LAVAT
Laboratory and Vacuum Technique

Vacuum Controller VPR 21

Operating Manual

last rev. 03-2024

Product Identification

In all communications with LAVAT, please specify the information on the product nameplate.

Intended Use

The VPR 21 is used together with VPR 21/20 gauges for total pressure measurement. All products must be operated in accordance with their respective Operating Manuals.

Contents

Safety

Personnel Qualifications

All work described in this document may only be carried out by persons who have suitable technical training.

General Safety Instructions

• Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.

Communicate the safety instructions to all other users.

General Safety Instructions

DANGER: Mains voltage
Contact with live parts is extremely hazardous when any liquids penetrate into the unit.
Make sure no liquids penetrate into the equipment.

The disconnecting device must be readily identifiable and easily reached by the user.
To disconnect the controller from mains, you must unplug the mains cable.

Disconnecting device according to EN 61010-1

Liability and Warranty

LAVAT assumes no liability and the warranty becomes null and void if the end-user or third parties:
• disregard the information in this document
• use the product in a non-conforming manner
• make any kind of interventions (modifications, alterations, etc.) on the product.

Technical Data

Mains specifications

Voltage	100 - 240 VAC
Frequency	47 - 63 Hz
Power consumption	36 W
Overvoltage protection	115 – 140 % of 15 VDC
Protection class 1	
Connection	European appliance connector IEC 320 C14
Safety standards	UL 60950-1, IEC/EN 60950-1
	UL 62368-1, IEC/EN 62368-1

Ambiance

Temperature	
Storage	–20 to +60 °C
Operation	+ 5 to +50 °C
Relative humidity	20 – 90 % rel. H max.
Use	indoors only, max. altitude 2000 m
Degree of protection	IP20 (EN 60529)

Compatible gauges

Number of channels	2
Compatible types	VPR 21/20

Gauge connection

SENSOR connector	D-SUB 9, female (pin assignment → page 8)

Operation

Front panel	TFT touch display with 5-inch size and 800x480 pixels resolution

Measurement values

Display range	10^{-2} - 10^{5} Pa
Resolution	16 bit ADC
Measurement period	200 ms
Pressure units	Pa, mbar

Main supply

Voltage	+15 VDC
Current	750 mA

Switching function

Relay	2
Digital output	2
Digital input	1
Adjustment range	5×10^{-2} – $3x10^{4}$ Pa
OUTPUT connector	D-SUB 9, female
Contact positions	→ page 9

Switching relay

Relay type	OPTO SPST NO
Load max.	40 V DC/AC, 1.6 A (ohmic)

Switching Digital Output

Load max.	5 VDC, 20 mA

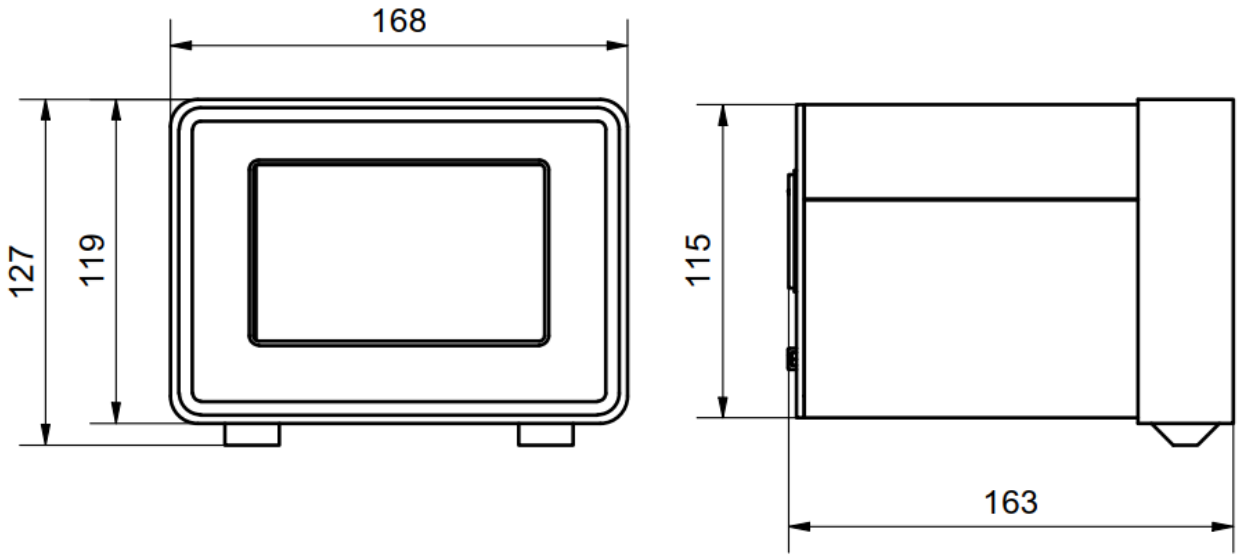
Switching Digital Input

Load max.	5 VDC, 20 mA

Communication

USB	Micro USB 2.0 Type AB
Ethernet	Rj45, 10 Mb/s, 100 Mb/s, IPv4
Wireless	IEEE 802.11b/g/n (2.4 GHz WiFi)

Dimensions [mm]



Installation

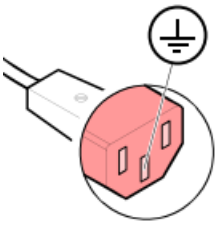
The Vacuum Controller VPR 21 is suited for use as desk-top unit.

Select a location where the admissible maximum ambient temperature (→ page 5) is not exceeded (e.g. due to sun irradiation).

DANGER: Damaged product
Putting a product which is visibly damaged into operation can be extremely hazardous. If a product is visibly damaged do not put it into operation and make sure it is not inadvertently put into operation.

Mains Power Connector

The unit is supplied with a power cord. If the mains cable is not compatible with your system, use your own, suitable cable with protective ground.



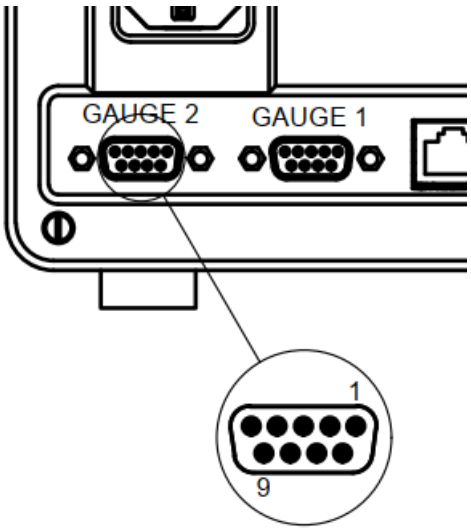
DANGER: Line voltage
Incorrectly grounded products can be extremely hazardous in the event of a fault.
Use only a 3-conductor power cable (3×1.5 mm2) with protective ground. The power connector may only be plugged into a socket with a protective ground. The protection must not be nullified by an extension cable without protective ground.

SENSOR Connector

Connect the gauge to the SENSOR connector on the rear of the unit.

Protective low voltage
According to EN 61010, voltages exceeding 30 V (ac) or 60 V (dc) are hazardous.

Pin assignment



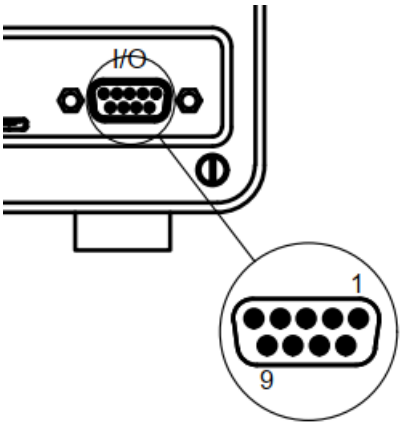
Pin	Signal
1	GND
2	MIN (1) trimmer
3	Signal
4	NC
5	Supply (+3,3 VDC)
6	GND
7	MAX trimmer
8	MIN (2) trimmer
9	Supply (+3,3 VDC)

I/O Connector

Connect the peripheral components to the I/O connector on the rear of the unit. This connector allows to evaluate and switch the digital output / input and relays.

Protective low voltage
According to EN 61010, voltages exceeding 30 V (ac) or 60 V (dc) are hazardous.

Pin assignment



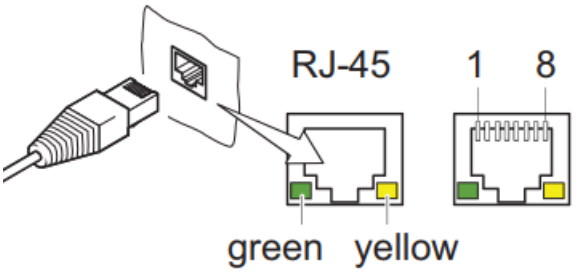
Pin	Signal
1	Digital Output 1
2	Digital Input*
3	Supply (+5 VDC)
4	Relay 1 (-)
5	Relay 2 (-)
6	Digital Output 2
7	GND
8	Relay 1 (+)
9	Relay 2 (+)

*Note: Digital input has a nominal impedance of 10k Ohm. Do not connect additional (parasitic) impedance, otherwise the input will work as a voltage divider and it could cause faulty function.

ETHERNET Connector

The LAN (Ethernet) connection enables direct communication with the device via PC.

Pin assignment



Pin	Signal
1	TD+
2	TD-
3	RD+
4	NC
5	NC
6	RD-
7	NC
8	NC

Status of Ethernet connection

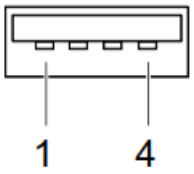
LED	Status	Meaning
Green (link)	Light up	Hardware connection exist
	Dark	No hardware connection
Yellow (activity)	Light up (flickering)	Data transmission runs
	Dark	No data transmission / No connection

USB Connector

The USB connection enables direct communication with the device via PC.
If a virtual series interface (COM) is not automatically set up, download and install the driver at
https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers?tab=downloads

Protective low voltage
According to EN 61010, voltages exceeding 30 V (ac) or 60 V (dc) are hazardous.

Pin assignment



Pin	Signal
1	VBUS (+5 VDC)
2	D-
3	D+
4	GND

Operation

All the functions of VPR 21 can be operated via touch display located on the front panel.

Turning the device on and off

Make sure the VPR 21 is correctly installed and the specifications in the Technical Data are met.

Turning the device on

The power switch is located on the rear of the unit.

After power on, the VPR 21:

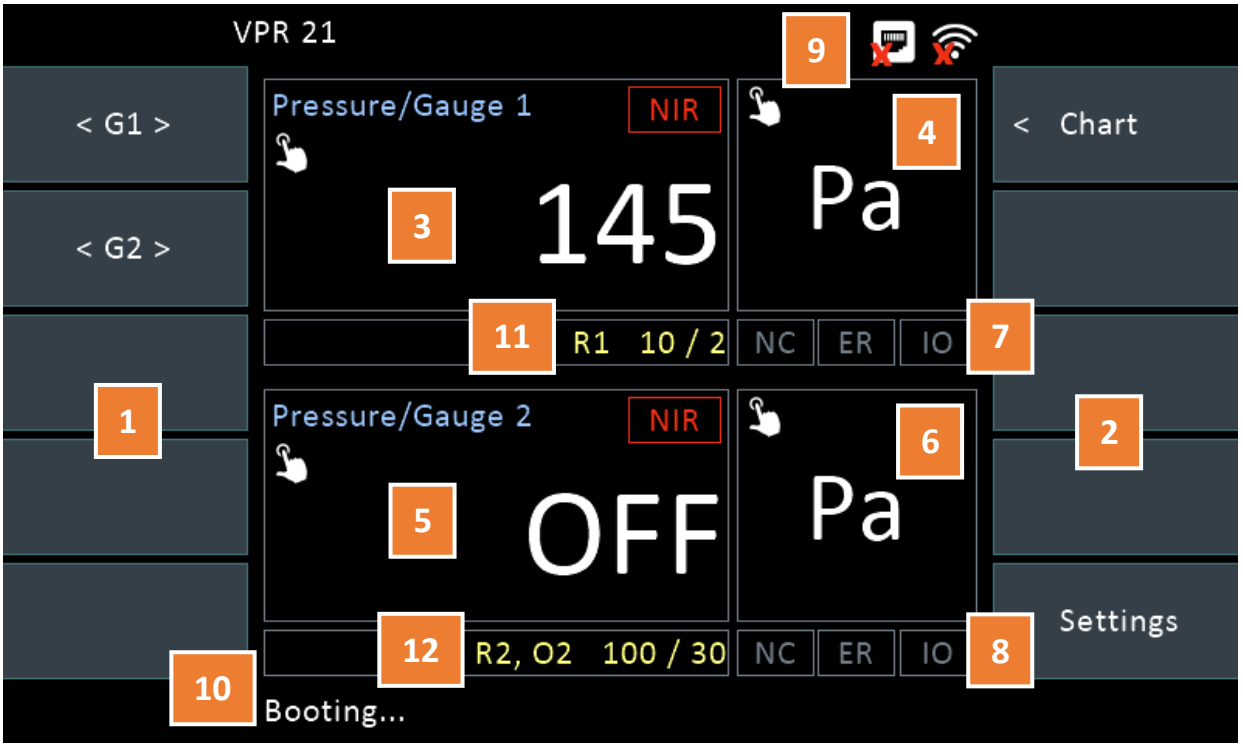
- automatically performs a booting sequence
- activates the parameters that were in effect before the last
- switches to the measurement mode

Turning the device off

Turn the device off with the power switch.
Wait at least 30 s before turning the device on again in order for it to correctly initialize itself.

Measurement Mode

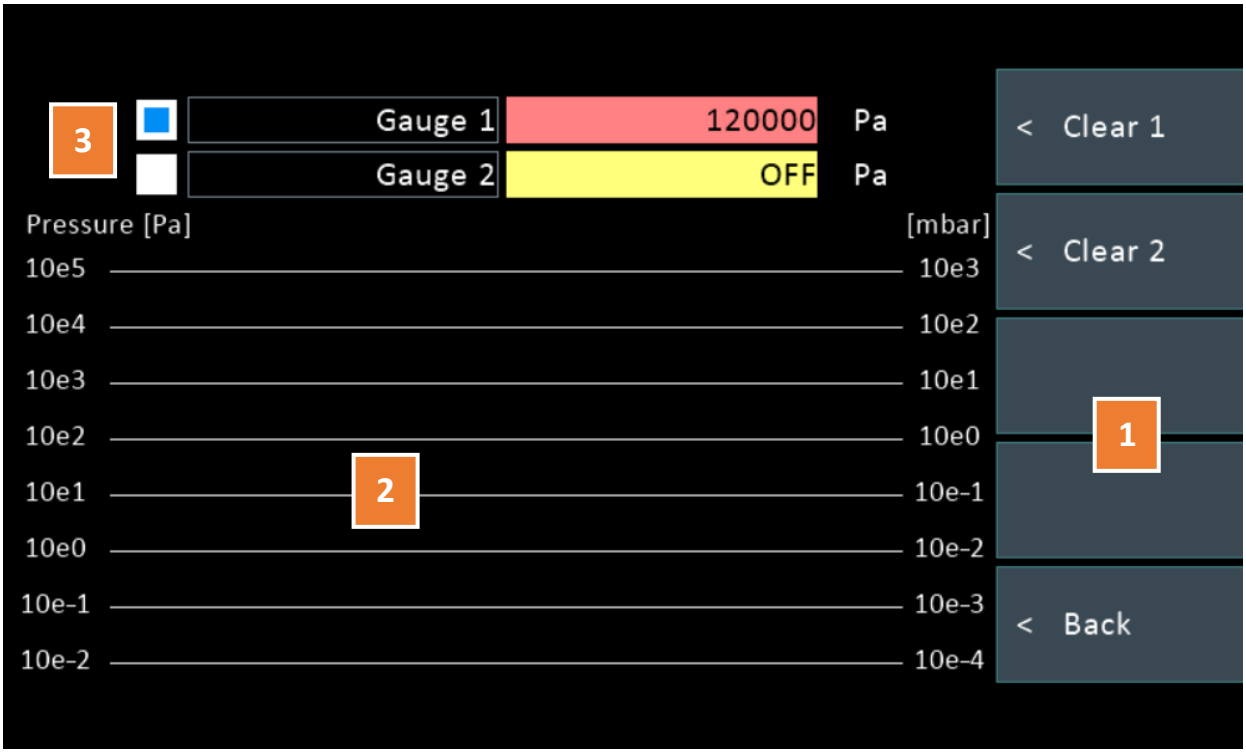
The measurement mode is a default screen which initializes after device is booted up.



1	Left Menu ▪ <G1> Manual switch of relay or digital output for Gauge 1 ▪ <G2> Manual switch of relay or digital output for Gauge 2
2	Right Menu
3	Gauge 1 channel info (pressure) ▪ Power switch – tap to switch the gauge on or off ▪ **NIR** – indication when the gauge is out of range (normally not shown)
4	Units of pressure for Gauge 1 ▪ Tap to switch the units
5	Gauge 2 channel info (pressure) ▪ Power switch – tap to switch the gauge on or off ▪ **NIR** – indication when the gauge is out of range (normally not shown)
6	Units of pressure for Gauge 2 ▪ Tap to switch the units
7	Status bar for Gauge 1 and I/O ▪ **NC** – Gauge is not connected ▪ **ERR** – Gauge error / Filament rupture ▪ **IO** – indication of switching function
8	Status bar for Gauge 2 and I/O ▪ **NC** – Gauge is not connected ▪ **ERR** – Gauge error / Filament rupture ▪ **IO** – indication of switching function
9	Indication icons of network status (Ethernet, WiFi)
10	Message box
11	Switching function setup for Gauge 1 or voltage Format: <I/0> <Setpoint> / <Threshold>
12	Switching function setup for Gauge 2 or voltage Format: <I/0> <Setpoint> / <Threshold>

Chart view

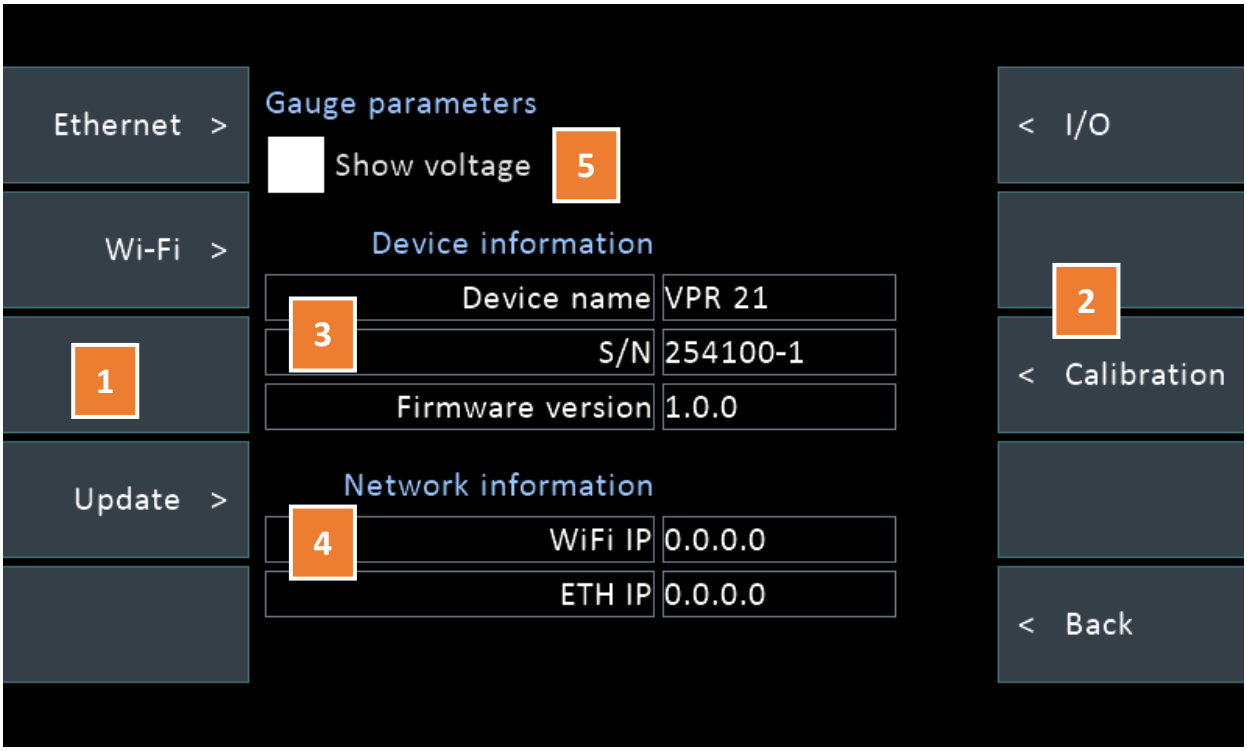
Continuous measurement can be shown in graphical mode.



1	Right Menu ▪ Clear 1 – clear values of gauge 1 measurement ▪ Clear 2 – clear values of gauge 2 measurement
2	Chart (Red – gauge 1, Yellow – gauge 2)
3	Gauges info ▪ Tap the checkboxes to include / exclude measurement values into the chart

Settings

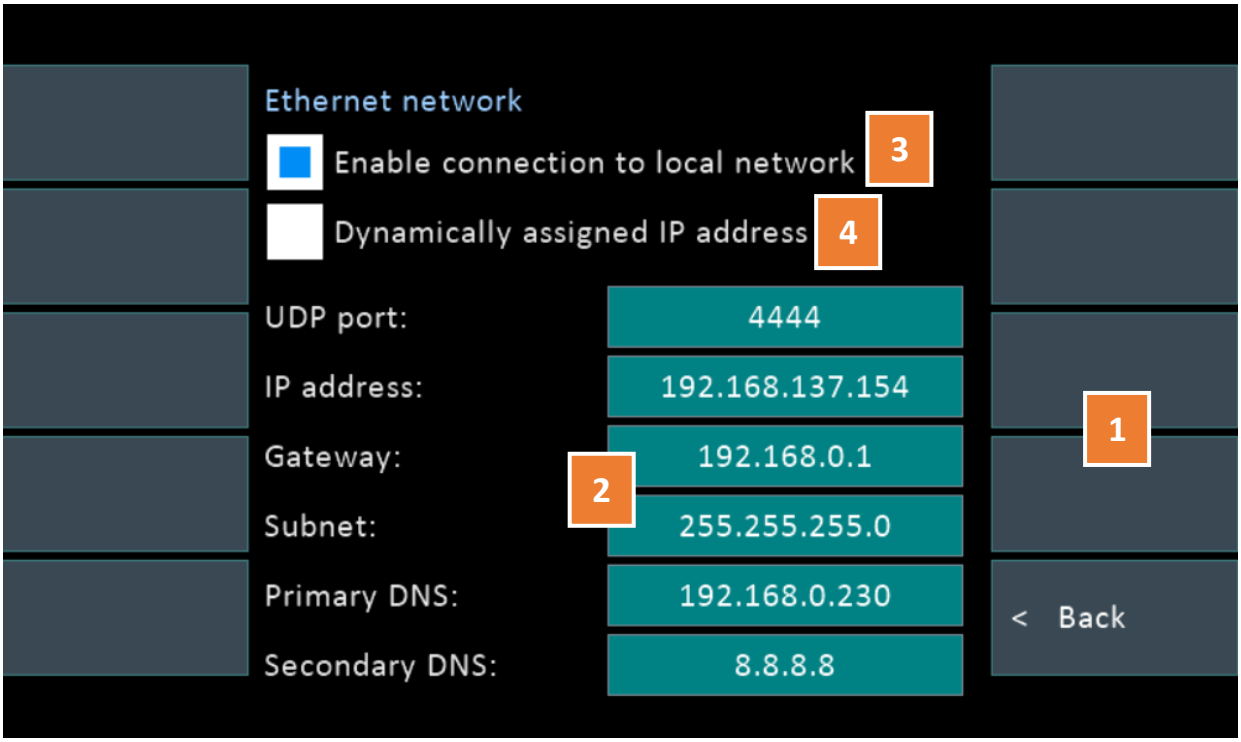
Go to device settings to make changes, update the device, set up a network connection and switching functions or to make a gauge calibration.



1	Left Menu
2	Right Menu
3	Device info
4	Network info (IP address) – available only when Ethernet or WiFi connection is allowed
5	When selected the voltage will be shown at measurement mode instead of switching function

Configuring Ethernet

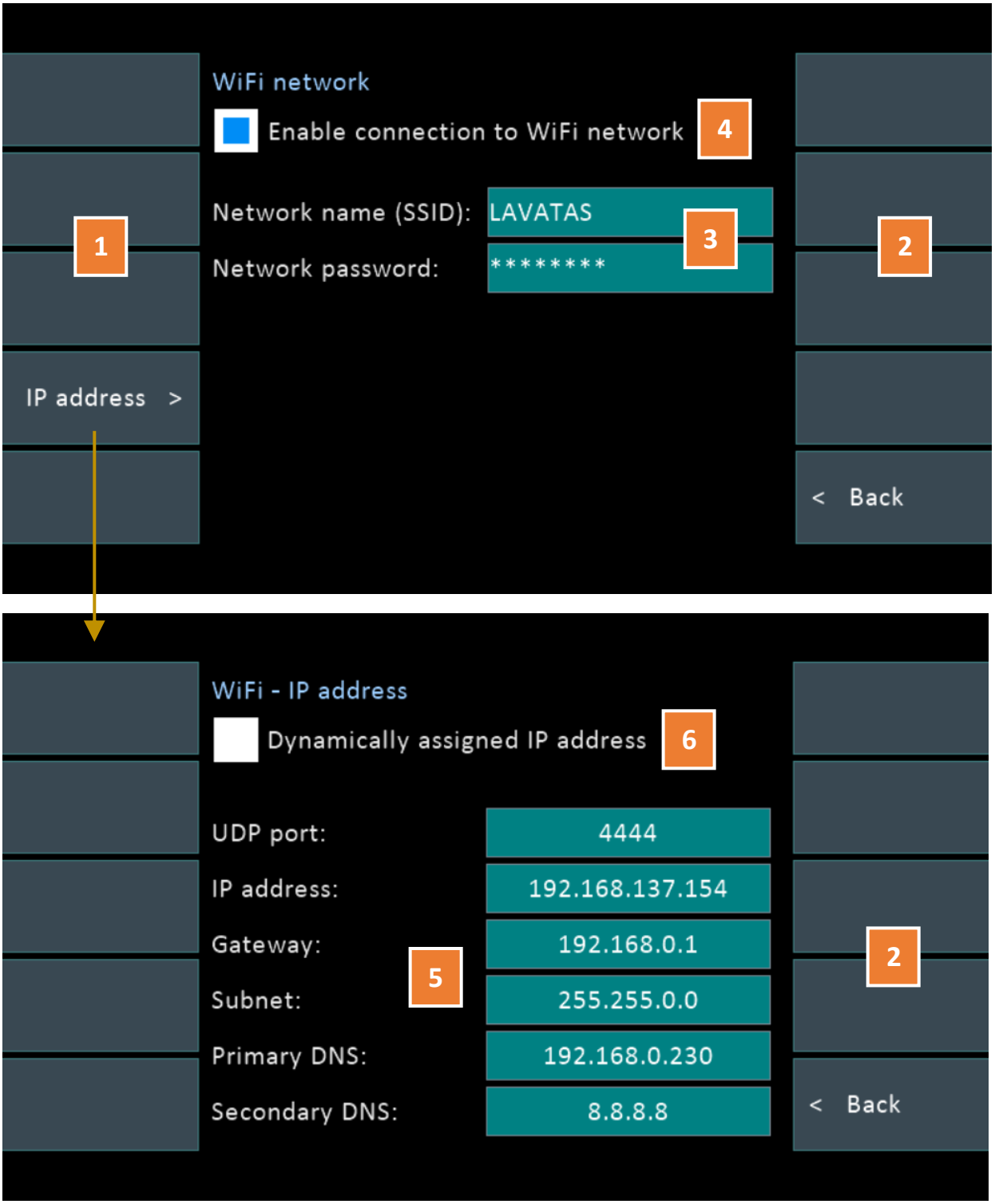
The VPR 21 communicates with other devices connected to LAN via UDP protocol using VPR21 Datagram (→ page 20).



1	Right Menu
2	Network info (UDP port, IP addresses) ▪ Available for manual entry
3	Enable / disable Ethernet connection
4	Enable / disable DHCP assignment

Configuring Wi-Fi

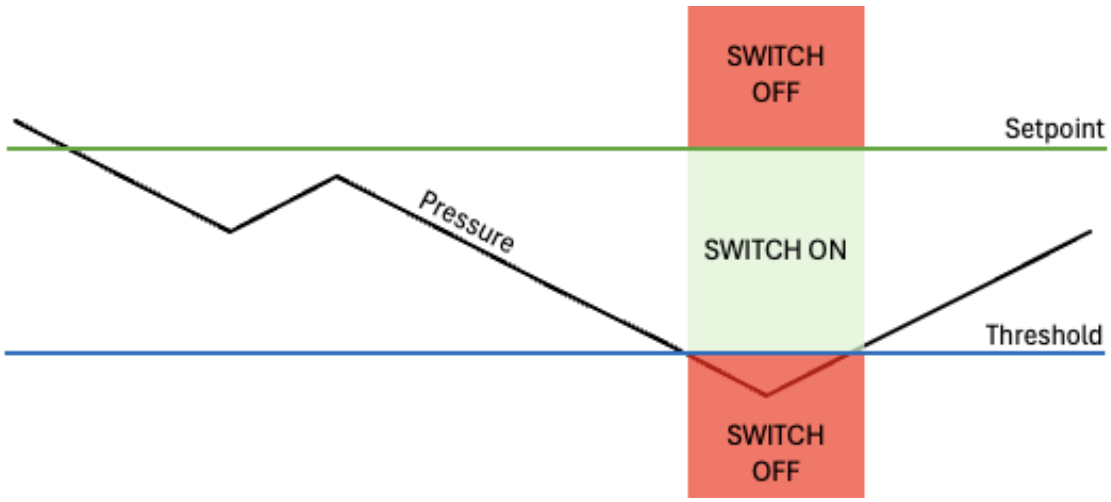
The VPR 21 communicates with other devices connected to Wireless Network via UDP protocol using VPR21 Datagram (→ page 20).



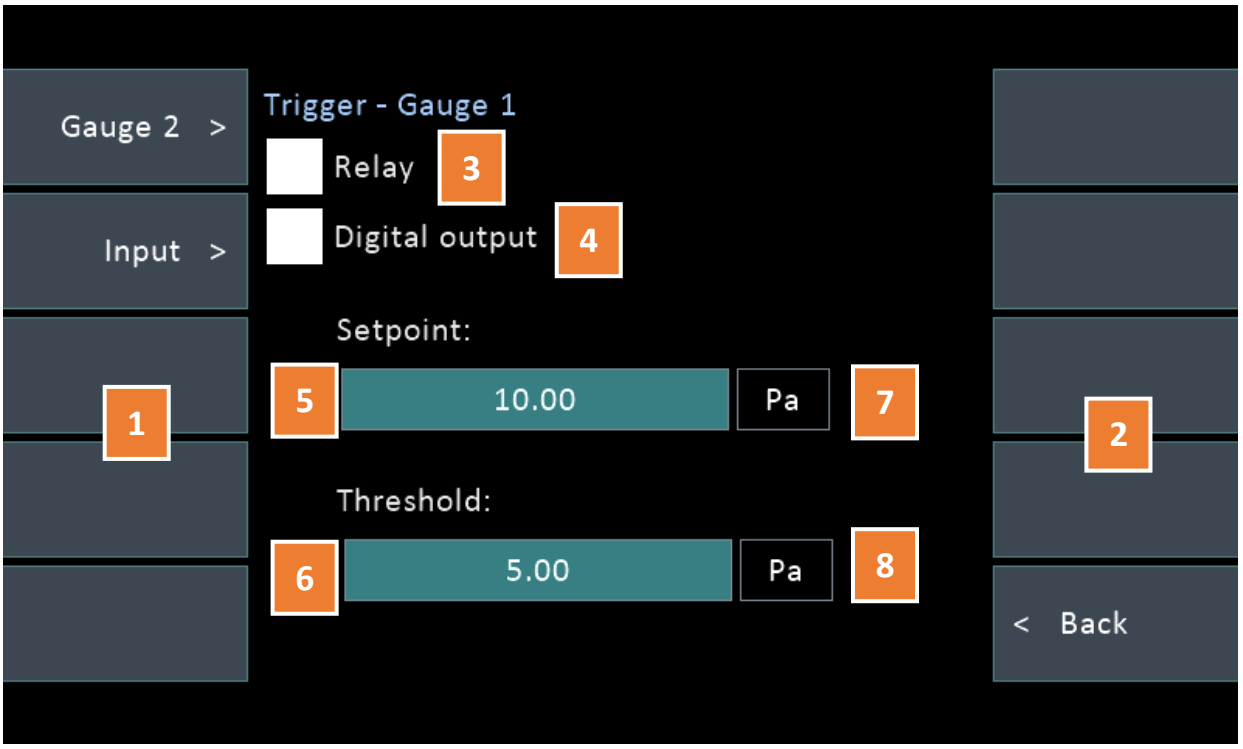
1	Left Menu
2	Right Menu
3	Network info (connection to Wireless Network)
4	Enable / disable Wi-Fi connection
5	Network info (UDP port, IP addresses) ▪ Available for manual entry
6	Enable / disable DHCP assignment

Switching function

The VPR 21 has a switching function with adjustable setpoint and threshold for digital outputs and relays.



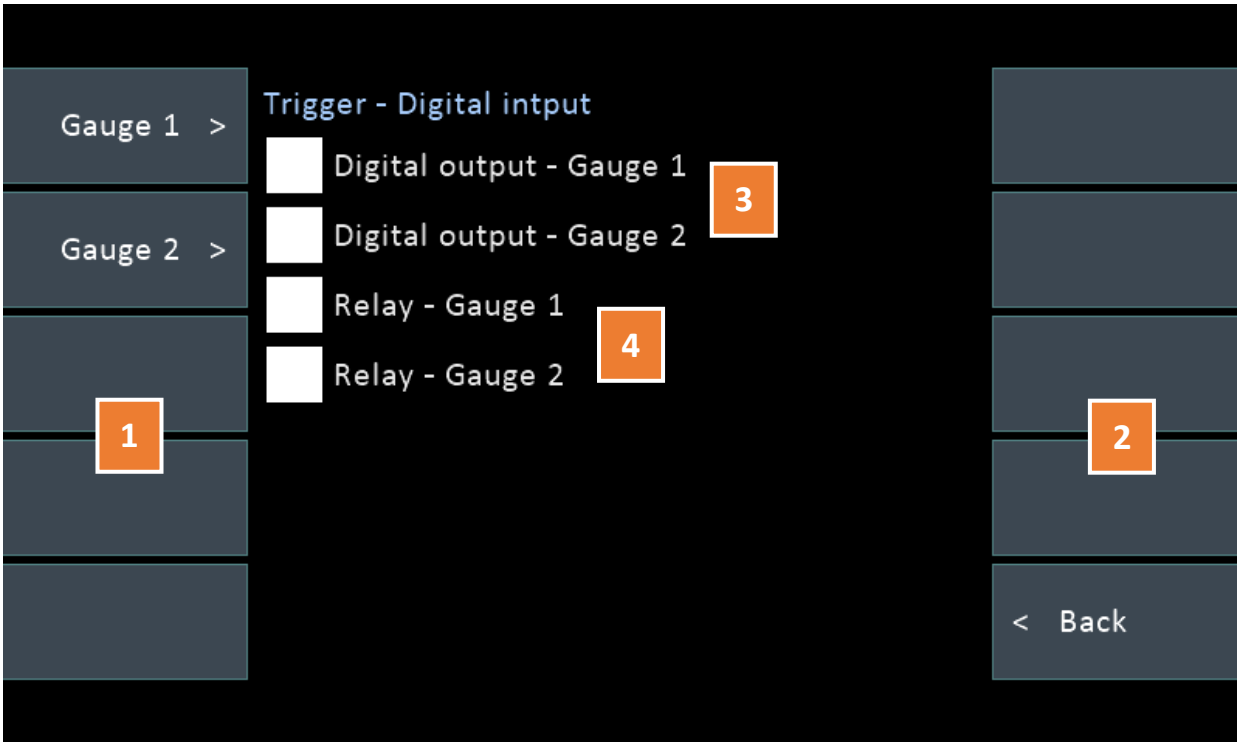
Following screen is shown when I/O menu is selected. The setpoint and threshold pressure can be set within 0,05 – 30000 Pa (0,0005 – 300 mbar) and threshold value must be less than setpoint value. Wrong input is signaled by red color. These values are also shown in measurement mode screen (→ page 12).



1	Left Menu
2	Right Menu
3	Enable / disable relay switching
4	Enable / disable digital output switching
5	Setpoint pressure
6	Threshold pressure
7	Selected units (→ page 12)
8	Selected units (→ page 12)

Digital Input

The VPR 21 can be configured to switch digital outputs or relays when digital input changes its state.

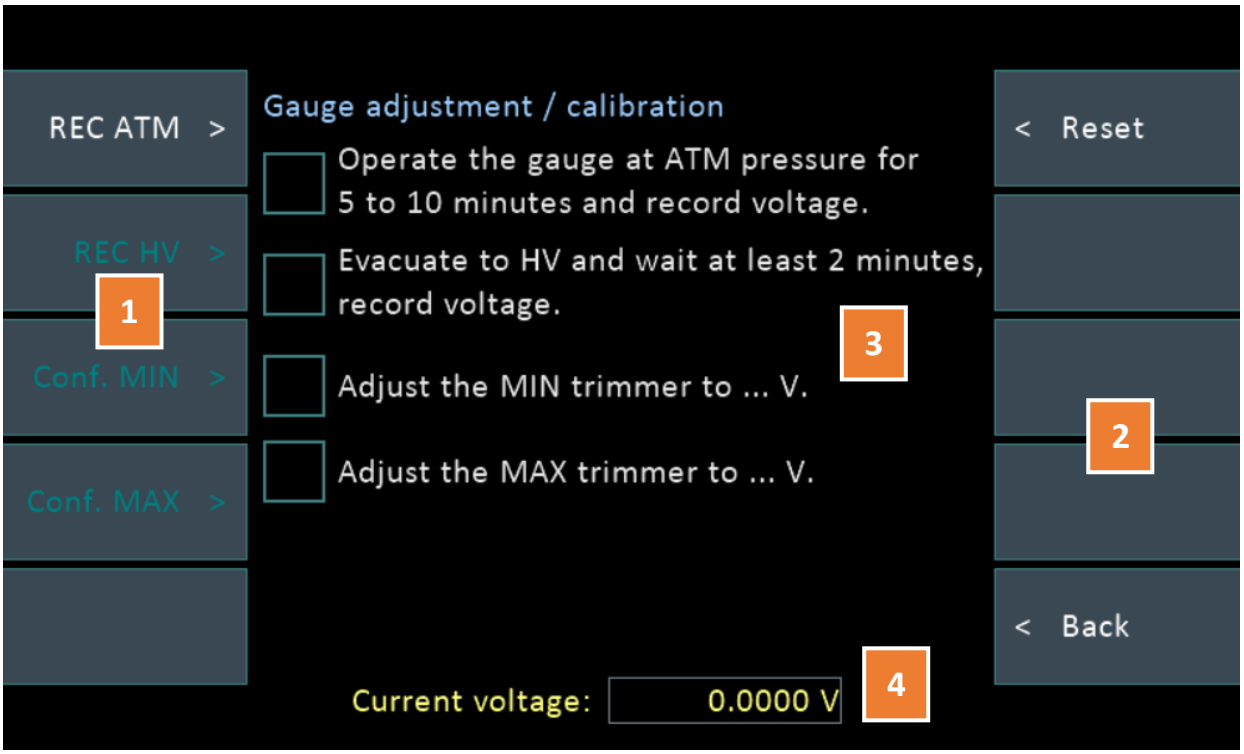


1	Left Menu
2	Right Menu
3	Enable / disable digital outputs switching when digital input is HIGH
4	Enable / disable relays switching when digital input is HIGH

Calibration Wizard

The VPR 21 has a calibration wizard for regular calibration of gauges.

Calibrated gauge must be connected to channel Gauge 1.



1	Left Menu
2	Right Menu
3	Steps / instructions of calibration process
4	Current voltage of Gauge 1 (calibrated gauge)

Calibration

The calibration process is described in manual for Pirani Gauge VPR 21/20.

Follow the instructions of Calibration Wizard to complete the calibration successfully.

Device Update

The VPR 21 periodically checks for updates after Internet connection was established. A notification on Settings screen is showed when an update is available. The update can be installed by pressing Update button.

Serial Interface

The VPR 21 can be connected to PC via USB interface and communication is processing via VPR21 Datagram where Data Payload is transmitted (→ Communication Protocol).

Designation	**Value**
HW Interface	COM
Baud rate	115200 Baud

Communication Protocol

The VPR 21 device uses User Datagram Protocol (UDP) as a transport layer protocol that provides a simple communication service for transmitting datagrams in IP networks. A UDP datagram consists of a datagram header followed by the payload. The UDP datagram header consists of 4 fields, each of which is 2 bytes (16 bits).

Data Payload

Standard payload is composed of several nodes.

Common nodes

Key	Description	Value (ASCII)
SN	Serial number *	254100-X
SEP	Separator	;
UM	Unit of measure	0 = Pa, 1 = mbar
RSP	Response	OK = success, NOK = syntax error

* Serial number of the device can be obtained on Settings screen (→ page 14)

Connection check

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Connection check	00

Transmitted message (device to PC):

SN	SEP	RSP

Obtain a pressure from Gauge 1

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Obtain pressure from Gauge 1	01

Transmitted message (device to PC):

SN	SEP	UM	SEP	P

Key	Description	Value (ASCII)
P	Pressure	Number (float)

Obtain a pressure from Gauge 2

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Obtain pressure from Gauge 2	02

Transmitted message (device to PC):

SN	SEP	UM	SEP	P

Key	Description	Value (ASCII)
P	Pressure	Number (float)

Setting a setpoint for Gauge 1

Received message (PC to device):

SN	SEP	CMD	SEP	UM	SEP	SP	SEP	TR

Key	Description	Value (ASCII)
CMD	Command: Set a setpoint for Gauge 1	03
SP	Setpoint *	Number (float)
TR	Threshold **	Number (float)

* Setpoint pressure must be within 0,05 – 30000 Pa (0,0005 – 300 mbar)

** Threshold pressure must be within 0,05 – 30000 Pa (0,0005 – 300 mbar) and must be less than Setpoint pressure

Transmitted message (device to PC):

SN	SEP	RSP

Setting a setpoint for Gauge 2

Received message (PC to device):

SN	SEP	CMD	SEP	UM	SEP	SP	SEP	TR

Key	Description	Value (ASCII)
CMD	Command: Set a setpoint for Gauge 2	04
SP	Setpoint *	Number (float)
TR	Threshold **	Number (float)

* Setpoint pressure must be within 0,05 – 30000 Pa (0,0005 – 300 mbar)

** Threshold pressure must be within 0,05 – 30000 Pa (0,0005 – 300 mbar) and must be less than Setpoint pressure

Transmitted message (device to PC):

SN	SEP	RSP

Obtain a switching state of relay for Gauge 1

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Obtain a switching state of relay for Gauge 1	05

Transmitted message (device to PC):

SN	SEP	R1

Key	Description	Value (ASCII)
R1	Switching state of a relay for Gauge 1	0 = not switched (open), 1 = switched (closed)

Obtain a switching state of relay for Gauge 2

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Obtain a switching state of relay for Gauge 2	06

Transmitted message (device to PC):

SN	SEP	R2

Key	Description	Value (ASCII)
R2	Switching state of a relay for Gauge 2	0 = not switched (open), 1 = switched (closed)

Obtain a switching state of digital output for Gauge 1

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Obtain a switching state of digital output for Gauge 1	07

Transmitted message (device to PC):

SN	SEP	O1

Key	Description	Value (ASCII)
O1	Switching state of a digital output for Gauge 1	0 = not switched (LOW), 1 = switched (HIGH)

Obtain a switching state of digital output for Gauge 2

Received message (PC to device):

SN	SEP	CMD

Key	Description	Value (ASCII)
CMD	Command: Obtain a switching state of digital output for Gauge 2	08

Transmitted message (device to PC):

SN	SEP	O2

Key	Description	Value (ASCII)
O2	Switching state of a digital output for Gauge 2	0 = not switched (LOW), 1 = switched (HIGH)

Switch a relay for Gauge 1

Received message (PC to device):

SN	SEP	CMD	SEP	SW

Key	Description	Value (ASCII)
CMD	Command: Switch a relay for Gauge 1	09
SW	Switching state	0 = not switched (open), 1 = switched (closed)

Transmitted message (device to PC):

SN	SEP	RSP

Switch a relay for Gauge 2

Received message (PC to device):

SN	SEP	CMD	SEP	SW

Key	Description	Value (ASCII)
CMD	Command: Switch a relay for Gauge 2	10
SW	Switching state	0 = not switched (open), 1 = switched (closed)

Transmitted message (device to PC):

SN	SEP	RSP

Switch a digital output for Gauge 1

Received message (PC to device):

SN	SEP	CMD	SEP	SW

Key	Description	Value (ASCII)
CMD	Command: Switch a digital output for Gauge 1	11
SW	Switching state	0 = not switched (LOW), 1 = switched (HIGH)

Transmitted message (device to PC):

SN	SEP	RSP

Switch a digital output for Gauge 2

Received message (PC to device):

SN	SEP	CMD	SEP	SW

Key	Description	Value (ASCII)
CMD	Command: Switch a digital output for Gauge 2	12
SW	Switching state	0 = not switched (LOW), 1 = switched (HIGH)

Transmitted message (device to PC):

SN	SEP	RSP

Maintenance

The product requires no maintenance.

Cleaning the device

For cleaning the outside of the VPR 21, a slightly moist cloth will usually do. Do not use any aggressive or scouring cleaning agents.

DANGER: Mains voltage
Contact with live parts is extremely hazardous when any liquids penetrate into the unit.
Make sure no liquids penetrate into the equipment.

Troubleshooting

The system error messages are signaled on bottom of measurement mode screen.

Sensor errors are signaled in channel sections (→ page 12).

Repair

Please contact LAVAT service center at info@lavat.cz.

LAVAT assumes no liability and the warranty becomes null and void if repair work is carried out by the end-user or third parties.

Storage

Electronic component
Inappropriate storage (static electricity, humidity, etc.) can damage electronic components.