

KLAROconnect Operating manual

We provide clear water



Direct access
to the plant data



Operational safety
for the wastewater
treatment plant

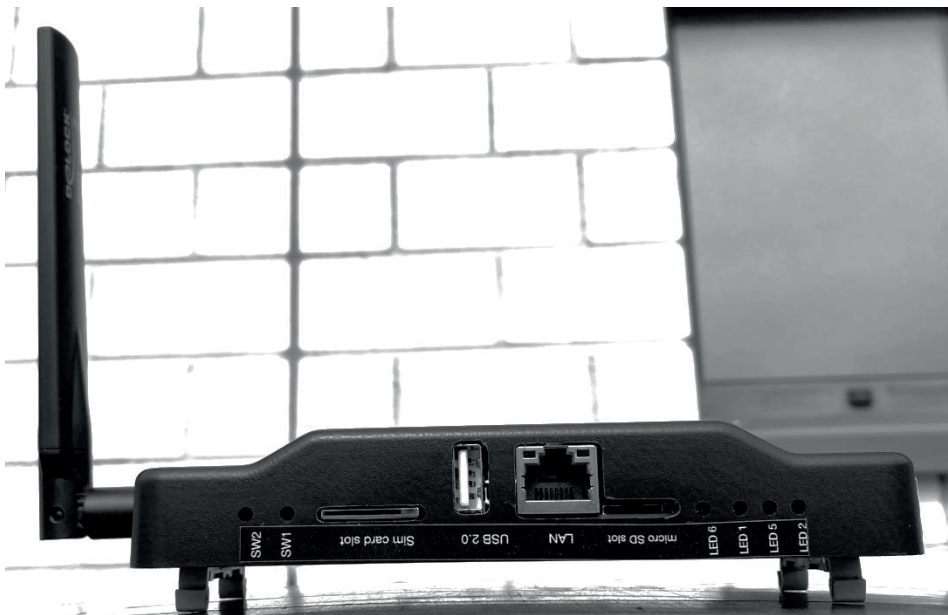


4G
LAN

317-EN-0622



Original operating instructions Communication module KLAROcon- nect



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IMPORTANT:

- These operating instructions contain information on the installation of electrical components and must therefore be read before mounting and commissioning the set!
- All safety instructions must be observed!
- Keep for future use.

1 About these operating instructions

These operating instructions are part of the product and must be read before the unit is put into operation. The operating instructions must be kept for the entire service life of the system and must be available for reference.

1.1 Original language of the documentary

This documentation was originally written in German.

1.2 Copyright

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1.3 Completeness

These instructions have been prepared with due care. Any liability of the manufacturer due to incorrect or missing information as well as linguistic deficiencies or typographical errors in the documentation is excluded. Should you find any incompleteness and/or errors, please inform us at the above address.

In preparing these instructions, care was taken to ensure that the facts stated therein correspond as closely as possible to the associated system. Nevertheless, all technical data, dimensions and illustrations in these instructions are non-binding. Possible claims regarding the specific design of a system cannot be derived from them.

We reserve the right to make changes to a system within the scope of improvements and further developments without changing these instructions. An obligation to install modified technology in already completed and delivered systems cannot be derived from this.

This documentation is updated regularly.

1.4 Responsibility

Any responsibility of the manufacturer does not apply:

- non-observance or insufficient use of the information in this manual,
- Use of spare parts or parts on the system that have not been approved by KLARO GmbH,
- Removal, manipulation or bypassing of protective devices,
- unauthorised changes to the system,
- improper execution of maintenance and replacement of spare parts.

Unauthorised modifications to the system or operation of the system outside the specifications provided by the manufacturer will invalidate any warranty claims.

2 Abbreviations

SIM	Subscriber Identity Module
PLC (English PLC)	Programmable Logic Controller (PLC)
RS232	Recommended Standard 232
ISM	Industrial, Scientific and Medical
URI	Uniform Resource Identifier
SCADA	Supervisory control and data acquisition
HTTP	Hypertext Transfer Protocol
JSON	Java Script Object Notation
WI	Web interface
GUI	Graphical User Interface
APN	Access Point Name
M2M	Machine to Machine
IoT	Internet of Things
MAC	Media Access Control
QR	Quick Response

3 Product description

3.1 System description

KLAROconnect is used for communication between the wastewater treatment plant and the KLARO WebMonitor. KLARO WebMonitor offers the possibility of remote monitoring, remote maintenance and remote control of the wastewater treatment plant from a distance using a smartphone or computer via the internet. You can find more information about this at <https://klaro-webmonitor.de/>. Via KLAROconnect, all operation-relevant data such as settings, events and operating hour meter readings of the KLAROcontrol.S and KLAROcontrol. M are transmitted to the KLARO WebMonitor.

KLAROconnect combines a 4G module and a LAN adapter. The enclosed antenna covers the frequency ranges 790 - 960 MHz, 1710 - 2170 MHz, 2570 - 2620 MHz. You will find more detailed information in the appendix to these operating instructions.

KLAROconnect is specifically optimised for M2M and IoT applications, delivering maximum data rates of up to 10 Mbps downlink and 5 Mbps uplink. KLAROconnect (SIM) is backward compatible with existing EDGE and GSM/GPRS networks, ensuring that it can connect in remote areas without 4G or 3G coverage.

The power connection is made directly to the control unit via the data cable included in the scope of delivery (art. no.: 982223). In the event of a power failure, KLAROconnect no longer works. Data transmission between KLAROconnect and the control is also carried out via the data cable.

The status of KLAROconnect is displayed via control LEDs.

A Velcro strap is supplied as standard for attachment.

3.2 Scope of delivery

970716 Additional package KLAROconnect indoor antenna I-cabinet PP, A-cabinet PP

970717 Additional package KLAROconnect indoor antennal-cabinet1/2/3, A-cabinet4/5, M-technology

970718 Additional package KLAROconnect indoor antenna A-Uni. / -pillar

970719 Additional package KLAROconnect external aerialA-cabinet3/4/5/uni / column

Article	Quantity	Designation	970716	970717	970718	970719
901471	1 STK	KLAROconnect	●	●	●	●
982223	1 STK	Data cable	●	●	●	●
901474	1 STK	LTE indoor antenna	●	●	●	●
901476	1 STK	LTE outdoor antenna	○	○	○	●
980194	10 CM	Velcro tape	●	●	●	●
901475	1 STK	Ethernet extension cable	●	○	○	○
980314	1 STK	Cable gland M16	○	●	○	●
980311	1 STK	Locknut M16	○	●	○	●

- Included in the scope of delivery
- not included in the scope of delivery

The following is a pictorial representation of components from the KLARO WebMonitor® packages (Velcro tape, cable gland and locknut are not shown).



Illustration 901474 LTE indoor antenna with tilt joint (always included as standard)



Picture 2901476 LTE outdoor antenna SMA 4G



Illustration 3901475 Ethernet extension cable FTP Cat6 right-angled 0.5m (as standard for I-cabinet PP)



Illustration 4982223 Data cable KLAROconnect KLAROcontrol.S/M

3.3 Mounting KLAROconnect

3.3.1 Velcro fastening



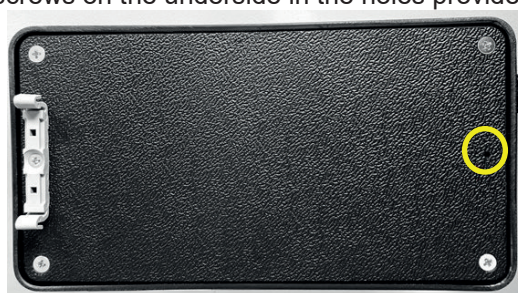
The Velcro tape included with the KLAROconnect is used to mount the communication module.

Note: The glued areas must be made dust-free before applying the Velcro tape.



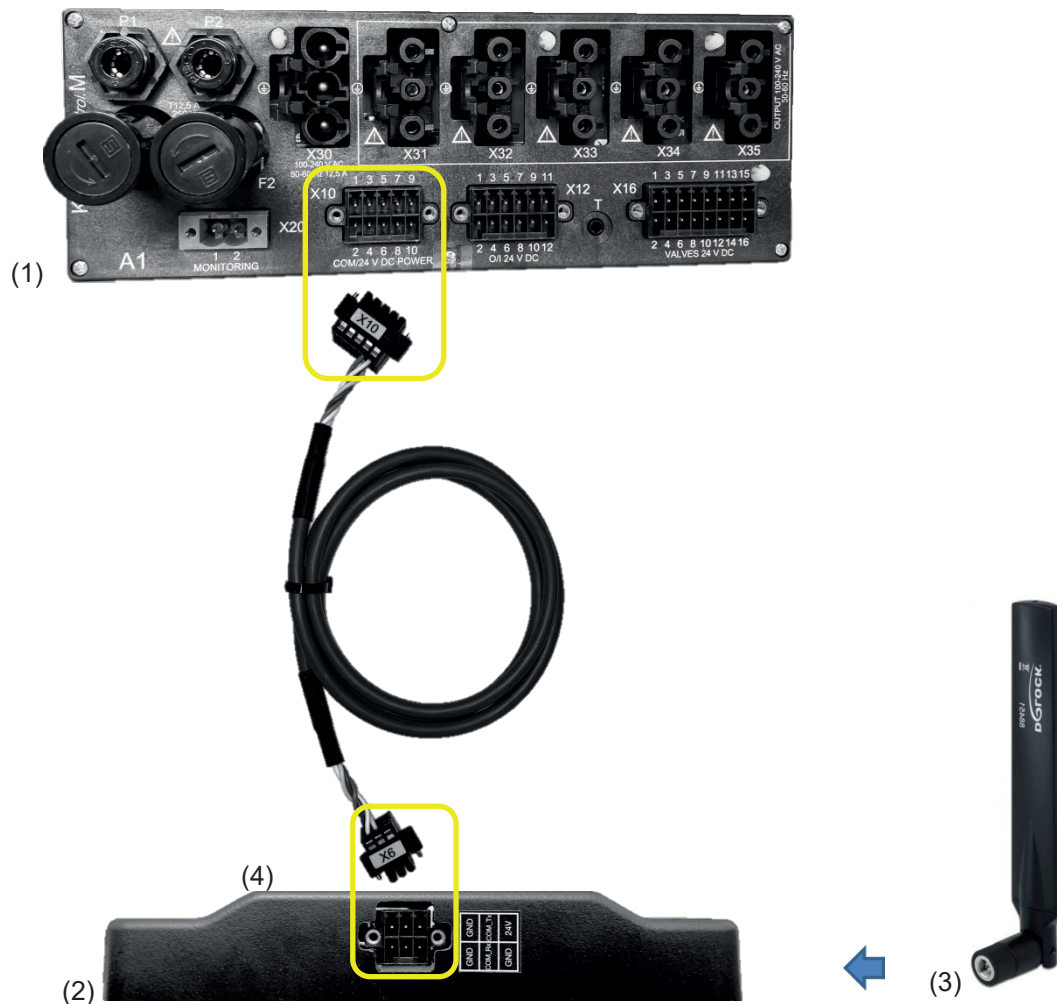
3.3.2 Mounting adapter (available from WAGO)

The KLAROconnect can be mounted on a DIN 35 rail using two mounting feet (WAGO 209-123). To do this, the mounting feet are mounted with the screws on the underside in the holes provided.



Basic connection diagram

- (1) Control unit KLAROcontrol.M or KLAROcontrol.S
- (2) KLAROconnect (communication module)
- (3) Antenna
- (4) Data cable (serial cable + power supply)



4 Commissioning

In the LAN adapter operating mode, the chapters 4.1 and 4.2 can be skipped.

4.1 Antenna

The antenna must be connected to the antenna socket of the KLAROconnect by means of a screw connection. The antenna must be positioned in such a way that reliable reception is possible. You can check the reception quality on site by trying out the SIM card in a mobile phone or smartphone beforehand.

4.2 Mini SIM card

For operation as a 4G module (modem), a valid mini SIM card must be present in the KLAROconnect:

- Mini SIM card format
- Recommended data volume per month >500MB
- The SIM card must be able to transmit M2M
- Deactivate the PIN (to do this, -insert the SIM card -into a mobile phone and deactivate the PIN request under the menu item "Security").

When the KLAROconnect is switched off (the LEDs are off), insert the SIM card into the device (see also chapter 5.3.1).

4.3 Switch on KLAROconnect

After the card has been inserted, KLAROconnect can be connected to the power supply (switch on KLAROcontrol).

The connection with KLAROcontrol is fully automatic. A WEB symbol appears in the KLAROcontrol display . KLAROconnect needs up to 8 minutes to start up completely.

After successful authentication, LED6 flashes with interval 100ms on, 100ms off, 100ms on, 700ms off. If a SIM card is used, LED5 flashes with an interval of 1800ms on, 200ms off. The KLAROconnect is now ready for communication.

If there is no signal changeover, this can have several causes:

Operating mode LAN connection

1. No internet
2. Firewall upstream
3. Missing or incorrect configuration of the KLAROconnect
4. Faulty contacting of the plug connections

Operating mode SIM connection

1. SIM card is not released
2. No mobile phone reception
3. Missing or incorrect configuration of the KLAROconnect
4. Faulty contacting of the plug connections

4.4 Control configuration

No settings need to be made in the control unit.

4.5 Create attachment in WebMonitor

After a successful connection has been established, the system can be created in the WebMonitor.

<https://klaro-webmonitor.de>

5 Interface description

The KLAROconnect has the following connections, operating elements and displays:

- X6 connector 6-pin (male) for power supply and RS232
- SMA antenna connector (female) for LTE antenna
- SW2 - Button (without function)
- SW1 - button
- Mini SIM card slot
- USB 2.0 (without function)
- LAN Ethernet connection RJ45
- Micro SD card slot
- LED6 Display
- LED1 Display (without function)
- LED5 Display
- LED2 Display (without function)

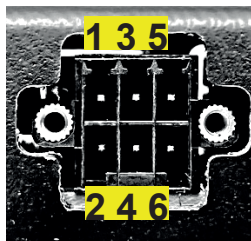


Figure 5: Interface overview

5.1 Electrical interfaces

5.1.1 Power supply and serial interface (-X6)

The power connection is made via the data cable included in the scope of delivery (art. no.: 982223). Data transmission between KLAROconnect and the KLAROcontrol.S or *KLAROCotrol. M* control unit is made via the X6 connection.



Pin #1	Pin #3	Pin #5
GND	COM_Tx	24V
GND	COM_Rx	GND
Pin #2	Pin #4	Pin #6

Figure 6 Power connection and serial interface -X6, assignment 6-pin WAGO 713-1423/107-000

5.1.2 USB 2.0

Connection: USB 2.0 Type A
Has no function.

5.1.3 LAN Ethernet connection

Connection: RJ45

Both control LEDs serve as a practical means of determining the operating mode of the LAN transceiver.

The LED1 (right) indicates the status of the transmission. If this LED1 flashes or flickers, then data is being transmitted.

LED2 (left) lights up when there is a connection to a network.

LED1 is the right-hand LED, LED2 the left-hand LED in the picture.

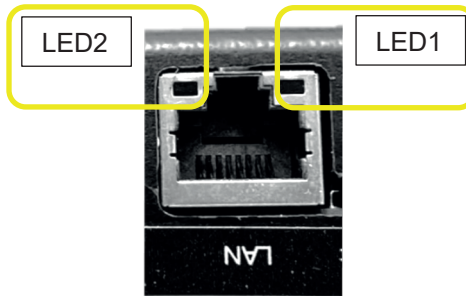


Figure 7 LAN connection

5.1.4 SMA antenna connection

Connection: SMA

The antenna should be screwed on hand-tight without tools. Please only use the LTE antenna included in the scope of delivery, other antennas may only be used after consultation with KLARO.

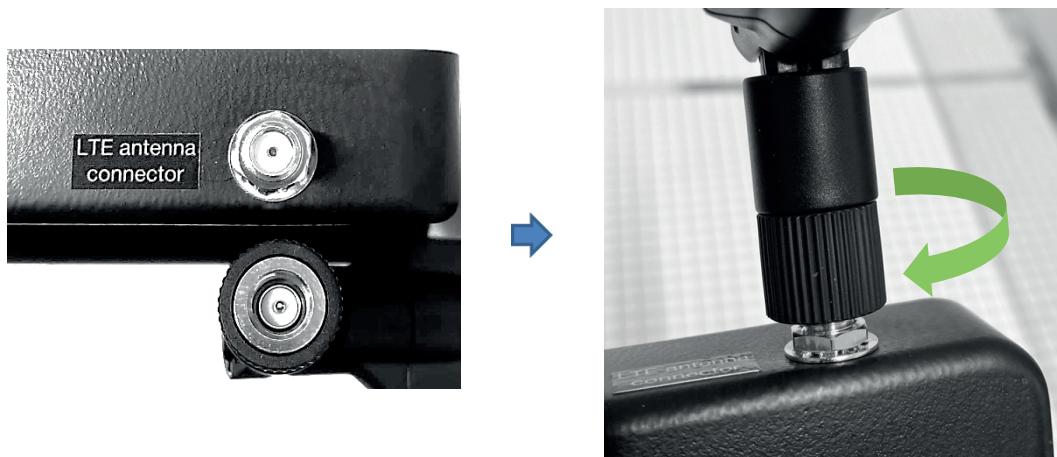


Figure 8: Attach the LTE antenna

5.2 Operating elements

5.2.1 SW1 - Reset button

SW1 is a reset button. It can be used to restart KLAROconnect. The button can be pressed with a fine tool or a biro refill.



Illustration 9 Press SW1

5.2.2 SW2 - Reset button

Without function.

5.3 Card slots

5.3.1 Mini-SIM- card slot

The SIM card slot is intended for mini-SIM.

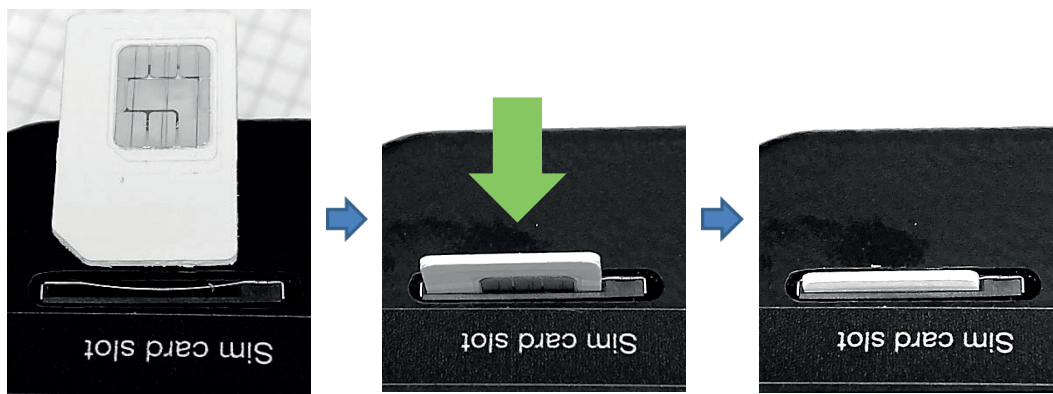


Figure 10 Insert the mini SIM card into the KLAROconnect.

Removing and inserting the SIM card during operation requires initialisation of the KLAROconnect software. Therefore, the KLAROconnect must be restarted after reinserting the SIM card. To do this, it is only necessary to de-energise KLAROconnect for approx. 5 seconds.



No liability is accepted for the loss of data due to the removal of the SIM card during operation. No liability is assumed for the correct initialisation of the KLAROconnect after reinserting a SIM card that was removed during operation.

5.3.2 Micro SD card slot

The micro SD card slot is for micro SD.

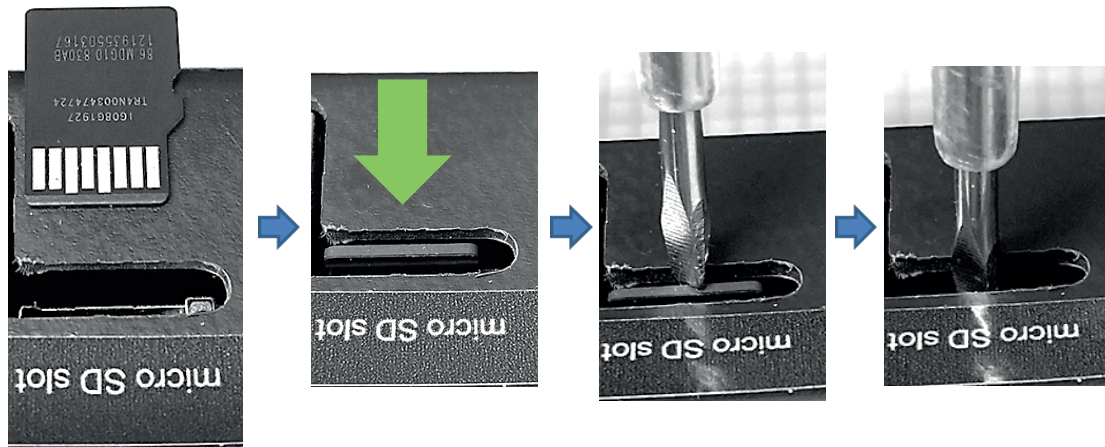


Figure 11 Inserting a micro SD card into KLAROconnect

5.4 Optical displays

5.4.1 LED6

LED 6 indicates the function of the communication module. There are the switching states ON and OFF. In the ON state, LED6 lights up green.

- Interval 100ms on, 100ms on, 800ms off: normal function
- In the event of a reset or similar, the LED lights up continuously for a few seconds or is continuously off.

5.4.2 LED5

LED 5 indicates the mobile radio connection of the communication module. There are the switching states ON and OFF. In the ON state, LED5 lights up green.

- Interval 200ms on, 1800ms off: no connection
- Interval 1800ms on, 200ms off: Connection present

6 Connecting the KLAROconnect to a computer

To connect the KLAROconnect to a computer, a router and an Ethernet cable are required.

1. Connect KLAROconnect (X6) and KLAROcontrol (X10) with a data cable (art.no.: 982223).
2. Connect KLAROconnect and computer to the router (LAN interface) using an Ethernet cable (RJ45).
3. Insert the SIM card into KLAROconnect. Unlock the PIN of the SIM card beforehand, e.g. by mobile phone or smartphone.
4. Establish power supply.

6.1 KLAROconnect Configuration

Entering <http://klaro.local> in the address bar of the Internet browser calls up the KLAROconnect menu. KLAROconnect menu can also be called up alternatively via the assigned IP in the DHCP server of the router.

6.2 SIM profile configuration

- A SIM card profile with details of the APN of the provider can be created via the graphical user interface (GUI).
- If the profile does not appear in the list after the new creation, reload the page with the F5 key.
- A profile can be connected, disconnected and deleted.
- *With the autoconnect option*, the created profile is automatically used to establish the connection when starting.
- The fastest available mobile radio standard is automatically used.

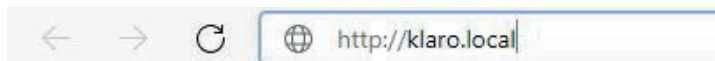
The APN depends on the provider of the SIM card and the purpose of use. APN is required for Machine to Machine (M2M) use.

Example:

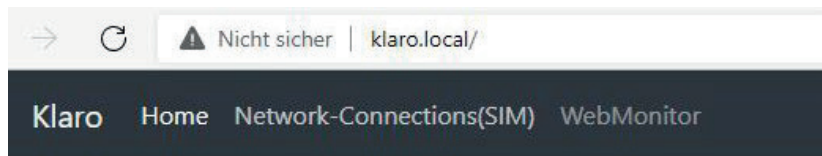
Olivia	Telecom
Connection-Name: * Olivia	Connection-Name: * Telekom
Number: placeholder	Number: placeholder
User: Username	User: t-mobile
Password: Password	Password: tm
Advanced	Advanced
APN: * rh	APN: * internet.t-mobile
NetworkID: placeholder	NetworkID: placeholder
PIN: PIN	PIN: PIN
☒ autoconnect	☒ autoconnect

6.2.1 Instructions SIM profile configuration

1. Call up the KLAROconnect menu via the graphical user interface.



2. Select the menu item "Network-Connections(SIM)"



Welcome

3. Delete old SIM profiles. To do this, select "Connection profiles" (tick) and delete with the "Delete" button. To update the display on the screen, press the F5 key. Then create a new profile with the "Add" button.

SIM-Profil Konfiguration

Connection-Profile

	CON-Name	Interface-Name	APN	Password
☒	mobile-Objcobytel	cdc-wdm0	Objcobytel.com	-
☐	testing	cdc-wdm0	internet.t-mobile	-

4. A new window "Mobile broadband" opens. The connection name can be freely assigned. The fields "Connection name" and "APN" must be filled in and are therefore marked with *. The entries for the User, Password and APN fields are specified by the provider of the SIM card.

Mobile broadband ×

Basic

Connection-Name: *

Number:

User:

Password:

Advanced

APN: *

NetworkID:

PIN:

☐ autoconnect

5. Describe the fields accordingly and activate "autoconnect".

Mobile broadband
×

Basic

Connection-Name: *

Number:

User:

Password:

Advanced

APN: *

NetworkID:

PIN:

☒ autoconnect

Add
Close

6. Press the "Add" button to save the settings. If the settings are successfully saved, a text with a green background appears. If the text appears with a red background, the attempt was not successful and the procedure must be repeated as described in the instructions. Then close the window with the Close or X button.

Mobile broadband
×

Basic

Connection-Name: *

Number:

User:

Password:

Advanced

APN: *

NetworkID:

PIN:

☒ autoconnect

Profil erstellt: Telekom t-mobile tm inernet.t-mobile

Add
Close

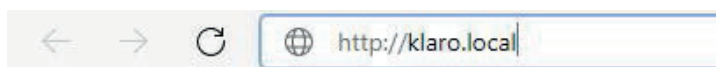
7. If no further configuration is required, the internet browser can be closed. Logging off is not necessary. In the further course, disconnect KLAROconnect and KLAROcontrol from the power supply. In the next step, carry out the commissioning (chapter 4).

6.3 Websocket URI

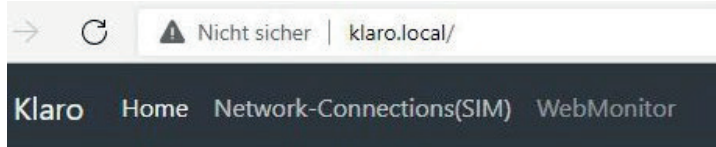
- Websocket client URI to connect to the WebMonitor can be set via the graphical user interface:
 Server Germany: ws://188.174.236.242:4000
 Server France: ws://193.248.238.194:4000
 Server Australia: ws://119.225.139.2:4000
- Websocket URI can be changed via the graphical user interface and is directly active.
- KLAROconnect forwards the defined messages (JSON) from the WebMonitor server to the KLAROcontrol (if the connection is established).
- Responses from the KLAROcontrol are passed on to the WebMonitor via the KLAROconnect using the websocket (ws://).

6.3.1 Websocket URI Configuration Guide

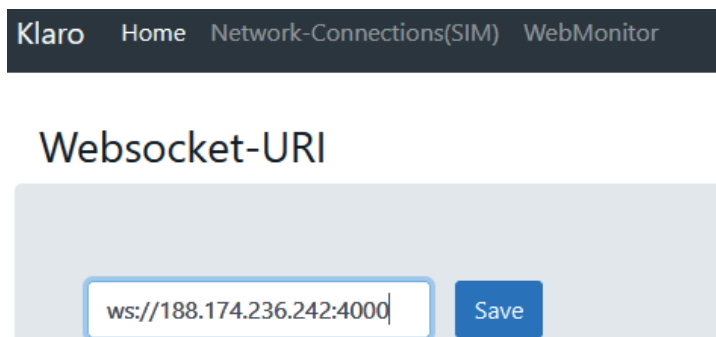
1. Call up the KLAROconnect menu via the graphical user interface.



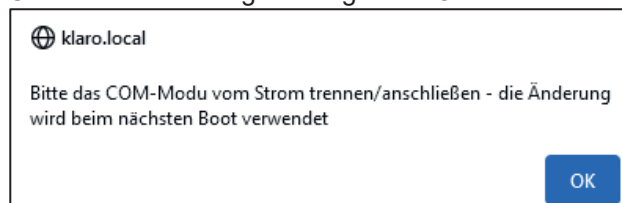
2. Select the menu item "WebMonitor"



3. Enter the URI, e.g. for the use of the KLARO WebMonitor Germany `ws://188.174.236.242:4000`, into the websocket field and save it with the "Save" button.



4. Confirm the following message with OK.



5. If no further configuration is required, the internet browser can be closed. Logging off is not necessary. In the further course, disconnect KLAROconnect and KLAROcontrol from the power supply. In the next step, carry out the commissioning (chapter 4).

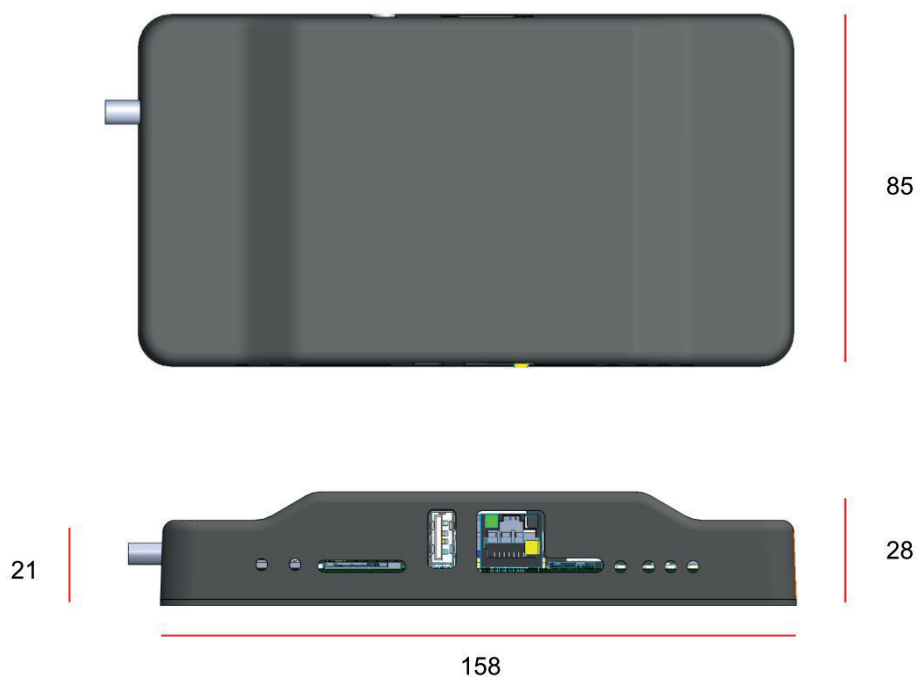
7 Software update via micro SD card

The software update for KLAROconnect can be made using a micro SD card with an image.

1. Flash the KLAROconnect image onto a micro SD card of at least 4GB using balenaEtcher.
2. Disconnect KLAROconnect and KLAROcontrol from the power supply.
3. Insert the micro SD card into KLAROconnect (see chapter 5.3.1).
4. Connect KLAROconnect to the KLAROcontrol and to the power supply.
5. Firmware is automatically installed from the micro SD card. (The process takes approx. 7 to 10 minutes).
6. After the process is completed, KLAROconnect switches off automatically. (Green power LED goes off).
7. Disconnect KLAROconnect and the KLAROcontrol from the power supply.
8. Remove the micro SD card.
9. Connect KLAROconnect to the KLAROcontrol and to the power supply.
10. KLAROconnect starts (web interface accessible via LAN on <http://klaro.local>).
11. Check SIM card configuration and re-create if necessary (chapter 7.3).
12. The arrows in the web symbol  in the KLAROcontrol flash at intervals of approx. 10 seconds after the connection is established.

8 Appendix

8.1 Dimensions KLAROconnect



8.2 Technical data KLAROconnect

- 4G Module Quectel EG21-G Mini PCIe
- Input voltage range: 24 V
- Operating temperature: -30°C to +85°C
- Dimensions: approx. 158 x 85 x 28 mm
- Weight: 170 g
- Interfaces: Power supply, SIM card reader, microSD, USB, SMA antenna connector (male), RS232 (V.24/V.28 on SUB-D)

Frequency Bands

EG21-G Mini PCIe:

LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B12/B13/B18/B19/B20/B25/B26/B28

LTE-TDD: B38/B39/B40/B41

WCDMA: B1/B2/B4/B5/B6/B8/B19

GSM: B2/B3/B5/B8

Voice

Speech Codec Modes:

HR/FR/EFR/AMR/AMR-WB

Echo Arithmetic:

Echo Cancellation/Noise Suppression

Audio:

Digital Audio and VoLTE (Voice over LTE) (Optional)

Electrical Characteristics

Output Power:

Class 3 (23 dBm $\pm$ 2 dB) for LTE-FDD bands

Class 3 (23 dBm $\pm$ 2 dB) for LTE-TDD bands

Class 3 (24 dBm $\pm$ 1/-3 dB) for WCDMA bands

Data

LTE:

LTE-FDD: **Max. 10 Mbps (DL)/Max. 5 Mbps (UL)**

LTE-TDD: Max. 8.96 Mbps (DL)/
Max. 3.1 Mbps (UL)

UMTS:

HSDPA: Max. 42 Mbps (DL)

HSUPA: Max. 5.76 Mbps (UL)

WCDMA: Max. 384 kbps (DL)/Max. 384 kbps (UL)

GSM:

EDGE: Max. 296 kbps (DL)/Max. 236.8 kbps (UL)

GPRS: Max. 107 kbps (DL)/Max. 85.6 kbps (UL)

Approvals

Carrier:

Deutsche Telekom (Europe)

Verizon*/AT&T*/T-Mobile*/Sprint* /

U.S. Cellular* (America)

Class E2 (27 dBm $\pm$ 3 dB) for GSM850 8-PSK
Class E2 (27 dBm $\pm$ 3 dB) for EGSM900 8-PSK
Class E2 (26 dBm $\pm$ 3 dB) for DCS1800 8-PSK
Class E2 (26 dBm $\pm$ 3 dB) for PCS1900 8-PSK
Class 4 (33 dBm $\pm$ 2 dB) for GSM850
Class 4 (33 dBm $\pm$ 2 dB) for EGSM900
Class 1 (30 dBm $\pm$ 2 dB) for DCS1800
Class 1 (30 dBm $\pm$ 2 dB) for PCS1900
Consumption:
2.8 mA @Sleep, Typ.
35 mA @Idle
Sensitivity:
LTE B1: -99.5 dBm (10 MHz)
LTE B2: -99.9 dBm (10 MHz)
LTE B3: -99.7 dBm (10 MHz)
LTE B4: -99.7 dBm (10 MHz)
LTE B5: -99.9 dBm (10 MHz)
LTE B7: -99.2 dBm (10 MHz)
LTE B8: -99.8 dBm (10 MHz)
LTE B12: -99.8 dBm (10 MHz)
LTE B13: -99.5 dBm (10 MHz)
LTE B18: -100 dBm (10 MHz)
LTE B19: -99.9 dBm (10 MHz)
LTE B20: -99.8 dBm (10 MHz)
LTE B25: -100 dBm (10 MHz)
LTE B26: -99.5 dBm (10 MHz)
LTE B28: -99.6 dBm (10 MHz)
LTE B38: -98 dBm (10 MHz)
LTE B39: -99.5 dBm (10 MHz)
LTE B40: -99.2 dBm (10 MHz)
LTE B41: -97.5 dBm (10 MHz)
WCDMA B1: -109.2 dBm
WCDMA B2: -110 dBm
WCDMA B4: -109.7 dBm
WCDMA B5: -110.4 dBm
WCDMA B6: -110.5 dBm
WCDMA B8: -110.5 dBm
WCDMA B19: -110.1 dBm
GSM850: -108 dBm
EGSM900: -108 dBm
DCS1800: -107.5 dBm
PCS1900: -107.5 dBm

Telus* (Canada)
Regulatory:
GCF (Global)
CE (Europe)
PTCRB (North America)
FCC (America)
IC (Canada)
Anatel (Brazil)
IFETEL (Mexico)
NCC (Taiwan, China)
JATE/TELEC (Japan)
RCM (Australia)
ICASA (South Africa)
Others:
RoHS
WHQL

* Under Development

8.3 LTE indoor antenna



Specification:

- Connectors: SMA connector
- Frequency range:
 - 790 - 960 MHz
 - 1710 - 2170 MHz
 - 2570 - 2620 MHz
- Antenna gain:
 - 1.0 - 3.5 dBi @ 790 - 960 MHz
 - 2.0 - 4.0 dBi @ 1710 - 2170 MHz
 - 3.0 - 4.0 dBi @ 2570 - 2620 MHz
- Impedance: 50 Ohm
- Polarisation: linear, vertical
- VSWR: 4.0
- Operating temperature: -10 °C ~ 55 °C
- Housing material: ABS
- Colour: black
- Length:
 - approx. 163.10 mm (with tilt joint)
 - approx. 137.00 mm (without tilt joint)
- Diameter:
 - approx. 19.60 mm (tip)
 - approx. 21.60 mm (max.)
 - approx. 13.50 mm (SMA)

8.4 LTE outdoor antenna



Specification:

- LTE Band: 1-10; 12-20; 23; 25-30; 33-41; 44
- Frequency ranges: 694 - 960 MHz, 1710 - 2700 Mhz
- GSM: 710/750/810/850/1800/1900
- P-GSM: 900
- R-GSM: 900
- T-GSM: 810/900
- UMTS: Volume I-X/XII-XIV/XIX
- WLAN 2.4 GHz
- ZigBee
- Z-Wave
- Bluetooth
- DECT
- Gain: 2 dBi
- Polarisation: linear vertical
- Impedance: 50 Ohm
- VSWR:
 - 2.0 max. @ 694~960 MHz/ 1710~2170 MHz
 - 3.0 max. @ 2400~2700 MHz
- Dimensions:
 - Height: 48 mm
 - Diameter: 50 mm
- Screw-on mounting 12 mm central hole
- Cable length: approx. 3 m
- Cable type: RG-174
- Cable attenuation: approx. 1 dB/m @ 1

GHz

- Cable connection: SMA connector
- Operating temperature: -10 °C ~ 55 °C
- ABS UV protected
- IP 67

8.5 Nameplate

Type plate contains information on product designation (type:), item number (art. no:), serial number in writing and bar code (SN:), power supply (U:), software version (SW:), hardware version (HW:). The MAC address is included in writing and QR code.



The subpage contains information about the SIM profile configuration and the set websocket URI.

Datum: _____	Datum: _____ Software: _____
User: _____	DE: ws://188.174.236.242:4000 ☐
Password: _____	FR: ws://193.248.238.194:4000 ☐
APN: _____	AU: ws://119.225.139.2:4000 ☐

Status: 06 / 2022

Subject to technical changes.

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