

TECHNICAL MANUAL DR-109

Clock with GPS, Ethernet and RS-485 functions

Introduction to the DR-109

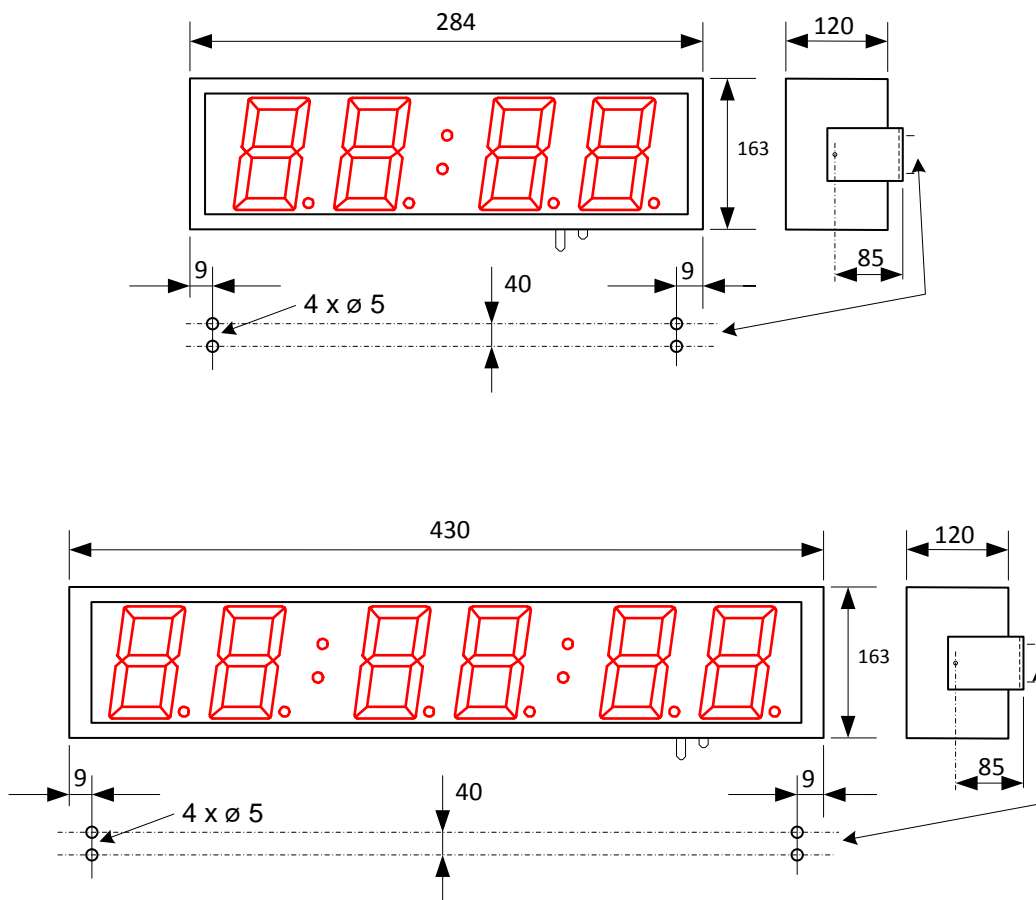
The DR-109 display is presented as an easy-to use clock adjusted and calibrated at factory. The main window shows the current time in HH:MM format. The main window can be set to turn on and turn off at the time set by user and is adjustable in brightness (see “Parameters” in this manual). In all cases, the display never turns off. There are add-on functions depending on the display. These functions are fully compatible and can be combined with each other:

If the display includes option A, it has an integrated GPS. The antenna contains a magnet that permit to fix it to a magnetic surface. The first time the display is turn on, the quality of the GPS signal must be verified some minutes after the power-up. This is done using one of the parameters of the display (see “GPS option” in this manual).

If the display includes option NE (Ethernet connectivity), this display hosts a web site where the user can see the status of the display and configure it. This function allows the display to be used as a server for other displays to synchronize the hour through the Ethernet, as well as updating its time and date through a SNTP server. User can configure and request the time through TCP/IP commands. The default IP is 192.165.1.100. See “Ethernet option” in this manual for more information.

If the display includes option X (RS-485 connectivity), this display can be configured as a RS.485 server/client. This means that the display can connect with other displays to sync between them, as well as the user communication through commands. If the display also includes the GPS or Ethernet option, the display can work as a bridge between both options. See “RS-485 option” for more information

Installation of the DR-109



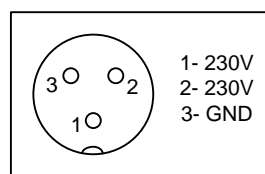
All dimensions are in millimetres

Powering the display

The power supply must be 88 to 264VAC, 47 to 63 Hz.

The power supply conductor section will be in line with consumption and the ground conductor will be a minimum section of 1.5m².

The power supply connector for 220VAC has 3 contacts and is situated in the lower part of the unit. Connect the power wires following the schema below



DR-109 characteristics.

Power supply	88 to 264VAC, 47 to 63 Hz.
Consumption	35VA
Consumption at minimum brightness	13,2VA.
Display	4 digits 7segments 100mm height + 2x two central dots. Red LED. Visibility 50 meters.
Display HH:MM:SS	4 digits 7segments 100mm height +2x two central dots. Red LED. Visibility 50 meters.
Environmental conditions	Operating temperature: -20 to 60°C. Storage temperature: -30°C to 70°C Relative humidity: 5-95% non condensation. Maximum environmental lighting: 1000 lux. Protection IP 41 or IP65.
Weight	4,5 Kg.

Timed power-up of the display

This display operates in two operation modes: full-operative mode and power-saving mode. In power-saving mode the display does not show the time in order to save energy when the display is not needed. If the power-saving function is not needed and the display should always be powered up, the both power-up and power-down times must be the same.

Parameters of the display

There are three keys on the back side of the display. These keys are used to access and navigate through the menu of the display. The identification of the keys is



Advance key. Access parameter/switch digits



Enter key. Validate parameter.



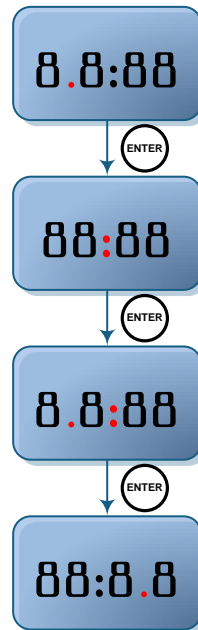
Increase key. Increase the value of the digit

Changing the time

In case the user wants to change the time, the Advance key must be pressed for three seconds. Using the Advance (to change digit) and the Increase (to increase the value of the digit) keys the present time can be changed. To leave the menu, press the Advance key past the digit corresponding to the units of the minute. If the time has changed, the seconds are changed to 0 when leaving the menu. Take in consideration that the time displayed in the menu must be UTC time. In case the display is configured to sync using the GPS or the SNTP connection, the time inserted by the user will be overwritten.

Modify parameters

If the user presses the Advance key for 6 seconds the parameter menu is displayed. In all cases the number the user is modifying is the one that flashes. The complete diagram of the parameters can be found in annex 1. In order to make configuration easy for the user, when changing a parameter, a point is turned on. This point changes depending on the sub-parameter (if it exists) the user is in.



Parameters are detailed below:

Parameter 1: Date configuration: This parameter configures the date, as well as the wintertime/summertime automatic switchover configuration. When entering this parameter, the day can be changed using the Increase and Advance key. To switch to month configuration, press the Enter key. Navigation here is the same as before. Once set the month, press the Enter key to switch to year configuration. Navigation here is the same as before. Once set the year, press the Enter key to switch to the following parameter, which has two parts:

Left digit: wintertime/summertime automatic switchover configuration

0 - Automatic switchover disabled. Time offset must be changed increasing or reducing value in parameter 3, leaving as the internal time, the UTC time.

1 - Automatic switchover enabled.

Right Digit: Weekday.

It allows to configure the present weekday, where 1 is Monday and 7 is Sunday

Parameter 3: Time offset: This parameter allows the user to configure its time zone, as well as changing the time offset in summertime/wintertime when configuring it manually, or for personal purposes; always counting that internal time count of the clock is GMT. First digit shows an upper hyphen when adding time and a hyphen when subtracting

Parameter 4: Display configuration: This parameter configures the time sync depending on the capabilities and the user desires. If the user selects a sync not allowed by capabilities, the display will not sync. For example, a display without Ethernet connection, selecting SNTP sync will have no effect. Options are:

0. Do not sync.
1. Sync with another display through Ethernet.
2. Sync through SNTP.
3. Sync with another display through RS-485.
4. Sync through GPS.

Parameter 5: Display power-up time: This parameter configures the time the display changes from power-save mode to full-operative mode. When accessing in this parameter, the hour the display changes to full-operative mode is shown. When the Enter key is pressed, the minutes are shown. To go back to the parameter menu, press the Enter key again.

Parameter 6: Display power-down time: This parameter configures the time the display changes from full-operative mode to power-save mode. When accessing in this parameter, the hour the display changes to power-save mode is shown. When the Enter key is pressed, the minutes are shown. To go back to the parameter menu, press the Enter key again.

Parameter 7: Website language. This parameter is shown if the display includes Ethernet option.

- 0 - Catalan
- 1 - Spanish
- 2 - English
- 3 - French
- 4 - German

Parameter 8: Display IP. This parameter is shown if the display includes Ethernet option. This parameter allows the user to change the IP address of the display. Access this parameter pressing the Advance key. Once inside, the first number of the IP address is shown. Modify it using the Increase and Advance keys and validate it using the Enter key. Do the same with the other 3 numbers of the IP address. To identify each number, think that the first number is shown without decimal point. Next numbers appear with decimal points, shifting left each number.

Parameter 9: RS-485 configuration. This parameter is shown if the display includes RS-485 option:
 Access this parameter pressing the Advance key. Change the code according to the desired configuration.

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

Once the serial line is configured, press the Enter key to modify the display address. This must be between 01 and 99. If the user presses the Enter key again, the End of Block can be modified. This can be:

Code	End of block
0	0Dh
1	0Ah
2	0Dh 0Ah
3	0Ah 0Dh
4	2Ah 0Dh
5	02h
6	03h
7	04h

Press the Enter key to go back to the menu.

Parameter A: GPS signal level: This parameter is only seen if the display includes GPS function. This parameter shows the quality of the GPS signal arriving to the antenna. Its maximum value is 50 and it must be over 20. If this occurs, the antenna must be moved closer to a window to get more signals.

Parameter J: Maintenance parameter: This parameter is used in factory and must not be modified.

Parameter P: Exit menu: Press Advance key to leave menu.

GPS option

Displays that include GPS sync with the GPS standard signal. This allows a better time sync without Ethernet connectivity

GPS antenna includes a magnet that can be fixed to a ferric surface. This antenna must be placed close to a window or in a place with “thin” roof. The most “hidden” the antenna is, the longer will take to get the GPS signal. GPS can spend up to half an hour to fix the signal if the antenna is “hidden” from the outside. If, after half an hour, the A parameter is lower than 20, move the antenna abroad.

The important parameters user must take in account are:

- Parameter 4.2: To sync through GPS, this parameter must be 4.
- Parameter A: This parameter shows the GPS signal quality.

Ethernet option

Ethernet options allows a new step in this displays type because it allows to connect displays using the same LAN in the installation, syncing them through the SNTP and providing a new user interface through the Web.

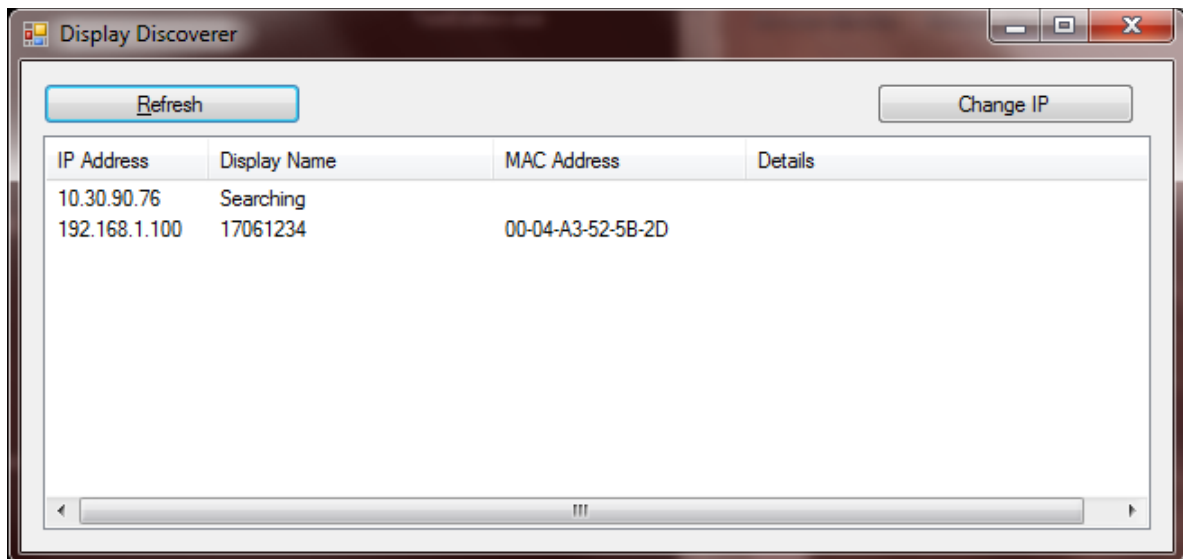
The first connection

There are several ways for accessing the display on the first time it's connected to the network.

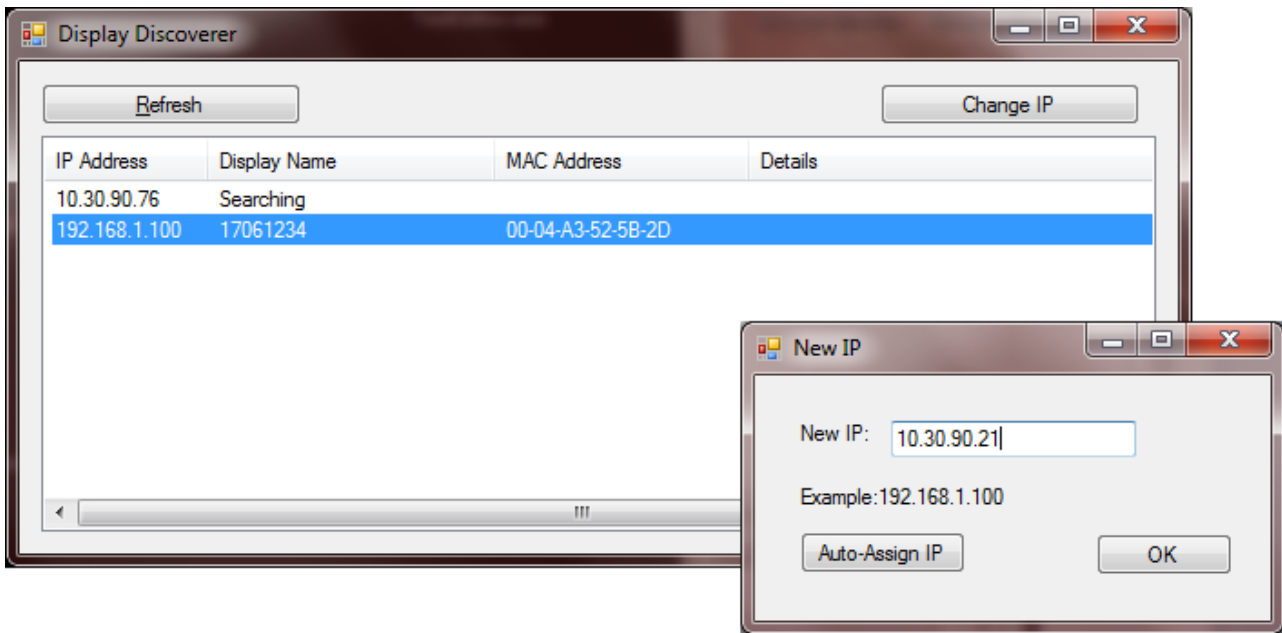
One of the ways is changing the IP address through parameters seen before

If the IP 192.168.1.100 (the default IP of the display) is in the range of your LAN, the display can be accessed typing the IP in the URL bar in your favourite browser.

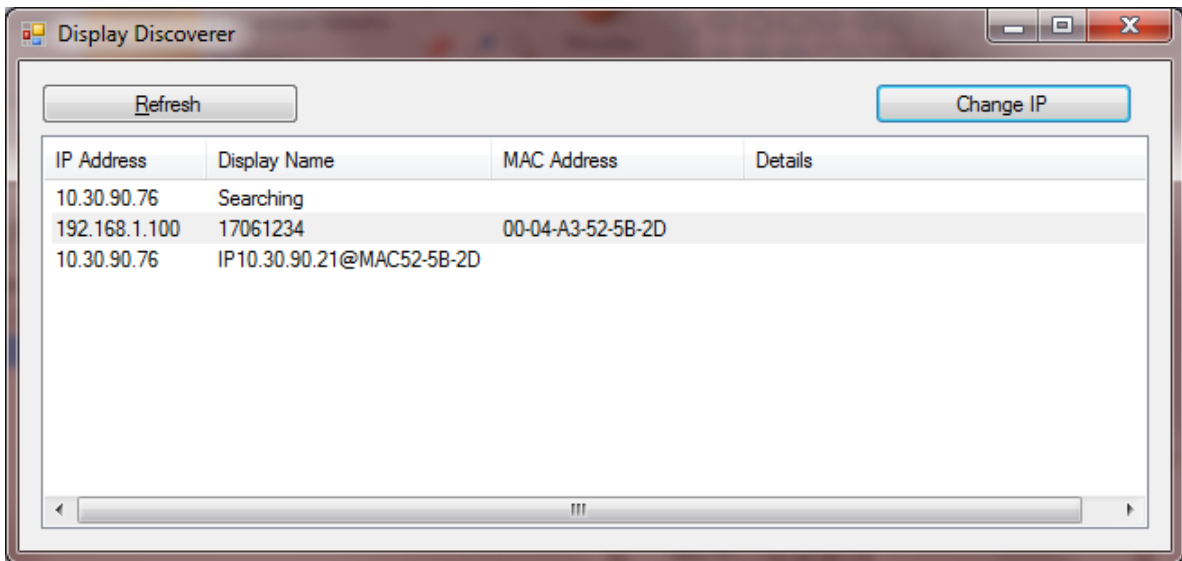
In case there is more than one display in the LAN or the default IP of the display is out of the IP range of you LAN, it is recommended to use the PC program "Display Discoverer", downloadable from the web www.lartet.com. In this program, the displays connected to the LAN are displayed, as well as their IP addresses, their MAC addresses (all MAC are 00:04:A3:xx:xx:xx) and its name. The default name of the display is its serial number. This name can be changed in the Ethernet tab of the web server of the display.



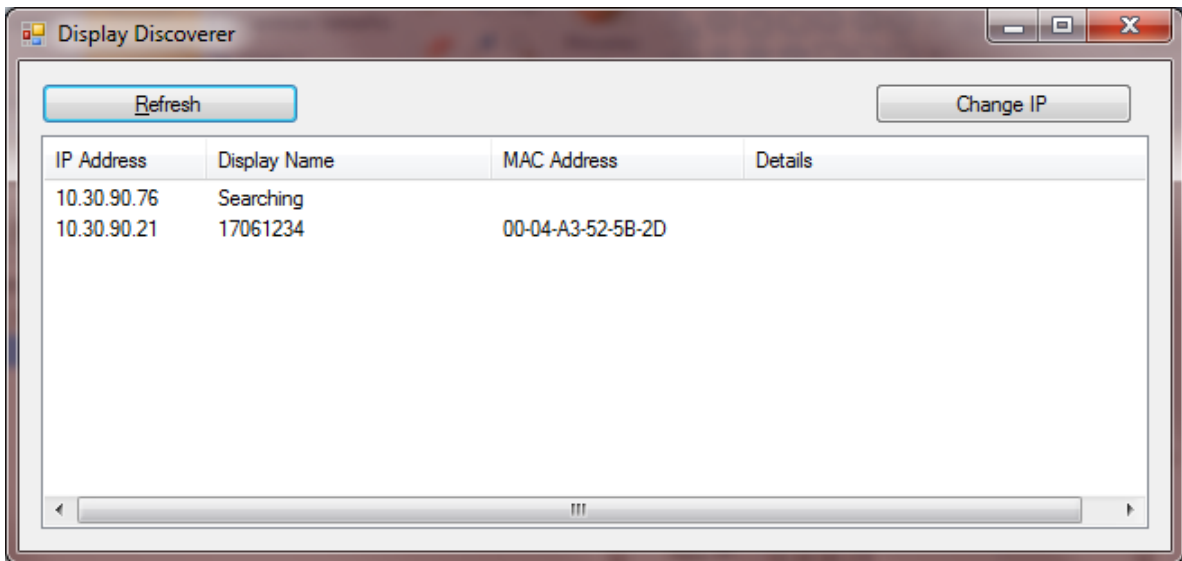
The first row shows the IP of the PC which is searching the displays and the second row a display we just have bought. As it is shown, the display has serial number 17061234 and the default IP is out of the range of the LAN. To change the IP address to a suitable one for our LAN, select the display and click the button "Change IP". When clicking this, a new window is opened where a new IP address can be typed.



Tip the new IP and click OK. There will appear a message in the main window with the message sent to the display.



After some seconds, click the “Refresh” button. The display appears with the new IP

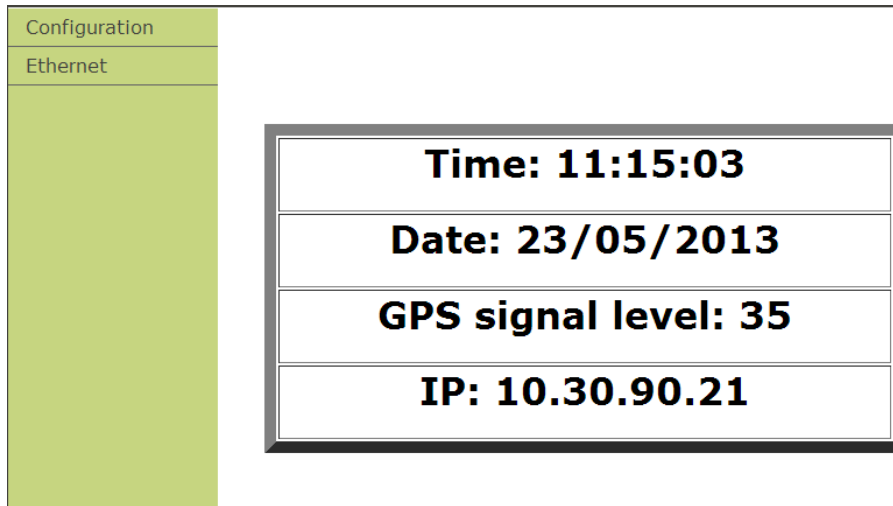


Click the display IP to open a new tab in the browser. The main page of the web server is shown.

User interface

Ethernet connection allows a new interface, much easier than the usual in displays. All configuration can be done through a website hosted at the display, so the user only needs a device connected to the LAN with web browser (computers, smartphones, tablets...). There is no contact with the display, which usually is in a difficult access point. The web page can be accessed remotely if the router is correctly redirected. See Annex 2: View the web page remotely for more information.

The main page shows the same date and time of the display, as well as the GPS signal quality (if the option is included) and the display IP. This main page is for the user to control the status of the display.



In the left menu there are two tabs: Configuration and Ethernet, accessible through user and password:

User: admin
Password: 12345678

First tab allows the user to configure the same parameters as the parameter menu in an easier and more intuitive way. When the user configures the display to sync through SNTP or another display, the server must be written in the field.

Clock

Ethernet

Parameter Configuration

Time (UTC)	<input type="text" value="17:34:28"/>	<input type="button" value="Validate"/>
Date (UTC)	<input type="text" value="25/03/2014"/>	<input type="button" value="Validate"/>
Local Time	<input type="text" value="+1"/>	
Weekday	<input type="text" value="Tuesday"/>	
Auto Time Change	<input type="text" value="Yes"/>	
Turn-on Time	<input type="text" value="12:00"/>	<input type="button" value="Validate"/>
Turn-off Time	<input type="text" value="12:00"/>	<input type="button" value="Validate"/>
Password	<input type="text" value="....."/>	<input type="button" value="Validate"/>
Time sync origin	<input type="text" value="SNTP"/>	
Time server	<input type="text" value="pool.ntp.org"/>	<input type="button" value="Validate"/>
Webpage Language	<input type="text" value="English"/>	

The second tab allows configuring the network parameters of the display, including the IP address, DNS, etc. The display can use DHCP to get these parameters on its own. The name of the display can be changed according to the needs of the user. This name is used to identify and access the display through web browser (typing the name in the URL)

Clock

Configuration

Ethernet configuration

Display name	<input type="text" value="New Name"/>
DHCP:	<input type="text" value="No"/>
IP address:	<input type="text" value="10.30.90.21"/>
Gateway:	<input type="text" value="10.30.90.200"/>
Subnet Mask:	<input type="text" value="255.255.255.0"/>
Primary DNS sever:	<input type="text" value="10.30.90.2"/>
Secondary DNS server:	<input type="text" value="10.30.90.3"/>
End of block in commands:	<input type="text" value="0Dh"/>
<input type="button" value="Validate"/>	

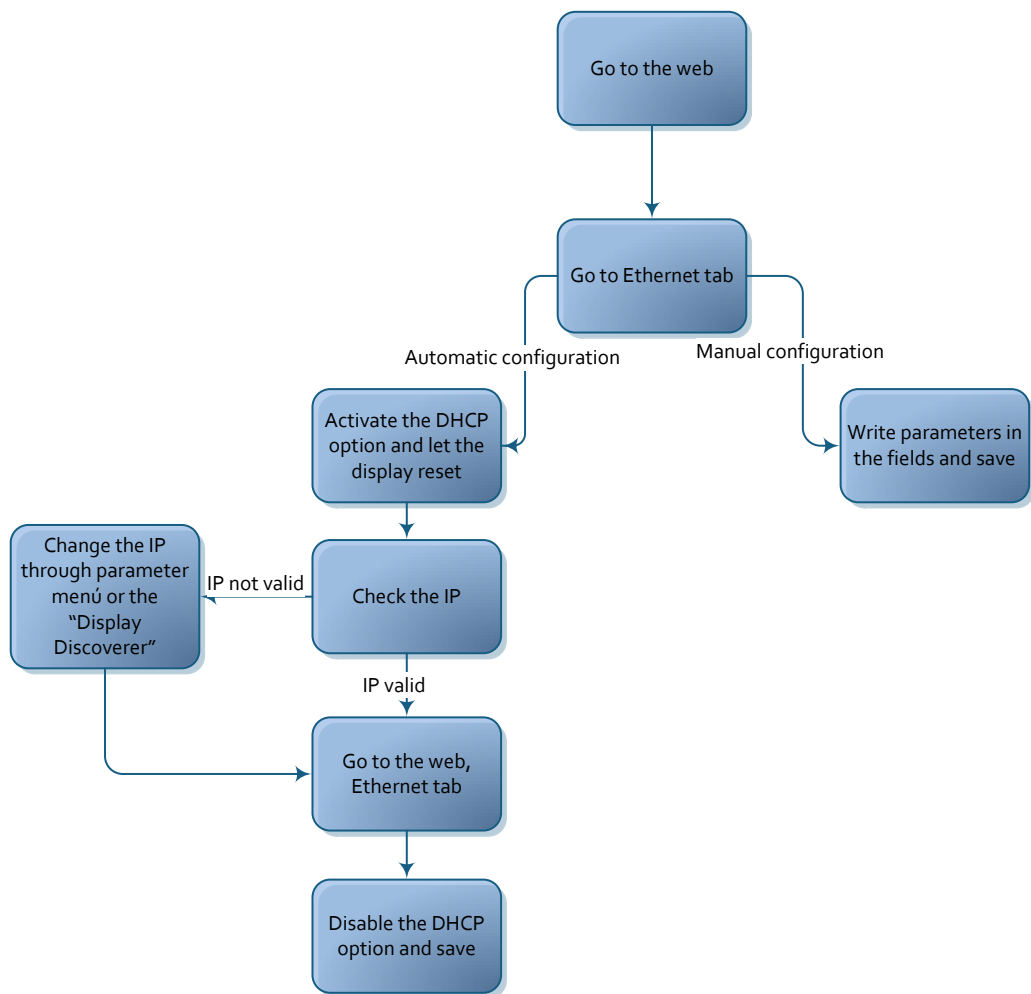
In case of failure or errors, reset the display by pressing the three keys all during a reset.

Ethernet parameter configuration

The Ethernet parameters, like the IP address, the Gateway, the subnet mask, etc can be configured manually or automatically through DHCP. Previously, the user must know the IP address he wants for the display. It is highly recommended to change the IP address from the default.

Once the user has accessed the Ethernet tab of the display webpage, configure the parameters manually or activate the DHCP protocol for the display to request all the network parameters automatically. When clicking the button "validate", the system saves the changes and reboots. If the parameters are put manually, the work is finished.

On the other side, the display may have changed the IP address. This IP address can be checked (and changed) through parameters or the "Display Discoverer". The DHCP can be left enabled or disabled. If the user modifies the IP address, the DHCP protocol will be disabled.

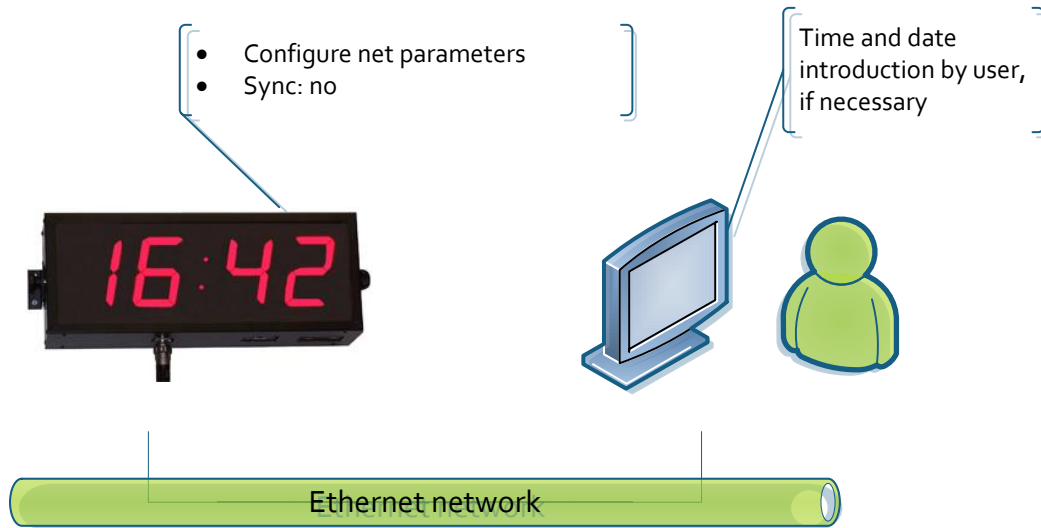


Ethernet network

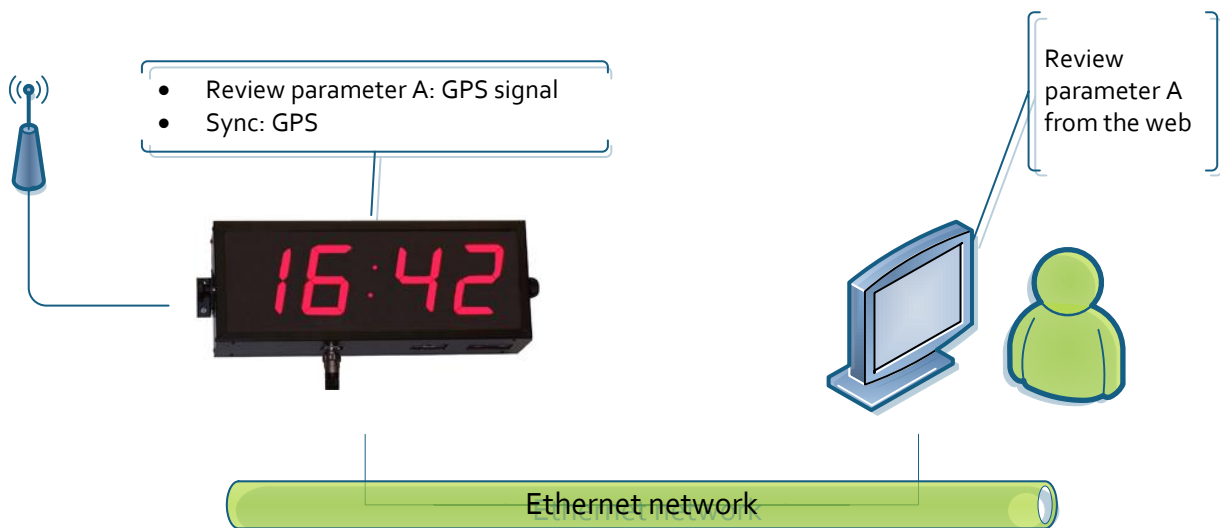
Many Ethernet networks can be configured to sync one or more displays. The possible networks are shown below, as well as the main actions/parameters (seen from the webpage) the user must configure. Other parameters don't care.

Networks with one display

One display

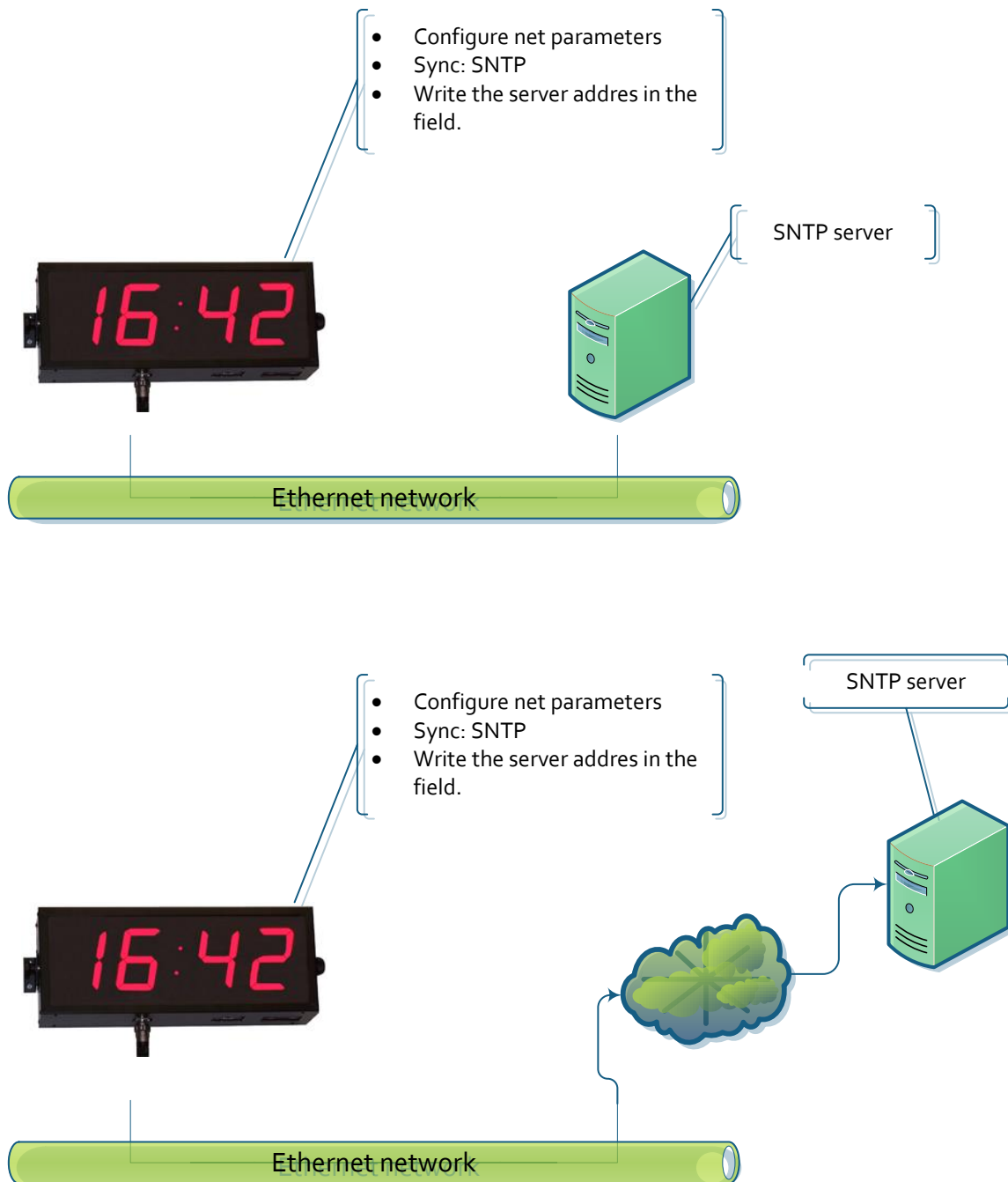


One display with GPS



One display. SNTP sync

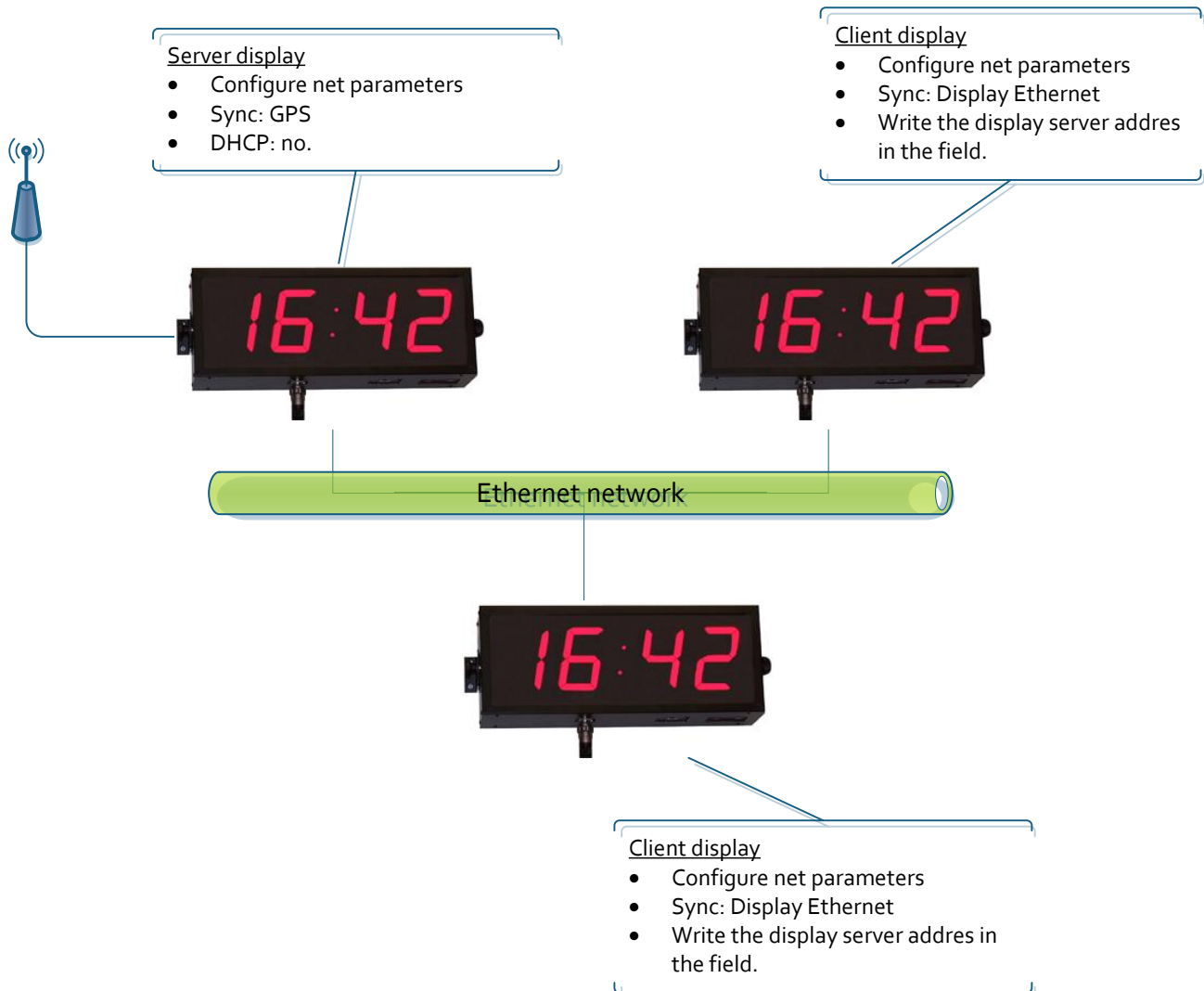
There are two options. Both are configured the same way.



Networks with more than one display

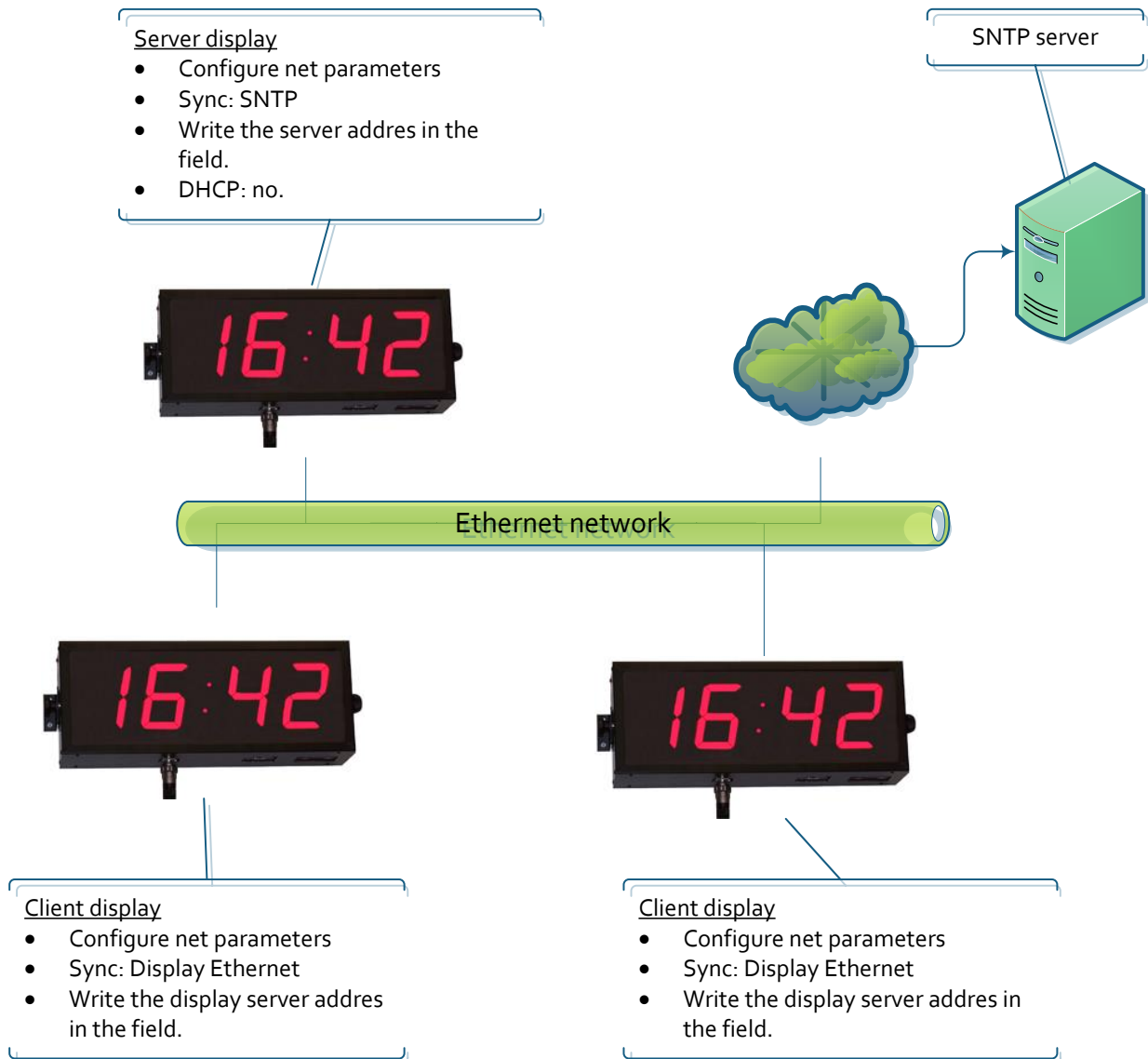
Sync through a display with GPS

The server display syncs itself with the GPS and others sync with the server display.



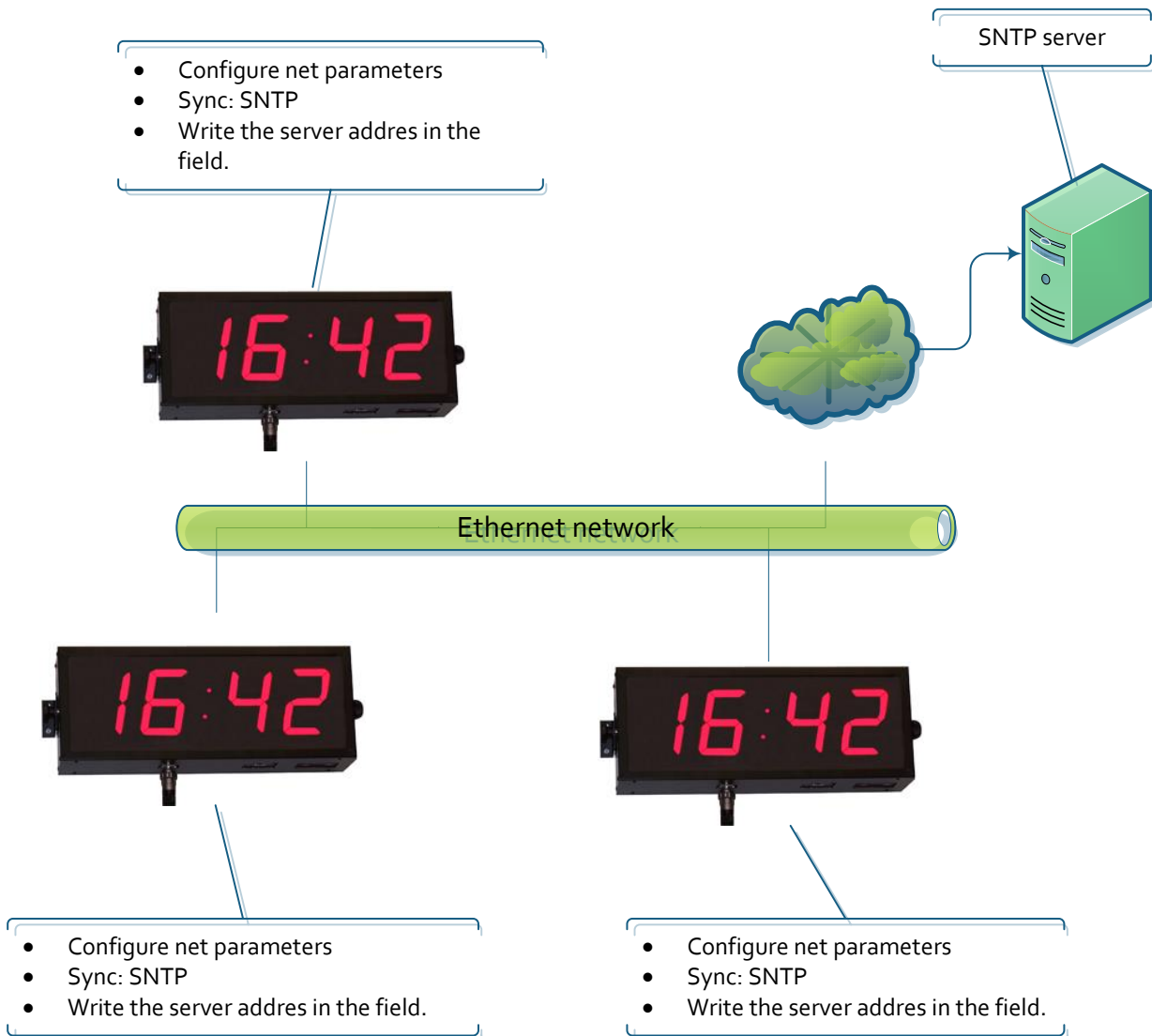
Sync through SNTP. Only one display connects to the SNTP server.

This works for both cases: connecting to a local SNTP server or a cloud SNTP server. Only one display is connected to the SNTP server and serves the time to the other displays



Sync through SNTP. All displays connect to the SNTP server

This works for both cases: connecting to a local SNTP server or a cloud SNTP server. All displays update from the SNTP server specified.



Communication with commands through Ethernet

The displays can obtain the displayed parameters through commands, as well as force the display time through TCP/IP commands. In this case, the display must be configured for not to sync another way or the sync will rewrite the programmed time. The frames are sent in ASCII (character) format. The end of block is the one defined by the user through the web page. The port the commands must be sent to is 9760.

The following frames can be sent

Command	Code	Data	End of block
Display time request	P H		
Time programming	F H		

Display time request

Frame

This frame only includes the code. This does not send any data.

	Code	End of block
ASCII	P H	
Hexa	50h 48h	

Response frame

	Code	Data							End of block
	Code	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	R H	DD	MM	AA		HH	MM	SS	
Hexa	52h 48h				20h				

Example: 13:06:00 16/05/2013

	Code	Data							End of block
	Code	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	R H	16	05	13		13	16	00	
Hexa	52h 48h	31h 36h	30h 35h	31h 33h	20h	31h 33h	31h 36h	30h 30h	

Time programming

Frame

	Code	Data							End of block
	Code	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	F H	DD	MM	AA		HH	MM	SS	
Hexa	46h 48h				20h				

Example: 13:16:00 16/05/2013

	Code	Data							End of block
	Code	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	F H	16	05	13		13	16	00	
Hexa	46h 48h	31h 36h	30h 35h	31h 33h	20h	31h 33h	31h 36h	30h 30h	

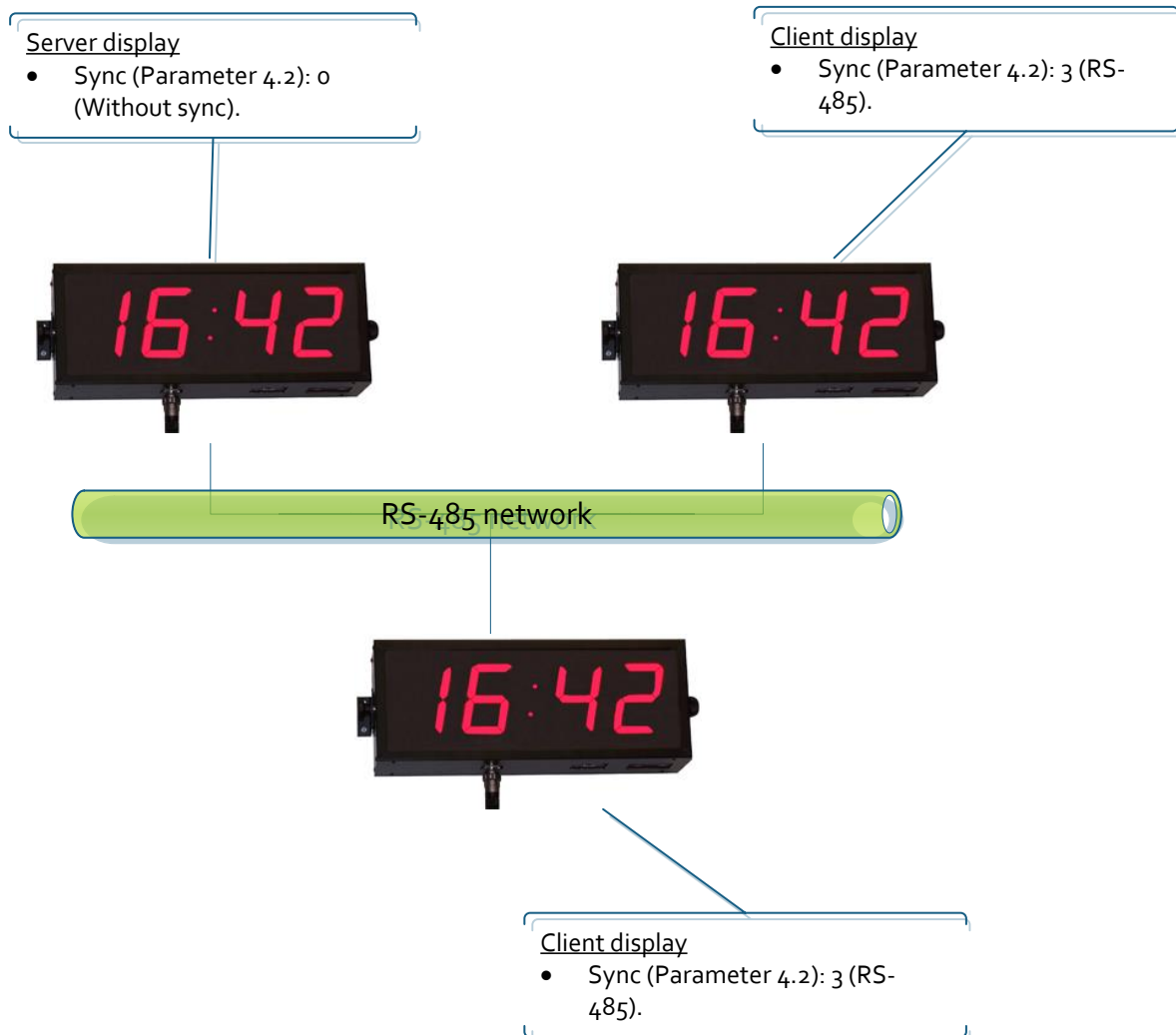
RS-485 option

The RS-485 allows the user to create a network for the displays to be synchronized. One display must be configured as a server and the others will configure with it. The parameter 9.1 (RS-485 configuration) must be the same for all.

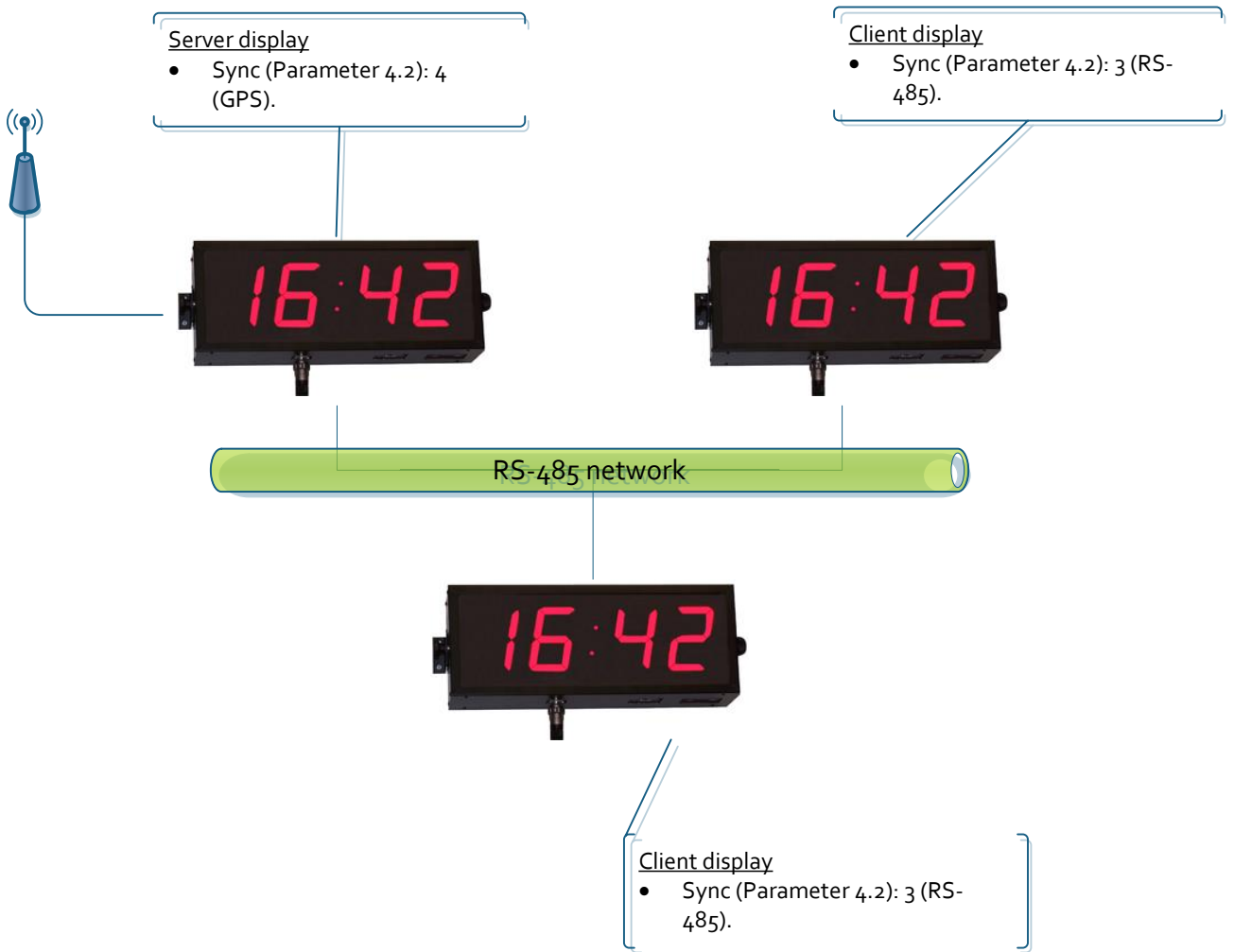
RS-485 network

There are many configurations possible, only with RS-485 or combining different options this displays offer. The following networks are the most usual, but the user can create new ones.

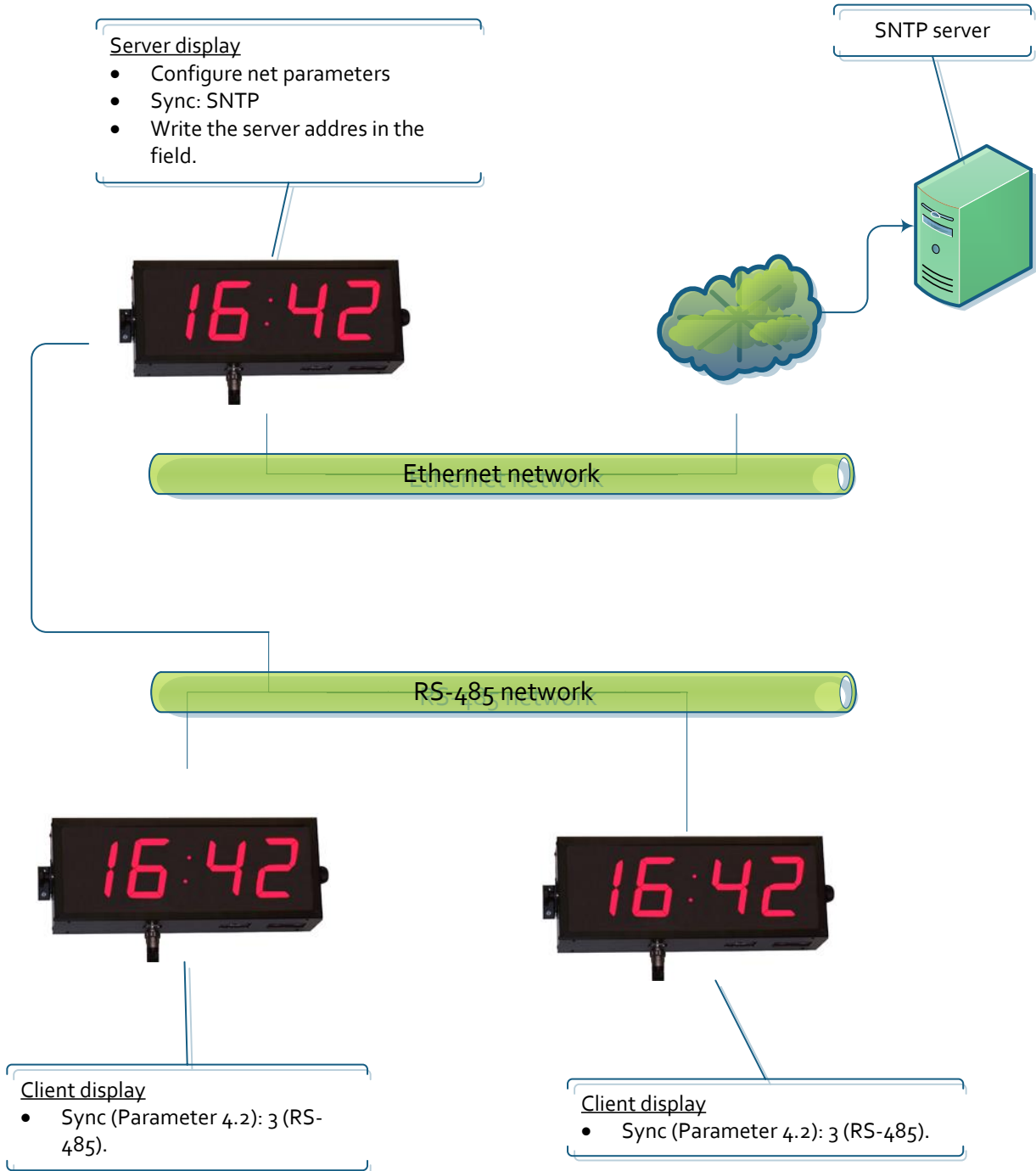
Sync through one display without more options.



Sync through a display with GPS



Sync though a display with Ethernet connected to a SNTP server.



Communication with commands through RS-485

The displays can obtain the displayed parameters through commands, as well as force the display time through RS-485 commands. In this case, the display must be configured for not to sync another way or the sync will rewrite the programmed time. The frames are sent in ASCII (character) format. The end of block is the one defined by the user through the web page. The port the commands must be sent to is 9760.

The following frames can be sent

Command	Code	Display address	Data	End of block
Display time request	P H			
Time programming	F H			

Display time request

Frame

This frame only includes the code. This does not send any data.

	Code	Address	End of block
ASCII	P H	H L	
Hexa	50h 48h		

Example: Request time from the display in address 03.

	Code	Address	End of block
ASCII	P H	03	
Hexa	50h 48h	30h 33h	

Response frame

	Code	Address	Data							End of block
	Code	Address	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	R H	H L	DD	MM	AA		HH	MM	SS	
Hexa	52h 48h					20h				

Example: Response from the frame sent in the example before. Time is 13:16:00 16/05/2013

	Code	Address	Data							End of block
	Code	Address	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	R H	03	16	05	13		13	16	00	
Hexa	52h 48h	30h 33h	31h 36h	30h 35h	31h 33h	20h	31h 33h	31h 36h	30h 30h	

Time programming

Frame

	Code	Address	Data							End of block
	Code	Address	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	F H	H L	DD	MM	AA		HH	MM	SS	
Hexa	46h 48h					20h				

Example: Send 13:16:00 16/05/2013 to the display at address 03.

	Code	Address	Data							End of block
	Code	Address	Day	Month	Year	Space	Hour	Minute	Second	End of block
ASCII	F H	03	16	05	13		13	16	00	
Hexa	46h 48h	30h 33h	31h 36h	30h 35h	31h 33h	20h	31h 33h	31h 36h	30h 30h	

Annex 2: View the web page remotely

The web page of the display is accessible remotely if the router is correctly configured. This is done redirecting an input from the router to the display.

User has to enter to the router configuration webpage, in the port redirection tab

A new port must be added

- External Start Port: This is the port the user is connecting from the Internet. It is recommended to be greater than 10000.
- External Final Port: The same port as the start port.
- Internal Start Port: The port the user enters wants to enter the display. In this case, the port is 80, which is the standard web page access.
- IP address: The LAN IP of the display

Port redirection configuration

Server name	External Start Port	External Final Port	Protocol	Internal Start Port	Internal Final Port	Server IP address
Display	10021	10021	TCP	80	80	192.168.1.100

Once the router is configured, the user can access the display from outside the LAN. This is accessed through the browser URL, writing "ExternalIP:ExternalPort". As an example: 212.170.48.90:10021 or http:\\212.170.48.90:10021

STATEMENT OF CONFORMITY



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

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

Model : DR-109 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 2014/30 UE Electromagnetic Compatibility
Standard UNE-EN 61000-6-4 Generic Emission Standard. Industrial environment.
Standard UNE-EN 61000-6-2 Generic Immunity Standard. Industrial environment.

Granollers, 5th February 2013