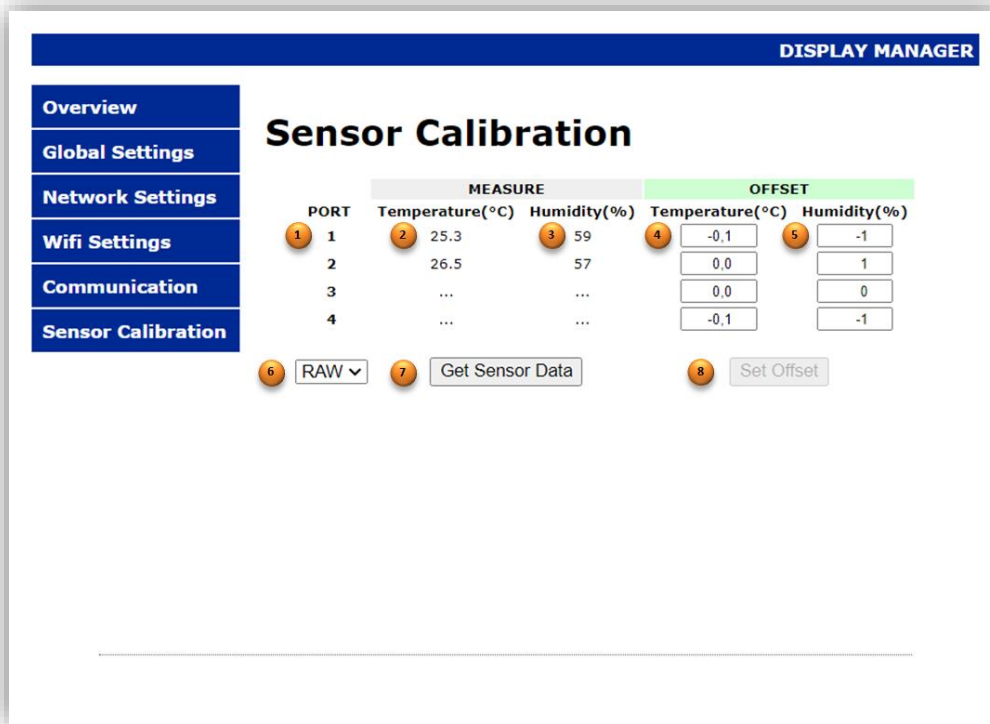


Fig. 4.16 Calibrating DC20/21TH Sensors

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 referenced port (1). Depending on the selector (6), it will display the temperature value as obtained from the sensor or compensated with the user-defined compensation values.
3. Humidity measurement for the sensor connected to the referenced 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 and obtain 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 you want to display the raw sensor measurements "RAW", or calibrated "CAL". The "CAL" mode is especially useful for comparing the sensor's readings once calibrated 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 getting values within its valid measurement range, "..." in the temperature and humidity measurements of the port. Likewise, when accessing the calibration section, if 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 selected mode in (6), being necessary to press this button again, to acquire a new set of measurements 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

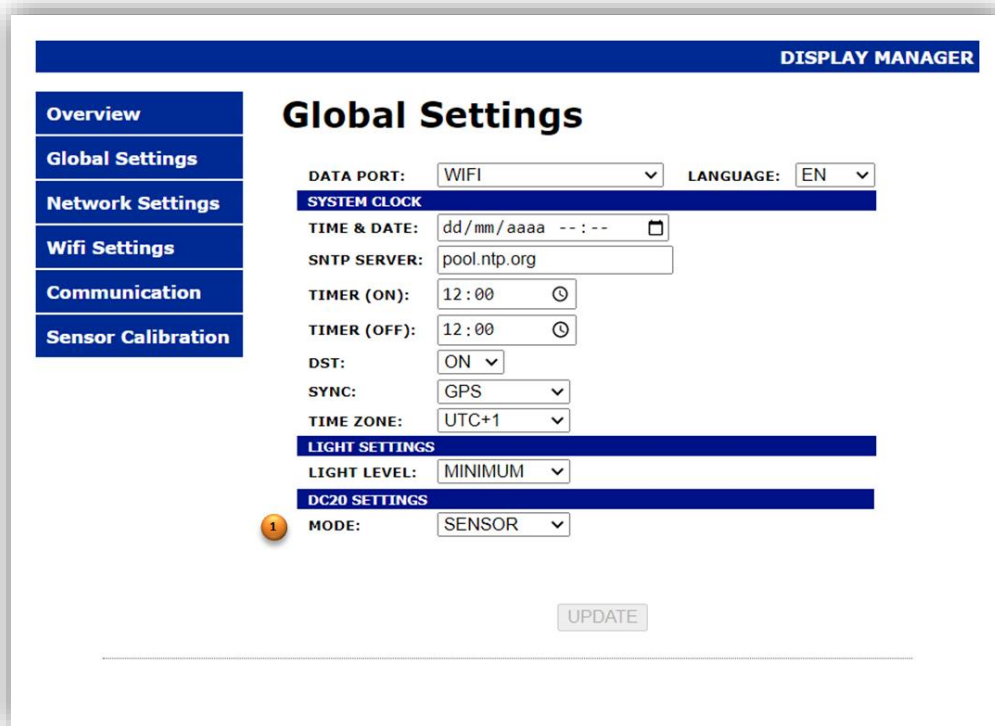


Fig. 4.17 Particular settings for the DC20/21TH model

1. Mode of operation; "Sensor" or "Repeater".
 - **Sensor Mode:** The display shows the average temperature and humidity value of all the sensors connected to its ports.
 - **Repeater Mode:** the display receives the average temperature and humidity values sent by the user through the interface and protocol configured on the device. In this mode, if 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 Flagging 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	COMANDOS														
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

Table 4.10 DC20TH Modbus Commands and Registers

Application examples:

Temperature Request, for a computer that is viewing 23.4 °C

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

*Write the average temperature and humidity in "Repeater" mode
Temperature = 23.6 °C, Humidity = 65%*

- 1) **RS485 Serial Interface | Destination display address: 01 | Protocol: ASCII | End of block: <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 | No. 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 record.

Once the records have been updated, we will display these values in the viewer (if we have the "Repeater" mode selected in the display).

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

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

4.3.5 DC10R

This model offers a simple, high-precision watch in HH:MM format, which combines an elegant and minimalist design with synchronization options such as GPS and the connection to time servers to continuously display the correct time.

4.3.5.1 Dynamic content in the Overview section

It does not add dynamic content.

4.3.5.2 Dynamic content in the Global Settings section

It does not add dynamic content.

4.3.5.3 Flagging 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

Table 4.11 DC10R Modbus Commands and Registers

Application Examples:

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

- 1) **Interface: Ethernet | Protocol: TCP | End of block: <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 block: <CR>**
 - a. Request: @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 | No. 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 ASCII special characters.

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

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

4.3.6 DC22RT

This model integrates a simple, high-precision watch in HH:MM format, with a thermometer with a resolution of the tenth of a degree. This combination makes it an ideal piece of equipment for offices or production areas, since having synchronized time information allows you to keep an organized production schedule. In the same way, 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 0).

4.3.6.2 Dynamic content in the Global Settings section

It does not add dynamic content.

4.3.6.3 Flagging Alerts and Errors

Same as DC10TH (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

Table 4.12 DC10TH Modbus Commands and Registers

Application examples:

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

- 1) **Interface: Ethernet | Protocol: TCP | End of block: *<CR>** (Host Link)
 - a. Request: **PT***<CR>
 - b. Answer: **RT24.9***<CR>
- 2) **RS485 Serial Interface | Destination display address: 01 | Protocol: ASCII | End of block: <LF> <CR>**
 - a. Request: **@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 ASCII special characters.

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

<LF> (Line feed) 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 °C and a relative humidity of 63%.

1) Ethernet Interface | Protocol: MODBUS TCP/IP | Function 04h | Dir. Check-in: 07h | No. 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 crash-free day 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 raised, and a safe work environment is promoted. This builds a collective commitment to take preventative measures, follow safe practices, and keep safety a priority.

4.3.7.1 Dynamic content in the Overview section

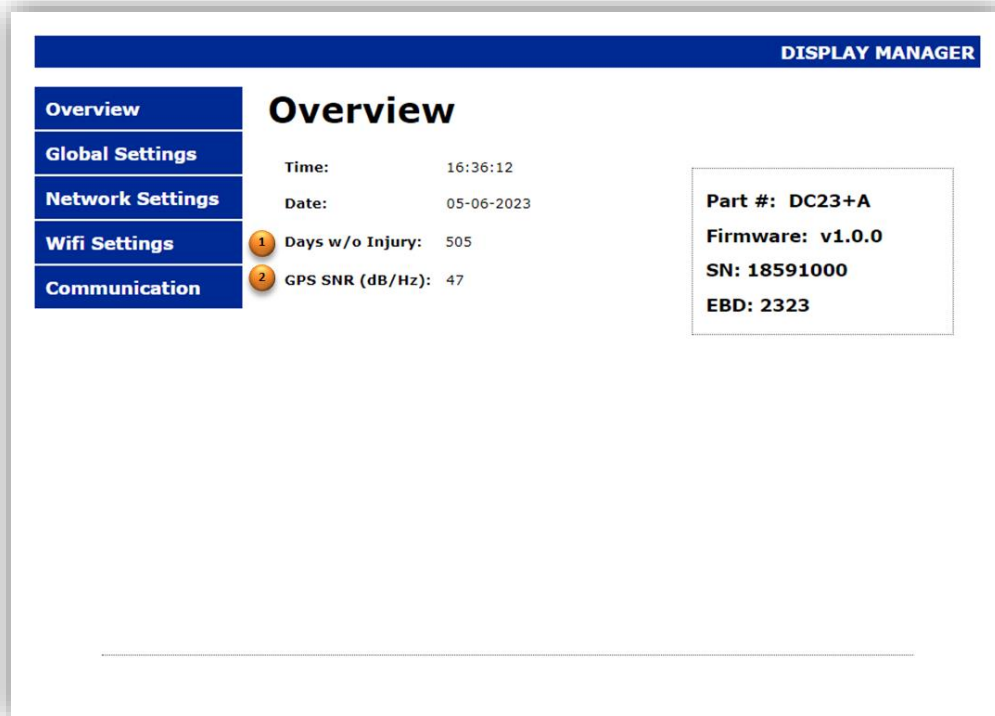


Fig. 4.18 Information shown in the DC23 Dynamics section.

1. Value of the accident-free day counter. In the event that the settings made (see section 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 device has been purchased with the GPS time synchronization option (+A option), it will indicate the signal-to-noise ratio (SNR) of the GPS. The higher the SNR, the better the received signal strength and the less likely it is that changing atmospheric conditions will excessively 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 enabled (SYNC= GPS, see section 4.1.2) the message "OFF" will be displayed.

4.3.7.2 Dynamic content of the Global Settings section

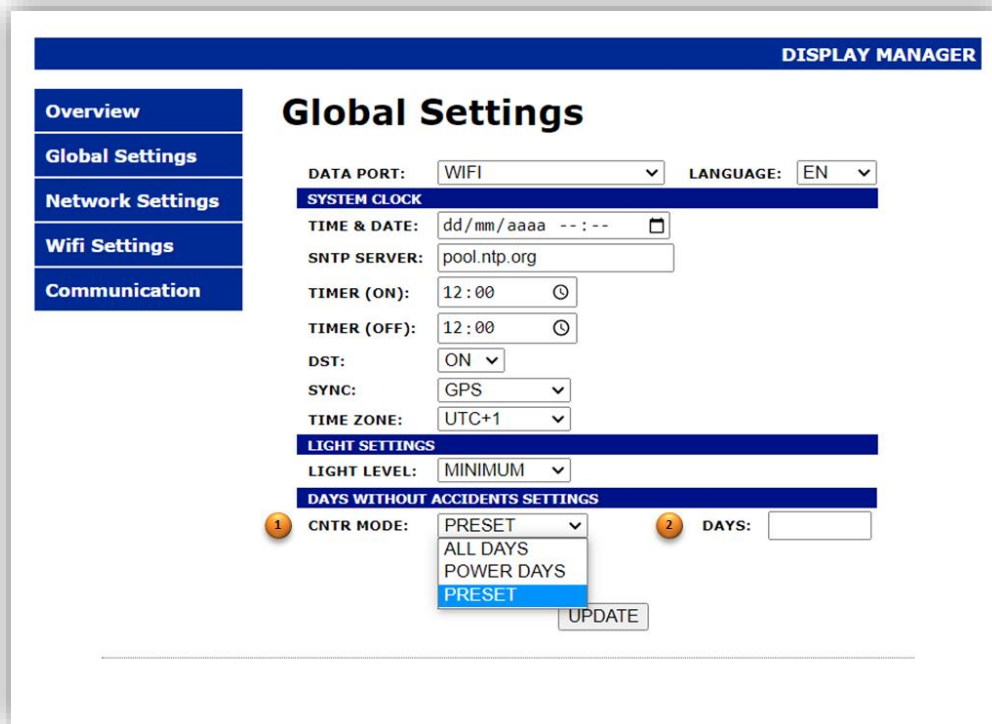


Fig. 4.19 Adjustments to the DC23 Dynamic Section

1. Accident-free day counting mode. You have the following options:
 - **PRESET:** Allows you to set the crash-free days value that will be displayed in the display. Internally the display also records the date with which this adjustment has been made, so it is especially important that the display has the correct date and time before setting the accident-free days.
 - **ALL DAYS:** In this mode, all the days that have elapsed from the date on which the Preset was made will be counted *and* the value of days without accidents will be pre-established.
These types of displays base their operation on the information of your internal clock, so it is extremely important that the 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 that 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. Therefore, if this display is installed on the same power supply line of electrical machines or lighting in the work room, and if 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 number of days elapsed* and those *exclusively worked*, since the equipment simultaneously records these values.

It is worth noting those situations where certain settings can cause inconsistent information in the display.

Case 1) The internal clock of the visualizer 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 signaled 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 one to determine if an interval of one day has elapsed to increase the counter and update the registration date. Therefore, if in this mode we set the internal clock of the display to a date before the last feeding date, the message "----" will be displayed (This situation will only affect this mode and not the **ALL DAYS** mode, as long as the new adjustment date is not earlier than the one on which the *Preset* was made)

IMPORTANT: To avoid these situations, it is advisable to make a new preset with the value of accident-free days 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 accumulated value in Power Days mode is lost, since the internal counters are reset with the date of the *Preset*.

1. The 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 Flagging 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

Table 4.13 DC23 Modbus Commands and Registers

Application Examples:

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

- 1) **Interface: Ethernet | Protocol: TCP | End of block: None**
 - a. Request: PD
 - b. Answer: RD506
- 2) **RS485 Serial Interface | Destination display address: 01 | Protocol: ASCII | End of block: <CR>**
 - a. Request: @01PD<CR>
 - b. Answer: @01RD506<CR>
- 3) **Ethernet interface | Function 04h (Read Input Registers) | Protocol: Modbus TCP/IP | Dir. Start Log: 0Ah | No. of Registers: 1**
 - a. Answer:

REG 0Ah
506

Establecer el valor de días sin accidentes a 10

- 1) **Interface: Ethernet | Protocol: TCP | End of block: None**
 - a. Request: VT10
 - b. Answer: VT
- 2) **Interfaz Serie RS485 | Dirección visualizador destino: 01 | Protocolo: ASCII | Final de trama: <CR>**
 - a. Request: @01VT10<CR>
 - b. Answer: @01VT<CR>
- 3) **Ethernet interface | Protocol: Modbus TCP/IP**
 - a. **10h Function (Preset Multiple Registers) | Log Start: 0Ah | No. 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 ASCII special 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, as surpassing 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

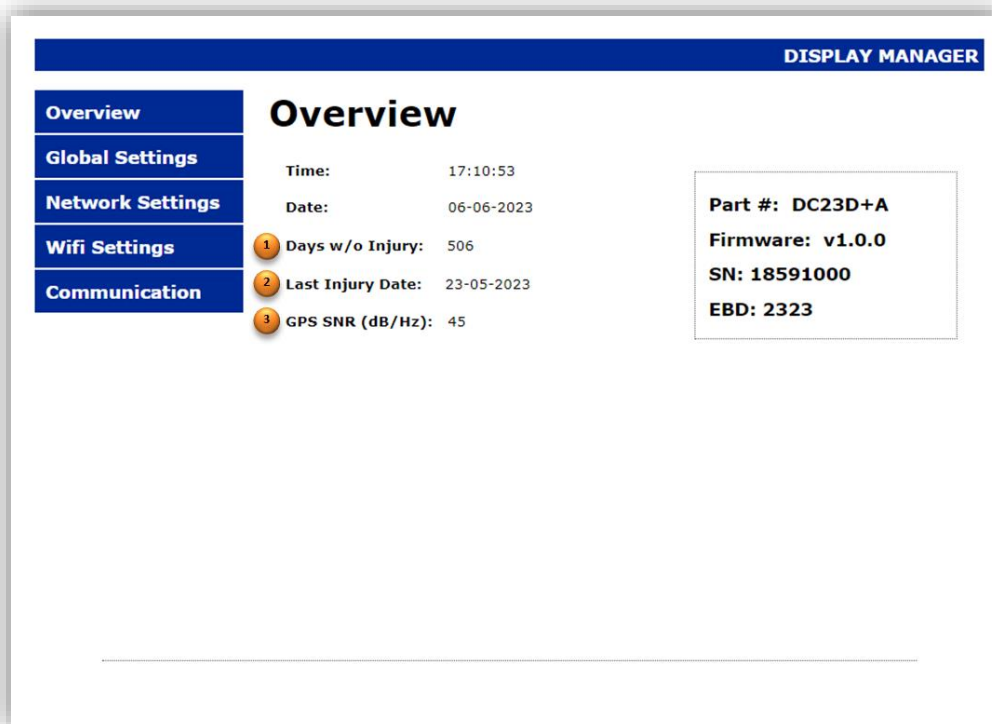


Fig. 4.20 Information shown in the DC23D model dynamic section.

1. Value of the accident-free day counter. In the event that the adjustments made (see section 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), either the date of the last accident or the record of accident-free days will be displayed.
3. **[OPTIONAL]** If the device has been purchased with the GPS time synchronization option (+A option), it will indicate the signal-to-noise ratio (SNR) of the GPS. The higher the SNR, the better the received signal strength and the less likely it is that changing atmospheric conditions will excessively 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 enabled (SYNC= GPS, see section 4.1.2) the message "OFF" will be displayed.

4.3.8.2 Dynamic content of the Global Settings section

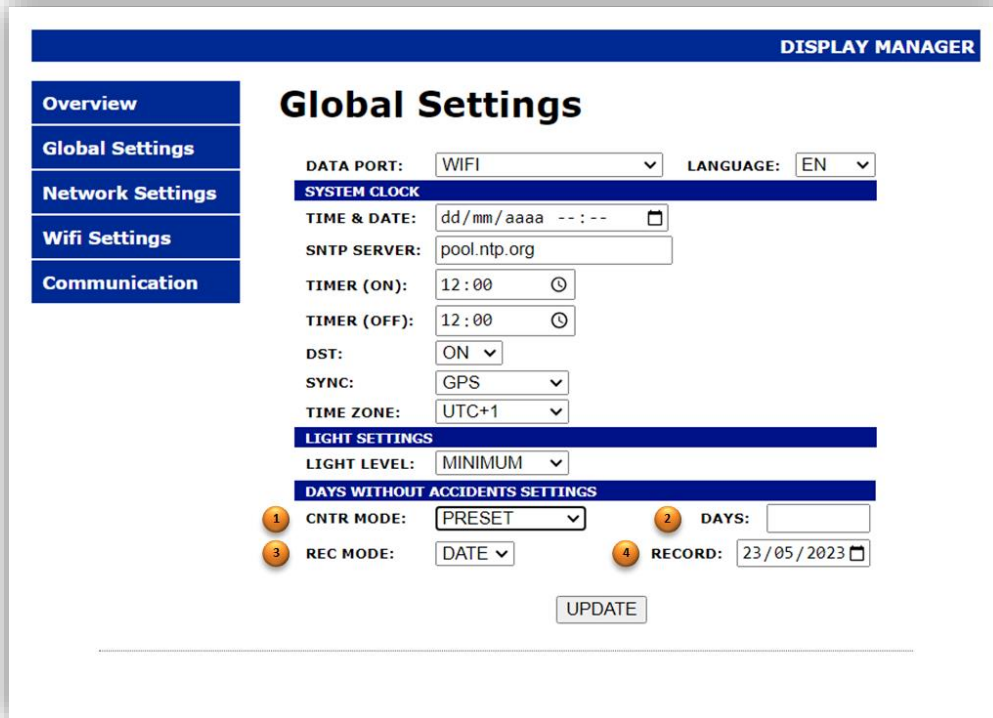


Fig. 4.21 Information shown in the DC23D model dynamic section.

1. Accident-free days are counted, see section 4.3.7.2 for the different options.
2. Value of the accident-free days you want to set in the display, this control appears only when the **Preset** option is selected in (1), see 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), this field displays the appropriate control for entering either the accident-free record or the date of the last accident. In the date controls, clicking on the icon located at the far right of the control opens a calendar that makes it easier to enter 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 accident-free days are values that are controlled exclusively by the user. Under no circumstances does the display modify 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 whenever they see fit.

4.3.8.3 Flagging 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

Table 4.14 DC23D Modbus Commands and Registers

Application Examples (I):

Ask for the date of the last accident from a viewer that has this parameter set to the date 25/03/2023

1) Interface: Ethernet | Protocol: TCP | End of block: None

- a. Request: FR
- b. Answer: RF25-03-2023

Ask for the record of days without accident from a viewer that has this parameter set to the value 244

2) RS485 Serial Interface | Destination display address: 01 | Protocol: ASCII | End of block: <CR>

- a. Request: @01DR<LF>
- b. Answer: @01RD244<LF>

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

**3) Ethernet interface | Function 04h (Read Input Registers) | Protocol: Modbus TCP/IP
Dir. Start Log: 0Ah | No. 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 ASCII special characters.

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

Application Examples (II):

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

1) Interface: WIFI | Protocol: UDP | End of block: None

- a. Request: VF1-3-23 (The format is also valid VF01-03-2023)
- b. Answer: VF

Write the accident-free days record parameter with the value 675

2) RS485 Serial Interface | Destination display address: 01 | Protocol: ASCII | End of block: <CR>

- a. Request: @01VD675<CR>
- b. Answer: @01VD<CR>

Enter all the information related to the days without accident display (counter value=0, day record=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 | No. of registers: 5

- a. Values to Write to the registers:

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

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

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

5 FIRMWARE UPDATE

Firmware updates fix detected bugs, include improvements to device performance, and optimizations to increase overall system stability. 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 working condition.

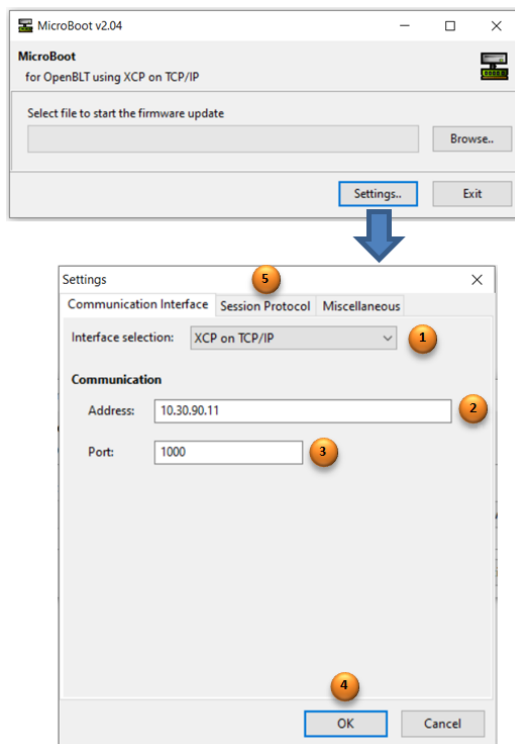
For greater ease, the user will be able to update the equipment through the company's local network, without the need to be in the physical location where the display or displays to be updated are installed.

To be able to remotely update your devices, you need to download the **MicroBoot** application (<https://www.lartet.com/en/download-center/>) and follow these steps:

5.1 Setting up the MicroBoot app

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

When you open the app, go to the "Settings" option to set up the communication.



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

Fig. 5.1 MicroBoot Configuration

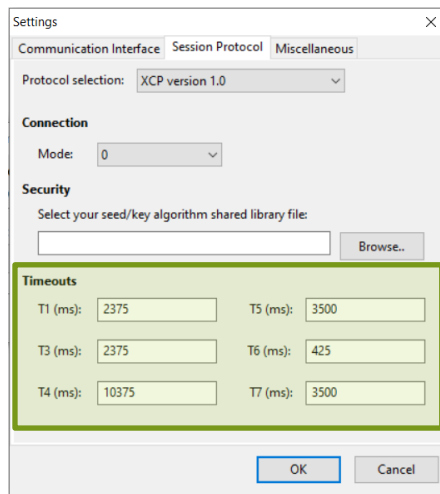


Fig. 5.2 Update protocol timeouts

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.

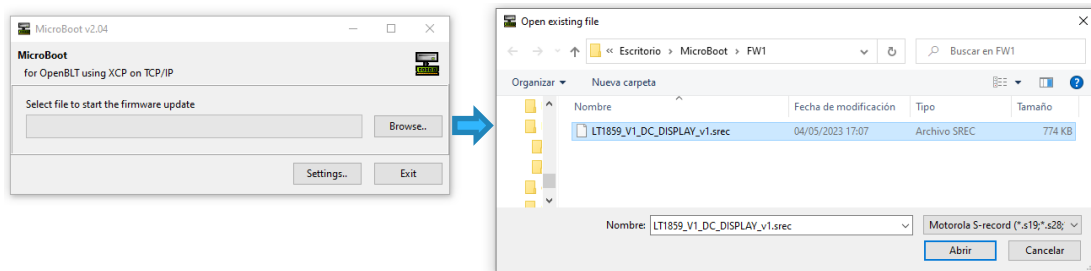


Fig. 5.3 Selecting the Update File

Selecting the file and pressing the "Open" button will start the update process. On the main screen of the application, you will see the progress bar advancing until the update process is complete.

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 doesn't start.

If the display shows "**bP1**" when starting the update process, it indicates that the device expects communication over the IP that the display has configured, and therefore MicroBoot should be configured with this IP (see Fig. 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.

The display will always be updated by the IP that the device has defined. In cases where a problem has arisen during the update through your IP (power failure, cable disconnection, 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 is disconnected and reconnected, it will be observed that "bP0" is displayed for a time interval. During this time interval, the emergency IP can attempt the update process. 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 configuration of the device will not be lost if unfortunately, any update has been corrupted.

If the update process does not start or takes longer than usual when updating a display, 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 potential issues have been identified and fixed, repeat the update process.

DECLARATION OF CONFORMITY

DECLARATION OF CONFORMITY

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

As the builder of the **LARTET brand equipment**:

Model: DC-10TH (V2) in all its versions.
Model: DC-41RTH (V2) in all its versions.
Model: 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.

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

Directive: 2014/35/UE	Low voltage directive.
Norm UNE-EN 60204-1:2019	Machine safety.
	Electrical equipment of the machines.
Directive: EMC 2014/30 UE	Electromagnetic Compatibility Directive.
UNE-EN 61000-6-2:2019	Generic standards. Immunity in industrial settings
UNE-EN 61000-4-4:2013	Immunity tests to fast electrical transients in bursts.
UNE-EN 61000-4-2:2010	Electrostatic Discharge Immunity Test.
Directive 2011/65/UE:	Restrictions on the use of certain substances in electrical and electronic equipment.

Granollers, 22 de June de 2023