MICO24 Nano

INSTALLATION GUIDE

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CONTENT

1. DESCRIPTION....2
2. TECHNICAL CHARACTERISTICS AND REGULATIONS....2
2.1. Technical characteristics....2
2.2. Regulations....3
2.3. Utility model....3
3. HARDWARE DESCRIPTION....4
3.1. Layout of elements....4
2.2. Dimensions....4
2.3. Status LEDs....5
2.4. Side label quick connection....5
2.5. X1-X2 Power supply connectors....6
2.6. X3-X4 PT100 connectors....6
2.7. X5-X6 Current transformers connectors....7
2.8. X7 motor voltage connector....8
2.9. X8-X9 Digital Input-Output connectors....8
2.10. X10-X11 Analog inputs connectors....9
4. CONFIGURATION WEBSITE....10
4.1. Accessing the configuration website....10
4.2. Current Values....11
4.3. Network....11
4.4. Measurements....12
4.5. Hardware configuration....15
4.6. Certificates....17
4.7. Help....17
5. SEND DATA REQUIREMENTS....18
5.1. Internet connections requirements....18
6. MODBUS TCP SERVER....18
6.1. Modbus TCP protocol....18
6.2. Modbus TCP server table....19
7. WEB PLATAFORM....20
7.1. Web plataform access....20
7.2. Current equipment status....20
7.3. Consulting current equipment status....21
7.4. Consulting equipment parameters....22
8. VERSION CONTROL....23

1. DESCRIPTION

MICO24 Nano is a data acquisition circuit developed by Effitronix, especially designed for Industry 4.0. The device is capable of performing production controls, quality controls and predictive maintenance.

Based in IoT technology, it is easy to install and automatically sends all the signals to the MICO24 platform, which analyses and manages them directly from the cloud.

This installation guide describes the characteristics of MICO24 Nano's hardware and software. The guide contains all the information necessary to correctly install and configure the equipment. If you need more information, please consult our website (www.effitronix.com) or phone 93 812 43 82.

2. TECHNICAL CHARACTERISTICS AND REGULATIONS

IMPORTANT

Before carrying out any maintenance or modification of connections, make sure the equipment is disconnected from the power. Bear in mind that when the equipment is connected, the terminals can be dangerous if touched.

Before connecting the equipment, read all the information and manuals carefully. If you use the equipment in a manner not specified by the manufacturer, protection and safety could be compromised.

The circuit must be protected against overintensity and overvoltage

2.1. Technical characteristics

List of inputs	
No.	Description
3	Digital inputs PNP
5	Analog. inputs 4-20mA
4	Analog. inputs 0-10Vdc ⎓
3	Temperature probes PT100
1	Motor control (voltage and current)
List of outputs	
No.	Description
3	Digital outputs NPN NO
Connectivity	
Internet connection by cable and AP Wi-Fi	

Table 1- *List of inputs*

General	
Power supply	24Vdc ±10% ⎓
Consumption	5W
Temperature	0-50ºC
Humidity	5-95%
Dimensions	120x120x45mm
Weight	270g
Protection	IP 20
Digital inputs PNP	
Voltage	24Vdc ⎓
Current	30mA
Max. frequency	120Hz
Digital outputs NPN NO	
Voltage	24Vdc ⎓
Max. current	500mA
Motor control specifications	
Nominal voltage V_{L-L}	100-500Vac ~
Nominal voltage V_{L-N}	60-285Vac ~
Frequency	50-60Hz
Input impedance	5MΩ
Analog inputs	
Voltage inputs	0-10Vdc ⎓
Current inputs	4-20mA

Table 2- *Technical characteristics*

The circuit can be mounted on DIN rail EN 60715

2.2. Regulations

Safety
EN 61010-1
EN 61010-2-30 CATIII 300
Emissions
EN 55032:2015
Immunity
EN 61000-4-2
EN 61000-4-3
EN 61000-4-4

CE

Table 3- *Applicable regulations*

2.3. Utility model

The MICO24 Nano adquisition circuit is registered in the Spanish Office of Patents and Marcs under the protection of an utility model.

Utility: **U201830158**

3. HARDWARE DESCRIPTION

3.1. Layout of elements

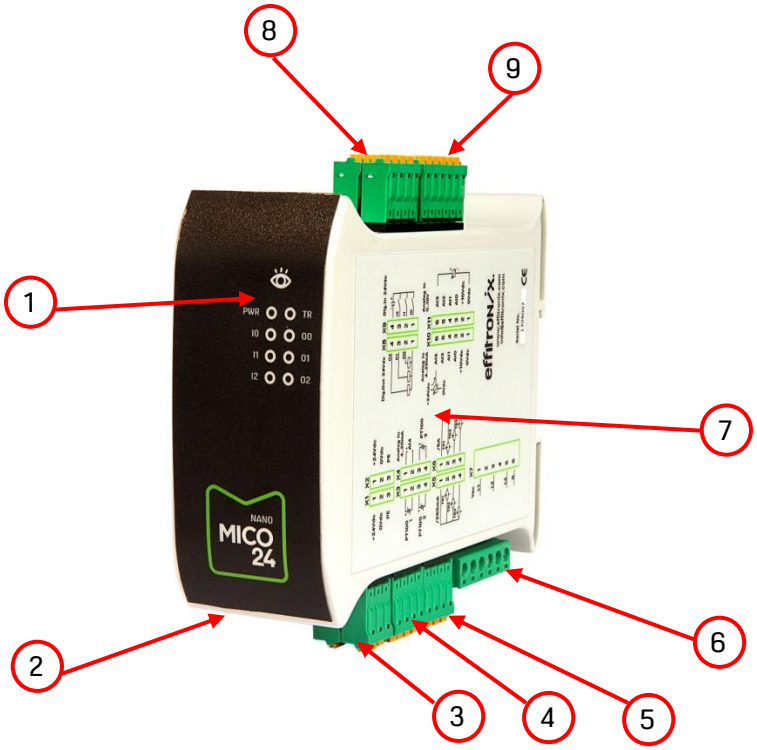

Fig. 1 *MICO24 Nano*

1	Status LEDs
2	LAN Ethernet 10/100 connection
3	X1-X2 Connectors 24Vdc power supply
4	X3-X4 Connectors PT100 and 4-20mA inputs
5	X5-X6 Connectors Current transformer inputs
6	X7 Connector Voltage inputs
7	Side label rapid connection information and serial number
8	X8-X9 Connectors Digital inputs and outputs
9	X10- Connectors X11 Analog inputs 4-20mA and 0-10V

Table 4- *Identification of elements*

2.2. Dimensions

H	120mm
D	120mm
W	45mm

Table 5- *Dimensions*

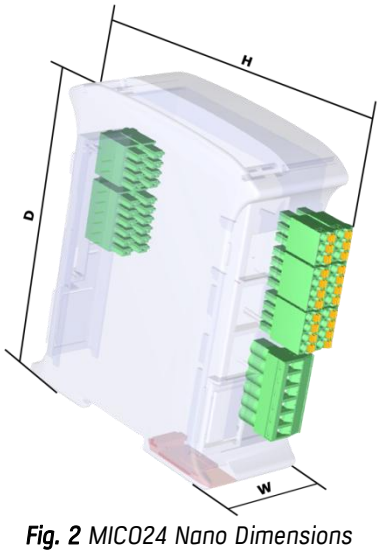

Fig. 2 *MICO24 Nano Dimensions*

2.3. Status LEDs

Status LEDs		
ID	Description	
	*Start up:* Auto test sequence	
	Light 1	*Blue*: Equipment controlled on standby
		Green: Equipment controlled in operation OK
		Red: Equipment controlled in alarm
	Light 2	*Green*: Equipment connected to LAN network
		Red: Equipment NOT connected to LAN network
	Light 3	*Green*: Sending data to web platform OK
		Yellow: Error sending data to web platform
PWR	*On*: Equipment powered	
	Off: Equipment not powered	
TR	*Flashing*: Measuring transformers	
I0	*On*: Digital input 0 on	
	Off: Digital input 0 off	
I1	*On:* Digital input 1 on	
	Off: Digital input 1 off	
I2	*On*: Digital input 2 on	
	Off: Digital input 2 off	
O0	*On*: Digital output 0 on	
	Off: Digital output 0 off	
O1	*On*: Digital output 1 on	
	Off: Digital output 1 off	
O2	*On*: Digital output 2 on	
	Off: Digital output 2 off	

***Table 6**- Description of LEDs*

2.4. Side label quick connection

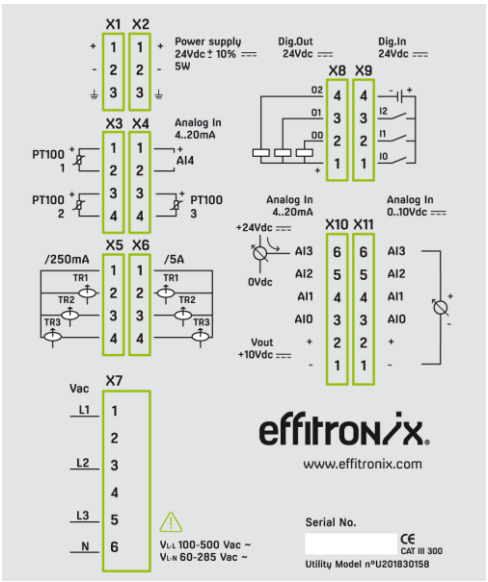

***Fig. 3** Connection label*

On one side of the MICO24 Nano you can find an informative label of how to connect the different elements and sensors in the acquisition circuit. The serial number is on the lower right-hand side.

2.5. X1-X2 Power supply connectors

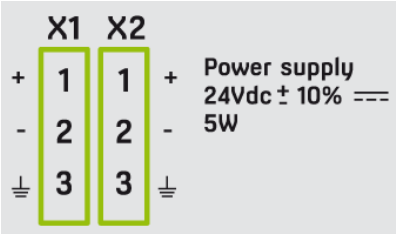

Fig. 4 X1-X2 Detail

Connector X1		
Pin	ID	Description
1	+	12-24Vdc power supply 10W 850mA
2	-	0Vdc power supply
3	PE	Earth
Connector X2		
Pin	ID	Description
1	+	12-24Vdc power supply
2	-	0Vdc power supply
3	PE	Earth

Table 7- X1-X2 connector characteristics

2.6. X3-X4 PT100 connectors

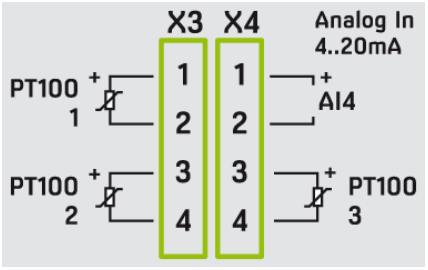

Fig. 5 X3-X4 Detail

Connector X3		
Pin	ID	Description
1	PT100 1 +	Positive probe signal No. 1 PT100 (red cable)
2	PT100 1 -	Negative probe signal No. 1 PT100 (white cable)
3	PT100 2 +	Positive probe signal No. 2 PT100 (red cable)
4	PT100 2 -	Negative probe signal No. 2 PT100 (white cable)
Connector X4		
Pin	ID	Description
1	AI4+	Positive Input signal 4-20mA No. 4
2	AI4-	Negative Input signal 4-20mA No. 4
3	PT100 3 +	Positive probe signal No. 3 PT100 (red cable)
4	PT100 3 -	Negative probe signal No. 3 PT100 (white cable)

Table 8- X3-X4 connector characteristics

2.6.1. *Example of AI4 connection*

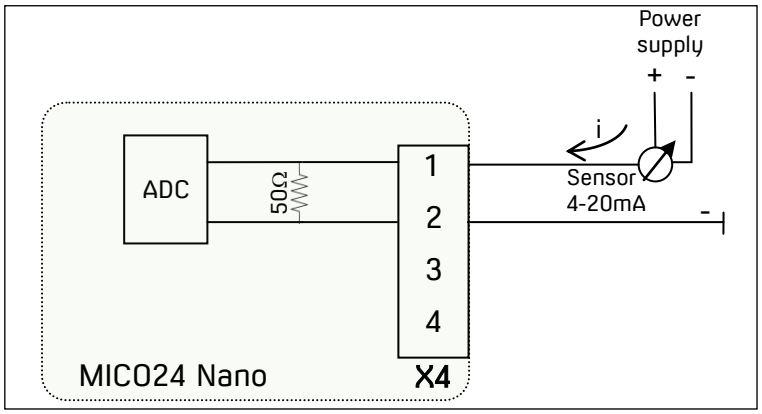

Fig. 6 *AI4 connection example*

2.7. X5-X6 Current transformers connectors

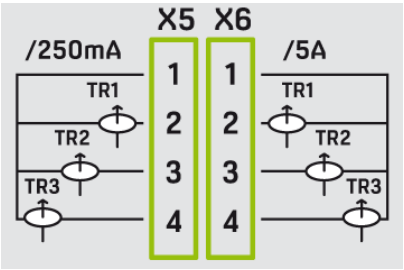

Fig. 7 *X5-X6 Details*

X5 Connector		
Pin	ID	Description
1	/250mA	Common current transformers /250mA
2	TR1 /250mA	Current transformer signal Phase 1 /250mA
3	TR2 /250mA	Current transformer signal Phase 2 /250mA
4	TR3 /250mA	Current transformer signal Phase 3 /250mA
X6 Connector		
Pin	ID	Description
1	/5A	Common current transformer /5A
2	TR1 /5A	Current transformer signal Phase 1 /5A
3	TR2 /5A	Current transformer signal Phase 2 /5A
4	TR3 /5A	Current transformer signal Phase 3 /5A

Table 9- *X5-X6 connector characteristics*

2.8. X7 motor voltage connector

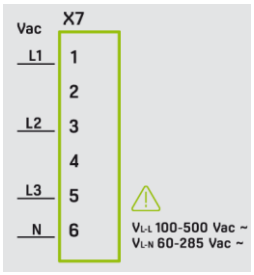

Fig. 8 X7 Detail

X7 Connector		
Pin	ID	Description
1	L1	Line voltage L1 (max. 500V)
2		
3	L2	Line voltage L2 (max. 500V)
4		
5	L3	Line voltage L3 (max.500V)
6	N	Neutral voltage

Table 10- X7 connector characteristics

2.9. X8-X9 Digital Input-Output connectors

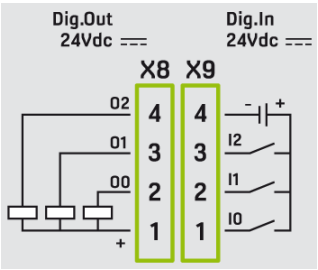

Fig. 9 X8-X9 Detail

X8 Connector		
Pin	ID	Description
1	+	Common 24V for digital outputs
2	O0	Digital output 0
3	O1	Digital output 1
4	O2	Digital output 2
X9 Connector		
Pin	ID	Description
1	I0	Digital input 0 (max. 120Hz)
2	I1	Digital input 1 (max. 120Hz)
3	I2	Digital input 2 (max. 120Hz)
4	-	0V digital inputs common

Table 11- X8-X9 connector characteristics

2.10. X10-X11 Analog inputs connectors

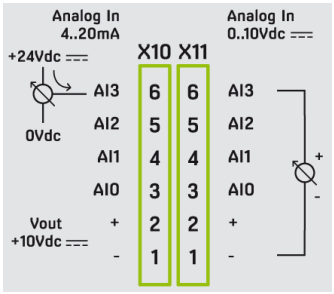

Fig. 10 X10-X11 Detail

X10 Connector		
Pin	ID	Description
1	+	Common 0V for analog inputs
2	-	Common 10V for analog inputs
3	AI0	Analog input 4-20mA No. 0
4	AI1	Analog input 4-20mA No. 1
5	AI2	Analog input 4-20mA No. 2
6	AI3	Analog input 4-20mA No. 3
X11 Connector		
Pin	ID	Description
1	+	Common 0V for analog inputs
2	-	Common 10V for analogical inputs
3	AI0	Analog input 0-10V No. 0
4	AI1	Analog input 0-10V No. 1
5	AI2	Analog input 0-10V No. 2
6	AI3	Analog input 0-10V No. 3

Table 12- X10-X11 connector characteristics

3.10.1. AI0 connection example

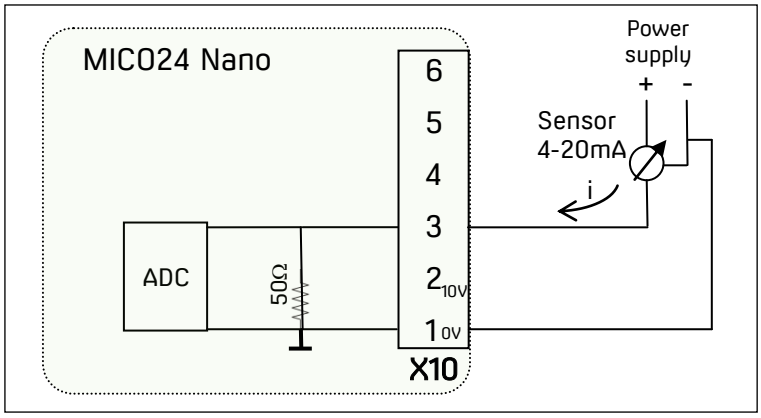

Fig. 11 AI0 connection example

4. CONFIGURATION WEBSITE

4.1. Accessing the configuration website

To access the configuration website for MICO24 for the first time, connect to your Wi-Fi network and enter your default IP on any browser.

4.1.1. Wifi connection

By default, MICO24 Nano acts as a Wi-Fi AP. The SSID of the Wi-Fi network generated by MICO24 Nano is Nano_XXXXXXX, where XXXXXXX corresponds to the digits of the MICO24 Nano serial number, which can be seen on the side label [*See 1.4.*].

The password to access the Wi-Fi network is *mico24nano*.

4.1.2. Accessing the configuration web server

Once connected to the MICO24 Nano Wi-Fi network, you can access the configuration web server, entering the address 192.168.100.1 from the browser of any mobile device or PC.

If you had previously configured the RJ45 network card, you can also connect to the web server from any equipment on the same network, entering the IP that you have configured.

A web page will open, requesting a username and password. By defect, to edit parameters they are:

User: *admin*
Password: *admin*

Fig. 12 *MICO24 Nano web configuration login*

4.2. Current Values

The default screen that will load when you enter the valid username and password will allow you to consult the current values of the different signals arriving at the acquisition circuit, on a table.

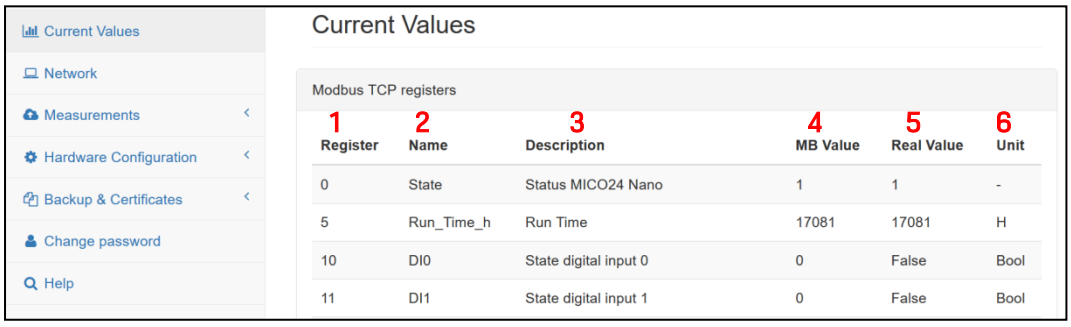

Fig. 13 Current values screen

In addition to the current value being read (5) with its corresponding unit (6), the web table also enables you to consult the register position (1) and the value of the signal in the Modbus TCP server (4). The name (2) and description columns (3) help us to clearly identify the origin of each signal.

4.3. Network

For the equipment to send data to the web platform, it is indispensable to configure the connection parameters of the network card according to the LAN it is connected to. This can be done from the "*Network*" tab of the web application.

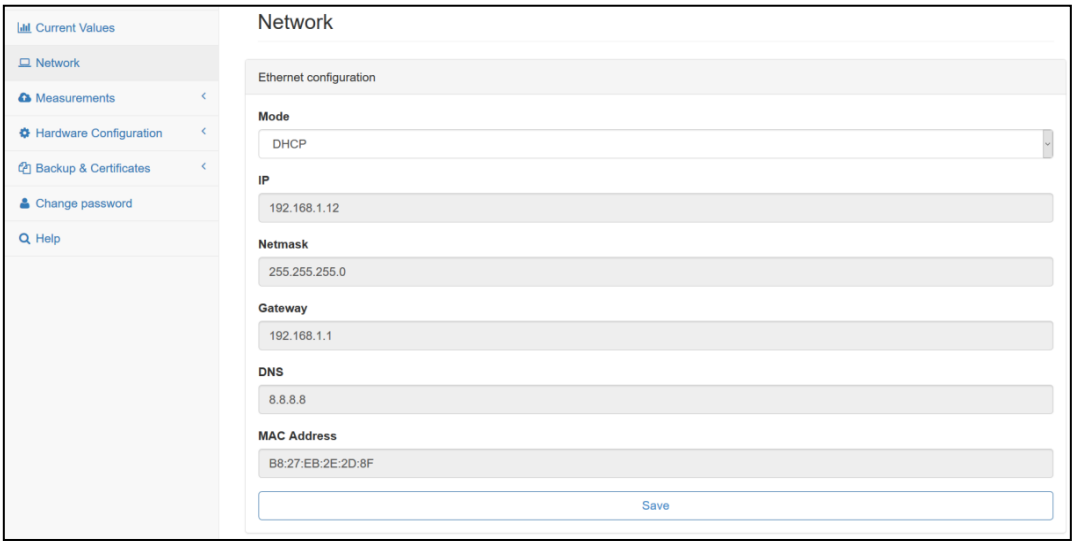

Fig. 14 Network configuration screen

The first thing to select is if a static IP will be used or if there will be a DHCP server that will assign it a dynamic IP.

In the case of a dynamic assignment, it is not necessary to enter any other parameter and we can save the configuration by clicking on the button "*Save*" on the lower part of the screen.

If you want to use a static IP, you will have to fill in the other fields: IP address, netmask, default gateway and DNS server. Once all the data has been entered, you can save the configuration by clicking on "*Save*" on the lower part of the screen.

From this screen, you can also consult the MAC address of the equipment's network card.

4.4. Measurements

On the left-hand side of the web, you will find a tab "*Measurements*". Clicking on it will display another tab with different options:

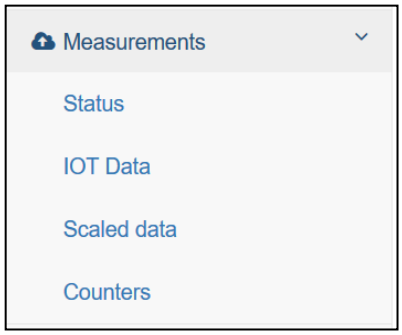

Fig. 15 *Measurements*

4.4.1. IoT Data

The "Status" tab enables you to configure the definition of the controlled equipment status. From the application, it is possible to generate 2 states: Stopped and OK.

From this tab, you can configure the variable and the threshold to be used to decide if the equipment is on. In the upper box, you will find a dropdown menu where you can select the variable you are interested in. In the central box, you will find the threshold, i.e., if the variable selected in the upper box is found to be below this value, the equipment controlled is considered stopped. If this is not the case, the equipment is in operation and the text entered in the lower box will appear in the web platform text.

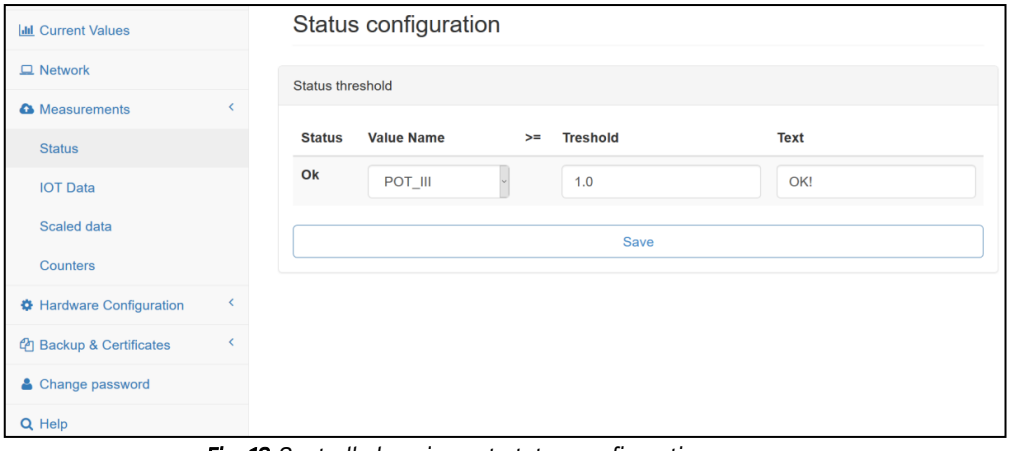

Fig. 16 *Controlled equipment status configuration screen*

4.4.2. Send Data

This screen allows you to select which of the signals captured by the MICO24 Nano will be sent to the web platform. It is recommendable not to send to the platform signals from inputs not being used.

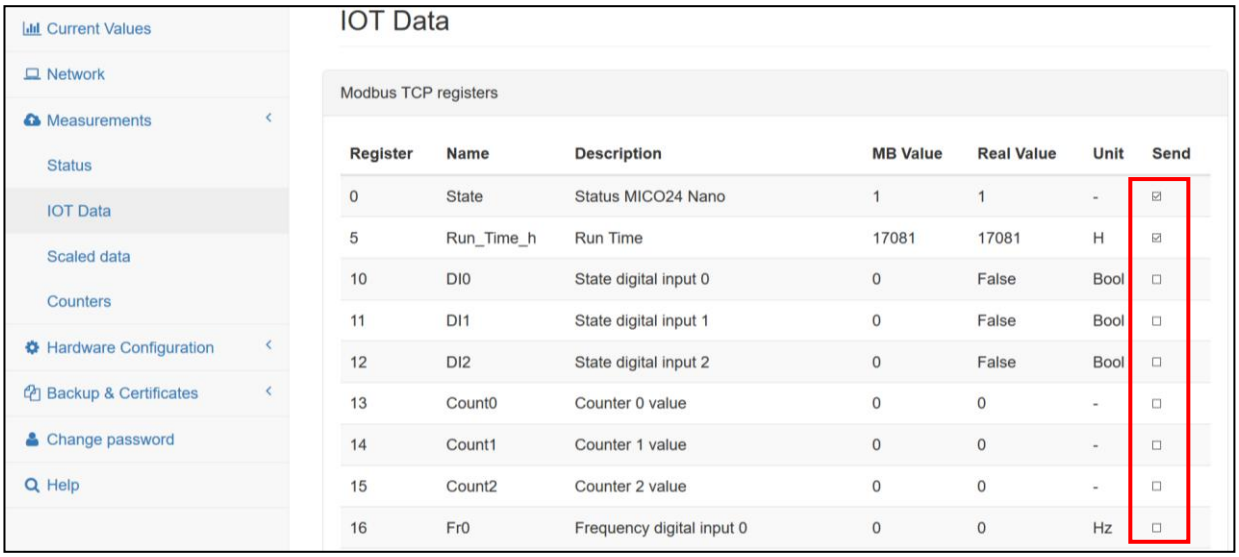

Fig. 17 *Screen for configuring data to send to the web platform*

The table format is the same as in the initial screen [*See 4.2.*], but with a column on the far right (box named "*Send*"). Only signals that have the box in the last column ticked will be sent to the web platform.

4.4.3. Scaled Data

This screen allows you to configure the signals from the analog inputs. For each of the signals, you can assign a name to the input and scale the value.

The screen is divided in two tables. The first one allows the user to configure frequency and analogical inputs (both 0-10V and 4-20mA). In the "*Alias*" (1) column we can introduce the name for the variable in the web platform, while the columns "*Min*" (2) and "*Max*" (3) indicate the minimum and maximum value for the measured signal. In order to save the changes in the configuration, "*Save*" (4) button must be pressed.

The second table allows the configuration of the signals from the three temperature sensors. In the "*Alias*" (5) column we can introduce the name for the variable in the web platform, while in the "*Constant Value*" (6) column we can add a constant *Offset* value which will be summed to the sensor lecture. In order to save the changes in the configuration, "*Save*" (4) button must be pressed.

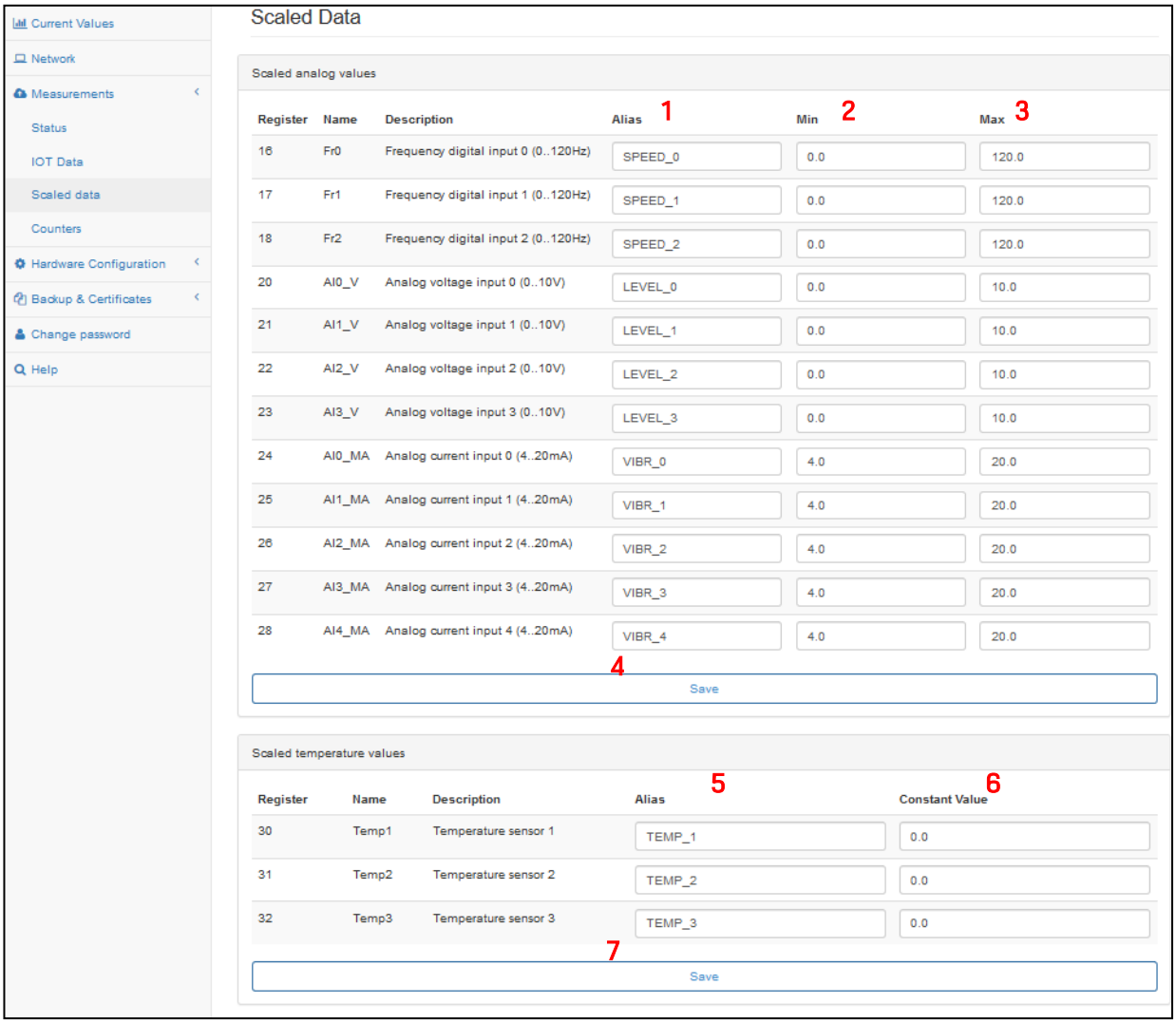

Fig. 18 *Screen for configuring analog input signals*

4.4.4. Counters

There are two time counters programmed. The first one (*Run_Time_h*), counts the operating hours of the controlled device, while the second counter (*Run_Time_M*) counts the elapsed hours since the last inspection.

From "*Counters*" screen not only is it possible to check the value of the counters, but also it is possible to reset them or even programming a digital input in order to set the counter to zero once the digital input is activated.

Pushing "*Reset*" button (1) forces the counter to be set to zero. In order to activate the reset from a digital input, it is necessesary to enable "*Use digital input as reset*" option (2) and save the configuration by pushing "*Save*" (3).

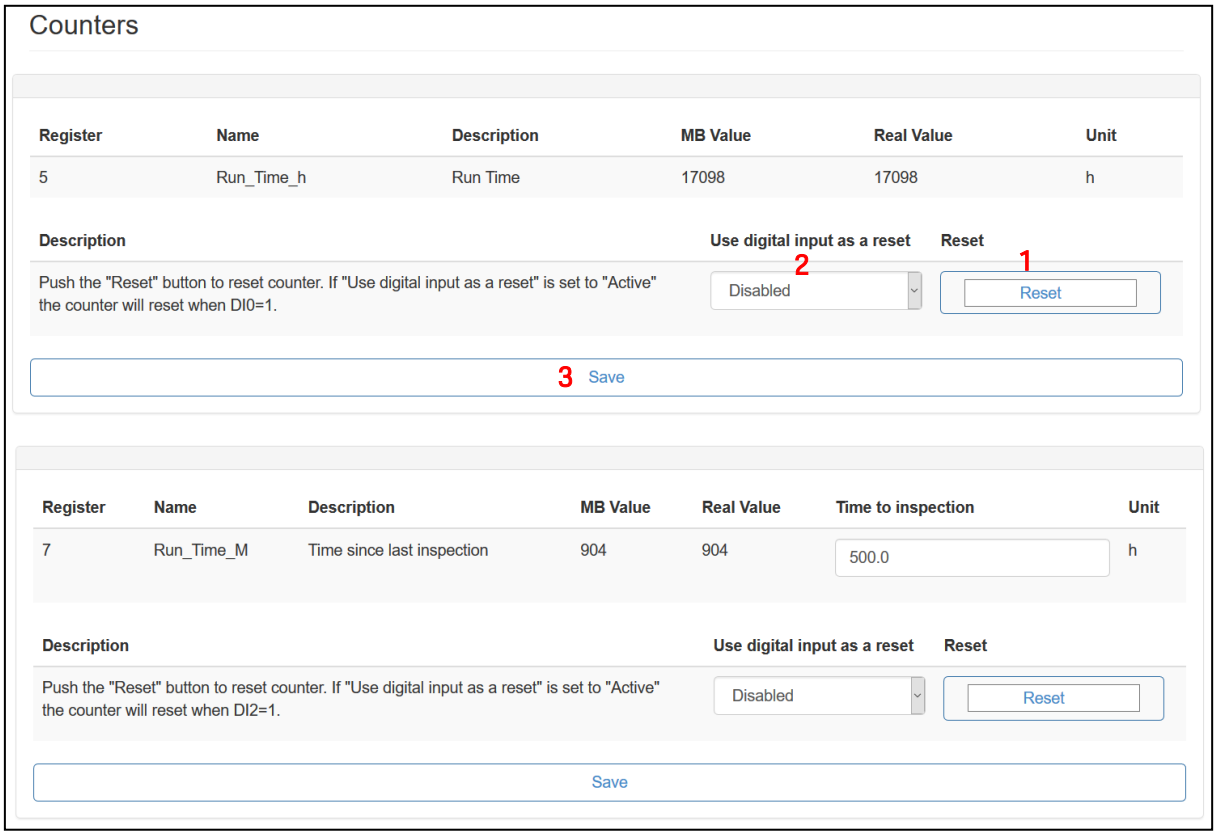

Fig. 19 *Screen to reset counters*

4.5. Hardware configuration

The left-hand side menu of the web has a tab "*Hardware Configuration*". Clicking on it with drop down the tab.

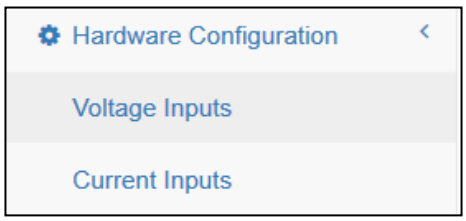

Fig. 20 *Hardware configuration*

4.5.1. Voltage Inputs

This screen allows you to calibrate the voltage measurement. At the top cell (1) the line-to-neutral voltage connected needs to be indicated. At the bottom cell (2) it is possible to configure the number of averages used to refresh the voltage measured value. The larger this value is, the longer it will take to refresh voltage values, but at the same time we will get a smoother graph.

In order to apply changes to the device configuration, it is necessary to press "*Calibration*" button (3). The device will start the calibration process and we will see how the voltage inputs are not refreshed for a certain time.

Important: when a calibration is done, the 3 voltage lines V_{L1}, V_{L2}, V_{L3} must be connected.

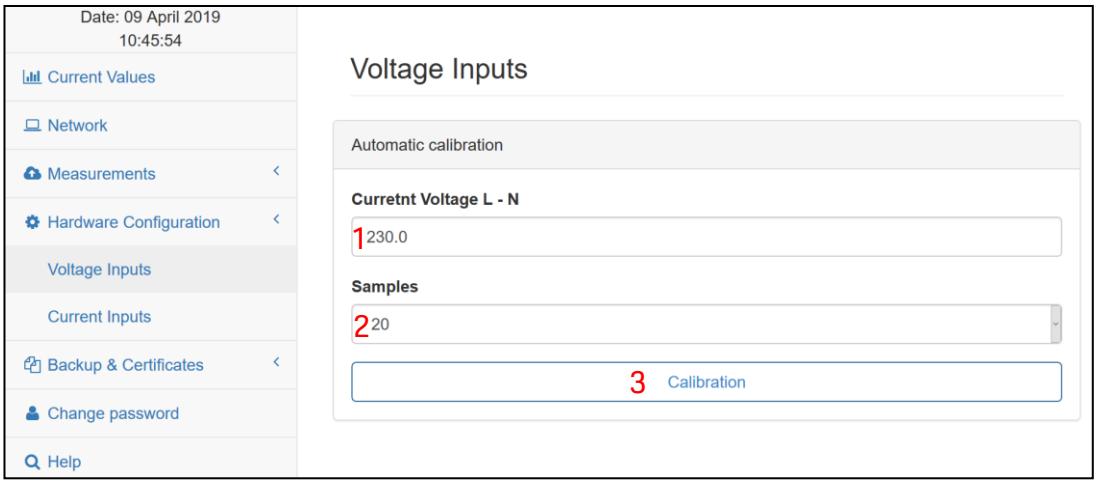

Fig. 21 *Voltage calibration screen*

4.5.2. Current transformers inputs

This screen allows you to configure the inputs to the current transformers.

In the top box, select the type of transformer to be used (/250mA or /5A). Also indicate the transformation ratio in the central box. The transformation ratio corresponds to the division between the current of the primary circuit with regard to the secondary. In this manner, a 100/5 transformer, for example, will have a transformation ratio of 20. The last box enables you to assign a constant gain to common for all the 3 current inputs to calibrate the measurement if necessary.

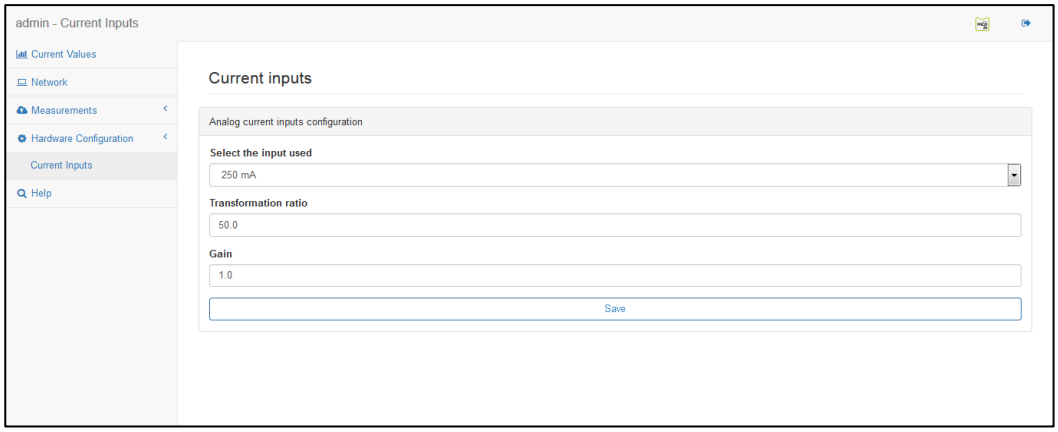

Fig. 22 *Screen for configuring current transformers*

4.6. Certificates

In order to access into certificates management screen, it is necessary to press "*Backup & Certificates*" from the left menu and, after that, clicking "*Certificates*".

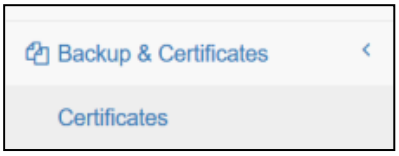

Fig. 23 *Access to Certificates screen*

In "*Certificates*" screen it is possible to check the certificate currently uploaded to the device. Furthermore, it is also possible to upload a new certificate. To do so, *Browse* button (2) must be pressed. Then we must select the .zip file containing the desired new certificate and finally, by pressing *Upload* button (3) we will be able to make the certificate change effective.

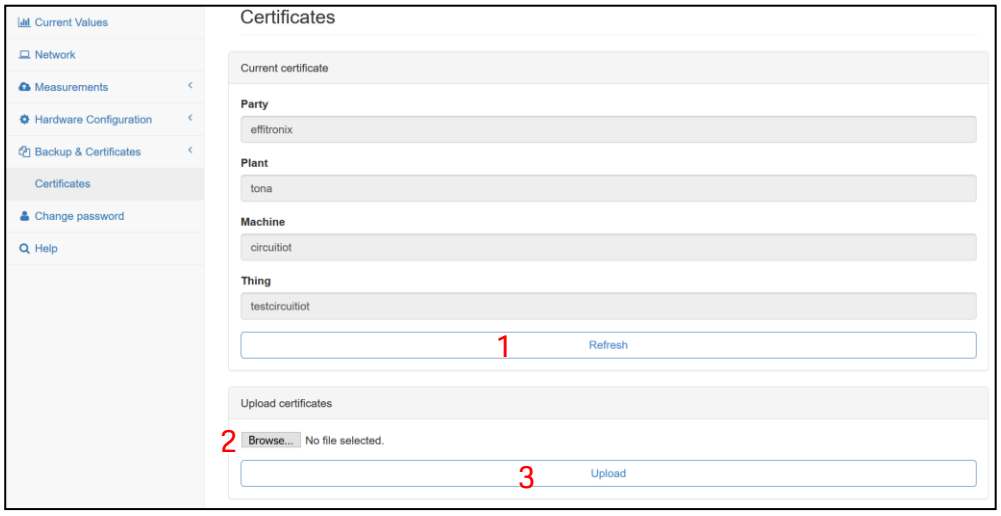

Fig. 23 *Certificate management screent*

4.7. Help

Fig. 24 *Help button*

Click in the button "*Help*" on the left-hand side menu and you will be redirected to the Effitronix website, from where you can download this guide. It will be necessary to have an Internet connection for this to work.

5. SEND DATA REQUIREMENTS

5.1. Internet connections requirements

Sending data to the web platform will be done through the Amazon AWS IoT infrastructure, which guarantees a safe connection as well as data encryption.

For a connection point for MICO24 Nano to have access to Internet. It is necessary that at least it authorises the exit of data to:

- Web domain: *amazonaws.com*
- Port: 8883

6. MODBUS TCP SERVER

MICO24 Nano incorporates a Modbus TCP server, that allows integration of data collected from the equipment to any control application.

6.1. Modbus TCP protocol

The Modbus TCP server of MICO24 Nano uses the standard Modbus 502 port, both for TCP and UDP. All the data is published as "*Holding Registers*", so the only valid reading and writing functions are:

- FC03 – Reading multiple registers (0x03)
- FC16 – Writing multiple registers (0x10)

6.2. Modbus TCP server table

Nom Variable	Description	Address	Type	Mult. Factor	Unit	Access
State	Controlled equipment status	0	Word	1		R
Run_Time_h	Hours of operation controlled equipment	5	Word	1	h	R
Run_Time_M	Hours since last inspection	7	Word	1	h	R
DI0	Digital input 0	10	Bit			R
DI1	Digital input 1	11	Bit			R
DI2	Entrada digital 2	12	Bit			R
Count0	Pulse counter digital input 0	13	Word	1		R/W
Count1	Pulse counter digital input 1	14	Word	1		R/W
Count2	Pulse counter digital input 2	15	Word	1		R/W
Fr0	Frequency digital input 0 (max. 120Hz)	16	Word	10	Hz	R
Fr1	Frequency digital input 1 (max. 120Hz)	17	Word	10	Hz	R
Fr2	Frequency digital input 2 (max. 120Hz)	18	Word	10	Hz	R
AI0_V	Analog input 0 voltage 0-10V	20	Word	100	V	R
AI1_V	Analog input 1 voltage 0-10V	21	Word	100	V	R
AI2_V	Analog input 2 voltage 0-10V	22	Word	100	V	R
AI3_V	Analog input 3 voltage 0-10V	23	Word	100	V	R
AI0_MA	Analog input 0 current 4-20mA	24	Word	100	mA	R
AI1_MA	Analog input 1 current 4-20mA	25	Word	100	mA	R
AI2_MA	Analog input 2 current 4-20mA	26	Word	100	mA	R
AI3_MA	Analog input 3 current 4-20mA	27	Word	100	mA	R
AI4_MA	Analog input 4 current t 4-20mA	28	Word	100	mA	R
Temp1	Input temperature probe 1 PT100	30	Word	100	ºC	R
Temp2	Input temperature probe 2 PT100	31	Word	100	ºC	R
Temp3	Input temperature probe 3 PT100	32	Word	100	ºC	R
V_L1_N	Voltage phase 1-Neutral	40	Word	100	V	R
V_L2_N	Voltage phase 2-Neutral	41	Word	100	V	R
V_L3_N	Voltage phase 3-Neutre	42	Word	100	V	R
V_L1_L2	Voltage phase 1 – Phase 2	43	Word	100	V	R
V_L2_L3	Voltage phase 2 – Phase 3	44	Word	100	V	R
V_L3_L1	Voltage phase 3 – Phase 1	45	Word	100	V	R
A_L1	Current Phase 1	46	Word	100	A	R
A_L2	Current Phase 2	47	Word	100	A	R
A_L3	Current Phase 3	48	Word	100	A	R
POT_III	Three-phase power	49	Word	100	kW	R
FR_III	Three-phase frequency	50	Word	100	Hz	R
CPU_Temp	CPU Temperature	90	Word	10	ºC	R
OUT0	Digital output 0	100	Bit			R/W
OUT1	Digital output 1	101	Bit			R/W
OUT2	Digital output 2	102	Bit			R/W

Table 13- *Table Modbus TCP server*

7. WEB PLATAFORM

The MICO24 web platform allows you to consult the data that MICO24 Nano circuit is sending, anytime and anywhere. It is also possible to consult the data history and launch alarms or warnings.

7.1. Web plataform access

To access the platform, just go to the MICO24 website (*https://mico24.effitronix.com*) from any browser on a PC or mobile device. A default window will open where you will enter the username and password supplied to you by Effitronix.

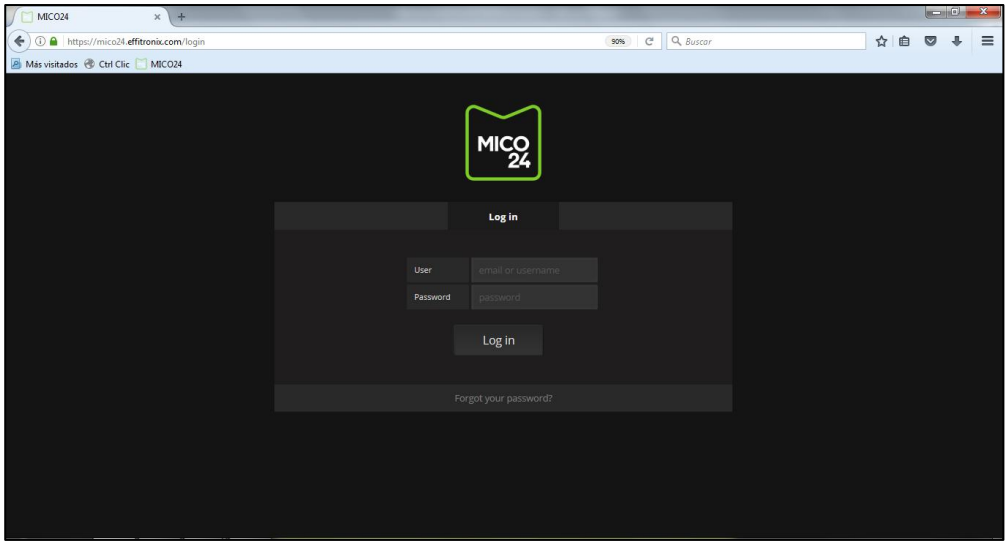

Fig. 25 *MICO24 web platform login screen*

7.2. Current equipment status

The home screen will show the current status of all the equipment and elements controlled through the MICO24 system and the MICO24 Nano equipment.

Fig. 26 *Home screen equipment current status*

Whenever you want to return to the home screen, click on the tab to the right of the MICO24 logo at the top left-hand side of the screen. In the dropdown menu, click on "Home".

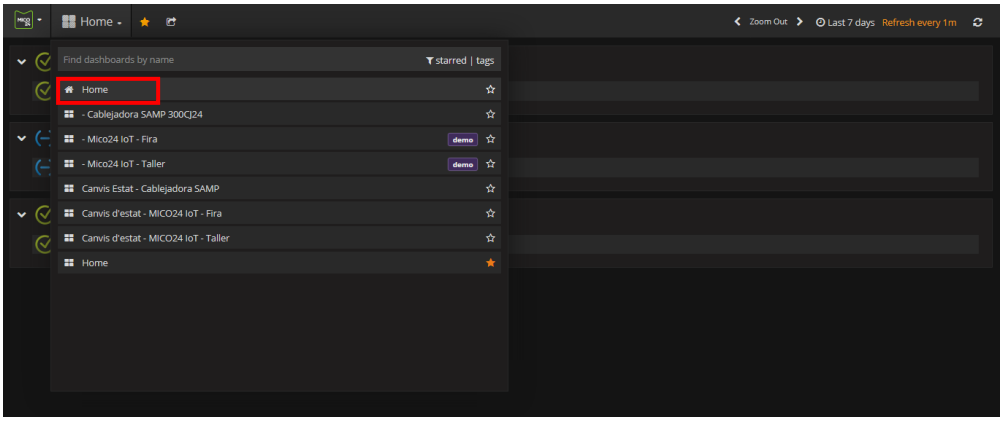

Fig. 27 Home screen equipment current status

7.3. Consulting current equipment status

Click on the status icon in the current equipment status screen [*See 7.2.*] and you will access a new screen where the latest status changes of the equipment can be consulted.

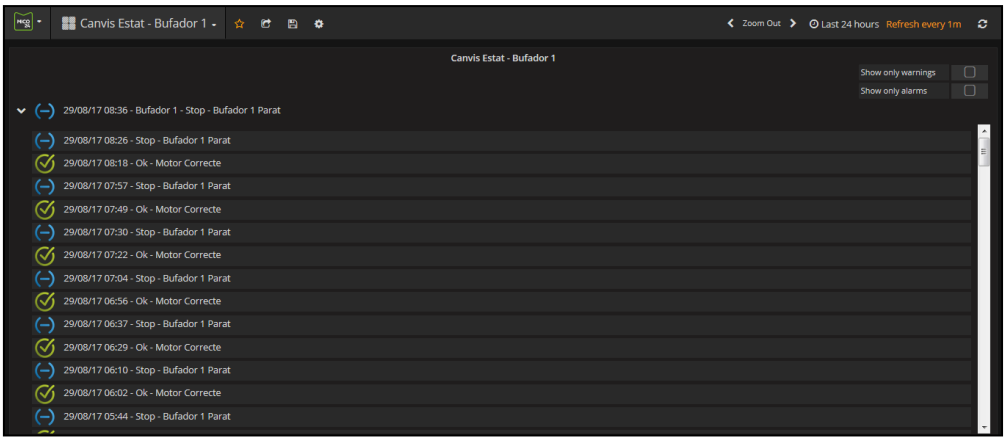

Fig. 28 Consulting the latest status changes

7.4. Consulting equipment parameters

Clicking on the equipment name on the current equipment status screen [*See 7.2.*], you will access the screen for consulting the different parameters being monitored. It will always display the parameters during the time window selected at the top right-hand side. Click on the name of one of the parameters and a graph will open up where you can see the evolution of the same in the selected temporal window.

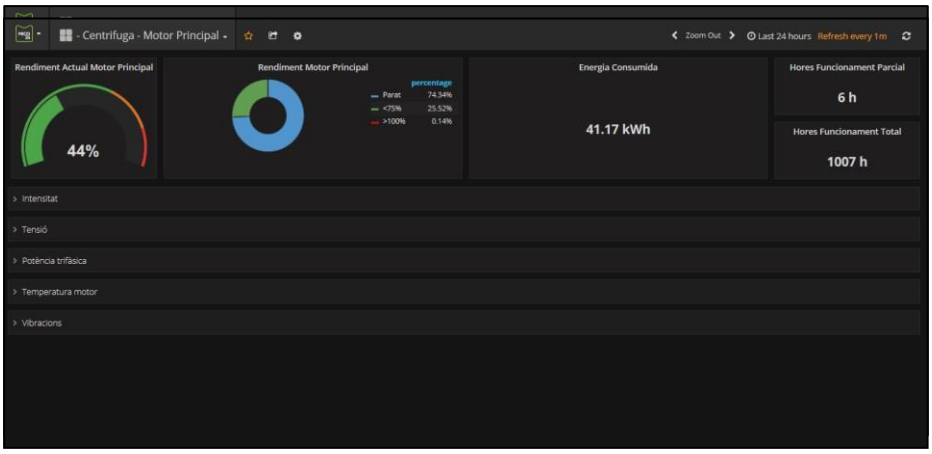

Fig. 29 *Consult parameters element screen*

Fig. 30 *Graphic example of a parameter*

8. VERSION CONTROL

Version Control	
Date	Description
2019/05/06	Original version
2020/01/31	Analog inputs connector X10