Monitoring
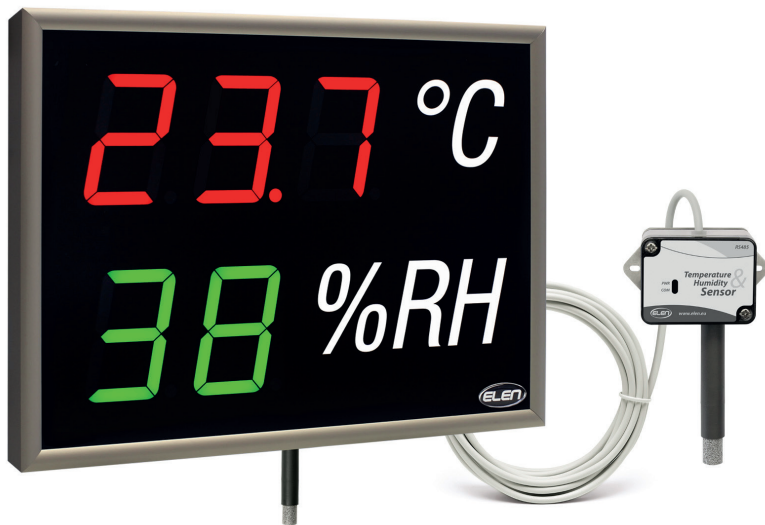# Air Temperature and Humidity

Large-size LED Displays

NDA 100/3-2 TH(S) RG L20 230AC(PoE) LAN

User Manual (FW ver. 2.00 - MODBUS)

ELEN

1. Brief Description

The NDA 100/3-2 TH(S) series systems are electronic devices designed to monitor air temperature and relative humidity. The measurements are made by a high-precision digital sensor, which can be internal plug-in type (version THS) or external wired (version TH). Measured values are displayed on a large size LED display, or can also be viewed remotely on a PC and logged in a database for later review. For this purpose various communication interfaces are offered: USB, RS485, LAN or PoE LAN and DataLoggerTH software application is available for download. In case of LAN interface, user can monitor the measured temperature and humidity on the local Intranet as well, assuming his PC is located on the same LAN network.

Communication of display with external sensor or with external devices (e.g. PCs or PLCs) is performed via MODBUS protocol. Displays equipped with USB or RS485 interface use MODBUS RTU protocol, whereas displays with Ethernet LAN interface use MODBUS TCP/IP protocol. This protocol can be used to obtain temperature and humidity data from display and to adjust display's configuration settings using external devices such as PCs, PLCs and various control units. Display can therefore be easily integrated into various data acquisition systems or building management systems - BMS.

2. Models Available

There are eight different display and four sensor types available. Their selection depends on intended application. Some applications require displaying temperature and humidity values without a need of logging measured values. Other may require remote connection to a PC and data logging.

List of available display product types:

1. NDA 100/3-2 **THS R** L20 230AC **USB**
2. NDA 100/3-2 **TH R** L20 230AC **USB**
3. NDA 100/3-2 **THS RG** L20 230AC **RS485**
4. NDA 100/3-2 **TH RG** L20 230AC **RS485**
5. NDA 100/3-2 **THS RG** L20 230AC **LAN**
6. NDA 100/3-2 **TH RG** L20 230AC **LAN**
7. NDA 100/3-2 **THS RG** L20 **PoE LAN**
8. NDA 100/3-2 **TH RG** L20 **PoE LAN**

Meaning of the letter code:

NDA	Numerical Displays for Air quality.
100/3-2	Digit height 100 mm, 3 digits temp., 2 digits humidity.
THS	Display includes internal plug-in temp./humidity sensor.
TH	Display has connection for external sensor.
R	Red color LEDs.
RG	Multi color LEDs (red/green/yellow).
USB/RS485/LAN/PoE LAN	– Display interface used for data logging and setting display parameters.

List of available temperature and humidity **sensor** product types:

1. THS Sensor 52 12DC RS485
2. THS Sensor 52 24DC RS485-GI
3. THS Sensor 40 12DC LAN
4. THS Sensor 40 PoE LAN

Meaning of the letter code:

THS Sensor	Temperature and Humidity Sensor.
52 or 40	Enclosure protection rating, IP 52 / IP 40.
12DC/24DC/PoE	Power supply voltage.
RS485/LAN/PoE	Communication interface.

3. Technical Specifications – LED Display

The large-size LED display consists of super-bright single color (version R) or multi-color (version RG) 7-segment LED modules with 100 mm digit height and 120° wide viewing angle. These parameters ensure excellent readability even from a far distance.

Its mechanical construction is made of aesthetic platinum color anodized aluminium frame and gray tinted non-glare front glass. Back panel is made of steel, painted with black powder paint. Display's enclosure is suitable for use in indoor environment only. Flexible power supply cable for connecting to power mains is attached to back panel of display via cable gland. In case of product model with PoE interface, device is powered directly from PoE LAN.

Display Parameters

Number of viewing sides	1
Digit height	100 mm
Format of digits	88,8 °C + 88 %RH
Fixed units label	°C (°F), %RH (%HR, %r.F.) as required. White letters on black background.
LED elements	Super-bright 7-segment LED modules, suitable for indoor light conditions, AlInGaP LED chips with long lifetime.
LED color	Red or multi-color Red/Green/Yellow. Depends on product type ordered.
Readability range	Up to 40 meters.
Enclosure protection class	IP 20, indoor use only.
Frame construction	Anodized aluminium frame, steel back panel coated with black powder paint.
Frame color	Platinum grey.
Front cover	Non-glare PMMA glass, grey tinted, 3 mm thick.
Brightness control	Automatic, depending on ambient light conditions, or direct control of brightness level set by user.
Power supply	100-240 VAC, 50/60Hz, flexible power cord 2m or PoE Class 3
Data connections	Depends on product type purchased: USB, RS485 (for data logging), RS485 (for external sensor), LAN, PoE
Dimensions	470 x 350 x 59 mm
Weight	4,5 kg
Operating temperature	0°C to +50°C
Mounting	Wall installation bracket included.

4. Technical Specifications – Temperature / Humidity Sensor

The measurements of air temperature and humidity are performed by a high-accuracy and precision digital sensor. The sensor device can be internal plug-in type (version THS) or external wired (version TH).

Sensor Parameters

Sensor type	Sensirion SHT31-DIS
Temperature range	-40°C to +80°C
Temperature accuracy	±0,3°C typical (±0,2°C for T > 0°C)
Temperature resolution	0,1°C
Relative humidity range	0% to 100% RH (displays up to 99%)
Relative humidity accuracy	+/-2% RH typical (more)
Relative humidity resolution	1% RH
Connection, version THS	Internal plug-in sensor. 3,5 mm Jack connector, sensor unit plugs into bottom side of display frame.
Connection, version TH	External wired sensor. Cable with preinstalled connector. Cable length 5 m. Other lengths possible on request.

5. Connections

Power Supply Connection

Important! - Powering of display should be performed after the sensor (internal or external) and data line cables (if applicable) have been connected.

All display models, except for the version with PoE interface, are designed for input power 100–230 VAC, 50 / 60 Hz. Flexible power supply cable with EU type 2-prong plug is attached directly to display from the back panel. To apply power, insert the power cable plug into the power mains socket.
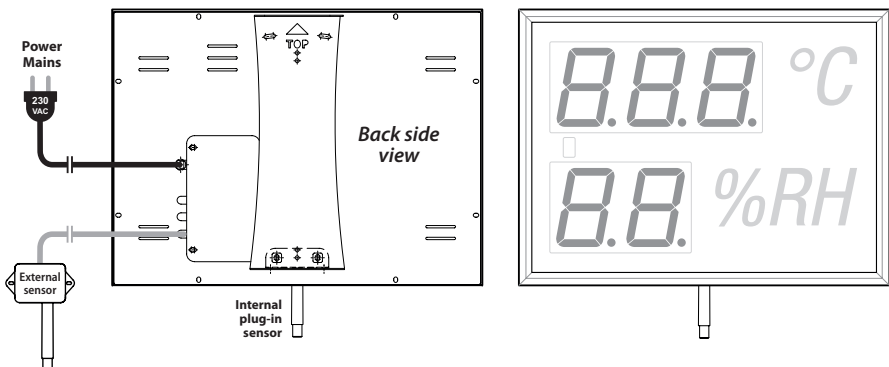
Internal Plug-in Sensor Connection (NDA…THS version)

If your display delivery includes internal plug-in temperature and humidity sensor (NDA…THS version) insert the sensor device into the opening hole in the bottom side of display frame. To ensure proper electrical connection the connector of the sensor must be inserted all the way in. The connector type is 3,5 mm Jack.

External Sensor Connection (NDA…TH version)

If you purchased external sensor "THS Sensor 52 12DC RS485" as an optional accessory, your display includes input connector for this sensor.
External sensor has a 4-wire cable with EUROCLAMP connector already preinstalled. Plug this connector into its corresponding connector "P1" (green color connector) located on the PCB board. All PCB connectors are accessible on the back panel of large size LED display under a small door plate. The door plate is secured by two screws which must be removed first. Once you remove the door plate, attach the sensor cable connector into its corresponding PCB connector. Then insert and screw the door plate back again. Use the slots in the door plate to route the cable. External temperature/humidity sensor is powered directly from the large size LED display. No additional external power supply is necessary.
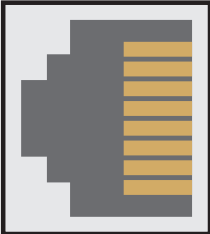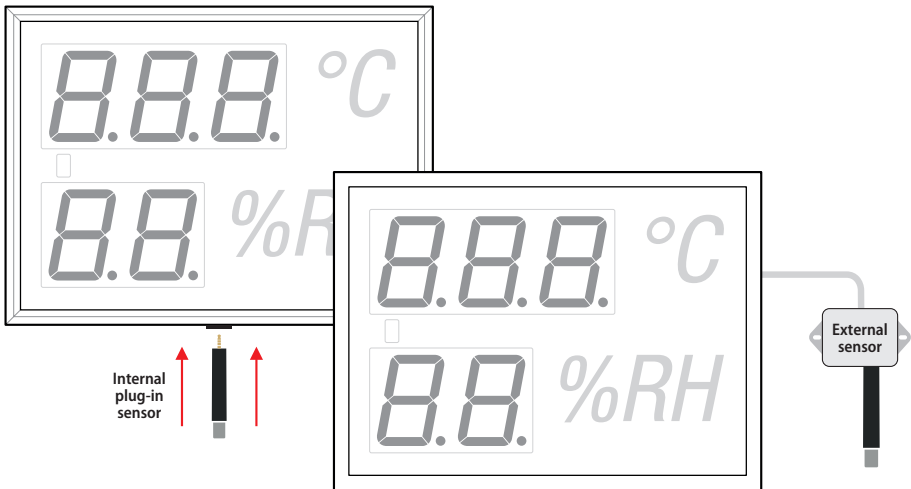

LAN Ethernet TCP/IP Communication Connection

LAN communication is performed via standard Ethernet TCP/IP protocol. Socket RJ45 is located on the PCB board under a small cover door plate on the back panel of large size LED display. The door plate is secured by two screws which must be removed first. Once you remove the door plate, attach the LAN cable connector into its corresponding PCB connector. Then insert and screw the door plate back again. Use the slots in the door plate to route the cable.
You can plug standard CAT5 type LAN cable from LAN network port (e.g. switch or hub) directly into this socket. Please see table below for pinout description.
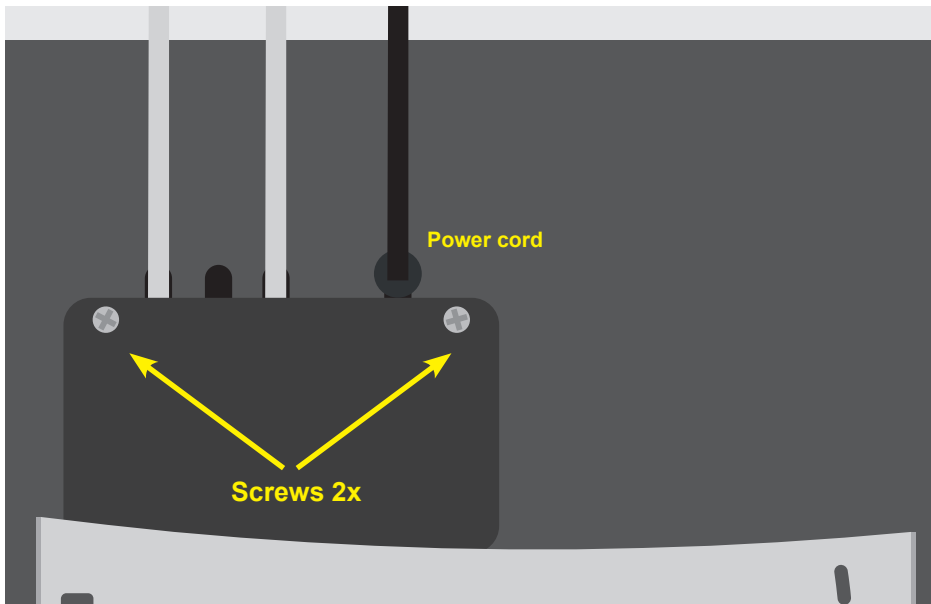
LAN Interface Connector – P9
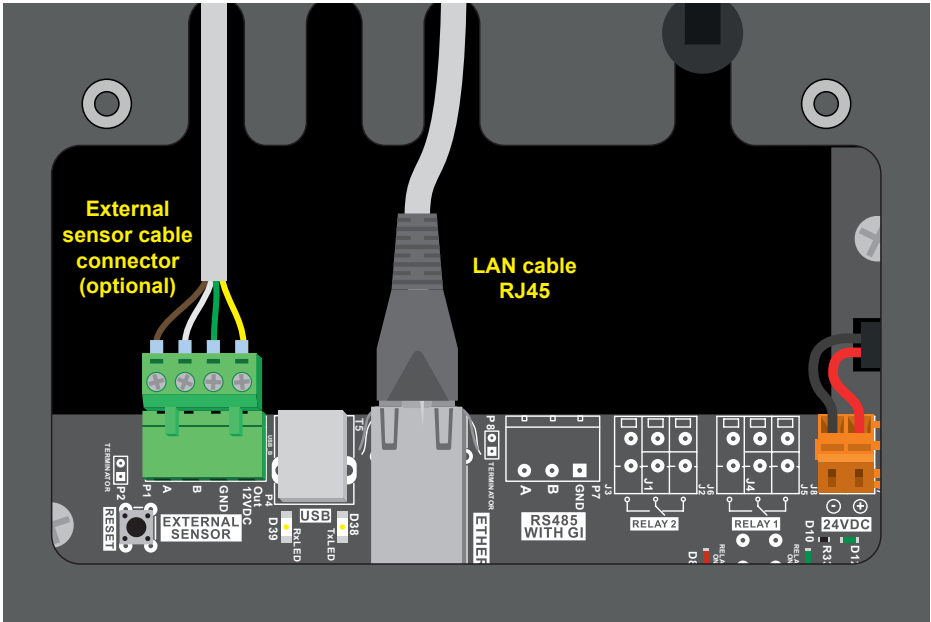
Ethernet 10/100 RJ45 shielded connector is used.

Connector view		Signal	Direction
Connector RJ45 view to hole — pin 1 — pin 2 — pin 3 — pin 4 — pin 5 — pin 6 — pin 7 — pin 8	1	TX+	output
	2	TX-	output
	3	RX+	input
	4	NC (LAN), +Vdc (PoE)	
	5	NC (LAN), +Vdc (PoE)	
	6	RX-	input
	7	NC (LAN), -Vdc (PoE)	
	8	NC (LAN), -Vdc (PoE)	
		shield	

The IP address, SubNet Mask and Gateway of display have been programed at factory. These values are printed on a label located on the back side of display. **Factory default IP address is 192.168.0.69.**

You can change the factory set IP address, Subnet mask and Gateway via web browser as described later in this manual.

Details of Cable Connections

Power cord

Screws 2x

External sensor cable connector (optional)

LAN cable RJ45

EXTERNAL SENSOR — RESET — USB B — ETHER — RS485 WITH GI — RELAY 2 — RELAY 1 — 24VDC
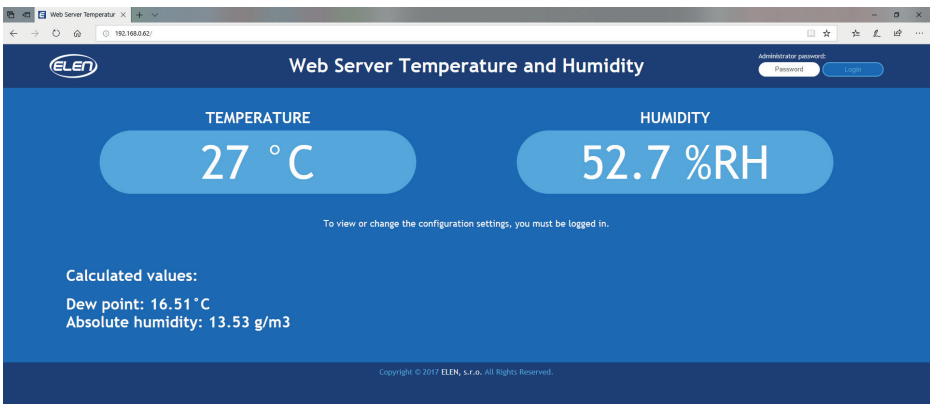
6. Internet Web Browser Connection

Reading Measured Values

Display has a programmed web server. This feature allows remote connection with display using a standard PC based Internet web browser (Internet Explorer, Mozilla Firefox, etc.) Simply enter the numeric IP address of display into browser's URL field (For example: "192.168.0.69"). Browser will connect with the correspond display and will show its displayed values. See screenshot below.

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Web Server Temperature and Humidity

Administrator password: Password | Login

TEMPERATURE

27 ˚C

HUMIDITY

52.7 %RH

To view or change the configuration settings, you must be logged in.

Calculated values:

Dew point: 16.51˚C
Absolute humidity: 13.53 g/m3

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You can view more displays at the same time by opening several tabs on your browser and entering their corresponding IP addresses into each tab's URL field.

Configuring Display

When connected with display via its IP address in the web browser, you can enter the Administrator menu. This can be done by entering the Password in top right field of the browser window. Default password is "**admin**". The password can be changed later in the administrator menu.

Press Login button or Enter to access the web server configuration menu. The web server configuration menu will appear in the browser's window. See screenshot on the next page.

The configuration menu provides many options to the user. Following is a short description of each option.

Note: Do not forget to press the Set button after making each change. Otherwise the change will be discarded.

ture and Humidity

Logout

TY

%RH

| Display | Sensor No.1 | Sensor No.2 | Password |

Display settings:

Display mode:	Sensor No. 1 ▾	Set
Brightness mode:	Automatic ▾	Set
Curve slope (1 - 100):	90	Set
Display ID:	1	Set

USB virtual serial COM port settings:

Baud Rate:	19200 ▾	Set
Parity:	Even ▾	Set

8 data bits, 1 stop bit

MODBUS RS-485 Serial Settings:

Baud Rate:	19200 ▾	Set
Parity:	Even ▾	Set

8 data bits, 1 stop bit

MODBUS TCP/IP Settings:

MAC:	0-1E-C0-FC-A1-2F	
IP address:	192.168.0.69	Set
Subnet mask:	255.255.255.0	Set
Gateway address:	192.168.0.1	Set
TCP/IP port for MODBUS:	502	Set
TCP/IP port for factory services:	10001	Set

Set
Set

:

Set
Set
On ⦿ Off Set
0   Set
On ⦿ Off Set

. 2:
essory)
Enable ⦿ Disable Set
ygrostat ▾ Set
Set
Set

is under voltage.
ive after 10 seconds!

ture and Humidity

Logout

TY

%RH

| | | Set |
| | | Set |

:

		Set
		Set
On ◉ Off	Set
0	Set
On ◉ Off	Set

2:
(essory)

Enable ◉ Disable	Set
/grostat ▼	Set
	Set
	Set

is under voltage.
ive after 10 seconds!

| Display | **Sensor No.1** | Sensor No.2 | Password |

Sensor No. 1 settings:

| Sensor No. 1 connection: | Internal ▼ | Set |
| Sensor No. 1 ID: | 1 | Set |

If MODBUS TCP/IP External Sensor is Connected:

| Sensor No. 1 IP address: | 192.168.0.67 | Set |
| Sensor No. 1 TCP/IP port: | 502 | Set |

If MODBUS RS485 External Sensor is Connected:

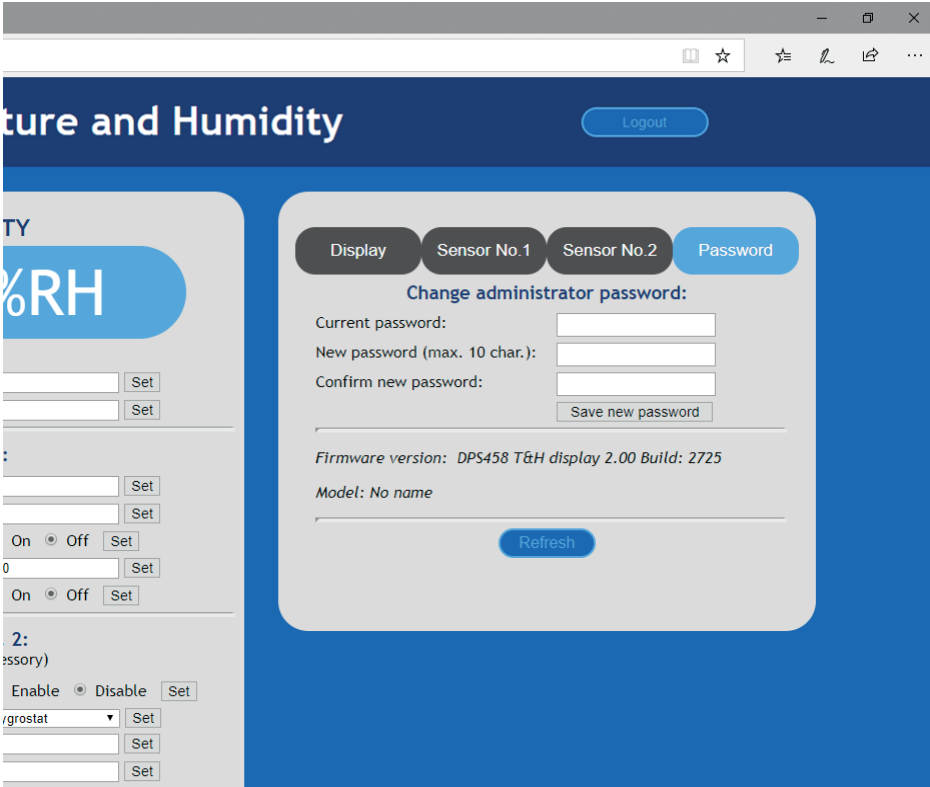| Baud Rate: | 19200 ▼ | Set |
| Parity: | Even ▼ | Set |

8 data bits, 1 stop bit

Connection settings are the same as for sensor No. 2.

MODBUS Settings for Sensor No.1:

Sensor No. 1 Function:	4	Set
Sensor No. 1 Register address for temperature:	0	Set
Sensor No. 1 Register address for humidity:	10	Set

TEMPERATURE

Displays temperature value currently on display.

Offset	**-9,9°C to +9,9°C** Allows user to implement offset correction to measured values from -9,9°C to +9,9°C. Default value is 0. Please be cautious when using this feature because sensors are already calibrated from factory. Under normal circum-stances there should be no need to change it.
Temperature Units	**Celsius / Fahrenheit**
Display color	Sets the color of display's LEDs to red/green/yellow. *Valid for displays with color LEDs only (version RG).*

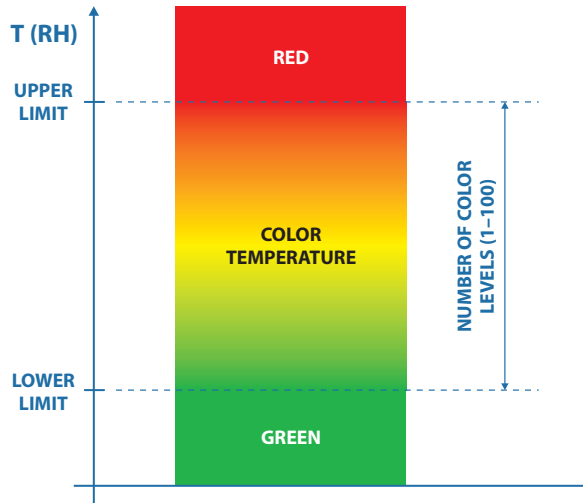|	
Alarms	Allows visual signalization when values exceed limit values.
Upper limit	Sets the upper limit value for the alarm.
Lower limit	Sets the lower limit value for the alarm.

Color temperature   **On/Off**, special feature used with color LEDs. Display's LED color will change automatically in dependence on displayed temperature value.

Number of color levels (1 to 100)

Sets the number of color levels during transition from lower limit (green) to upper limit (red) and wise versa when color temperature function is ON.

Temperature blinking   **On/Off**, enables or disables blinking (flashing) of display when the upper or lower limit is exceeded.

Relay No. 1   Display can be equipped with two optional relays offered as optional accessory.

Relay No. 1 function   **Enabled / Disabled**
Enables or disables Relay No. 1.

Function of relay No. 1   **Thermostat / Hygrostat / Temperature Alarm**
Sets the function of relay No. 1 according to your application.

OFF if temperature is higher than

Relay No. 1 is OFF when temperature is above than this value.

ON if temperature is lower than

Relay No. 1 is ON when temperature is below this value.

HUMIDITY

Humidity   Similar options as described for the temperature menu above are possible for humidity as well.

Display settings

Display mode   **Sensor No. 1 / Sensor No. 2 / Average from 2 sensors**

> **Sensor No. 1**
> Display will show measured value from sensor No. 1 as configured above.
> **Sensor No. 2**
> Display will show measured value from sensor No. 2 as configured above.
> **Average from 2 sensors**
> Display will show average value from 2 sensors, if two sensors are connected.

Brightness mode   **Automatic / Direct**

> **Automatic** Automatic control of brightness according to ambient light conditions,
> via built-in light sensor.
> **Direct** Direct control of brightness via fixed brightness level entered by user.
> Default factory setup is automatic.

Brightness level (1 – 100)
> If **Direct** mode is selected above, this value sets fixed LED brightness level from 1 to 100.

Curve slope (1 – 100)
> If **Automatic** mode is selected above, this value sets the slope of brightness regulation curve.

Display ID   **1 – 247**
Designates internal RS485 address ID number of display.
(MODBUS slave address.)

USB virtual serial COM port settings

Baud Rate   1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200.
Baud rate for USB communication interface (default: 19200 Bd)

Parity   None, Even, Odd
Parity type settings for USB interface (default: EVEN)

MODBUS RS-485 Serial Settings

Baud Rate   1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200.
Baud rate for RS485 communication interface (default: 19200 Bd)

Parity   None, Even, Odd
Parity type settings for RS485 interface (default: EVEN)

MODBUS TCP/IP Settings

MAC   Shows MAC address of connected display.
User cannot change this field.

IP address   Shows IP address of display (same IP address as in the URL field of the browser).
Factory default IP address is on the label located on the back panel of display.
Enter new IP address according to your LAN setting.

Subnet mask   Shows factory default Subnet mask of connected display.
Enter new Subnet mask according to your LAN.

Gateway address   Shows factory default Gateway address of connected display.
Enter new Gateway address according to your LAN.

TCP/IP port for MODBUS

Shows MODBUS TCP/IP port.
Enter new MODBUS TCP/IP port according to your LAN.
Default factory value is **502**.

TCP/IP port for factory services

Shows TCP/IP port for factory services.
Enter new TCP/IP port for factory services according to your LAN.
Default factory value is **10001**.

Sensor No. 1 settings

This menu allows user to configure the type of sensor used and its parameters.

Sensor No.1 connection

Internal, RS-485, Ethernet, MODBUS slave, None
Select what type of sensor is paired with display.
Internal – display is equipped with plug-in internal sensor.
RS485 – external sensor is attached to display via cable.
Ethernet – LAN type sensor is paired with display.
MODBUS slave – LED display is used as a displaying unit for a control system
(e.g. PC, PLC, etc.), which sends it's temperature and humidity data.
None – no sensor is connected

Sensor No. 1 ID   Sensor No. 1 ID number or MODBUS slave address.

If MODBUS TCP/IP External Sensor is Connected

Sensor No. 1 IP address

IP address of sensor No. 1, if **Sensor No. 1 connection:** is set to Ethernet.

Sensor No. 1 TCP/IP port

TCP/IP port number of sensor No. 1, if Sensor No. 1 connection: is set to Ethernet.
Default: 502. (MODBUS standard default.)

If MODBUS RS485 External Sensor is Connected

Baud Rate   **1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200**
Baud rate for sensor No. 1, if Sensor No. 1 connection: is set to RS-485.
Default: 19200. (MODBUS standard default.)

Parity   **None, Even, Odd**
Parity type of sensor No. 1, if Sensor No. 1 connection: is set to RS-485.
Default: EVEN. (MODBUS standard default.)

Baud rate and Parity of sensor No. 1 and No. 2 have the same settings because they are on the same RS485 bus.

MODBUS Settings for Sensor No.1

Sensor No. 1 Function
>> **3, 4**
>> Function number, which is used for reading temperature and humidity values.
>> Default: 4. (Default for ELEN sensors.)

Sensor No. 1 Register address for temperature
>> **0 to 65535**
>> Address of register, which contains temperature value.
>> The temperature value must be signed int and in tenths of °C.
>> Default: 0. (Default for ELEN sensors.)

Sensor No. 1 Register address for humidity
>> **0 to 65535**
>> Address of register, which contains humidity value.
>> The humidity value must be signed int and in tenths of %RH.
>> Default: 10. (Default for ELEN sensors.)

Sensor No. 2 settings

This menu allows user to configure the type of sensor used and its parameters.

Sensor No.2 connection
>> RS-485, Ethernet, None
>> Select what type of sensor is paired with display.
>> RS485 – external sensor is attached to display via cable.
>> Ethernet – LAN type sensor is paired with display.
>> None – no sensor is connected

Sensor No. 2 ID   Sensor No. 2 ID number or MODBUS slave address.

If MODBUS TCP/IP External Sensor is Connected

Sensor No. 2 IP address
>> IP address of sensor No. 2, if **Sensor No. 2 connection:** is set to Ethernet.

Sensor No. 2 TCP/IP port
>> TCP/IP port number of sensor No. 2, if Sensor No. 2 connection: is set to Ethernet.
>> Default: 502. (MODBUS standard default.)

If MODBUS RS485 External Sensor is Connected

Baud Rate   **1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200**
>> Baud rate for sensor No. 2, if Sensor No. 2 connection: is set to RS-485.
>> Default: 19200. (MODBUS standard default.)

Parity   **None, Even, Odd**
>> Parity type of sensor No. 2, if Sensor No. 2 connection: is set to RS-485.
>> Default: EVEN. (MODBUS standard default.)

Baud rate and Parity of sensor No. 1 and No. 2 have the same settings because they are on the same RS485 bus.

MODBUS Settings for Sensor No.2

Sensor No. 1 Function
> **3, 4**
> Function number, which is used for reading temperature and humidity values.
> Default: 4. (Default for ELEN sensors.)

Sensor No. 2 Register address for temperature
> **0 to 65535**
> Address of register, which contains temperature value.
> The temperature value must be signed int and in tenths of °C.
> Default: 0. (Default for ELEN sensors.)

Sensor No. 2 Register address for humidity
> **0 to 65535**
> Address of register, which contains humidity value.
> The humidity value must be signed int and in tenths of %RH.
> Default: 10. (Default for ELEN sensors.)

*Note: Do not forget to press the **Set** button after making each change.*
*Otherwise the change will be discarded. When finished with settings, click the **Refresh** button.*

Stop bits are set automatically according to parity settings as per MODBUS protocol specifications. (Valid for all communication interfaces of display.)

It is possible to reset the IP address back to factory default value by pressing and holding the **RESET** button for **5** seconds. The **RESET** button is located near the external sensor connector P1 on the back panel.
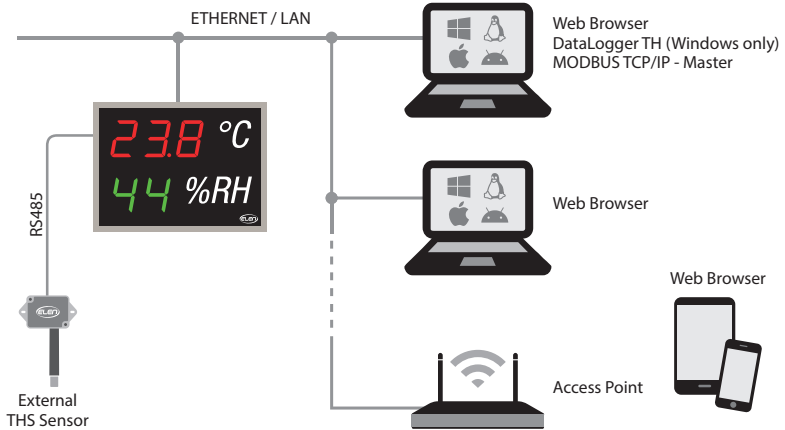
Change administrator password

Enter new password if you want to change it.
Default password is "**admin**".
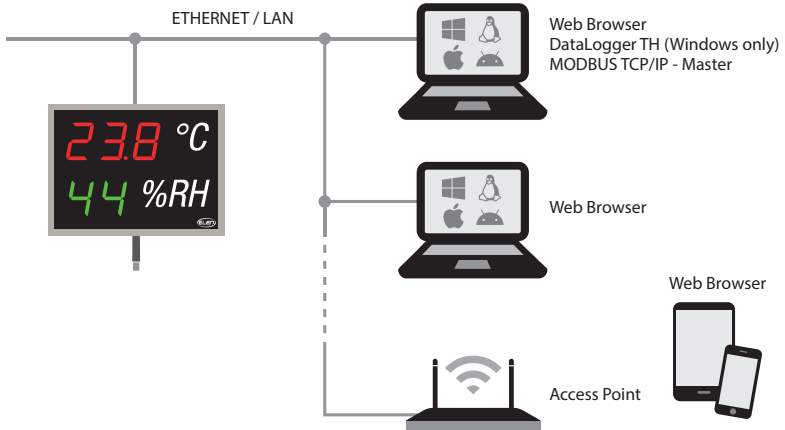Click on the "save new password" button when finished.

Current password	Enter current password.
New password	Enter new password, max. 10 characters.
Confirm new password	Re-enter new password.

Application diagram

NDA 100/3-2 TH RG L20 230AC LAN / NDA 100/3-2 TH RG L20 PoE LAN

ETHERNET / LAN

RS485

External
THS Sensor

Web Browser
DataLogger TH (Windows only)
MODBUS TCP/IP - Master

Web Browser

Web Browser

Access Point

NDA 100/3-2 THS RG L20 230AC LAN / NDA 100/3-2 THS RG L20 PoE LAN

ETHERNET / LAN

Web Browser
DataLogger TH (Windows only)
MODBUS TCP/IP - Master

Web Browser

Web Browser

Access Point

EC DECLARATION OF CONFORMITY
No. 19102107 / No. 19102108

Manufacturer: ELEN, s.r.o.
Lubochnianska 16
080 06 Lubotice
Slovak Republic

The undersigned, representing the manufacturer above herewith declares that the following products are in conformance with the EMC Directive 2014/30/EU, LVD Directive 2014/35/EU and RoHS Directive 2011/65/EU and are CE marked accordingly.

Name of Product: Large size numerical display
Types: NDA 100/3-2 TH(S) RG L20 230AC LAN
NDA 100/3-2 TH(S) RG L20 PoE LAN

Description: This product is an electronic device used to display numerical information – air temperature and humidity.

Harmonised standards used:

Safety: EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013

EMC: EN 55032:2012/AC:2013
EN 61000-3-2:2014
EN 61000-3-3:2013
EN 61000-4-2:2009
EN 61000-4-3:2006 + A1:2008 + A2:2010
EN 61000-4-4:2012
EN 61000-4-5:2014
EN 61000-4-6:2014
EN 61000-4-8:2010
EN 61000-4-11:2004

RoHS: EN 50581:2012

Year when the CE mark was assigned: 2019

Representative: Ing. Ladislav Schichman
Title: Managing Director

Signature:
Date: October 21, 2019