USER MANUAL

DC-24 and DC-25

Thermometer and hygrometer

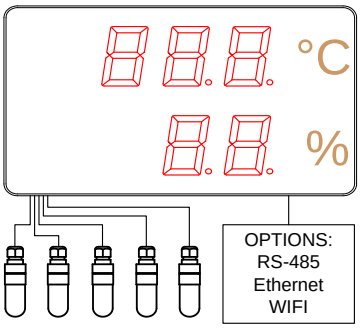
1600K24A

Content

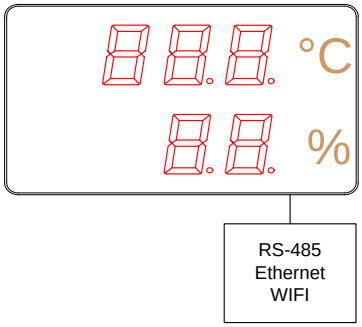
1. INTRODUCTION AND GENERAL CHARACTERISTICS

Numerical displays DC-24 and DC-25 are displays for the accomplishment of the Real Decreto 1826/2009, in the section relative to the temperature and humidity displaying in the public access locals with air-conditioning.

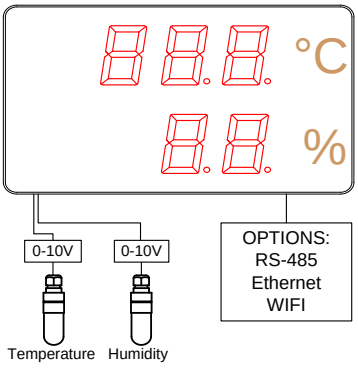
DC-24 displays admit form 1 to 5 sensors, calculating the mean value of all them. It automatically detects the number of sensors and displays its state once the display is initialized. The temperature and humidity sensor is placed in a case that permits a very easy installation using the support included in the package. The recommended position of the sensor is at 1,7m from the floor. The display can include RS-485, Ethernet or Wifi connectivity as options.



DC-25 displays are aesthetically identical to the DC-24 but do not have sensor. They must receive the data from RS-485, Ethernet or Wifi.



DC-24/A displays are aesthetically identical to the DC-24 but they have an analogical input 0-10V for each temperature and humidity sensor. The display can include RS-485, Ethernet or Wifi connectivity as options.



1.1. Characteristics of the DC-24 and DC-25 displays

Supply Voltage.....88 to 264 VAC 47 to 63Hz.
Consumption DC-24S and DC-25S.....12VA.
Consumption DC-24S and DC-25S.....24VA.
Display.....7 segments, 100mm high + decimal point.
.....LED colour red, blue, white or green depending on
.....the model
.....Viewing distance: max 50 meters.
Text.....Silkscreen with maximum limits.
Environmental Conditions.....Operation Temperature: -20 to 60ºC.
.....Storage temperature: -30ºC to 70ºC.
.....Humidity: 5-95% RH non condensing.
.....Maximum environmental illumination: 1000 lux.
.....Sealing: IP41 .

1.2. Temperature and humidity sensor characteristics.

Temperature sensor
Resolution..... 0.1°C
Precision..... ±0.5° at 25°C
Response time..... 20s
Working range..... -20°C to 80°C
Humidity sensor
Resolution..... 1%
Precision..... ±3.5% between 30% and 70%
Response time..... 4 s
Environmental Conditions..... Sealing: IP65 .

1.3. Analog input characteristics.

Input signal
Configuration..... Differential asymmetrical.

Voltage input
Range..... ±10V DC
Resolution..... 0.5 mV
Input impedance..... 1 MOhm

Accuracy to 22° ±5°C
Maximum error..... ±(0,1% of reading + 3 digits)
Temperature coefficient..... 100ppm/°C
Warm up time..... 5 minutes

Conversion method
Technique..... Sigma-Delta
Resolution..... 16 bits
Rate..... 25 samples/s

Display
Temperature resolution..... -9.9 / 99.9.
Humidity resolution..... 0 / 99.

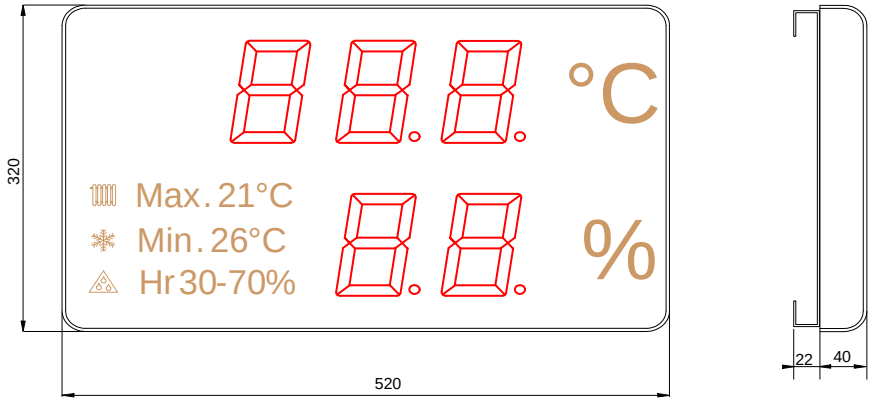
1.4. Weight of the displays.

The weight of the DC-24S and DC-25S is 5kg.

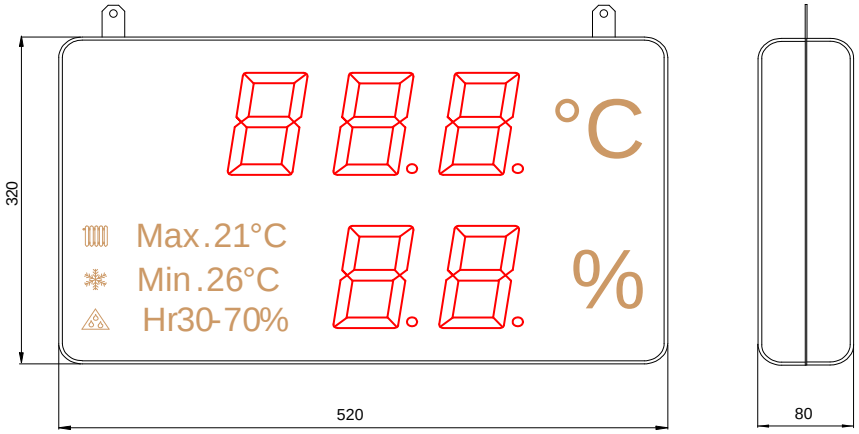
The weight of the DC-24D and DC-25D is 7kg.

1.5. Dimensions of the DC-24 and DC-25.

1.5.1. Dimensions of the DC-24S and DC-25S.

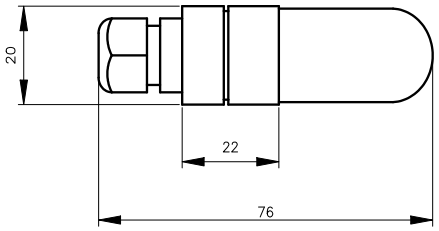


1.5.2. Dimensions of the DC-24D and DC-25D.



1.5.3. Dimensions of the sensor case

The dimensions of the sensor case in mm are:



1.6. Display mounting

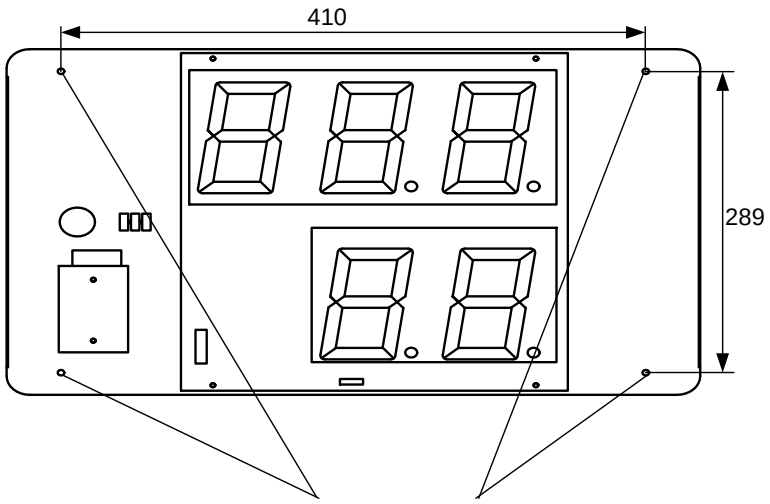
1.6.1. Mounting of the DC-24S and DC-25S.

The DC-24S and DC-25S displays can be fixed to the wall in two ways:

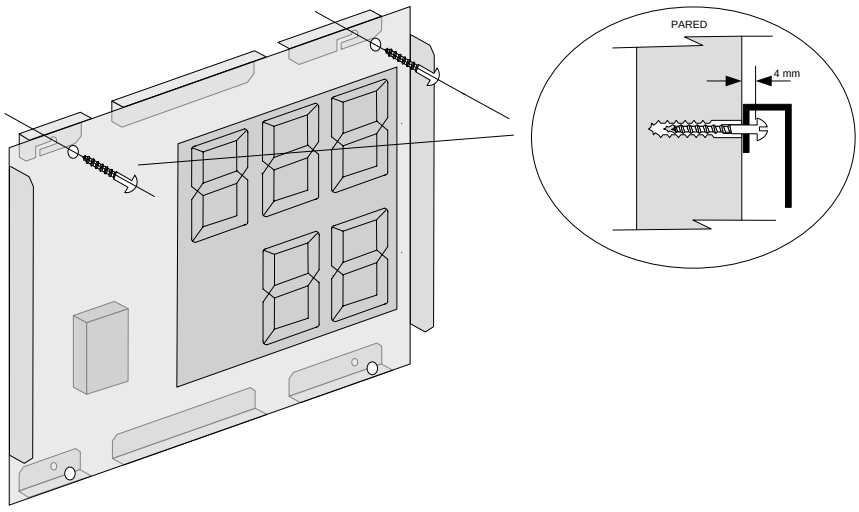
1– Hanged. Place 2 of the supplied plug at 410mm from one to the other. Insert the screws leaving their head outside for 4mm. Hang the display using the upper-side zig-zag.

2– Screwed. Remove the methacrylate cover. Place the 4 supplied plugs at the distance showed in the drawing. Place the 2 upper screws, leaving their head outside for 4 mm. Hang the display using the upper-side zig-zag. Place the lower screws Tighten all the screws. Replace the methacrylate cover.

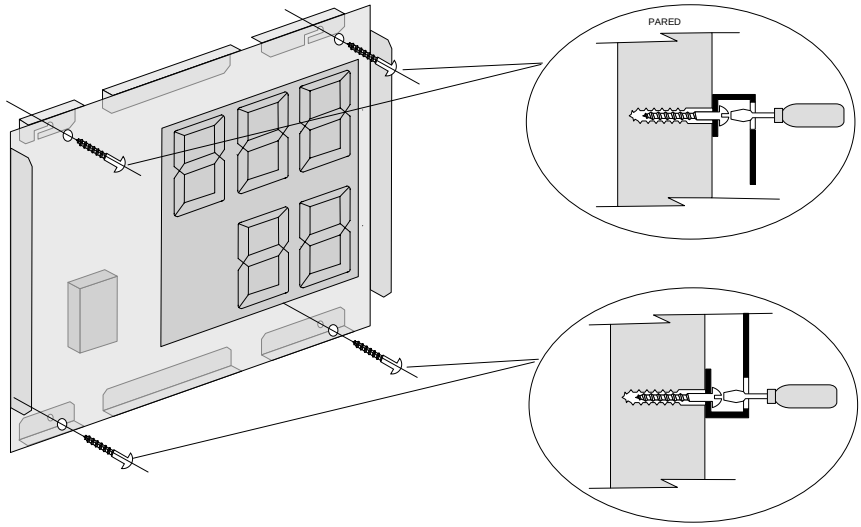
The screws and plugs are provided with the display



Hanged:



Screwed:



1.6.2. Mounting of the DC-24D and DC-25D.

The DC-24D and DC-25D displays must be hanged using the rings the display has. Cables or chains can be used

The power cables and the sensor can be fixed to the mounting elements without tightening them.

IN ANY WAY THE POWER OR THE SENSOR CABLES CAN BE USED FOR HANGING THE DISPLAY

2. INSTALLATION

The installation of the **DC-24** and **DC-25** is not particularly delicate but some important considerations must be taken into account.

The display must not be anchored to places subject to vibrations, nor should it be installed in places which generally surpass the limits specified in the display characteristics, both in terms of temperature and humidity.

The degree of protection of displays **DC-24** and **DC-25** is IP41, meaning that they are protected against penetration by solid foreign objects of a diameter of about 1mm and against the vertical fall of water droplets. Sealing of the sensor case is IP65, what means that is completely isolated from dust and jets of water

Displays **DC-24** and **DC-25** should not be installed in places with an illumination level in excess of 1000 lux. Neither should the display be placed in direct sunlight as visibility would be lost.

2.1. Accessing inside the display.

The access to the interior of the display is only authorised to technical staff. The interior must be accessed only for installation and maintenance purposes only.

Disconnect the power of the display before its manipulation

To access the interior, unscrew the 4 screws placed in both sides (2 screws per side) Allen key 2mm.

2.2. Powering the display.

Power supply must be from **100VAC to 240VAC, 50/60 Hz.** You must use a Schuko type plug that has grounded terminal.

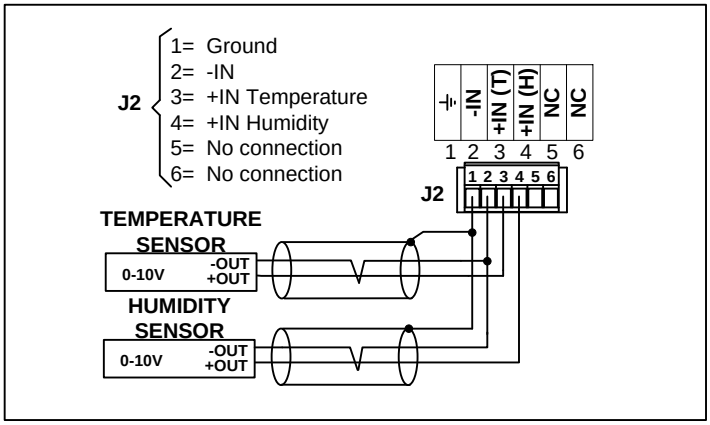
In case you have to lengthen the cord, the connection must be made on the terminal located within the display.

In two-sided displays, **DC-24D** and **DC-25D**, the powering cable enters in the display through a gland.

2.3. Connexion of the sensors in the displays with analog input.

In all the assemblies, the inputs connection must be done using a twisted and shielded cable.

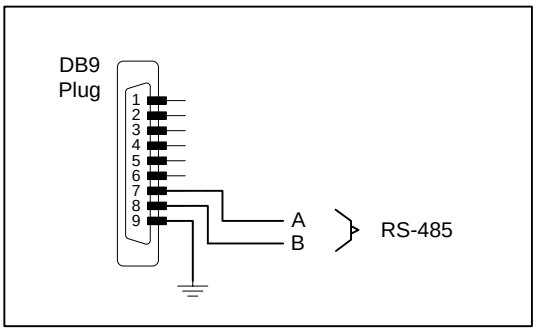
The shield must be connected to the clamp 1 of the input connector.



2.4. Serial line connection.

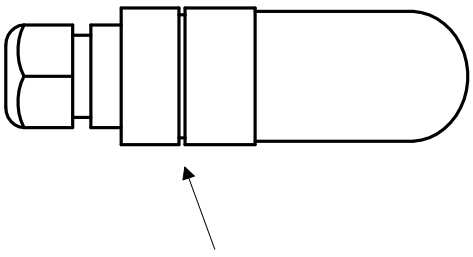
The displays of the series **DC-24X** and **DC-25X** admit connection through the RS-485 line. The connection must be done using a DB9 connector placed in the interior of the display

The connection schematic is the one that follows



2.5. Placing the sensor.

The temperature and humidity sensor is placed in a black nylon part, protected by a cap that permits the humidity to pass through but not water. The connexion cable enters through a gland. The set must not be manipulated to keep the IP65 sealing.



Slot for mounting on support

In the displays with more than one sensor, there is no order or priority. There can be connected between 1 and 5 sensors in any of the connectors. The display detects the sensor when powering on the display.

The temperature and humidity sensor should be placed at 1,7m high from the floor. Due to the fact that the display is expected to be in crowded places, it is recommended to protect the cable of the sensor using a tube.

In the sensor placing must be avoided:

1. The air streams due to doors
2. Placing it in climate control systems outputs
3. Proximity to fridges
4. Walls with direct sunlight

In case the sensor cable must be extended, the colours of the cables must be respected. The colour identification is

BL = White
MAR = Brown
VER = Green
AMA = Yellow

The cable type must be YCY 4 x 0.22 shielded

3. OPERATION.

3.1. Initial reset.

Before connecting the display to the network, we must ensure that all of the connections have been carried out correctly and that the display is firmly in place.

Each time we connect the display to the power supply network, an initial reset occurs which tests all of the segments comprising the display. The test consists of the sequential illumination of all of the digits with the number "8", all of the digits with the value "0", all of the decimal points are lit up and finally the version code.

From this point, the DC-24 displays show the active sensors (activated = 1, deactivated = 0) and then the current temperature and the humidity

In the DC-25 displays, the version code is displayed until the first message with data is received.

In the DC-24A and DC-25A, the measures from the inputs are displayed.

3.1.1. Displays with several sensors.

In the displays with several sensors, the displayed value is the mean value of the sensed by the connected sensors,

The display detects the connected sensors and calculates the mean value depending on the active sensors.

If when powering up there is no sensor detected, “0” is displayed in the 5 digits. If once the display is initialized there is no sensor detected, “E02” is displayed instead of the temperature

3.2. Programming parameters

Displays with connectivity options or analog inputs must be programmed previously to its use. The parameters the user must configure are:

Displays with RS-485 serial line

1- Address of the display in the network.
2- Transmission baud rate, data bits, parity, stop bits.
3- Sensor control and communication control: ASCII, Modbus RTU-ASCII, Modbus RTU-Word
F- Quit menu. Press “*”

Displays with Ethernet and Wifi

1- Display the MAC address of the display
2- No use.
3- Sensor control and communication protocol: TCP/IP and Modbus/TCP
4- Reset communications port.
F- Quit menu. Press “*”

Displays with analog input.

In the displays with analog input, the user must define 2 points of the line that determine all the values. Every point is set by 2 voltages and 2 displaying values.

There must be a line for temperature and another for humidity.

1- Input voltage for the first point of the line. Temperature
2- Displayed value for the first point of the line. Temperature
3- Input voltage for the second point of the line. Temperature
4- Displayed value for the second point of the line. Temperature
5- Input voltage for the first point of the line. Humidity
6- Displayed value for the first point of the line. Humidity
7- Input voltage for the second point of the line. Humidity
8- Displayed value for the second point of the line. Humidity

3.2.1. Modify parameters RS-485, Ethernet or Wifi.

To modify the parameters the user must access the three programming keys placed on the top inside the display. See paragraph 3.1 to see how to access inside the display.

The programmation keys are placed in the top of the displays. The identification of the keys is

Advance key: “* “
Increase key: “+”

To program the parameters, the three digits on the top are used. The left digit, identificated with the digital point, indicates the parameter number and the two right digits indicate its value. The flashing digit is the one the user can modify with the “+” key

To enter the menu, main the “*” key pressed for 3 seconds. Once this time is passed, the first parameter is displayed.

There are then two options:

1- Modify the parameter value
By pressing the Advance key "*", entry is gained to modify the parameter value.
To go back to displaying the parameter number, press “*”again.
To increase the parameter value, press the “+” key.

2- Select another parameter
In order to select another parameter, the parameter number must be made to flash using the “*” key and then the new parameter may be selected using the “+” key.

3.3. RS-485 parameters.

3.3.1. Parameter 1 for RS-485: Address of the display.

It allows to configurate the address of the display in the RS-485 network. Value between 0 and 99.

3.3.2. Parameter 2 for RS-485: Serial line configuration.

The parameters of the serial line are codified in the following table:

Code	Baud Rate	Data bits	Parity	Stop bits
01	4800 Bauds	7 bits	No parity	1
02	9600 Bauds	7 bits	No parity	1
03	19200 Bauds	7 bits	No parity	1
04	4800 Bauds	8 bits	No parity	1
05	9600 Bauds	8 bits	No parity	1
06	19200 Bauds	8 bits	No parity	1
07	4800 Bauds	7 bits	Even	1
08	9600 Bauds	7 bits	Even	1
09	19200 Bauds	7 bits	Even	1
10	4800 Bauds	8 bits	Even	1
11	9600 Bauds	8 bits	Even	1
12	19200 Bauds	8 bits	Even	1
13	4800 Bauds	7 bits	Odd	1
14	9600 Bauds	7 bits	Odd	1
15	19200 Bauds	7 bits	Odd	1
16	4800 Bauds	8 bits	Odd	1
17	9600 Bauds	8 bits	Odd	1
18	19200 Bauds	8 bits	Odd	1
19	4800 Bauds	7 bits	No parity	2
20	9600 Bauds	7 bits	No parity	2
21	19200 Bauds	7 bits	No parity	2
22	4800 Bauds	8 bits	No parity	2
23	9600 Bauds	8 bits	No parity	2
24	19200 Bauds	8 bits	No parity	2
25	4800 Bauds	7 bits	Even	2
26	9600 Bauds	7 bits	Even	2
27	19200 Bauds	7 bits	Even	2
28	4800 Bauds	8 bits	Even	2
29	9600 Bauds	8 bits	Even	2
30	19200 Bauds	8 bits	Even	2
31	4800 Bauds	7 bits	Odd	2
32	9600 Bauds	7 bits	Odd	2
33	19200 Bauds	7 bits	Odd	2
34	4800 Bauds	8 bits	Odd	2
35	9600 Bauds	8 bits	Odd	2
36	19200 Bauds	8 bits	Odd	2

Table 1: RS-485 codes for configuration

3.3.3. Parameter 3 for RS-485: Sensor control and communication protocol

This parameter performs two functions

Left digit: Sensor control
0-> Disable sensor information
1 -> Enable sensor information

Right digit: Communication protocol,
The user can select between the following protocols:
0: ASCII: Really simple protocol that uses ASCII characters
1: ModBus RTU-ASCII: This uses the ModBus protocol, but the temperature and humidity data are coded in ASCII in the same block.
2: ModBus RTU-Word. This uses the ModBus RTU-Word protocol. The temperature and the humidity are independent words.
In the display that receives the data through serial line (DC-25), the sensor information must be disabled.

3.3.4. Parameter F: Exit menu

Press the key "*" to exit the parameter menu. Before exiting the parameters are saved.

3.4. Parameters Ethernet and Wifi.

3.4.1. Parameter 1 for Ethernet and Wifi: MAC address of the display.

To know the MAC address, access parameter 1 and, using the "*" key, access the 3 last values of the MAC address. The first 3 numbers are always 00 -20 - 4A, so the first value displayed in the parameter is the 4th value of the MAC.

3.4.2. Parameter 2 for Wifi: Load the IP configuration through the RS-232 port.

To access the serial port for the first time, the RS-232 serial port and the Hyperterminal (or a similar program) must be used. See paragraph 4.7.1 for more information.

3.4.3. Parameter 3 for Ethernet and Wifi: Sensor control and communication protocols.

This parameter performs two functions

Left digit: Sensor control
0-> Disable sensor information
1 -> Enable sensor information

Right digit: Communication protocol,
The user can select between the following protocols:
0: TCP/IP: Really simple protocol that uses ASCII characters
1: ModBus TCP: This uses the ModBus protocol, the temperature and humidity data are coded in ASCII or integer in the same block.

In the display that receives the data through serial line (DC-25), the sensor information must be disabled.

3.4.4. Parameter 4 for Ethernet and Wifi: Load the default port configuration in the Ethernet or Wifi port.

To load the default values in the communication port, program the value 99 and press the "*" key. During the load time, the digits "99" are flashing. When it has finished, the parameter 4 is displayed again.

3.4.5. Parameter F: Exit menu.

Press the key "*" to exit the parameter menu. Before exiting the parameters are saved.

3.5. Modify parameters for the analog inputs.

The analog inputs must be configured to adapt the display to the specifications of the analog sensor

To modify the parameters the user must access the three programming keys placed on the top inside the display. See paragraph 3.1 to see how to access inside the display.

The programmation keys are placed in the top of the displays. The identification of the keys is

Advance key: "* "
Increase key: "+"
Validate key "E"

To program the parameters, the three digits on the top are used. The left digit, identified with the digital point, indicates the parameter number and the two right digits indicate its value. The flashing digit is the one the user can modify with the "+" key. Press the "*" key to change the digit to modify. Accept the value with the "E" key.

To enter the menu, main the "*" key pressed for 3 seconds. Once this time is passed, the first parameter is displayed.

There are then two options:

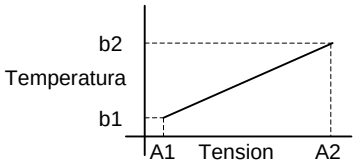
1- Modify the parameter value
By pressing the Advance key "*", change the digit to the one you want to modify.
To increase the parameter value, press the "+" key.
To validate the parameter value, press the "E" key

2- Select another parameter
In order to select another parameter, the parameter number must be made to flash using the "*" key and then the new parameter may be selected using the "+" key.

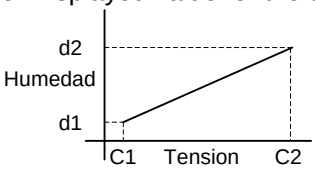
3.5.1. Parameters of the analog inputs.

Remember that the left digit of the parameter 3 must be 1.

For each of the sensors, temperature and humidity, 4 parameters must be programmed, so they define 2 points of a line. For each point a voltage level and the value to display must be programmed.



Parameter A1: Temperature. Input voltage for the first point.
Parameter b1: Temperature. Displayed value for the first point.
Parameter A2: Temperature. Input voltage for the second point.
Parameter b2: Temperature. Displayed value for the second point.



Parameter C1: Humidity. Input voltage for the first point.
Parameter d1: Humidity. Displayed value for the first point.
Parameter C2: Humidity. Input voltage for the second point.
Parameter d2: Humidity. Displayed value for the second point.

3.5.2. Default settings.

The displays are provided with the following values

Temperature	Humidity
Parameter A1 = 0.0 V	Parameter C1 = 0.0 V
Parameter b1 = -9.9°C	Parameter d1 = 0%

3.5.3. Error codes.

The display can detect any malfunction, so they are displayed and codified as the following table

	Temperature	Humidity
Correct value	E10	E01
Value ≥ 100ºC	E20	
Value ≤ -10,0ºC	E30	
Value ≥ 100%		E02
Value <20%		E03
Error on the parameters	E40	E04
Input voltage < minimum	E50	E05
Input voltage > maximum	E60	E06

If there is error in both sensors, the displayed value is the addition of both errors. If there is only one error, a “1” is seen in the sensor that works correctly and the error code in the other sensor

For example: Parameter error in both sensors. Displayed value: E44.
Error in the temperature sensor. Displayed value: E41.

4. COMUNCATION PROTOCOLS

In this paragraph, the different protocols will be explained, as well as the programmation of the displays through them. The formats of values of the numbers and characters are written in this manual are:

- When telling about a hexadecimal number, this will be followed by an “h”.
- When telling about a decimal number, this will be followed by a “d”.
- When telling about a binary number, this will be followed by a “b”.
- When telling about an ASCII character, this will be explained in the context.

As an example, the X ASCII character can be explained as 58h, 88d or 1011000b, as needed in the moment. Number 15 ASCII can be seen as 31h 35h, 49d 53d or 110001d 110101d.

4.1. ASCII protocol for RS-485

This protocol allows communicating with any device that disposes serial line and can configure the communication protocol, as a PC or PLC. There can be 99 devices connected to the net with the corresponding amplifiers every 30 devices.

Using this protocol forces the display to work on slave mode. This means that the display waits for a message and, once verified, it responds depending on the command received.

To understand how to configure the protocol, the used terms are used

Message. It is formed by all the necessary characters to establish the dialogue. For each correct message received, the display returns a response message. The message consists of three parts: The header, the data and the end of block

Header. It is used to identify the beginning of the message. The character @ (64d, 40h) followed by the address of the display is sent.

Data block: The data block can consist of commands or responses. The valid commands are the following

The command **PT** is a request to the display to ask for the current temperature and humidity values.

The command **VT** is an order to the display to shoe temperature and humidity values that are sent.

End of block: It is used to identify the complete arrival of the block. It is used the character “Carry return” (13d 0Dh)

4.1.1. Displays DC-24/X. Read values from the display

To read the current values of the temperature and humidity, the following message must be sent:

	Header	Address	Code	End of block
Characters	@	High Low	P T	Carry return
Decimal	64d		80d 84d	13d
Hexadecimal	40h		50h 54h	0Dh

The address of the display is formed by 2 digits between 0 and 99

Example: Data request to the display at address 15

	Header	Address	Code	End of block
Characters	@	1 5	P T	Carry return
Decimal	64d	49d 53d	80d 84d	13d
Hexadecimal	40h	31h 35h	50h 54h	0Dh

Response from the display

The response message from the display is the following:

	Header	Address	Code	Temp	Space	Hum	End of block
Characters	@	High Low	P T	T T , T		H H	Carry return
Decimal	64d		80d 84d		32d		13d
Hexadecimal	40h		50h 54h		20d		0Dh

The address returned is the one of the display

Temperature and humidity are sent in the indicated format, separated by a comma.

Response frame example. Temperature = 24,7 and relative humidity = 63%

	Header	Address	Code	Temp	Space	Hum	End of block
Characters	@	1 5	P T	24,7		63	Carry return
Decimal	64d	49d 53d	80d 84d	50d 52d 44d 55d	32d	54d 51d	13d
Hexadecimal	40h	31h 35h	50h 54h	32h 34h 2Ch 37h	20h	36h 33h	0Dh

4.1.2. Displays DC-25/X. Send values to the display

To send values of the temperature and humidity to the display, the following message must be sent:

	Header	Address	Code	Temp	Space	Hum	End of block
Characters	@	High Low	V T	T T , T		H H	Carry return
Decimal	64d		86d 84d		32d		13d
Hexadecimal	40h		56h 54h		20d		0Dh

The address of the display is formed by 2 digits between 0 and 99

Example: Data sent to the address 04. Temperature 18.6°C and relative humidity 47%.

	Header	Address	Code	Temp	Space	Hum	End of block
Characters	@	1 5	V T	18,6		47	Carry return
Decimal	64d	49d 53d	86d 84d	49d 56d 44d 54d	32d	52d 55d	13d
Hexadecimal	40h	31h 35h	56h 54h	31h 38h 2Ch 36h	20h	34h 37h	0Dh

Response from the display

The response message from the display is the following:

	Header	Address	Code	End of block
Characters	@	High Low	V T	Carry return
Decimal	64d		86d 84d	13d
Hexadecimal	40h		56h 54h	0Dh

The address returned is the one of the display

Example: Frame returned when data has been sent

	Header	Address	Code	End of block
Characters	@	0 4	V T	Carry return
Decimal	64d	48d 52d	86d 84d	13d
Hexadecimal	40h	30h 34h	56h 54h	0Dh

4.2. PROTOCOL MODBUS RTU - ASCII for RS-485

This protocol allows the user to communicate with devices that dispose of ModBus RTU protocol

It uses the function 10h and the data block is in ASCII mode. The values can be read or sent. **If the user wants to send the values to the display, the sensor must be disabled** (see paragraph 3.3.3)

To read the values from the display, the following command must be sent

Addr.	Func.	Register High	Register Low	Words High	Words Low	Bytes num	Data	Low CRC	High CRC
	10h	01h	01h	00h	01h	02h	P T		
03h	10h	01h	01h	00h	01h	02h	50h 54h	93h	DEh

The first byte is the address of the display inside the network. The three following bytes must be 10h, 01h and 01h. The bytes 5 and 6 correspond to the number of words of the data field. In the data field the characters “PT” must be placed, so the display know the user is requesting data

In the previous example, the CRC is calculated for the display at the 03 address.

An example of the response of the display is the following message

Addr	Func.	Register High	Register Low	Words High	Words Low	Bytes num
	10h	01h	01h	0	5	0Ah
03h	10h	01h	01h	00h	05h	0Ah

Data					Low CRC	High CRC
P T	23,7		51			
50h 54h	32h 33h 2Eh 37h	20h	35h 31h	20h	D1h	19h

In the response message, the received code is repeated and the temperature and humidity values are added, separated by the space character (20h). After the humidity, there is another space character (20h) so the byte number is even. If the display detects an error in the received block, the error code with the following data code is sent

Address.	Error	Error code	Low CRC	High CRC
	90h			

The possible errors are:

02 = CRC error.

To write values in the display, the following message must be sent:

Addr.	Func.	Register High	Register Low	Words High	Words Low	Num. bytes
	10h	01h	01h	0	5	0Ah
03h	10h	01h	01h	00h	05h	09h

Data					Low CRC	High CRC
V T	25,3		47			
56h 54h	32h 35h 2Ch 33h	20h	34h 37h	00h	F4h	9Ch

The first byte is the address of the display inside the network. The three following bytes must be 10h, 01h and 01h. The bytes 5 and 6 correspond to the number of words of the data field. In the data field the characters “VT” must be placed, followed by the temperature and humidity data. At the end, a 00h character must be sent so the number of byte sent is even.

The response from the display is the following message:

Addr.	Func.	Register High	Register Low	Words High	Words Low	Num. bytes	Data	Low CRC	High CRC
	10h	01h	01h	00h	01h	02h	V T		
03h	10h	01h	01h	00h	01h	02h	56h 54h	90h	7Eh

In the response message, the received code is repeated until the control code (V). If the display detects an error in the received block, the error code with the following data code is sent

Addr.	Error	Error code	Low CRC	High CRC
	90h			

The possible errors are:

02 = CRC error.

4.3. PROTOCOL MODBUS RTU - Word for RS-485

This protocol allows the user to communicate with devices using the protocol Modbus RTU

This protocol uses the function 06h to write and the function 03h to read data from the display. The data block is a Word. The user can write or read data. **If the data must be sent, the sensor mist be disabled modifying the parameter 3. See paragraph 3.3.3 "Parameter 3 for RS-485: Sensor control and communication protocol"**

The temperature is sent multiplied per 10 when writing or reading. As an example 21,6 ºC will be sent as 216 (00D8h)

To write the temperature value, the data must be sent to register 0001h (40001h). The data format must be 16-bit word format. In the following example, the data block structure is detailed for a 19,7ºC (00C5h) temperature writing.

Func.	Reg. H	Reg. L	Data	Low CRC	High CRC
06h	00h	00h	00h C5h	48h	7Bh

To write the humidity value, the data must be sent to register 0002h (40002h). The data format must be 16-bit word format. In the following example, the data block structure is detailed for 57% (0039h) humidity writing.

Func.	Reg. H	Reg. L	Data	Low CRC	High CRC
06h	00h	01h	00h 39h	19h	FAh

If the data block is correctly received, the display responds with the same data block it has received

If there is an error in the reception, the display responds with an error detection block with the following data.

Addr.	Error	Error code	CRC low	CRC high
	86h			

The possible errors are:

02 = CRC error.

To read the temperature value, the data request must be sent to register 0003h (40003h). In the following example, the data block structure is detailed for a temperature request.

Addr.	Func.	Start Addr. H	Start Addr. L	Num. Reg. H.	Num. Reg. L.	Low CRC	High CRC
03h	03h	00h	02h	00h	01h	24h	28h

If the block is correctly received, the display responds with the temperature value in 16-bit Word format. **Remember that the temperature is multiplied per 10.**

Response block example. Temperature: 23,8ºC

Addr.	Func.	Num. bytes	Data	Low CRC	High CRC
03h	03h	02h	00h EEh	41h	C8h

To read the humidity value, the data request must be sent to register 0004h (40003h). In the following example, the data block structure is detailed for a humidity request.

Addr.	Func.	Start Addr. H	Start Addr. L	Num. Reg. H.	Num. Reg. L.	Low CRC	High CRC
03h	03h	00h	03h	00h	01h	75h	E8h

If the block is correctly received, the display responds with the humidity value in 16-bit Word format.

Response block example. Humidity: 52%

Addr.	Func.	Num. bytes	Data	Low CRC	High CRC
03h	03h	02h	00h 34h	C0h	53h

If there is an error in the reception, the display responds with an error detection block with the following data.

Addr.	Error	Error code	CRC low	CRC high
	83h			

4.4. TCP/IP, UDP/IP PROTOCOL

The display only accepts frames ending with a block ending it can see. (End of clock = Carry return = 0Dh)

Local Port = 10001.

4.4.1. UDP protocol

To use the UDP protocol, the communication port must be programmed with the default configuration

To use UDP/IP, the Local Port must be 10001

UDP Datagram Mode
Datagram Type must be 01.
Active Connection
Remote Host: IP address of the PC to which the display is connected.
Remote Port: Port of the PC to which the display is connected.

4.4.2. Read values from the display

To read the current temperature and humidity the following frame must be sent:

	Code	End of Block
Characters	P T	Carry return
Decimal	80d 84d	13d
Hexadecimal	50h 54h	0Dh

Response from the display

The response frame from the display is the following:

	Code	Temperature	Space	Humidity	End of block
Characters	P T	TT.T		HH	Carry return
Decimal	80d 84d		32d		13d
Hexadecimal	50h 54h		20h		0Dh

Response block in protocols TCP/IP and UDP/IP. Example.

Frame returned by the display with values 24.7ºC and 63%

In protocol ModBus/TCP the characters PT are not returned

	Code	Temperature	Space	Humidity	End of Block
Characters	P T	24,7		63	Carry return
Decimal	80d 84d	50d 52d 44d 55d	32d	54d 51d	13d
Hexadecimal	50h 5h4	32h 34h 2Ch 37h	20h	36h 33h	0Dh

4.4.3. Send values to the display. Displays without sensor.

To send the temperature and humidity values to a display without sensor, the following block must be sent

	Code	Temperature	Space	Humidity	End of Block
Characters	V T	TT.T		HH	Carry return
Decimal	86d 84d		32d		13d
Hexadecimal	56h 54h		20h		0Dh

Response block in protocols TCP/IP and UDP/IP. Example.

The response block from the display is the following

In the ModBus/TCP protocol, the field “Data” is empty.

	Code	End of Block
Characters	V T	Carry Return
Decimal	86d 84d	13d
Hexadecimal	56h 54h	0Dh

Sending data to the display. Example

Example with the values 23.6ºC temperature and 58% humidity.

	Code	Temperature	Space	Humidity	End of Block
Characters	V T	23,6		58	Carry return
Decimal	86d 84d	50d 51d 44d 54d	32d	53d 56d	13d
Hexadecimal	56h 54h	32h 33h 2Ch 36h	20h	35h 38h	0Dh

4.5. ModBus/TCP PROTOCOL

The frame must accomplish the ModBus/TC specifications for being accepted by the display.

4.5.1. Modbus/TCP protocol

End of block is not necessary.

Local Port = 502.

4.5.2. Read data from the display

To read the current temperature and humidity, the functions 03h or 10h must be used. The blocks are the following

Function 03h.

The temperature is in register 40003 (address 02h) and the humidity in the register 40004 (address 03h)

Read temperature:

Identifier	Protocol	Number of bytes	Unit	Function	Start address	Number of registers
08h 62h	00h 00h	00h 06h	01h	03h	00h 02h	00h 01h

Response from the display

The response frame from the display is the following.

In this example, the identifier is 0862h and the read temperature is 20.5ºC = CDh

Identifier	Protocol	Number of bytes	Unit	Function	Number of registers	Data
08h 62h	00h 00h	00h 05h	01h	03h	02h	00h CDh

Read temperature and humidity

Temperature and humidity can be read reading 2 registers from the register 40003.

In this example, the identifier is 0618h, the read temperature is 20.5ºC (CDh) and the humidity is 42% (1Ah)

Sent frame:

Identifier	Protocol	Number of bytes	Unit	Function	Start address	Number of registers
06h 18h	00h 00h	00h 06h	01h	03h	00h 02h	00h 02h

Response from the display

Identifier	Protocol	Number of bytes	Unit	Function	Number of registers	Data
06h 18h	00h 00h	00h 07h	01h	03h	04h	00h CDh 00h 2Ah

Function 10h

Temperature and humidity can be read using the function 10h.

In the frame, the following codes must be codified.

Unit = 01h
Function = 10h
Start address = 00h 00h

Identifier	Protocol	Num bytes	Unit	Function	Start addr	Num. regist.	Num. Bytes	Data
01h 0Ah	00h 00h	00h 09h	01h	10h	00h 00h	00h 01h	02h	50h 54h

In the data field, the characters PT (50h 54h) must be sent.

Response from the display. Example.

In this frame, the data received are 20.4ºC and 42%

Identifier	Protocol	Number bytes	Unit	Function
01h 0Ah	00h 00h	00h 0Dh	01h	10h

Data	
00h 00h 00h 01h	32h 30h 2Eh 34h 20h 34h 32h

4.5.3. Send temperature and humidity

In the repeater displays, the temperature and humidity can be sent using the function 06h or 10h.

Function 06h. The temperature must be sent to the register 40003 (address 02h) and the humidity must be sent to the register 40004 (address 03h).

In this example, the identifier is 0618h and the temperature sent is 21.1ºC (D3h)

Frame to send:

Identifier	Protocol	Num. Bytes	Unit	Function	Start address	Num. registers
00h 32h	00h 00h	00h 06h	01h	06h	00h 02h	00h D3h

Response from the display:

The response from the display is the same block sent.

Function 10h mode ASCII

Sending temperature and humidity using the function 10h.
In the frame, the following codes must be codified.

Unit = 01h
Function = 10h
Start address = 00h 00h

Identifier	Protocol	Num. bytes	Unit	Function	Start address
00h 37h	00h 00h	00h 11h	01h	10h	00h 00h

Num. Registers	Num. Bytes	Data	Data
00h 05h	0Ah	56h 54h	31h 39h 2Eh 34h 20h 35h 37h

In this example, in the data field the values 19,4°C 57% must be sent.

Response from the display:

The response from the display is the same frame received from the identifier until the number of registers.

Identifier	Protocol	Num. bytes	Unit	Function	Start address	Num. Registers
00h 37h	00h 00h	00h 11h	01h	10h	00h 00h	00h 05h

Function 10h mode Word

Sending temperature and humidity can be sent using the function 10h.
In the frame, the following codes must be codified.

Unit = 01h
Function = 10h
Start address = Register 40003 (Address 02h)

Identifier	Protocol	Num. Bytes	Unit	Function	Start address
00h 37h	00h 00h	00h 0Bh	01h	10h	00h 02h

Number of registers	Number of bytes	Data
00h 02h	04h	00h F3h 00h 39h

In this example, in the data field the values 19,4°C 57% must be sent.

Response from the display:

The response from the display is the same frame received from the identifier until the number of registers.

Identifier	Protocol	Number of bytes	Unit	Function	Start address	Number registers
00h 37h	00h 00h	00h 0Bh	01h	10h	00h 00h	00h 04h

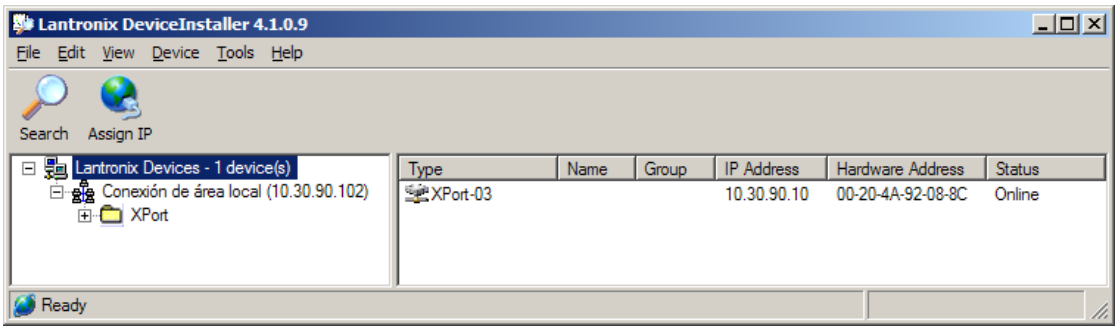
4.1. IP Address. Ethernet option

Before being able to communicate with the display an IP address must be assigned. To assign an IP address the DeviceInstaller program from Lantronix must be used, which can be downloaded free from their website: www.lantronix.com

Select: Support → Technical Support → Firmware/Downloads.
Select: DeviceInstaller.

Once the program is installed and running, press the "Search" button to locate the connected displays. The display must be turned on and connected to the network.

If there are no network problems, a screen similar to this should be displayed.



The IP address with which the equipment is supplied is: 10.30.90.10

The Hardware Address is the unit MAC code.

To assign the IP address you must first select the equipment by clicking on the XPort-03 to which you wish to assign the address. Then press Assign IP and follow the instructions.

IMPORTANT: All units are dispatched from the factory with the same IP address. Therefore to configure various units, they must be connected to the Ethernet and the address must be assigned one by one.

4.2. Modifying the port settings.

To modify the port configuration the DeviceInstaller program from Lantronix must be used, which can be downloaded free from their website: www.lantronix.com

Select: Support → Technical Support → Firmware/Downloads.
Select: DeviceInstaller.

Once the program is installed and running, press the "Search" button to locate the connected displays. The display must be turned on and connected to the network.

If there are no network problems, the same screen for configuring an IP address should be displayed. See 4.1 "IP Address."

To access the setup you must first select the unit clicking on the XPort-03 that you wish to modify.

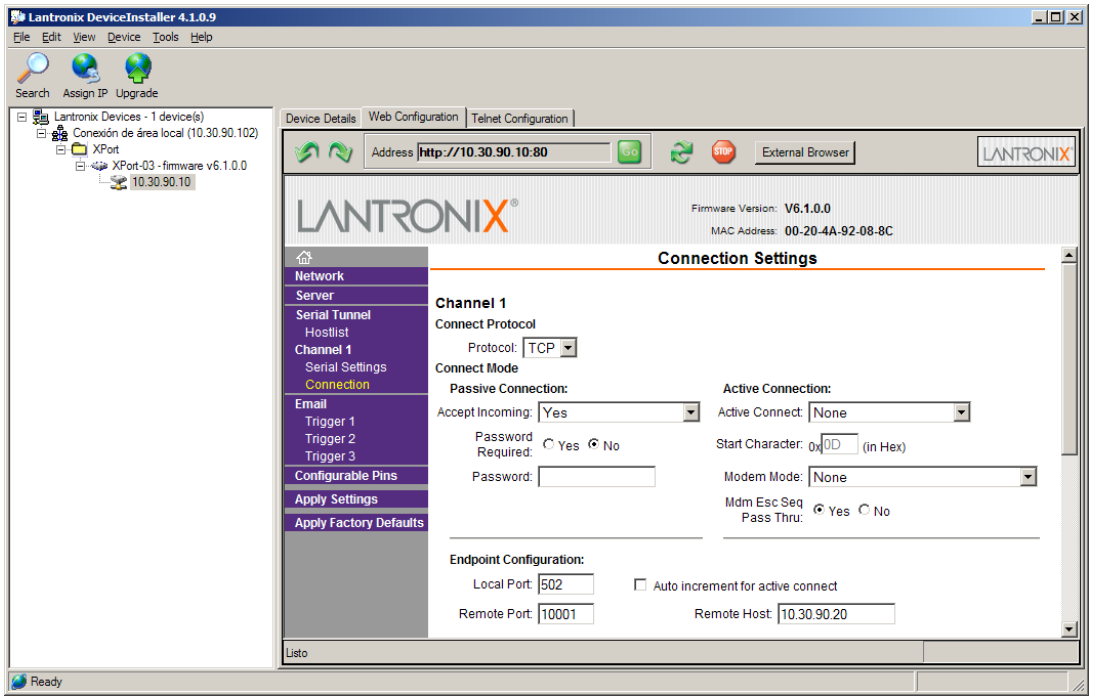
Then press Web Configuration and the GO key placed at the right side of IP address.

Enter your computer User Name and Password.

To access the setup the Local Port, select **Channel1->Connection.**

You will see a screen similar to the one above.

In Local Port insert the new value and click **OK** on the bottom of the page.



4.2.1. UDP/IP configuration

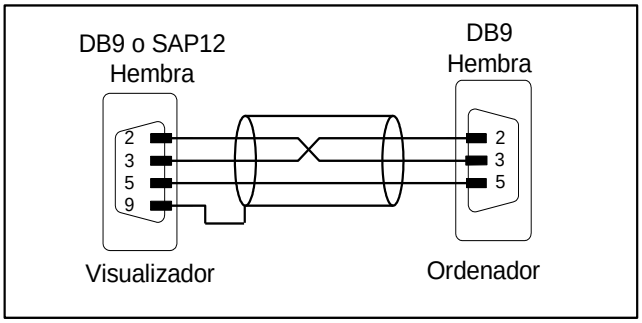
Select **Channel 1 -> Connection** in the left menu.
Select the UDP protocol in “Connection protocol”
Select **Datagram Type = 1** in Datagram Mode
Introduce the following in Endpoint Configuration

Local Port = 10001
Remote Port = Port of the equipment that will be connected.
Remote Host = IP address of the equipment that will be connected.

Click OK in the bottom of the page.
Click **Apply Settings** in the left menu.

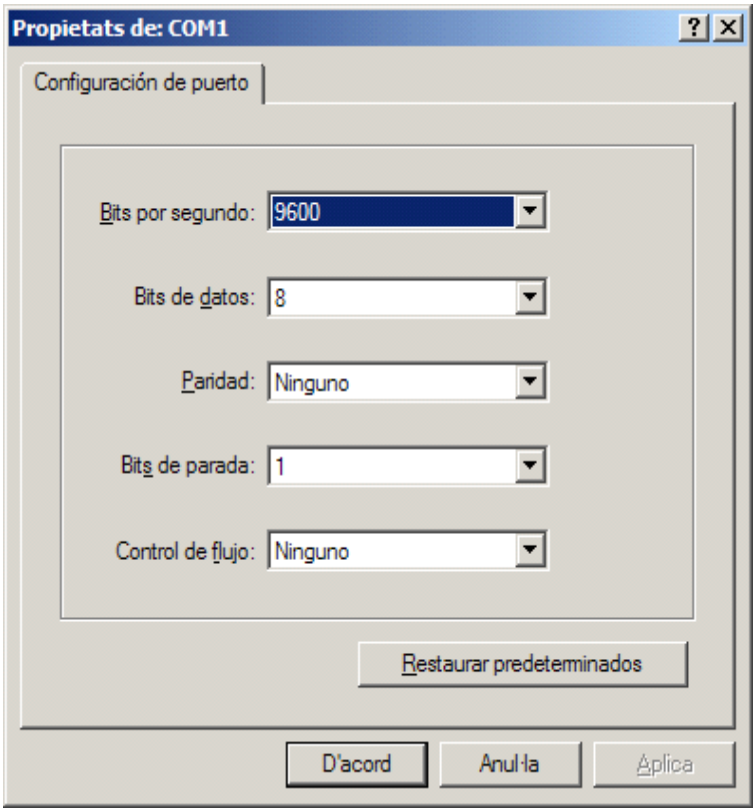
4.3. IP address. Wifi.

The easiest way to set up the IP address is by using the Hyperterminal program and the serial line of computer. The cable's wiring diagram is the classic crossover.

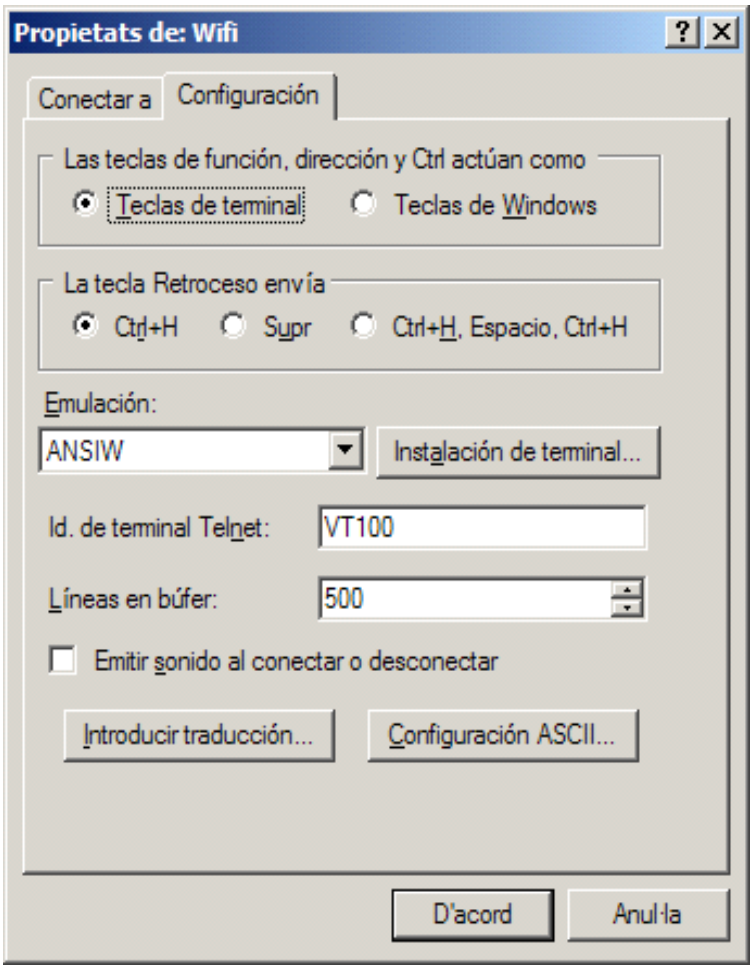


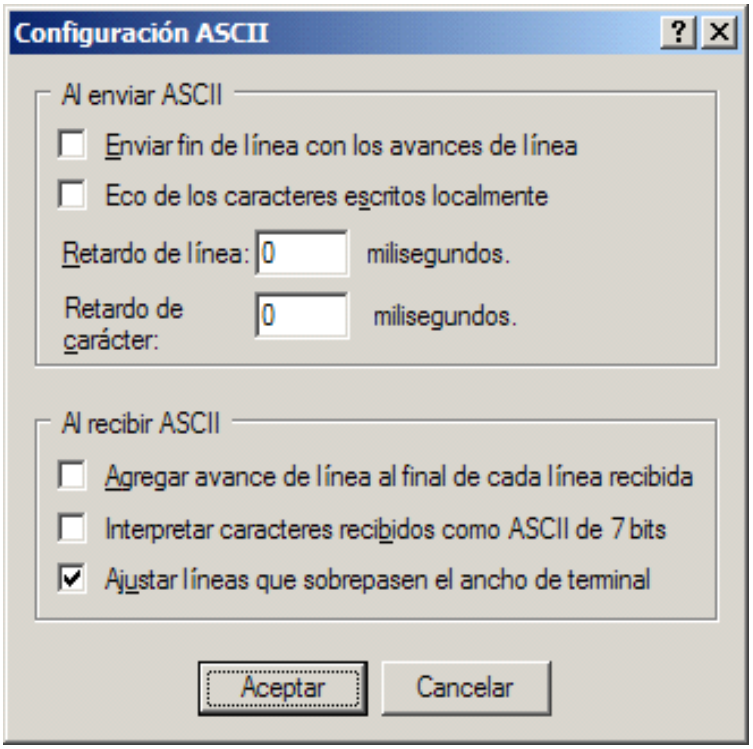
The configuration of the Hyperterminal must be:

- Baud rate: 9600 Bauds
- Data Bits: 8
- No parity
- Stop Bits: 1
- Hardware flow control: None.



The attached Hyperterminal set up have been verified and work correctly, but any other set up may work also correctly.





To set up the Wifi module using the Hyperterminal or any other program, you must follow a time sequence. A time error on steps 5 and 6 forces to return to step 3.

4.3.1. Accessing Wifi module configuration

In order to access to Wifi module configuration the next steps must be followed:

1– Connect the serial cable (see 4.3 “IP address”) between the computer and the display.

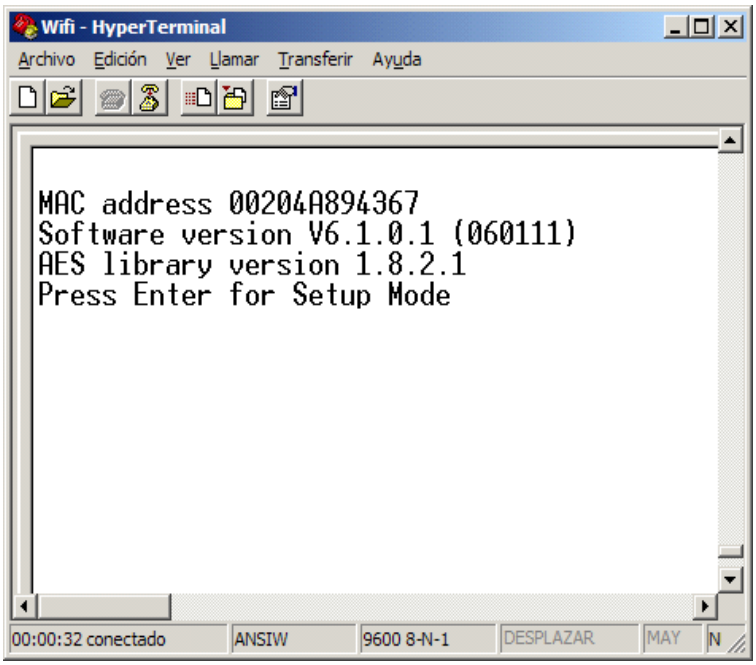
2– Open Hyperterminal.

3– Select the display’s parameter 7. See **¡Error! No se encuentra el origen de la referencia.** REF _Ref353780144 \h **¡Error! No se encuentra el origen de la referencia.**

4- Push the advance key. (Key *)

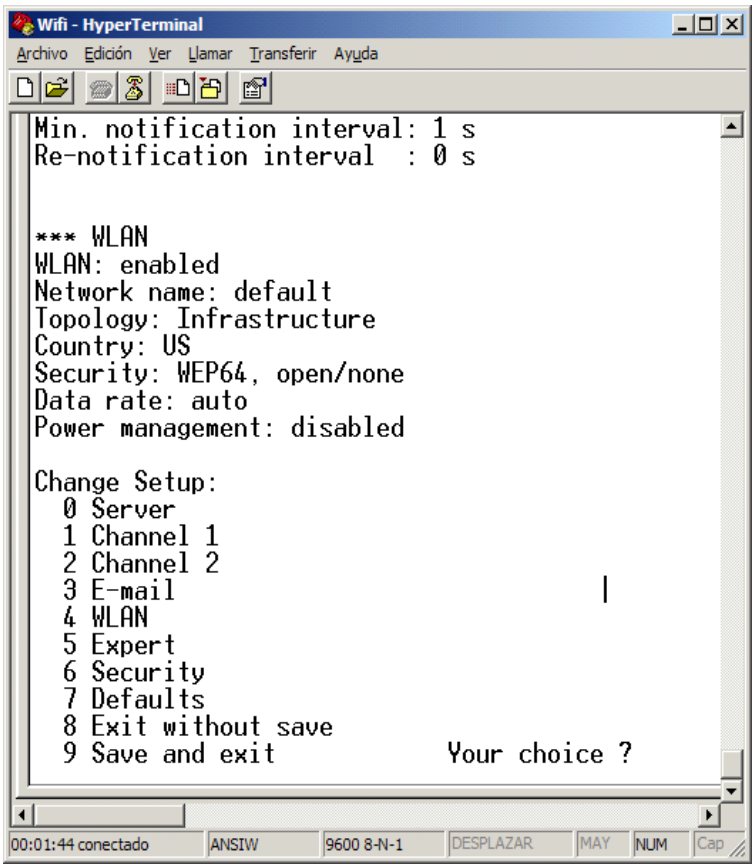
5– Keep pushed the lower case letter **x** before the display counters equals 0. Remain pushing until the following screen is displayed.

The maximum delay since pushing the advance key (step 4) until to push x key is 10 seconds.



6– At this time you have **3 seconds** to push the Intro key on your keyboard.

7– The following screen is shown.



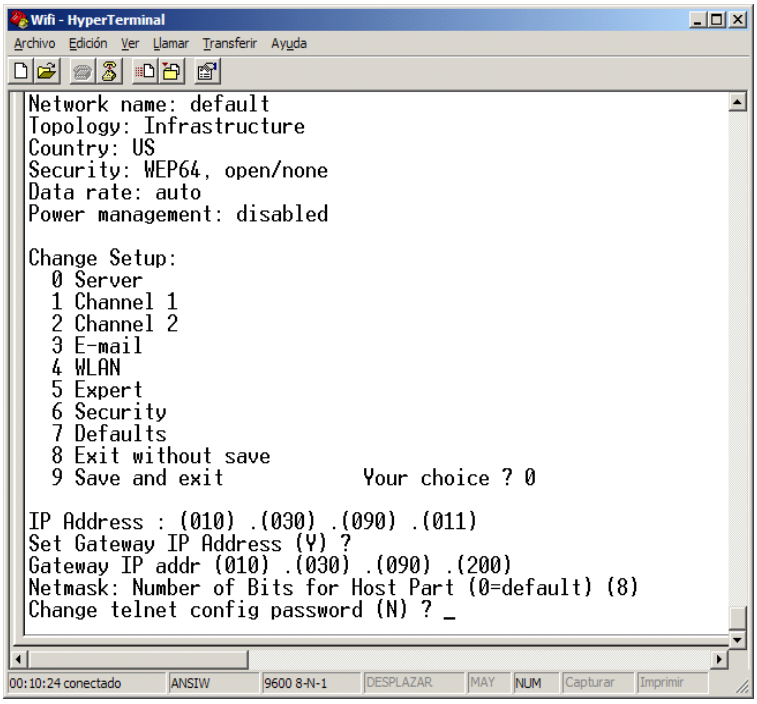
8– You must set up:

0 Server + Intro

4 WLAN + Intro

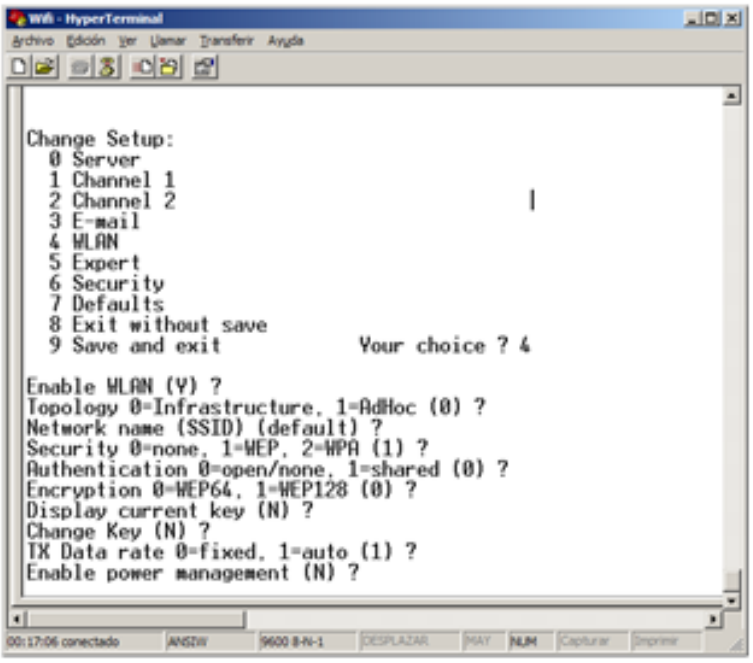
Example of Server Set up

Ask your network administrator the IP and Gateway address.



Example of WLAN Set up

Ask your network administrator the correct values



To exit select 8 (Exit without save) or 9 (Save and exit).

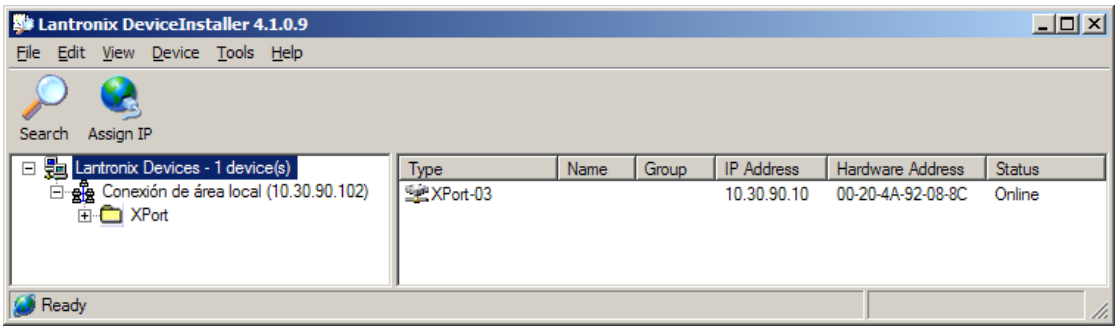
4.4. Set up IP Address using the DeviceInstaller.

Before being able to communicate with the display an IP address must be assigned. To assign an IP address the DeviceInstaller program from Lantronix must be used, which can be downloaded free from their website: www.lantronix.com

Select: Support → Technical Support → Firmware/Downloads.
Select: DeviceInstaller.

Once the program is installed and running, press the "Search" button to locate the connected displays. The display must be turned on and connected to the network.

If there are no network problems, a screen similar to this should be displayed.



The IP address with which the equipment is supplied is: 10.30.90.10

The Hardware Address is the unit MAC code.

To assign the IP address you must first select the equipment by clicking on the XPort-03 to which you wish to assign the address. Then press Assign IP and follow the instructions.

IMPORTANT: All units are dispatched from the factory with the same IP address. Therefore to configure various units, they must be connected to the Ethernet and the address must be assigned one by one.

4.5. Modifying the port settings.

To modify the port configuration the DeviceInstaller program from Lantronix must be used, which can be downloaded free from their website: www.lantronix.com

Select: Support → Technical Support → Firmware/Downloads.
Select: DeviceInstaller.

Once the program is installed and running, press the "Search" button to locate the connected displays. The display must be turned on and connected to the network.

If there are no network problems, the same screen for configuring an IP address should be displayed. See 4.1 "IP Address."

To access the setup you must first select the unit clicking on the XPort-03 that you wish to modify.

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DECLARACION DE CONFORMIDAD

CE

DISEÑOS Y TECNOLOGIA, S.A.
Poligon Industrial Les Guixeres
C/ Xarol 8C
08915 BADALONA España

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

Model : DC-24 in all versions.
Model: DC-25 in all versions.

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

Directive: LVD 2006/95/CEE Low Voltage Directive.
Standard UNE-EN61010-1 Security in electric equipment.

Directive: EMC 2004/108/CEE Electromagnetic Compatibility
Standard UNE-EN 61000-6-4 Generic Emission Standard. Industrial environment.
Standard UNE-EN 61000-6-2 Generic Immunity Standard. Industrial environment.

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Badalona, 5th February 2013

Alicia Alarcia
Technical Director