s::can
A Badger Meter® Brand

Water Quality Terminal

con::cube D-330

Badger Meter

SCA-UM-04777-EN-02 (January 2026)

User Manual

S-453-M-EN

Table of Contents

1 GENERAL

This manual contains, firstly, general information (chapter 1) and safety guidelines (chapter 2). The next chapter (chapter 3) provides a technical description of the product itself as well as information regarding transport, scope of delivery, correct storage and disposal of the product. In the further chapters the installation (chapter 4), the initial startup (chapter 5) and the operation (chapter 6) of the product are explained. Furthermore information regarding data management (chapter 7), how to perform a function check (chapter 8) and maintenance (chapter 9) can be found in this manual. Information regarding troubleshooting (chapter 10), the available accessories (chapter 11) and the technical specifications (chapter 12) complete the document.

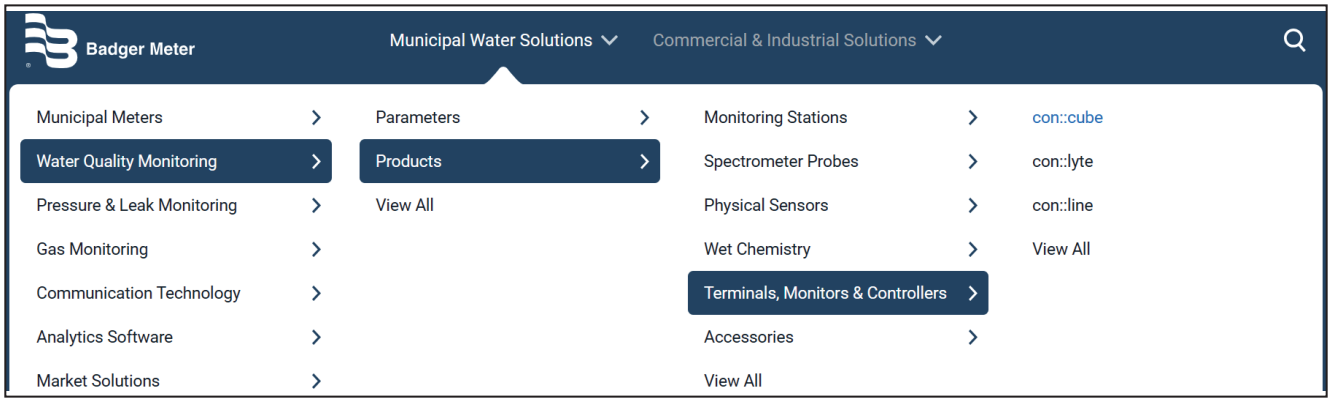
Every term in this document that is marked *italic and underlined*, can be found on the display of your controller for operation or as lettering on your Badger Meter product.

In spite of careful elaboration this manual may contain errors or incompletion. Badger Meter Austria does not assume liability for errors or loss of data due to such faults in the manual. The original manual is published in English and German by Badger Meter Austria. This original manual serves as the reference in case discrepancies occur in versions of the manual after translation into other languages.

This manual refers to the Badger Meter products listed in chapter 3 at the time of publication (see version date in the footer). Information and technical specifications from Badger Meter manuals of earlier publication dates are replaced by this manual.

The electronic version (PDF-document) of this manual is available on the Badger Meter Website at:

- *Resources > Product Documentation* (https://www.badgermeter.com/product-documentation)
  Filtered by: Brand = con::cube
- *con::cube V3 IoT Terminal*
  (https://www.badgermeter.com/products/water-quality-monitoring/terminals/concube-v3-iot)
- Download link: https://badgermeter.widen.net/content/m9hwxt1rs5/original?download=false&x.app=api



2 SAFETY GUIDELINES

Installation, electrical connection, initial startup, operation and maintenance of any Badger Meter product as well as complete Badger Meter measuring systems must only be performed by qualified personnel. This qualified personnel has to be trained and authorised by the plant operator or by Badger Meter Austria for these activities. The qualified personnel must have read and understood this user manual and have to follow the instructions contained in this manual.

For the proper initial startup of complete Badger Meter measuring systems, the manuals for the controller and software used for operation (con::lyte, con::cube, con::line, moni::tool, Io::Tool), the connected probes and sensors as well as the used additional devices (e.g. compressor) have to be observed.

The operator has to obtain the local operating permits and has to comply with the joint constraints associated with these. Additionally, the local legal requirements have to be observed (e.g. regarding safety of personnel and means of labour, disposal of products and materials, cleaning, environmental constraints). Before putting the measuring device into operation, the operator has to ensure that during mounting and initial startup – in case they are executed by the operator himself – the local legislation and requirements (e.g. regarding electrical connection) are observed.

All Badger Meter products are leaving our factory in immaculate technical and safety conditions. Inappropriate or not intended use of the product, however, can cause danger! The manufacturer is not responsible for damage caused by incorrect or unauthorised use. Any kind of manipulation of the device is strictly prohibited - except for the activities described in this document. Conversions and changes to the device must not be made, otherwise all certifications and guarantee / warranty become invalid. For details regarding guarantee and warranty please refer to our general conditions of business (GTC).

2.1 Declaration of Conformity

This Badger Meter product has been developed, tested and manufactured for electromagnetic compatibility (EMC) and according to applicable European standards, as defined in the declaration of conformity. A CE-mark is applied on the device.

The full text of the EU declaration of conformity related to this product can be requested from Badger Meter Austria or your local Badger Meter sales partner or can be downloaded from the Badger Meter Website (https://www.badgermeter.com/en-gb/products/water-quality-monitoring/terminals/concube-v3-iot/).

For further details about certifications related to this product please refer to the technical specifications located at the end of this manual.

2.2 Special Hazard Warning

Because the Badger Meter measuring systems are frequently installed in industrial and municipal waste water applications, one has to take care during mounting and demounting of the system, as parts of the device can be contaminated with dangerous chemicals or pathogenic germs. All necessary precautions should be taken to prevent endangering of one's health during work with the measuring device.

3 TECHNICAL DESCRIPTION

3.1 Intended Use

The con::cube is an high-performance, power efficient industrial computer for on-line operation of s::can spectrometer probes (spectro::lyser, nitro::lyser, carbo::lyser, etc.) and i::scan as well as ISE probes (e.g. ammo::lyser) and all other Badger Meter sensors (e.g. pH::lyser, oxi::lyser). Furthermore readings of third party sensors can be integrated via standard interfaces. Once connected to probes and sensors the con::cube fullfils all tasks of a complete monitoring station due to the following scope of functions:

- Numerical and graphical display of the readings from the connected measuring devices
- Simple initialisation of spectrometer probes, i::scan, ISE probes and sensors
- Simple initialisation and parameterisation of infrastructure (e.g. automatic cleaning devices)
- Parameter calibration of spectrometer probes, i::scan, ISE probes and sensors
- Storage of measurement results and all other station information in a local database

- Transfer of measurement results via Modbus RTU/TCP interface
- Transfer of measurement results via analog outputs (optional)
- Transfer of measurement results via Profibus DP interface (optional)
- Transfer of measurement results via SDI12 interface (optional)
- Transfer of measurement results via FTP / sFTP file transfer
- ransfer of measurement results via EtherNet/IP (from moni::tool V5.2 onwards)
- Potential free digital output relay triggered by current reading

- Integration of external sensor signals via RS485 input
- Integration of external sensor signals via analog or digital input (optional)

- Network connectivity via ethernet, WLAN or optional 4G modem
- Remote control of Badger Meter monitoring station via ethernet, WLAN or optional 4G modem
- Data synchronisation to central data collection systems via ethernet, WLAN or optional 4G modem
- Display of current and historical readings
- Alarming and Triggering depending on water quality monitored

In all types of applications, the respective acceptable limits, which are provided in the technical specifications in the respective user manuals, have to be observed. All applications falling outside of these limits, and which are not authorised by Badger Meter Austria GmbH in written form, do not fall under the manufacturer's liability.

The device must only be used for the purpose described in this user manual. Use in applications not described in this manual, or modification of the device without written agreement from Badger Meter Austria, is not allowed. Badger Meter is not liable for claims following from such unauthorised use. In such a case, the risks are the sole responsibility of the operator.

3.2 Functional Principle

The con::cube is equipped with an operation software (moni::tool) that can be operated via a color graphical display with touch functionality. The software starts automatically when the con::cube is powered up. The con::cube collects readings for probes and sensors using a digital bus connection. It displays the data, stores all information and makes it available for further use.

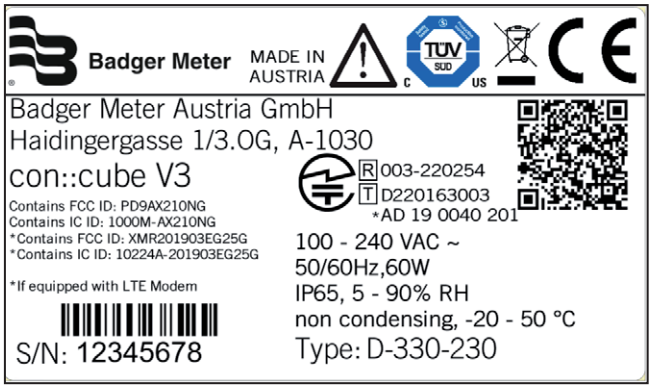
3.3 Product

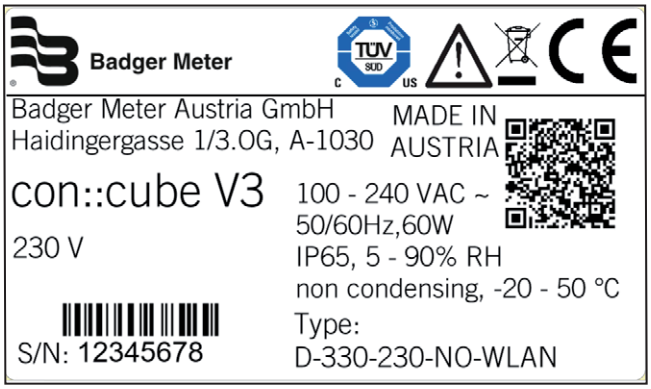
The following device variants and accessory parts of the con::cube are available. Regarding detailed information of the device variants, please refer to the technical specifications located at the end of this manual. Regarding detailed information of the accessory parts, please refer to section 11 (Accessories).

Type	Specification
D-330-230	Operator terminal with 100-240 VAC (+/-10%), 50-60 Hz power supply
D-330-024	Operator terminal with 10-35 VDC power supply
D-330-230-NO-WLAN	Operator terminal with 100-240 VAC (+/-10%), 50-60 Hz power supply, without WLAN / WiFi
D-330-024-NO-WLAN	Operator terminal with 10-35 VDC power supply, without WLAN / WiFi
D-330-TOUCH	Display and touch screen input module
D-330-4GLX	4G modem (OS Linux)
D-315-OUT-PROFIBUS	Profibus DP (output module)
D-315-OUT-SDI12	SDI 12 (output module)
D-315-OUT-MA	2 analog outputs (output module)
D-315-IN-MA	2 analog inputs for integration of third party readings (input module)
D-315-IN-RELAY	2 digital inputs for integration of third party readings (input module)
D-330-ANTENNA-PLUG	internal antenna adapter cable and connector for 4G modem
D-330-ANTENNA	external, high range antenna, incl. 10 m extension cable for 4G modem
D-303-LX	Licence Linux application (fix installed OS)

The device is typified by a type label, as shown on the right, that contains the following information:

- Manufacturer's name and country of origin
- Several certification marks
- Device name (con::cube V3)
- Type of power supply
- Bar code
- Device serial number (S/N)
- Information on power supply
- Environment rating (IP)
- Acceptable humidity limits
- Acceptable temperature limits
- Item number (Type)
- QR code to user manual





1 Color graphical display with touch screen

2 Screw to open housing cover

3 Status (blue, yellow or red)

4 1 x M12 connector socket for s::can spectrometer probe

5 4 x connectors sockets 6-pin for i::scan, ISE probes or sensors

6 1 x Ethernet (LAN) connector

7 1 x USB connector

8 2 x cable glands M16 (optional for Profibus or antenna plug)

9 3 x cable glands M16

10 1 x cable gland M16 (optional antenna plug)

11 2 x cable glands M20

12 Holder for housing cover

13 Desiccant package (to be installed during initial startup)

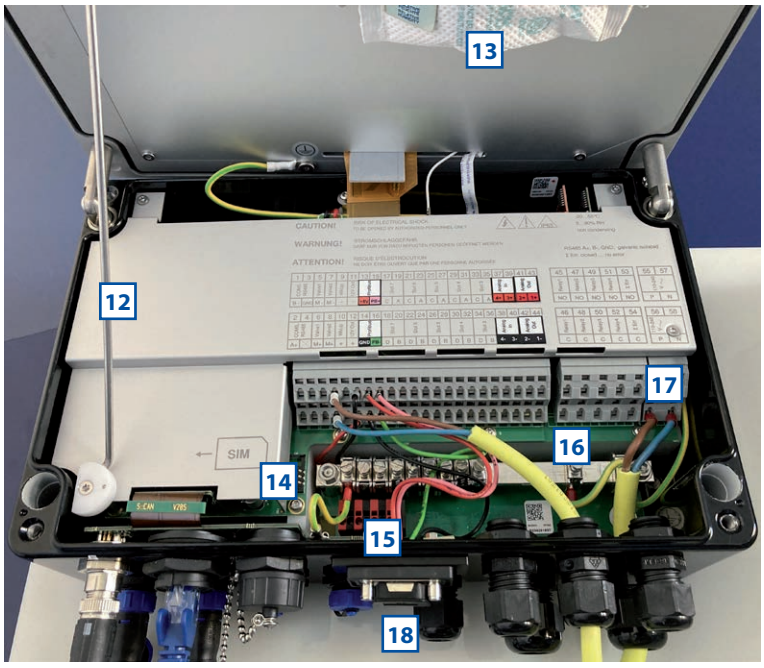
14 Insert for SIM card

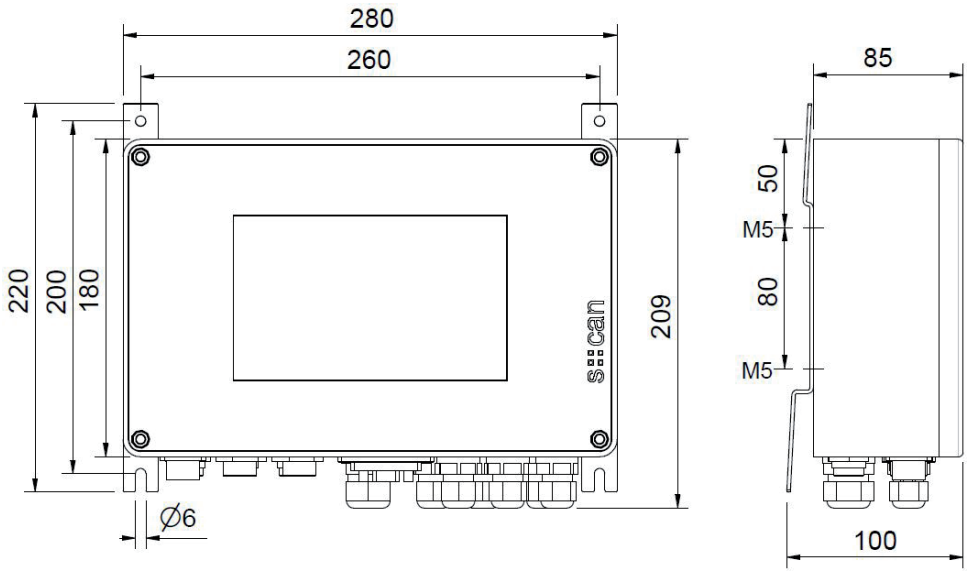
15 Additional cable terminals for connection to 12 VDC out

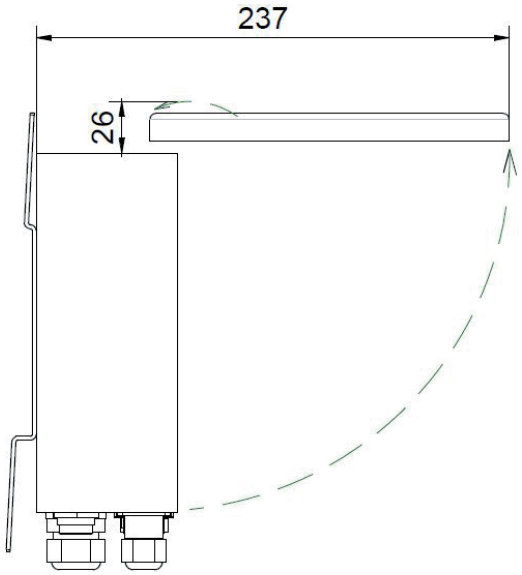
16 Grounding bar

17 Power supply connection

18 Optional Profibus connector







Ensure correct orientation of mounting rails. Top of con::cube has to be tilted backwards to prevent any water flowing over the touch screen or entering the housing when device is opened.

Dimensions of con::cube in mm

3.4 Storage, Transport and Disposal

The permissible limit values for operation, storage and transportation of the device are specified in the last chapter of this manual (Technical Specifications) and must be observed. In addition, the device should not be exposed to strong impacts and vibrations. The device must be stored away from solvent vapors, radioactive and strong electromagnetic radiation.

Damage to the device caused by wrong storage / transport will not be covered by guarantee / warranty.

Transport should be done in packaging that protects the device (original packaging if possible).

This product is marked with the WEEE symbol to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EC. The symbol indicates that this product should not be treated as household waste. It must be disposed and recycled as electronic waste. Please assist to keep our environment clean.

Take care that no sharp-edged or heavy objects are placed on the housing cover, which might scratch and / or damage the touch screen.

3.5 Scope of Delivery

Immediately upon receipt, please check the received consignment for completeness using the delivery note and check for any possible damage incurred during shipping. Please inform the delivering dispatcher and the sender immediately in case of any damages in transit.

The following parts should be included in the delivery:

- con::cube (part-no. D-330-xxx)
- Pen for touch screen
- Mounting rail (2 pieces) with 4 screws (M5x8)
- User manual con::cube (part-no. S-453-M)

The following parts could be included in the delivery if ordered as an option:

- Cable for power supply (part-no. C-31-xx)
- Gateway to 4G (part-no. D-330-4GLX)
- Internal antenna cable and connector (part-no. D-330-ANTENNA-PLUG)
- External antenna (part-no. D-330-ANTENNA)
- Different I/O modules, which are assambled into the con::cube already (part-no. D-315-OUT-MA, D-315-PROFIBUS, D-315-OUT-SDI12, D-315-IN-MA, D-315-IN-RELAY)
- Weather shield for con::cube (part-no. F-51)

In case of incompleteness please contact your local Badger Meter sales partner immediately!

4 INSTALLATION

4.1 Environment

The con::cube is designed according to environmental protection rating IP 65 and is resistant against environment effects. Indoor use is preferred. In case of outdoor use the installation in a cabinet or on the separately available weather shield is highly recommended to protect the device (housing cover has to be securely closed).

Enclosure class IP 65 protection is only guaranteed if the housing cover is fixed tightly with the four screws, an operative desiccant bag is mounted inside the housing and the sealing of the housing cover is undamaged and placed correctly. In addition all cable glands have to be sealed correctly in that way they are closed tightly with the appropriate cables or dummy caps. All connectors must be covered with corresponding caps when not in use. Any damage caused by intrusion of water will not be covered by the warranty.

The correct installation of measuring instruments is an important prerequisite for satisfactory operation. Therefore the following checklist for the installation can be used to ensure that all sources for potential operational problems can be ruled out to the greatest possible extent during the installation, allowing the monitoring system to operate properly.

For information on environmental limitations (e.g. temperature), please also refer to the Technical Specifications located at the end of the manual.

- Easy accessibility (mounting, sampling, function check, demounting)
- Availability of sufficient space (probe / sensor, installation fitting, controller for operation, etc.)
- Best possible weather and splash water proof set-up
- Power supply for controller for operation (operational reliability, voltage, power, peak free)
- Oil- and particle free compressed-air supply (optional for automatic probe / sensor cleaning)
- Shortest possible distances between system components (probe – controller – compressed-air supply – energy supply)
- Correct dimensioning, mounting and protection of all cables and lines (non-buckling, no risk of stumbling, no damage etc.)
- Good connection to cellular network, if 4G-Modem shall be used for data transfer

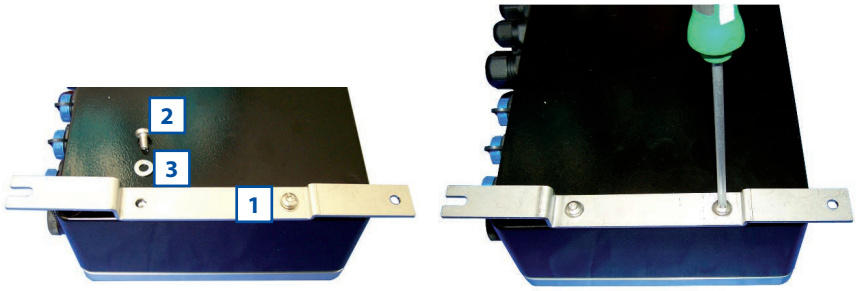
4.2 Mounting

For mounting and electrical installation the following tools and materials are necessary:

- Hexagonal wrench key (size 5) to open housing cover
- Torx wrench key (size TX 25) for fixing screws of mounting rails
- 2 mounting rails (included in delivery)
- 4 screws (M5) and 4 washers for fixing the two mounting rails onto the con::cube (included in delivery)
- 4 screws for fastening the con::cube on the wall (if required)
- Weather shield (F-51, if required)
- Power supply cable (C-31-xx, if required)
- Stripping tool for power supply line
- Cable end sleeves and crimper

The con::cube can be mounted quickly and easily onto a flat wall using one of the following methodes:

- With the two mounting rails included in delivery. Fasten the two mounting rails [1] onto the backside of the con::cube using the four screws [2] and the four spring washers [3] as shown on the right.



- With the four threaded holes on the backside of the con::cube to mount the device directly from the backside (M5 screws, not included in delivery).

For the correct dimensioning and space required for mounting, please refer to the figures in section 3.3 and the technical specifications.

5 INITIAL STARTUP

Once mounting and installation of the con::cube have been completed and checked (see section 4) the initial startup of the Badger Meter monitoring system will require the following actions, in the order presented below:

- Connect of the s::can spectrometer probe and the ISE probes, i::scan and sensors (see section 5.2).
- Connect the cleaning devices to the proper terminal connections in the cable terminal compartment (see section 5.3).
- Connect of optional sensors, used for the nano::station or micro::station, such as flow detector F-45-ALARM or pressure sensor F-500-P. (see section 5.4) and for the pipe::ccan hub (see section 5.5).
- Establish main power supply to the con::cube (see section 5.6) and wait until the operation software moni::tool has started up (see section 5.7).
- Please note all information in the moni::tool manual for further startup and configuration of the monitoring system.

Before closing the con::cube housing cover finally, mount the desiccant bag, included in delivery, on the inside of the touch screen and ensure all cable glands are closed tightly (see section 4.1 and 9.2).

5.1 Plan of Terminal Connections

Once the housing cover has been opened (four hexagonal head screws removed) you have access to the cable terminal compartment of the con::cube (see section 11.3 also).

Opening of the cable terminal compartment must be carried out by authorised persons only (see section 2) and after disconnecting the power supply!

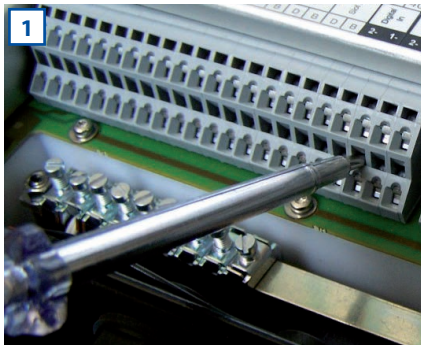
Be aware that cable clamps of relay contacts you have connected to the device might also have power supply (240 VAC), depending on how they have been interconnected!

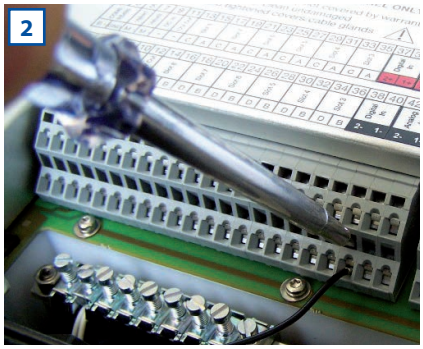
The con::cube is equipped with spring terminals that enable quick and easy wiring.

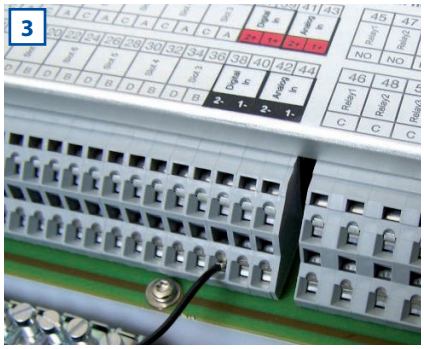
1 Insert a small screwdriver into the slot above the cable clamp you want to connect (see left picture below).

2 Move the screwdriver upwards, which opens the cable clamp, and insert the wire (see middle picture below).

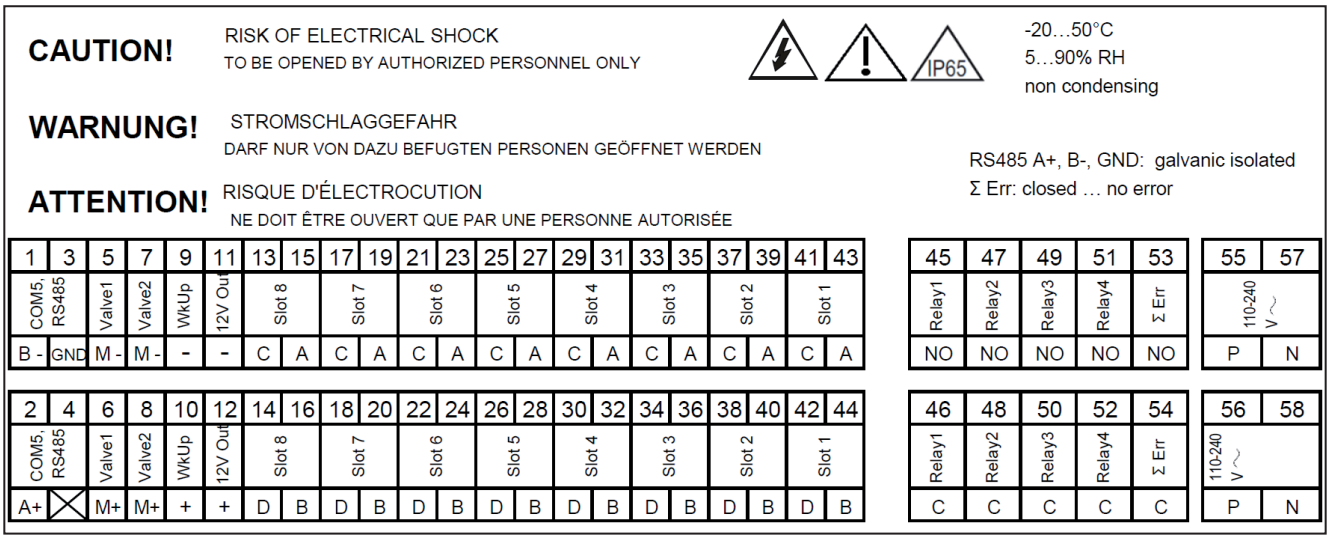
3 Move the screwdriver downwards and remove it. Now wire is locked in the cable clamp (see right picture below).



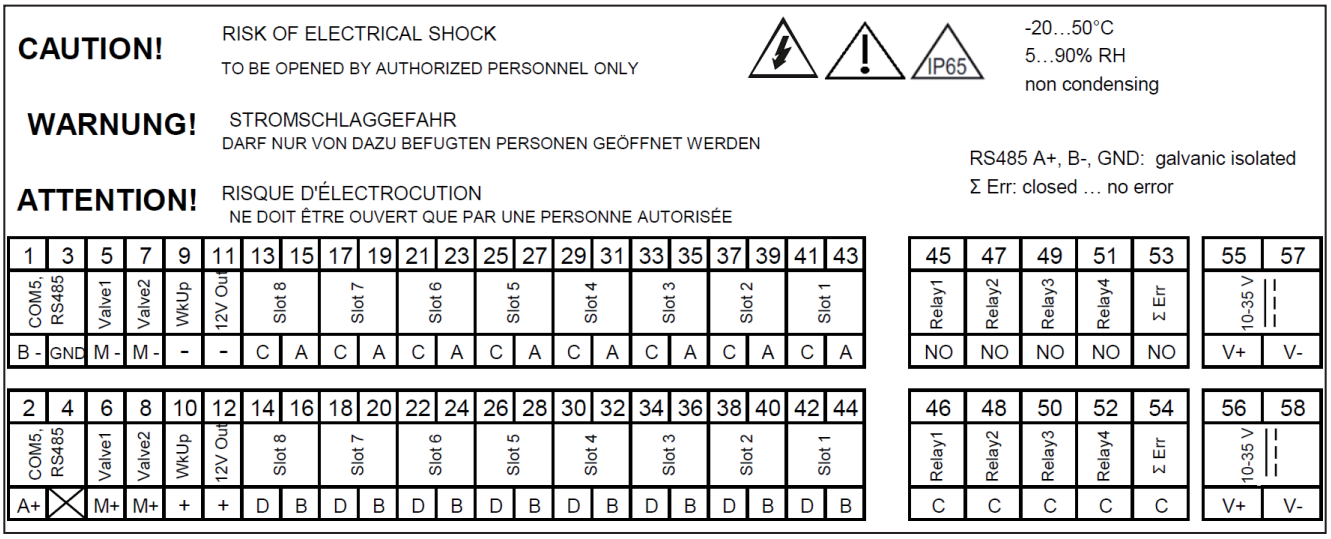




Badger Meter Austria recommends to use wires with isolated end sleeves for power supply and dater transfer.



Plan of terminal connections for con::cube D-330-230 (Terminals 5,7,9,11 use same GND, terminal 3 has its own GND)



Plan of terminal connections for con::cube D-330-024 (Terminals 5,7,9,11 use same GND, terminal 3 has its own GND)

5.2 Connection of Spectrometer Probe

A s::can spectrometer probe can be connected via the M-12 plug connector located on the con::cube. This connector is marked with no. 4 in the figure of section 3.3. If an extension cable is used the total length of the probe cable should not be more than 50 m. Further spectrometer probes can be connected via con::nect boxes (B-33-012).

The previous model of the spectrometer probe, which is equipped with a MIL-plug, can be connected with the adapter cable (C-32-MIL) to the M-12 plug or with a con::nect box (C-32) to the COM-5 port (clamps no.1 and 2 in the cable terminal compartment, see section 5.1).

Alternative or additional to the spectrometer probe it is possible to connect ISE probes, i::scan or other sensors via the 6-pin plug connectors located on the con::cube. These connectors are marked with no. 5 in the figure of section 3.3. If an extension cable is used the total length of the probe cable should not be more than 40 m. If necessary, the distribution box (B-41-HUB) must be used to increase the number of 6-pin connectors.

Before connecting the probes or sensors, ensure that the sensor plug and connector on the con::cube are dry and clean. Otherwise communication errors and / or device damage might occur. Connectors not in use should always be covered with the protective cap.

5.3 Connection of Cleaning Devices

For the automatic cleaning of the probe and sensors connected, the cleaning devices must be wired to the con::cube within the cable terminal compartment. The table below displays the different possibilities of connection.

Cleaning Device	Colour of wire	Labelling	Terminal no.
Cleaning valve via Valve 1	Blue	M+ / Valve 1	6
	Brown	M- / Valve 1	5
Cleaning valve via Valve 2	Blue	M+ / Valve 2	8
	Brown	M- / Valve 2	7
Autobrush / ruck::sack	Purple (yellow [1])	M+ / Valve 1	6
3-pin operation via Valve 1	Black (brown [1])	- / 12V Out	11 / black terminal
	Red (white [1])	+ / 12V Out	12 / red terminal
Autobrush / ruck::sack	Purple (yellow [1])	M+ / Valve 2	8
3-pin operation via Valve 2	Black (brown [1])	- / 12V Out	11 / black terminal
	Red (white [1])	+ / 12V Out	12 / red terminal
Autobrush / ruck::sack [2]	Purple (yellow [1])	M+ / Valve 1	6
2-pin operation via Valve 1	Black (brown [1])	M- / Valve 1	5
	Red (white [1])	M+ / Valve 1	6
Auto::brush / ruck::sack [2]	Purple (yellow [1])	M+ / Valve 2	8
2-pin operation via Valve 2	Black (brown [1])	M- / Valve 2	7
	Red (white [1])	M+ / Valve 2	8

[1] previous / alternatively used cable version
[2] Set cleaning duration for 2.pin operation min. 12 s for 2 complete turn arounds

Once the cleaning device has been electrically connected, the device needs to be configured within the moni::tool software (please refer to manual moni::tool).

5.4 Connection of Station Devices

The optional ordered station devices flow detector (F-45-ALARM) and pressure sensor (F-500-P) can be wired to the con::cube as explained in the table below.

Device	Colour of wire	Labelling	Terminal no.
Flow detector	Black	Digital In -	lower terminal block
F-45-ALARM	Black	12V Out - / GND	11 / black terminal
	The *12V Out +* terminal and the *4Digital In +* terminal must be connected with a seperate wire.		12 / red terminal with upper terminal block
Pressure sensor	Brown	12V Out +	12 / red terminal
F-500-P	Blue	Analog In +	upper terminal block
	The *12V Out -* terminal and the *Analog In -* terminal must be connected with a seperate wire.		11 / black terminal with lower terminal block

5.5 Connection of pipe::scan Hub

The connection cable (C-410-PS-CABLE) of the pipe::scan hub (C-450-PS-HUB) must be wired into the terminal compartment of the con::cube according to the table below.

Device	Colour of wire	Labeling	Terminal no.
12V power supply permanent	brown	+ 12V Out	12 or red terminal block on bottom
12V power supply permanent	blue	- 12V Out / GND Out	11 or black terminal block on bottom
Pump	white	NO Relay 1	45
Data RS 485	green	B- COM5	1
Data RS 485	yellow	A+ COM5	2
12V power supply switch	red	+ 12V Out	12 or red terminal block on bottom
Trigger auto::brush	violet	M+ Valve 1	6
Pressure sensor	red / blue	1 + Analog In	43
Pressure sensor	grey / pink	+ 12V Out	12 or red terminal block on bottom
Black wire included in delivery	The *1- Analog In* terminal and the *12V Out -* terminal must be connected with a seperate wire.		44 with 11 or black terminal block
Red wire included in delivery	The *C Relay* terminal and the *12V Out +* terminal must be connected with a seperate wire		46 with 12 or red terminal block

The remaining cable wires (black, grey and pink) are not used.

5.6 Connection of Main Power Supply

⚠ This type of work must be performed by authorised persons only (see section 2)!

Depending on the device type, the con::cube has to be connected to the appropriate power supply. The connection of power supply (AC or DC, respectively), must be done with an earthed conductor wire (PE - „protective earth“)!

The power supply earth (PE) has to be done properly according to the corresponding norms / standards with a max. restistance between earth grounding of power supply and site‘s earth grounding of 0.1 Ohm.

Process medium (e.g. waste water) must be connected to the same earth ground with less than 0.5 Ohm.

Connection of power supply for con::cube D-330-230	
No / [Labelling]	Assignment
55 / [P] or 56 / [P]	Conductor or phase, resp.
57 / [N] or 58 / [N]	Neutral wire

Connection of power supply for con::cube D-330-024	
No / [Labelling]	Assignment
55 / [V+] or 56 / [V+]	+ 24 VDC
57 / [V-] or 58 / [V-]	- 24 VDC

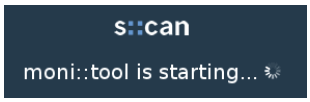
The connection in the cable terminal compartment has to be performed as displayed on the table above. The ground wire (PE) has to be connected to the grounding bar of the con::cube, which is marked with no.16 in the figure of section 3.3.

⚠ A switch or circuit-breaker must be included in the power supply. It must be suitable located and easily reachable. It must be marked as a disconnecting device for the monitoring equipment.

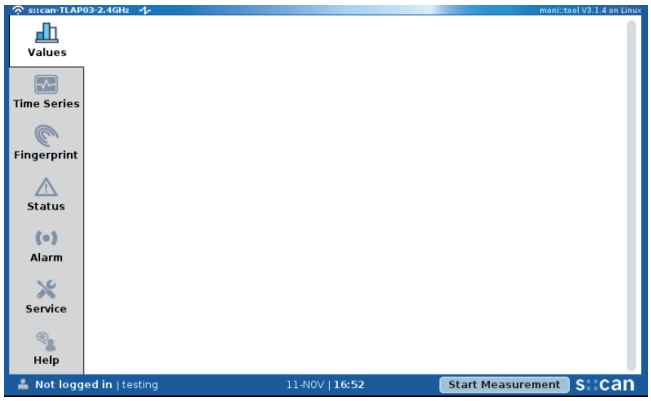
5.7 Starting up of Operation Software

Once the con::cube is connected to the power supply (see section 5.5), it will show the s::can logo for a few seconds while starting up. During the startup of moni::tool a message as shown on the right hand side is visible. Please consider that the complete start up procedure will require appox. 1 - 2 minutes.

When no probes and sensors have been installed yet (initial startup), only the main window and the menu tabs are visible on the display.



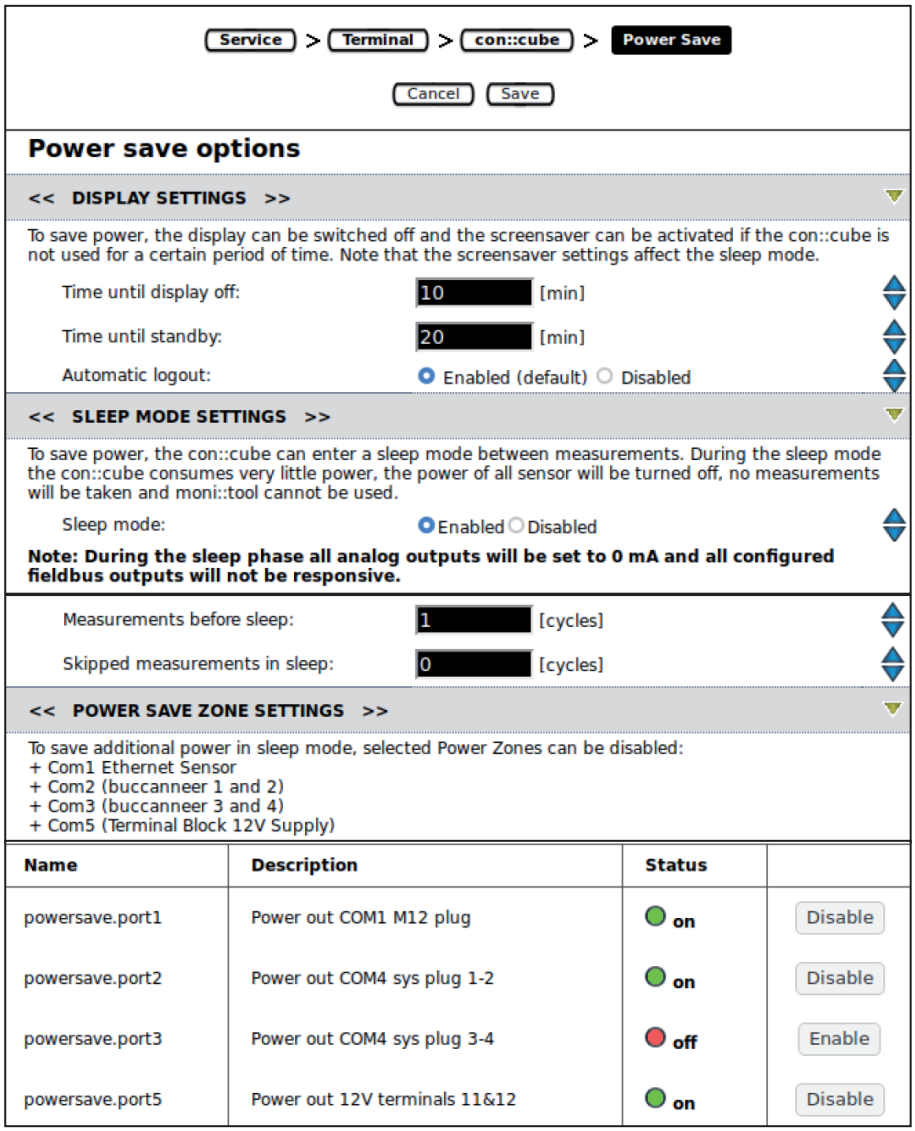
Please refer to the manual of the operation software moni::tool for all further tasks to complete the initialisation of your Badger Meter monitoring system.



5.8 con::cube Sleep Mode

For operation with low power consumption a specific sleep mode can be configured on the con::cube via moni::tool (*Service \ Terminal \ con::cube \ Power Save*). The sleep mode can be terminated at any time by touching the screen or by apply a voltage of 12 VDC to the *WkUp* terminals (9 and 10).

⚠ When using the sleep mode in combination with a 4G modem, the moni::tool version V3.1.4 or higher has to be used.



6 OPERATION OF CON::CUBE

The con::cube is equipped with the operating software moni::tool and uses multi touch technology and a webbrowser as grafical user interface. This means that moni::tool can be operated via webbrowser either directly on the touch screen of the con::cube with your fingers and / or a touch pen (see section 6.1) or via remote connection using a PC, notebook, tablett, etc. (see section 6.2). Please note that only one user can operate the con::cube directly (i.e. can be logged on).

The main frame of the moni::tool display contains the following items that are visible at all times.

1 Tabs for navigating between the main views

2 Clicking on this item will open the login window or logout window

3 Name of the monitoring station

4 Current system date and time (clicking on this icon will display date / time of the last measurement and actual date / time)

5 Clicking on the s::can logo will callup information on the installed software version, the con::cube and the network connections

6 Scrollbar to scroll the display up and down

6.1 Direct Operation of con::cube

Normally this direct operation is performed by a person standing in front of the con::cube and using the touch screen. Alternatively moni::tool can also be operated with a USB mouse and / or a USB keyboard. These devices can be connected to the USB-socket (marked with no.7 in the figure of section 3.3) of the con::cube. A USB-hub can be used to operate keyboard and mouse simultaniously.

Please keep in mind that a few service actions (e.g. touch calibration, see section 9.4) can be used in direct operation only.

6.2 Remote Operation of con::cube

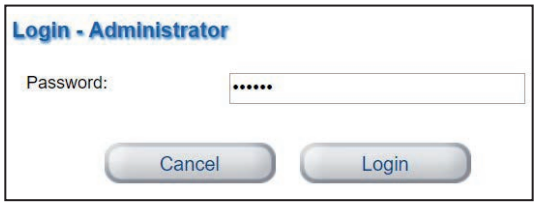
For any kind of remote operation the con::cube needs to be connected to the internet, a VPN network, a local network or directly to a PC (see section 6.5).

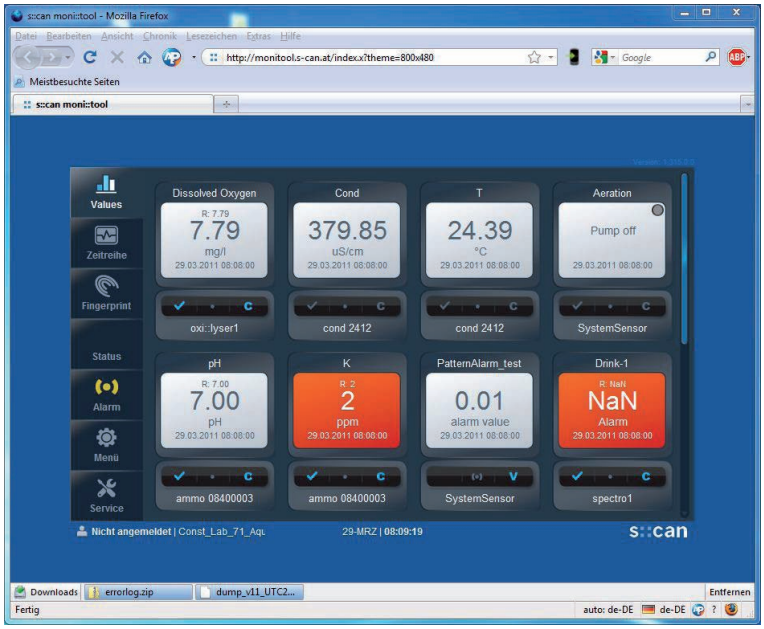
6.2.1 Remote Operation of con::cube via Webbrowser

The moni::tool software can be operated from any computer that has access to the con::cube. Simply enter the IP address of the con::cube into the address bar of your Webbrowser.

Several users can view moni::tool simultaniously but only one user can be logged in to change the configuration.

User = Administrator
Password = admin1



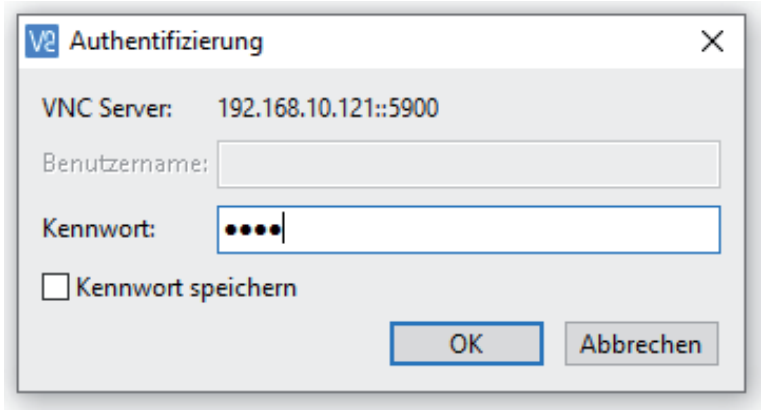


6.2.2 Remote Operation of con::cube via Terminal Program (VNC-Viewer)

The terminal program VNC-Viewer can be used for direct operation of the con::cube via remote connection. In this case keyboard, mouse and monitor of the computer running the VNC-Viewer can be used to operate the con::cube.

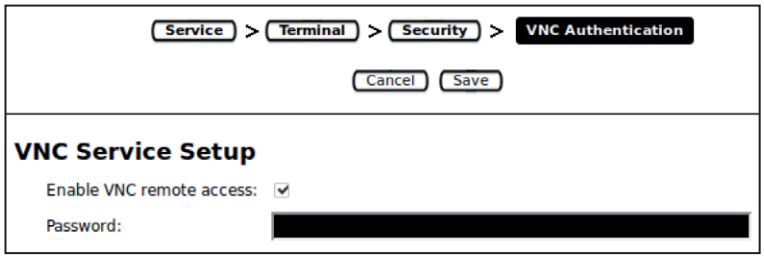
If you operate the con::cube via VNC-Viewer, all actions can be seen on the touch screen of the con::cube also.

When using the VNC-Viewer a login window will pop up once the remote connection was successful.



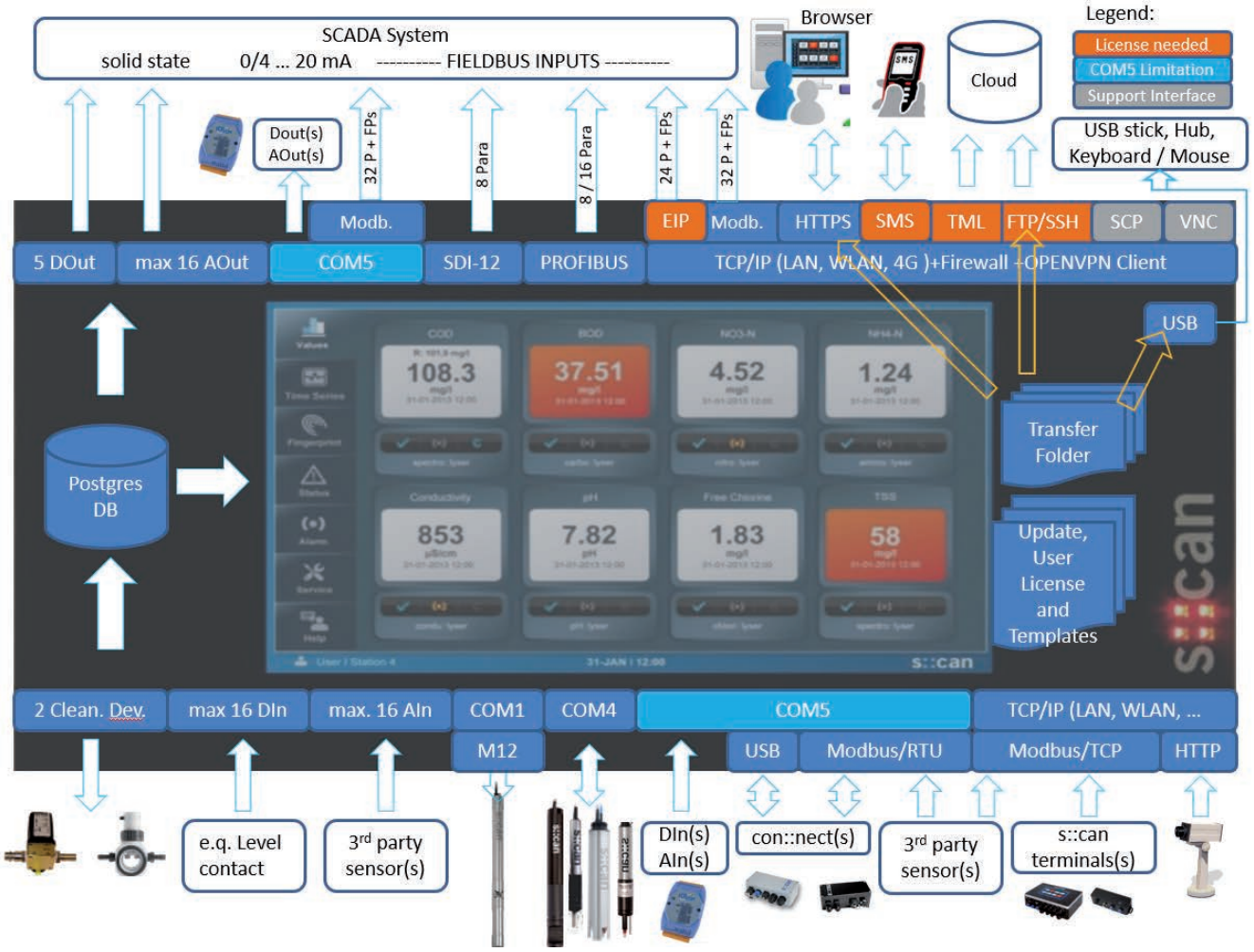
⚠ For operation of VNC-Viewer with moni::tool Version V3 the port 5900 has to be unlocked in the con::cube firewall. The VNC password to be entered is „scan“ (case-sensitive).

⚠ For operation of VNC-Viewer with moni::tool Version V4 the VNC authentication has to be enabled on the con::cube (*Service / Terminal / Security / VNC Authentication*) and an individual VNC password can be entered (see figure on the right).



6.3 con::cube Interfaces

The figure below offers an overview of all available interfaces, that can be used for operation of the con::cube.



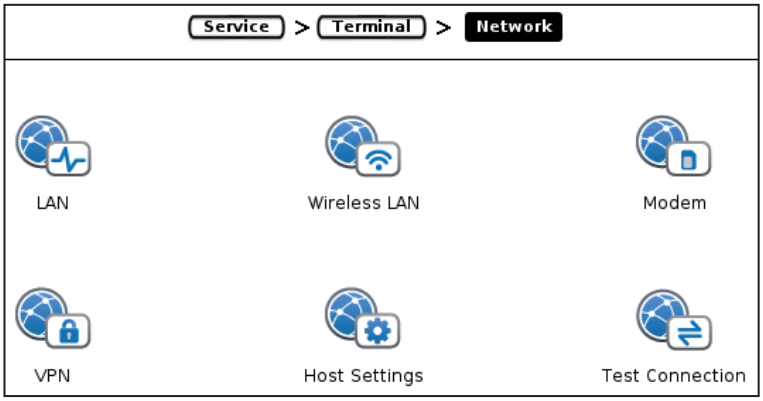
6.4 con::cube Network Integration and Security

For normal operation, remote control, data transfer and other features it might be necessary to setup a connectivity of the con::cube. Within this section the different possibilities are explained and security background is mentioned also.

The con::cube is based on Microsoft Windows XP embedded (XPe) operating system until moni::tool versions V2.5. From Version 3.0 on it is based on a Linux operating system (Debian).

While the XPe platform is well-proven and stable it already has reached the end of its mainstream support. Microsoft will still supply security updates within a certain period but won't fix non-critical issues. Linux will support further security updates.

Nonetheless, the con::cube is a complex device offering services over the network. Software security therefore is an issue which needs to be considered to safely operate the con::cube.



On the con::cube the TCP / IP interface can be used via LAN, WLAN or 4G Modem (optional). All these features can be configured within the *Service / Terminal / Network* menu (see manual moni::tool).

The table below contains all types of possible connectivity setups. Regarding the individual connection types please refer to the subsections afterwards.

con::cube	Type of data transfer	Connection type	Customer infrastructure	Security
acts as client (i.e. con::cube establishs the connection, performs a task and shuts down the connection)	■ FTP / sFTP data transfer ■ SSH data transfer ■ NTP-client (for system time synchronization)	all connection types	FTP / sFTP server SSH server	
acts as server (i.e. con::cube waits for a client to connect and responds to its request)	■ Modbus TCP ■ TML ■ VNC remote control ■ FTP remote control	LAN or WLAN	trusted network	
		4G private IP	internet	
		4G private IP	VPN server	
		4G public IP		
		open WLAN without WEP		

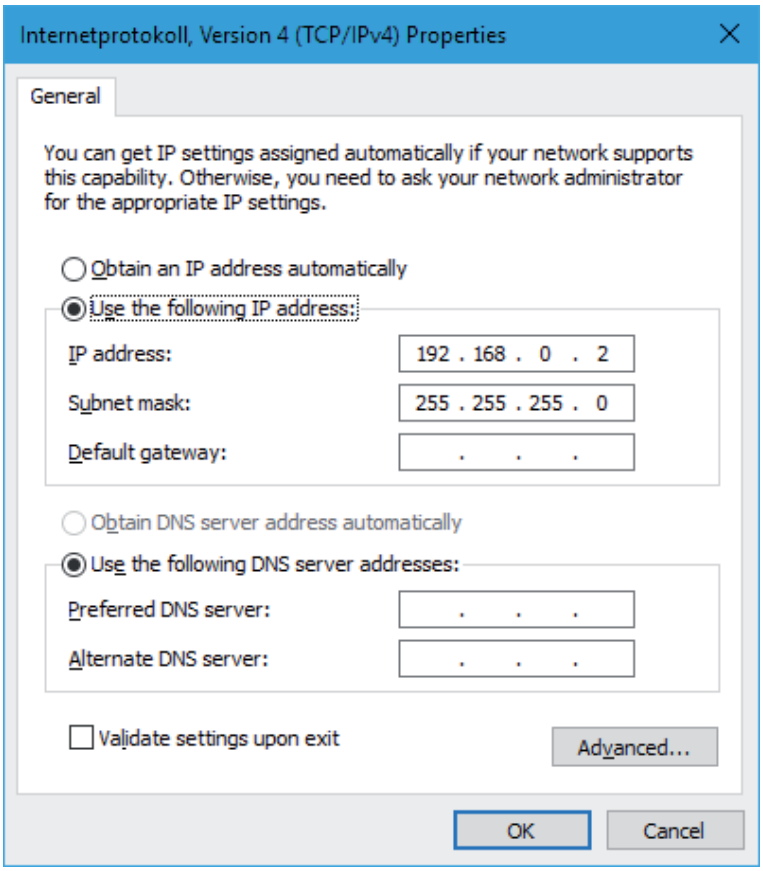
Because of the number of services offered, the con::cube MUST NOT be operated in environments where those services can be reached public. i.e. the con::cube MUST NOT be reachable from the internet. The most common configurations that are NOT safe are a 4G connection with a public IP address and a WLAN connection to a public, non-encrypted network.

It is always safe to operate the con::cube in a private network, i.e. in a LAN unless the firewall is configured to forward external requests to the con::cube (port-forwarding).

6.5 con::cube Connection Types

If one or several con::cube shall be integrated into one network, each device needs it's own IP address and also it's own computer name. By default the DHCP service is activated on the con::cube, therefore an IP address for the con::cube will be allocated automatically from the DHCP server of the network to which the con::cube is connected. The actual IP address of the con::cube will be displayed when pushing on the s::can logo on the lower right hand side of the moni::tool display.

If needed the DHCP service can be deactivated and the con::cube can be set to a fixed IP address. This might be necessary if a direct connection from the con::cube to your notebook shall be established. In this case perform the following steps:



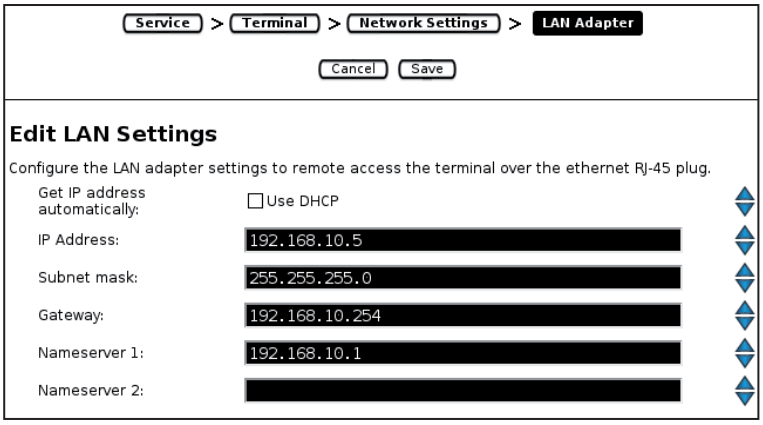
- Disable the *Use DHCP* checkbox on con::cube to deactivate the DHCP Server option (*Service / Terminal / Network Settings / LAN Adapter*).
- Ensure your PC is equipped with a properly installed network card and you have the user rights required to change network settings.
- Configure the IP address of your PC in the *Network environment* also to a fixed one, using the same settings as for the con::cube except the last number of the IP address. The example below shows a possible configuration:
  IP address of the con::cube: 192.168.10.12
  IP address of the PC: 192.168.10.2
  Subnet mask for both devices: 255.255.255.0
- Connect your network cable (RJ45) to the con::cube and to the PC when working via LAN (see section 6.5.1).
- Alternatively activate the WLAN on your notebook and on the con::cube (see section 6.5.2).
- Search for the con::cube in the *Network environment* of the PC. You can either use the IP address or the computer name of the con::cube for searching. The computer name ex factory can be found on the included acceptance certificate.
- In case a logon is needed use:
  User: scan
  Password: scan (case sensitive)

6.5.1 Connectivity via Network Cable (RJ45)

Connect the con::cube into the local area network (LAN) by plugging a network cable of the LAN into the ethernet socket of the con::cube (RJ45 - marked with no.6 in the figure in section 3.3).

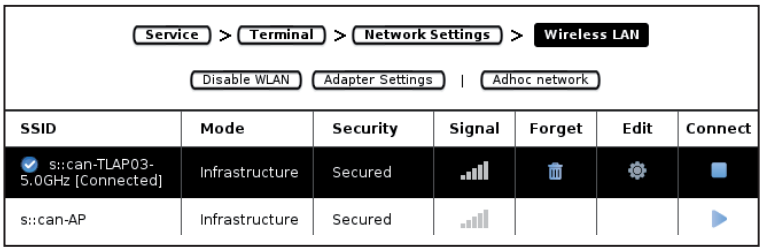
If needed, it can be configured via the moni::tool menu item *Service / Terminal / Network Settings / LAN Adapter*.

To ensure proper operation also with older types of PC / notebook, s::can recommends to use a cross-linked RJ45 cable for connection.



6.5.2 Connectivity via WLAN

The con::cube is equipped with an internal WLAN modem. The antenna is included in the housing cover. When you enable the WLAN modem via the moni::tool menu *Service / Terminal / Network Settings / WLAN* all available connections are displayed.

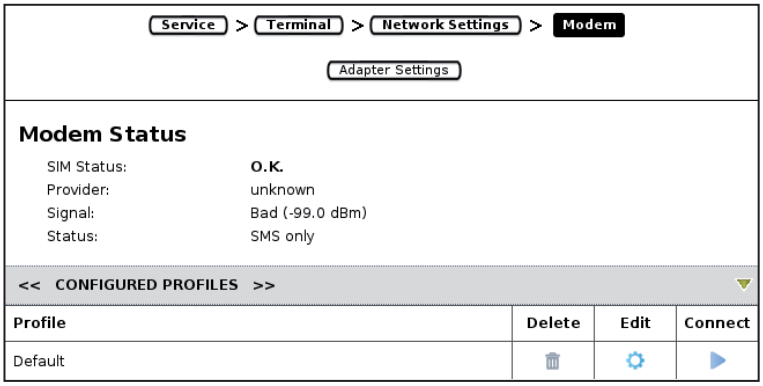


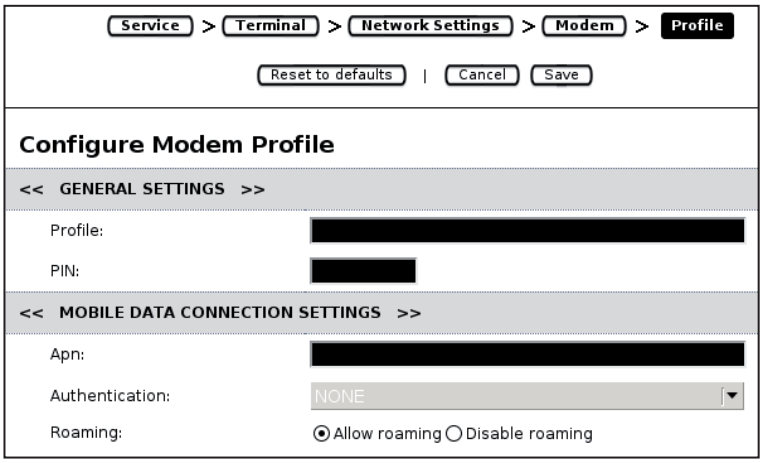
6.5.3 Connectivity via 4G Modem

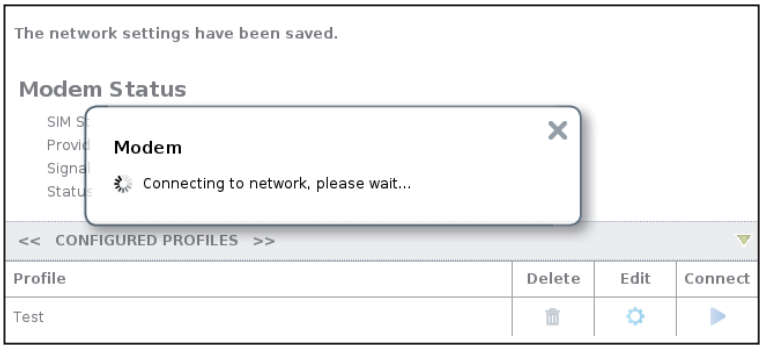
Optionally the con::cube can be equipped with an internal 4G modem. The antenna for this modem is already integrated in the housing cover. In addition an external antenna can be mounted (see section 11.1.3). As long as no SIM card is installed the modem status is *No SIM inserted*.

The configuration of the internal modem is performed by the following steps:

- Power off the con::cube, open the housing cover and install a SIM card into the holding signed with no.14 in the figure of section 3.3 . This SIM should be suited for data transfer and needs to support GPRS 4G.
- Power on the con::cube. The modem status will be *Ok* (*SIM Status*) and *SMS only* (*Status*).
- Configure a new modem profile (e.g. by editing the existing *Default* profile) via *Service / Terminal / Network Settings / Modem*.
- Select *Default* and push icon *Edit*.
- Enter a *Profile* name and the *PIN* of the SIM card.
- Enter the *Apn* and the *Authentication* of your provider.
- To avoid any problems select *Allow roaming* always.
- Push the *save* button to save your modem profile.
- Now the con::cube tries to connect to the network.
- After successful connection a user message asks you to reboot the con::cube. Push the button *Remind me later* to finish your modem configuration.
- Push the *Connect* symbol (blue triangle) to activate your modem profile.
- Once the con::cube is connected successfully the connection symbol is displayed in the left top corner. In addition you see the signal strength and the name of your provider.
- Reboot your con::cube to make all changes permanent.



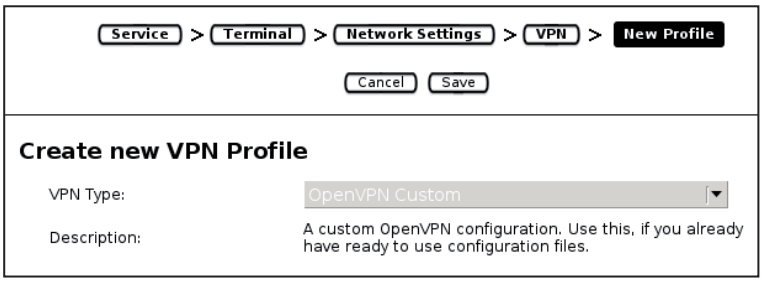


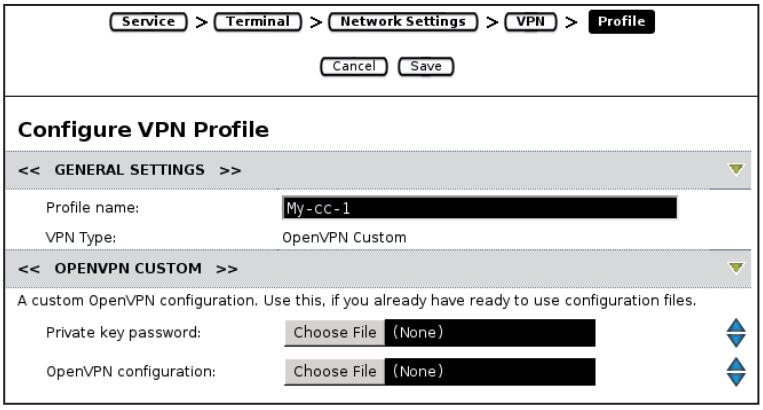


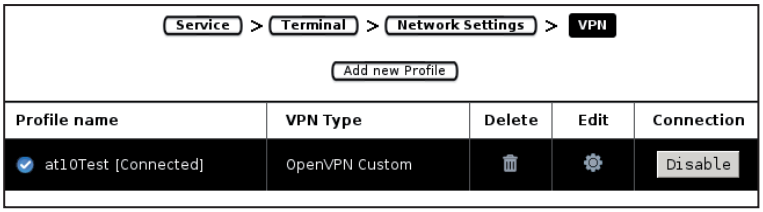
6.5.4 Connectivity via VPN

The con::cube can be connected to a VPN server. The configuration of a VPN profile on the con::cube is performed by the following steps:

- Select menu *Service / Terminal / Network Settings / VPN* to open the configuration screen.
- In case any VPN profile exists already, select this profile and delete it by pushing the trash icon.
- Push the button *Add new Profile*.
- Within the next window select the *VPN Type*, which is always *OpenVPN Custom*.
- Push the button *Save*.
- Within the next window enter a *Profile name*.
- Select the file containing the *Private key password* (e.g. *password.txt*).
- Select the file containing the *OpenVPN configuration* (e.g. *client.ovpn*).
- Push the button *Save*.
- Now the new profile should be listed in the table. Push the button *Enable* to activate the profile.
- Once the con::cube is connected to the VPN the display will look like the figure on the right.
- The static IP address of the VPN connection will be displayed after pushing the s::can logo in the lower right corner.





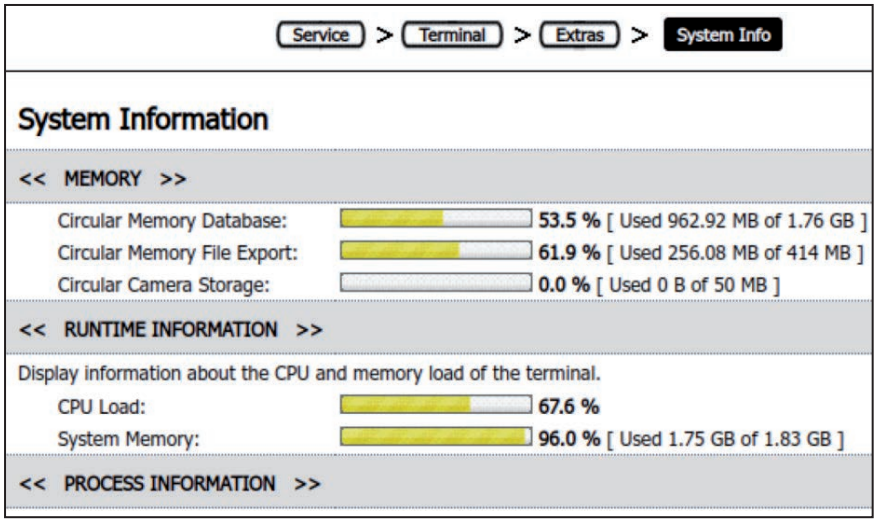


Please note that a VPN connection is only possible if the con::line is not configured for Sleep Mode. Badger Meter Austria offers the use of its own VPN server (part no. S-VPN-HOSTING or S-VPN-HOSTING-36).

7 DATA MANAGEMENT

7.1 Data Storage

The con::cube is equipped with 16 GB integrated memory. A part of this meory (1.76 GB) is reserved for the *Memory Database* to store measured fingerprints and parameter readings. In addition, part of the data is made available for quick download to a USB stick in a separate memory area (*Memory File Export*). The current memory usage can be displayed at any time via the menu item *Service / Terminal / Extra / System Info* (see figure on the right). As soon as a memory reaches 100% utilisation, the oldest results are deleted.



The table below shows two examples for the maximum amount of data that can be stored in the *Memory File Export* for download to a USB-stick.

Measuring Interval	Number of Fingerprints	Number of Parameters	Storage Capacity	Storage needed
2 minutes	1	16	39 weeks	1.5 MB / day
1 minutes	2	32	10 weeks	5.8 MB / day

7.2 Data Transfer

The con::cube with the operating software moni::tool provides several possibilities to transfer measurement results and other data and information.

7.2.1 Automatic Transfer of Measurement Results and Status Messages

- mA signal with optional installed output module (D-315-OUT-MA, see section 11.3.2) - *Service / Outputs / Analog Outputs*
- digital relay interfaces - *Servce / Outputs / Digital Outputs*
- Modbus TCP/IP interface (Ethernet RJ45) - *Service / Outputs / Fieldbus Outputs* (see section 7.2.2 and 7.4)
- Modbus RTU interface (COM-5) - *Service / Outputs / Fieldbus Outputs* (see section 7.2.2 and 7.4). Only possible, if COM-5 is not used as sensor connection.
- Profibus DP interface with optional installed output module (D-315-OUT-PROFIBUS, see section 7.2.2, 7.5 and 11.3.3) - *Service / Outputs / Fieldbus Outputs*
- SDI12 interface optional installed output module (D-315-OUT-SDI12, see section 7.2.2, 7.6 and 11.3.4) *Service / Outputs / Fieldbus Outputs*
- EtherNet/IP interface (S-500 ETH-IP, see section 7.2.2 and 7.7) - *Service / Outputs / Fieldbus Outputs*
- TML stream - *Service / Outputs / TML*
- FTP / sFTP - *Service / Outputs / File Output / FTP Transfer*
- SSH - *Service / Outputs / File Output / SSH Transfer*)

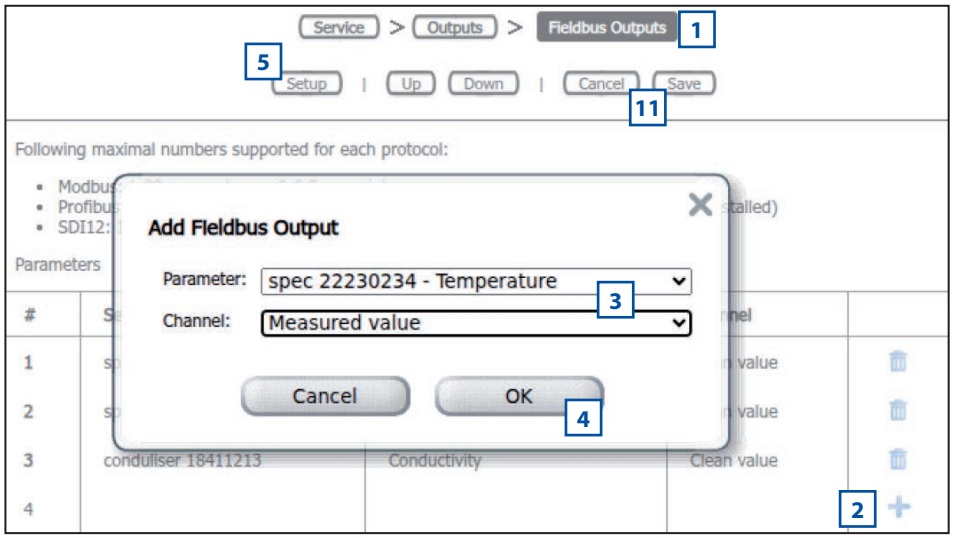
7.2.2 Configuration of Fieldbus Transfer on con::cube

For automatic data transfer via Modbus TCP, Modbus RTU, Profibus, SDI12 or EtherNet/IP the sequence of the data to be transfered and some customer specific settings for the transfer need to be configured on the con::cube.

1 Open moni::tool menu *Service > Outputs > Fieldbus Outputs*.

2 Within the list that pops up new parameter for transfer can be added by pushing the + sign.

3 The parameter name can be selected from the drop-down list *Parameter* and the parameter type (*Measured value* or *Clean value* from vali::tool) can be selected as *Channel*.



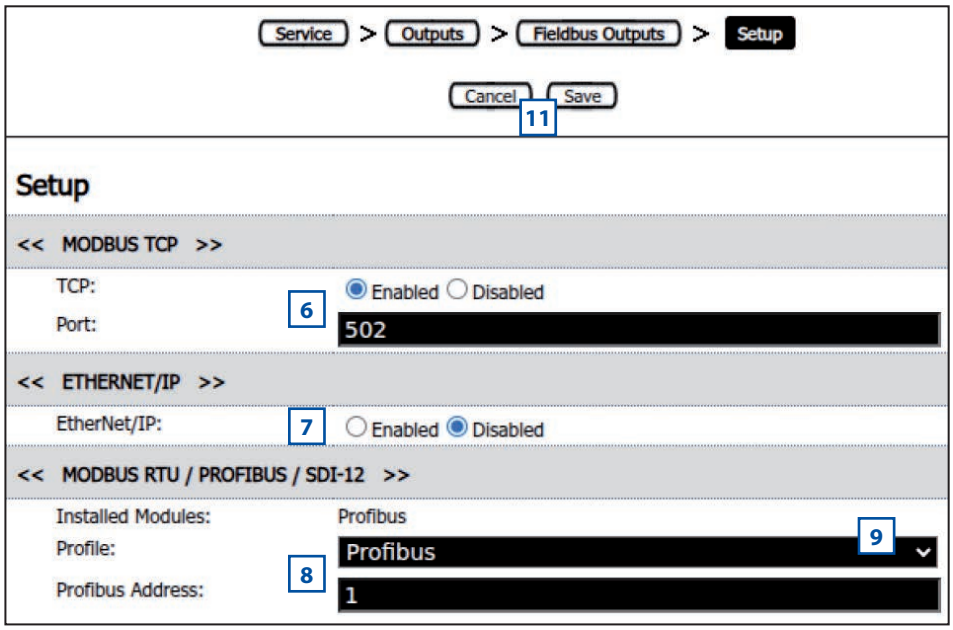
4 Push the button *OK* to add the new parameter to the transfer list.

5 Push the button *Setup* to open the window for configuration.

6 For data transfer via *MODBUS TCP*, tick the *Enable* box.

7 For data transfer via *EtherNet/IP*, tick the *Enable* box.

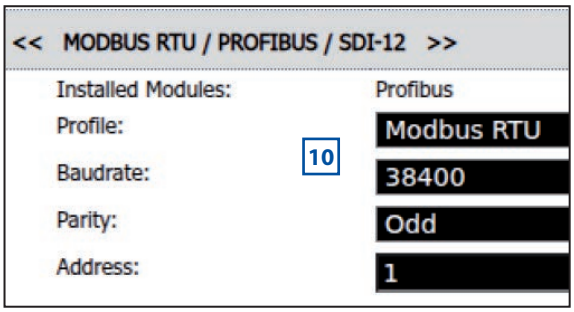
8 For data transfer via *PROFIBUS TCP*, select *Profibus* as Profile and enter the *Profibus Address* needed for the transfer.



9 Within the drop down menu *Profile* the options *Modbus RTU* or *SDI-12* can be selected also in case one of those types is used for data transfer.

10 In case of *Modbus RTU* data transfer the *Baudrate*, the *Parity* an the *Address* can be entered individually.

11 Push the button *Save* to store all modifications permantently or the button *Cancel* to avoid any changes.



7.2.3 Manual Transfer of Measurement Results and Status Messages

The measurement results, status messages and information stored on the con::cube can be downloaded manually to a directly connected USB stick or a remotely connected device as follows:

- stored result files - *Service / Outputs / File Outputs / Files*
- results from the data base - *Service / Outputs / File Outputs / Manual Download*
- Logbog of con::cube - *Status / Terminal / Logbook*

Detailled informationen on configuring data transfer and the content of the transferred files can be found in the moni::tool manual.

7.3 Data Types

All interfaces use a common representation of data types. Each accessible data item can be allocated to one of the types shown in the table below. The type of a given item can always be found by checking the Modbus mapping. In addition the name of the data item are prefixed by one or two letters to indicate the data type. Data types which are non standard need special attention and are marked specially. Data from Modbus mapping are directly mapped to the according Profibus address space.

Type	Description	Size (Bytes)	Prefix	Note
char[x]	string	x	ab	ASCII
bitmask	bitmask of 16 bits	2	bm	
int16	signed 16 bit integer	2	i	NaN = INT 16_MAX
unit16	unsigned 16 bit integer	2	ui	NaN = UNIT 16_MAX
float	IEEE-754 floating pints	4	f	NaN = 0xFFFF FFFF NaN = 0x7FC0 0000
enum	enum type	2	e	
timestamp TAI64N	timestamp format	6	ts	see http://cr.yp.to/proto/tai64.txt

For all data types the Big-Endian encoding is used.

- Characters are represented in ASCII. A single character (for example „a“) with ASCII code 0x61 has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0x61=´a‘								0x00							

- Character strings are represented in ASCII and have a fixed size. If not all bytes are needed the string must be filled with trailing spaces. A three character string (for example “abc”) of size 4 has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0x61=´a‘								0x62=´b‘							
0xXXXX + 1	0x63=´c‘								0x20=´ ´							

- The bitmask is used to represent up to 16 logical states. Unused states are zero by convention. A logical state with bits a15 to a0 has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	a15	a14	a13	a12	a11	a10	a9	a8	a7	a6	a5	a4	a3	a2	a1	a0

For example bitmask with a15:0 = (1100 1010 0011 0110) has the mapping

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	1	1	0	0	1	0	1	0	0	0	1	1	0	1	1	0

- A signed 16bit integer = ±0xXXYY (int16) has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xXX								0xYY							

For example -17289 = 0xBC77 has the mapping

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xBC								0x77							

- An unsigned 16bit integer = 0xXXYY (unit16) has the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xXX								0xYY							

For example 45311 = 0xB0FF has the mapping

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	0xB0								0xFF							

- Floats are represented in IEEE-754 format with 32bit standard precision and have the following mapping:

	Modbus register															
Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0xXXXX	s	e7	e6	e5	e4	e3	e2	e1	e0	f22	f21	f20	f19	f18	f17	f16
0xXXXX + 1	f15	f14	f13	f12	f11	f10	f9	f8	f7	f6	f5	f4	f3	f2	f1	f0

Timestamps are presented in TAI64n format, which is an unsigned integer counting the seconds from 1.1.1970 using the big-endian format. 1.1.1970 = 0x4000 0000 0000 0000 + 0x0000 0000, e.g. 400000004d9b3395 = 2011-04-05 15:21:47 (for further details please refer to www.tai64.com).

7.4 Data Transfer via Modbus Interface

The con::cube is equipped with a Modbus interface which support the standardized Modbus protocol via RTU or TCP / IP. This interface enables the integration of the con::cube into other networks and supports the following features:

- Reading of device description (see table - Mapping of Device specific Input Register or Device specific Holding Register)
- Reading of parameter results (see table - Mapping of Parameter specific Input Register or Parameter specific Holding Register)
- Reading of parameter status information (see table - Mapping of Parameter Status)
- Reading of system status information (see table - Mapping of System Status)

Access to this information is possible by reading input registers and / or by reading holding registers. The type and the location of the registers is described in the following sections.

The con::cube Modbus is specified according the Modbus-IDA Application Protocol V1.1a and supports the following function codes:

Function	Function code	Description (used for)
Read Input Register	0x04	Parameter readings Parameter status Device status
Read Holding Register	0x03	Device and parameter configuration settings, Mirrored input registers (for support of limited Modbus master devices)

Mapping of Device specific Input Register							
Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
device description	uiVersion	0x0000	unit16	1	R	Version of Modbus mapping protocol. For all changes in public registers: 0xAABB AA ... Major version BB ... Minor version (compatible)	0
	eVendor	0x0001	enum	1	R	Vendor code	1
	eModel	0x0002	enum	1	R	Device model	2
	abModel	0x0003	char[20]	10	R	Description of device model, filled with spaces	3
	abSerialNumber	0x000D	char[8]	4	R	Serial number, filled with spaces	13
	abSWRelease	0x0013	char[4]	2	R	Software release: 0xAABB AA ... Major version BB ... Minor version	19
device status public	tSampleTime	0x0068	time-stamp	6	R	Time when the parameter results have been updated. Timestamp of logged status and results	104
	bmDeviceStatus	0x0078	bitmask	1	R	Device status	120

Mapping of Parameter specific Input Register							
Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
parameter 1 result	bmP1Status	0x0080	bitmask	1	R	Para.1 status [1)]	128
	xP1Value	0x0082	float	2	R	Para.1 result	130
parameter 2 result	bmP2Status	0x0088	bitmask	1	R	Para.2 status [1)]	136
	xP2Value	0x008A	float	2	R	Para.2 result	138
parameter 3 result	bmP3Status	0x0090	bitmask	1	R	Para.3 status [1)]	144
	xP3Value	0x0092	float	2	R	Para.3 result	146
parameter 4 result	bmP4Status	0x0098	bitmask	1	R	Para.4 status [1)]	152
	xP4Value	0x009A	float	2	R	Para.4 result	154
parameter 5 result	bmP5Status	0x00A0	bitmask	1	R	Para.5 status [1)]	160
	xP5Value	0x00A2	float	2	R	Para.5 result	162
parameter 6 result	bmP6Status	0x00A8	bitmask	1	R	Para.6 status [1)]	168
	xP6Value	0x00AA	float	2	R	Para.6 result	170
parameter 7 result	bmP7Status	0x00B0	bitmask	1	R	Para.7 status [1)]	176
	xP7Value	0x00B2	float	2	R	Para.7 result	178
parameter 8 result	bmP8Status	0x00B8	bitmask	1	R	Para.8 status [1)]	184
	xP8Value	0x00BA	float	2	R	Para.8 result	186
parameter 9 result	bmP9Status	0x00C0	bitmask	1	R	Para.9 status [1)]	192
	xP9Value	0x00C2	float	2	R	Para.9 result	194
parameter 10 result	bmP10Status	0x00C8	bitmask	1	R	Para.10 status [1)]	200
	xP10Value	0x00CA	float	2	R	Para.10 result	202
parameter 11 result	bmP11Status	0x00D0	bitmask	1	R	Para.11 status [1)]	208
	xP11Value	0x00D2	float	2	R	Para.11 result	210
parameter 12 result	bmP12Status	0x00D8	bitmask	1	R	Para.12 status [1)]	216
	xP12Value	0x00DA	float	2	R	Para.12 result	218
parameter 13 result	bmP13Status	0x00E0	bitmask	1	R	Para.13 status [1)]	224
	xP13Value	0x00E2	float	2	R	Para.13 result	226
parameter 14 result	bmP14Status	0x00E8	bitmask	1	R	Para.14 status [1)]	232
	xP14Value	0x00EA	float	2	R	Para.14 result	234
parameter 15 result	bmP15Status	0x00F0	bitmask	1	R	Para.15 status [1)]	240
	xP15Value	0x00F2	float	2	R	Para.15 result	242
parameter 16 result	bmP16Status	0x00F8	bitmask	1	R	Para.16 status [1)]	248
	xP16Value	0x00FA	float	2	R	Para.16 result	250
parameter 17 result	bmP17Status	0x0100	bitmask	1	R	Para.17 status [1)]	256
	xP17Value	0x0102	float	2	R	Para.17 result	258
parameter 18 result	bmP18Status	0x0108	bitmask	1	R	Para.18 status [1)]	264
	xP18Value	0x010A	float	2	R	Para.18 result	266
parameter 19 result	bmP19Status	0x0110	bitmask	1	R	Para.19 status [1)]	272
	xP19Value	0x0112	float	2	R	Para.19 result	274
parameter 20 result	bmP20Status	0x0118	bitmask	1	R	Para.20 status [1)]	280
	xP20Value	0x011A	float	2	R	Para.20 result	282
parameter 21 result	bmP21Status	0x0120	bitmask	1	R	Para.21 status [1)]	288
	xP21Value	0x0122	float	2	R	Para.21 result	290

[1)] Please refer to table Mapping of Parameter Status

Mapping of Parameter specific Input Register							
Input register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
parameter 22 result	bmP22Status	0x0128	bitmask	1	R	Para.22 status [1)]	296
	xP22Value	0x012A	float	2	R	Para.22 result	298
parameter 23 result	bmP23Status	0x0130	bitmask	1	R	Para.23 status [1)]	304
	xP23Value	0x0132	float	2	R	Para.23 result	306
parameter 24 result	bmP24Status	0x0138	bitmask	1	R	Para.24 status [1)]	312
	xP24Value	0x013A	float	2	R	Para.24 result	314
parameter 25 result	bmP25Status	0x0140	bitmask	1	R	Para.25 status [1)]	320
	xP25Value	0x0142	float	2	R	Para.25 result	322
parameter 26 result	bmP26Status	0x0148	bitmask	1	R	Para.26 status [1)]	328
	xP26Value	0x014A	float	2	R	Para.26 result	330
parameter 27 result	bmP27Status	0x0150	bitmask	1	R	Para.27 status [1)]	336
	xP27Value	0x0152	float	2	R	Para.27 result	338
parameter 28 result	bmP28Status	0x0158	bitmask	1	R	Para.28 status [1)]	344
	xP28Value	0x015A	float	2	R	Para.28 result	346
parameter 29 result	bmP29Status	0x0160	bitmask	1	R	Para.29 status [1)]	352
	xP29Value	0x0162	float	2	R	Para.29result	354
parameter 30 result	bmP30Status	0x0168	bitmask	1	R	Para.30 status [1)]	360
	xP30Value	0x016A	float	2	R	Para.30 result	362
parameter 31 result	bmP31Status	0x0170	bitmask	1	R	Para.31 status [1)]	368
	xP31Value	0x0172	float	2	R	Para.31 result	370
parameter 32 result	bmP32Status	0x0178	bitmask	1	R	Para.32 status [1)]	376
	xP32Value	0x017A	float	2	R	Para.32 result	378

[1)] Please refer to table Mapping of Parameter Status

Mapping of Device specific Holding Register							
Holding register, 16bit, RO	Tag name	Address	Type	Length	R/W	Description	Address
device description	uiVersion	0x0FA0	unit16	1	R	Version of Modbus mapping protocol. For all changes in public registers: 0xAABB AA ... Major version BB ... Minor version (compatible)	4000
	eVendor	0x0FA1	enum	1	R	Vendor code	4001
	eModel	0x0FA2	enum	1	R	Device model	4002
	abModel	0x0FA3	char[20]	10	R	Description of device model, filled with spaces	4003
	abSerialNumber	0x0FAD	char[8]	4	R	Serial number, filled with spaces	4013
	abSWRelease	0x0FB3	char[4]	2	R	Software release: 0xAABB AA ... Major version BB ... Minor version	4019
device status public	tSampleTime	0x0068	time-stamp	6	R	Time when the parameter results have been updated. Timestamp of logged status and results	4104
	bmDevice Status	0x0078	bitmask	1	R	Device status	4120

Mapping of Parameter specific Holding Register							
Holding register, 16bit, RW	Tag name	Address	Type	Length	R/W	Description	Address
parameter 1 result	bmP1Status	0x1020	bitmask	1	R	Para.1 status [1)]	4128
	xP1Value	0x1022	float	2	R	Para.1 result	4130
parameter 2 result	bmP2Status	0x1028	bitmask	1	R	Para.2 status [1)]	4136
	xP2Value	0x102A	float	2	R	Para.2 result	4138
parameter 3 result	bmP3Status	0x1030	bitmask	1	R	Para.3 status [1)]	4144
	xP3Value	0x1032	float	2	R	Para.3 result	4146
.....							
parameter 32 result	bmP32Status	0x1118	bitmask	1	R	Para.32 status [1)]	4376
	xP32Value	0x111A	float	2	R	Para.32 result	4378

[1)] Please refer to table Mapping of Parameter Status

The representation of the system / device / parameter status and denotation of the single bits (b_0 ... b_{15}) is shown in the tables below. Bits that are not represented in the tables are not supported or reserved.

Each bit reperesents a condition (1=error, 0=o.k.)

Mapping of Parameter Status (bmPxStatus)			
Bit	Display (xPxValue)	Status	Description
b0	NaN or value	General parameter error	■ At least one internal parameter check failed ■ For details check all other status bits ■ Unknown failure if all other status bits are ok
b11	value	Maintenance necessary	■ vali::tool recommends check of system integrity (function check) ■ If system integrity is ok, the vali::tool configuration needs to be adapted.
b13	value	Parameter alarm	■ ana::tool / alarm parameter reports parameteralarm
b14	value	Parameter warning	■ ana::tool / alarm parameter reports parameterwarning

Mapping of System Status (bmDeviceStatus)			
Bit	Display (xPxValue)	Status	Description
b0	NaN	General device error	■ Communication to connected devices failed ■ Probe or sensor misuse ■ Probe or sensor malfunction or failure

7.5 Data Transfer via Profibus DP Interface

The Profibus DP output module (see section 11.3.3) provides a Profibus DP compatible fieldbus interface (according to IEC 61158) for the integration of the con::cube into Profibus DP networks. You can choose to transfer either the measured values including parameter status and measurement time for up to 8 parameters (D-315-OUT-PROFIBUS_08) or only the measured values for up to 16 parameters (D-315-OUT-PROFIBUS_16). The respective mapping is shown in the following two sections.

Only certified Profibus DP cables should be used for data transmission. The General Station Data File (GSD file) required for data transmission can be downloaded from the Badger Meter website.
https://www.badgermeter.com/products/water-quality-monitoring/terminals/concube-v3-iot

7.5.1 Profibus 8 Parameter Mapping

Byte	Hex	Length	Data Type	Name	Description
1	0x01	1	Byte		Profibus status code
2	0x02	1	Byte		Profibus status data
3 - 4	0x03 – 0x04	2	Bitmask	bmDeviceStatus	System status of con::cube
5 - 6	0x05 – 0x06	2	Bitmask	bmP1Status	Status of parameter 1
7 - 10	0x07 – 0x0A	4	Float	xP1Value	Reading of parameter 1
11 - 12	0x0B – 0x0C	2	Bitmask	bmP2Status	Status of parameter 2
13 - 16	0x0D – 0x10	4	Float	xP2Value	Reading of parameter 2
17 - 18	0x11 – 0x12	2	Bitmask	bmP3Status	Status of parameter 3
19 - 22	0x13 – 0x16	4	Float	xP3Value	Reading of parameter 3
23 - 24	0x17 – 0x18	2	Bitmask	bmP4Status	Status of parameter 4
25 - 28	0x19 – 0x1C	4	Float	xP4Value	Reading of parameter 4
29 - 30	0x1D – 0x1E	2	Bitmask	bmP5Status	Status of parameter 5
31 - 34	0x1F – 0x22	4	Float	xP5Value	Reading of parameter 5
35 - 36	0x23 – 0x24	2	Bitmask	bmP6Status	Status of parameter 6
37 - 40	0x25 – 0x28	4	Float	xP6Value	Reading of parameter 6
41 - 42	0x29 – 0x2A	2	Bitmask	bmP7Status	Status of parameter 7
43 - 46	0x2B – 0x2E	4	Float	xP7Value	Reading of parameter 7
47 - 48	0x2F – 0x30	2	Bitmask	bmP8Status	Status of parameter 8
49 - 52	0x31 – 0x34	4	Float	xP8Value	Reading of parameter 8
53 - 64	0x35 – 0x40	12	TAI64N	tSampleTime	Time of last measurement

The Status can be read as data type BITMASK of 16 bits (2 bytes) or as unsigned 16 bit integer (UNIT16).

7.5.2 Profibus 16 Parameter Mapping

Byte	Hex	Länge	Data Type	Name	Description
1 - 4	0x01 - 0x04	4	Float	xP1Value	Reading of parameter 1
5 - 8	0x05 - 0x08	4	Float	xP2Value	Reading of parameter 2
9 - 12	0x09 - 0x0C	4	Float	xP3Value	Reading of parameter 3
13 - 16	0x0D- 0x10	4	Float	xP4Value	Reading of parameter 4

Byte	Hex	Length	Data Type	Name	Description
17 - 20	0x11- 0x14	4	Float	xP5Value	Reading of parameter 5
21 -24	0x15 - 0x18	4	Float	xP6Value	Reading of parameter 6
25 - 28	0x19 - 0x1C	4	Float	xP7Value	Reading of parameter 7
29 - 32	0x1D - 0x20	4	Float	xP8Value	Reading of parameter 8
33 - 36	0x21- 0x24	4	Float	xP9Value	Reading of parameter 9
37 - 40	0x25- 0x28	4	Float	xP10Value	Reading of parameter 10
41 - 44	0x29 - 0x2C	4	Float	xP11Value	Reading of parameter 11
45 - 48	0x2D - 0x30	4	Float	xP12Value	Reading of parameter 12
49 - 52	0x31 - 0x34	4	Float	xP13Value	Reading of parameter 13
53 - 56	0x35 - 0x38	4	Float	xP14Value	Reading of parameter 14
57 - 60	0x39 - 0x3C	4	Float	xP15Value	Reading of parameter 15
61 - 64	0x3D - 0x40	4	Float	xP16Value	Reading of parameter 16

7.6 Data Transfer via SDI12 Interface

The SDI12 module (D-315-OUT-SDI12) provides a SDI12 compatible fieldbus interface for the integration of the con::cube into SDI12 networks. The module enables the transfer of readings and status information for up to eight parameters as well as the system status. The location and type of the values are shown in the table in section 7.5.

Parameter readings can be queried via a SDI12-Master connected to the con::cube using a simple terminal programm (e.g. Docklight). For reading of measurement results the following commands are needed (ASCII-code):

Action	Command	Description
Send	0M!<CR><LF>	Start measurement parameter 1
Answer	00001<CR><LF>	
Send	0D!<CR><LF>	Query of measurement result
Answer		Measurement result of parameter 1
Send	0M1!<CR><LF>	Start measurement parameter 2
Answer	00001<CR><LF>	
Send	0D!<CR><LF>	Query of measurement result
Answer		Measurement result of parameter 2
...		
Send	0M7!<CR><LF>	Start measurement parameter 8
Answer	00001<CR><LF>	
Send	0D!<CR><LF>	Query of measurement result
Answer		Measurement result of parameter 8

<CR> ..... Carriage Return
<LF> ..... Line Feed

7.7 Data Transfer via EtherNet/IP Interface

EtherNet/IP is an industrial fieldbus protocol designed for Ethernet-based networks. Badger Meter Austria has successfully integrated and certified EtherNet/IP support on con::cube since moni::tool version V5.2. EtherNet/IP allows external clients, commonly referred to as EtherNet/IP scanners (e.g., PLCs or data browser clients), to access device and parameter data. The following sections provide a concise overview of the supported features, configuration steps, and typical use cases.

For maximum reliability, only high-quality Ethernet CAT5/CAT5e/CAT6 LAN cables should be used for data transmission. The Electronic Data Sheet (EDS file) required for data transmission can be downloaded directly from the terminal using the standard EtherNet/IP CIP Object File Object 0x37.

EtherNet/IP uses CIP (Common Internet Protocol, also previously known as the Control Industrial Protocol) messages over an Ethernet network. Both EtherNet/IP and CIP are specified by the ODVA consortium. CIP defines some standard objects to facilitate the interoperability between EtherNet/IP devices and EtherNet/IP scanners. In addition to the standard objects, devices are expected to define their own user objects.

From a user perspective, the following two types messaging are usually supported:

- Implicit messaging:
  similar concept to Modbus Input Registers. These messages (also called I/O Assemblies) are used to get quickly read-only data, i.e. parameters and status values. Implicit messages are expected to be quick up to 504 bytes (that way they can be packed in a TCP/UDP packet without fragmentation).
- Explicit messaging:
  similar concept to Modbus Holding Registers. Those messages are typically used to allow configuring an EtherNet/IP device. In the implementation, only read access to device and parameter properties is currently supported.

7.7.1 Mapping of Implicit Messaging

Implicit messages are the primary data mover, i.e., to get parameter values and statuses. Messages are sent via UDP and are limited to up to 504 bytes only.

All exported scalar values (a single floating-point value) are packed together into four assemblies (Class 110, Instances 1 to 4). Each assembly contains the status, value, and timestamp of 24 parameters.

Each fingerprint consists of 221 floating-point values in total and is divided into two assemblies:

- The lower part of a fingerprint, containing wavelength values from 1 to 112 (Class 111, Instances 1 to 8).
- The higher part of a fingerprint, containing wavelength values from 113 to 221 (Class 112, Instances 1 to 8).

Implicit assemblies provide the parameter values as exported via Fieldbus outputs. Single parameter values are packed in 4 assemblies, each assembly having the data of 24 parameters. Up to 96 parameter values are exposed via implicit IO assemblies.

Please note that only T20 (Read Flow) assemblies are currently supported. O2T (Write Data Flow) assemblies are not supported currently.

- Instance Id 110 ... 113 simple parameter value

Attribute Id	Name	T20 Data flow (Read) Description of simple parameter value	Data Type	Example
1	xParameterValue1	Pack of simple parameter value + status	STRUCT OF SIMPLE	
2	xParameterValue2	Pack of simple parameter value + status	STRUCT OF SIMPLE	
3	xParameterValue3	Pack of simple parameter value + status	STRUCT OF SIMPLE	
...				
24	xParameterValue24	Pack of simple parameter value + status	STRUCT OF SIMPLE	

- STRUCT OF simple parameter value

Field Number	Name	Description	Data Type	Example
1	uiParameterStatus		unit16	0
2	pParameterPriv-Status		unit16	-
3	pParameterPriv-Status	Parameter value	float	
4	tSampleTime	Time when the parameter results were updated. Timestamp of logged status & results.	datetime TAI64N (12 bytes)	2023-12-15 10:59:18 UTC

For advanced use, Fingerprint are also available. Due to the fingerprint size (221 wavelength values), a single assembly is not enough to provide the complete fingerprint value. Thus, parameter data is packed in two assemblies: class 111 and class 112. Class 111 provides the first 112 values, whereas class 112 provides the second half. Up to 8 parameters are supported.

- Instance Id 120 ... 127 fingerpint parameter value lower part (1..112)

Attribute Id	Name	Description	Data Type
1	xFpParameterValueLo	fingerprint parameter value+status (lower part)	STRUCT OF FP

- Instance 130 ... 137 fingerpint parameter value higher part (113..221)

Attribute Id	Name	Description	Data Type
1	xFpParameterValueHi	fingerprint parameter value+status (lower part)	STRUCT OF FP

- STRUCT OF fingerprint parameter value

Field Number	Name	Description	Data Type	Example
1	uiFpParameterStatus		unit16	0
2	pFpParameterPrivSta-tus		unit16	-
3	xFpParameterPrivSta-tus	Parameter value	float[112]	
4	tFpSampleTime	Time when the parameter results were updated. Timestamp of logged status & results.	datetime TAI64N (12 bytes)	2023-12-15 10:59:18 UTC

7.7.2 Mapping of Explicit Messaging

Explicit messages are used in an intermittent way to retrieve configuration and events. Data is sent via TCP and has no size limit. Explicit messages are organized in 3-level hierarchical fashion:

- Class
- Instance
- Attribute Id.

The following schema is used in the mapping to describe up to 96 parameters and 8 fingerprints:

- class 100, instance 1: all properties of the measuring station
- class 101, instance 1: description for parameter 1
- class 101, instance 2: description for parameter 2
- class 101, instance 3: description for parameter 3
- …
- class 101, instance 96: description for parameter 96
- class 101, instance 97: description for fingerprint 1
- class 101, instance 98: description for fingerprint 2
- ...
- class 101, instance 104: description for fingerprint 8

- Class 100, Instance 1 provides station properties

Attribute Id	Name	Description of System Object	Data Type	Example	Access Rules
1	uiVersion	Modbus-mapping protocol version. For all changes in public registers: 0xAABB AA..major version, BB..minor version (compatible).	unit16	0x0101 = v1.1	read only
2	eVendor	Vendor code	unit16 enum	0x96C3 = s::can	read only
3	eModel	Device model	unit16 enum	0x0101=con::cube V3	read only
4	abModel	Device model description (padded with spaces)	string	„con::cubeV3 „	read only
5	abSerialNumber	Serial number (padded with spaces)	string	„24020001“	read only
6	abHWRelease	Hardware release. AABB AA ... major version BB ... minor version	string	„0101“	read only
7	abSWRelease	Software release. AABB AA ... major version BB ... minor version	string	„0101“	read only

Attribute Id	Name	Description of System Object	Data Type	Example	Access Rules
8	uiHWStarts	Device reboot counter	unit16	0	read only
9	uiParameter-Count	Number of active single parameters	unit16	8	read only
10	bmDeviceStatus	Terminal device status	unit16 bitmask	0000 0000 0000 0000b	read only
11	bmDevicePriv-Status	Terminal device status private	unit16 bitmask	-	read only
-	pDeviceStatu-sPrivate	Terminal device private status registers	unit16[2]	-	read only
12	abStationname	Stationname used in moni::tool	string	„ccLab02“	read only

Class 101, Instance 1 up to 96 provides the scalar single value parameter attributes. Up to 96 parameters are supported.

The current implementation (moni::tool V5.2) supports only up to 32 parameters. Class 101, Instance 97 to 104 provides fingerprint parameter attributes. Up to 8 fingerprints are supported.

- Class 101 Instance 1 ... 104

Attribute Id	Name	Description	Data Type	Example	Access Rules
1	abSensorName	Name of the sensor	string	„sp3-00000023“	read only
2	abParameterName	Name of the parameter	string	„Fingerprint“	read only
3	abParameterUnit	Unit of the parameter	string	„Abs/m“	read only
4	uiParameterUpper-Limit	Upper limit of parameter	unit16	NaN	read only
5	uiParameterLower-Limit	Lower limit of parameter	unit16	NaN	read only
6	uiParameterReso-lution	Parameter resolution (number of digits)	unit16	2	read only
7	uiParameterScale	Parameter scale factor. Used for all parameter values which depend on eParameterType	unit16 enum	0x000A = 10 … „0x00FF“=255/10=25,5.	read only
8	eParameterType	parameter datatype = type of param. result = type of upper/ lower limit = type of sample-measured and -reference value.	unit16 enum	3 = unsigned long	
9	eFPDetectorType		unit16		read only
10	eFPSource		unit16		read only
11	uiMPath		unit16		read only
12	abGKName	Name of global calibration	string	„RIV100FV22T“	read only
13	xParExtValue	Extended parameter value	STRUCT		

8 FUNCTION CHECK

A function check might be required for one of the following reasons:

- Initial startup
- Routine function check
- Suspicion of monitoring system malfunction
- Modification of monitoring system (e.g. integration of additional sensor or device)
- Change of measuring location

Depending on the application (water composition), the probes and sensors connected and the environmental conditions a regular function check (weekly to monthly) is recommended. The following sections provide an overview of all the actions that have to be performed to check the monitoring system quickly (see section 8.1). To check the plausibility of the displayed and collected readings and the integrity of a single probe or sensor, please refer to the according manuals of the connected probes and sensors.

8.1 Check System / Monitoring Station

What to check	How to check	What to do, if check failed
Power supply	LED on housing cover is on or at least flashing? moni::tool screen is displayed after touching the screen?	Check power supply. Dis- and reconnect power supply after one minute.
System running (up-to-date)	Click on system clock at the bottom of the moni::tool screen and check if current time and time of last measurement is current.	Check time and measurement settings. Please remind that polling of readings needs several seconds.
Automatic measurement active	Readings are actualized? Service mode not active?	Check measuring settings Leave Service mode
System status	LED is blue? Status icon is not flashing? Alarm icon is not flashing?	Click on flashing icon and see displayed information. See moni::tool manual for further details.
System stability	Check *Status > Terminal > Logbook* entries since last function check.	See help text and moni::tool manual for further details.
Installation	Housing, touch screen, cable connections and plugs are undamaged and tight?	Repair or replace damaged parts, that might influence the IP 65 protection (see section 4.1)
Function of automatic cleaning	Wait for next cleaning cycle or activate cleaning manually. Watch for air bubbles or listen if brush is rotating.	Check configuration, electrical connection, air tubes and cleaning device itself.
Efficiency of automatic cleaning	Perform function check of the probes and sensors connected to the automatic cleaning.	Improve automatic cleaning settings Replace cleaning brush
Datatransfer	Compare the readings displayed on the terminal for operation with those readings received by the used SCADA system.	Check data transfer settings. Use test function to check data transfer.

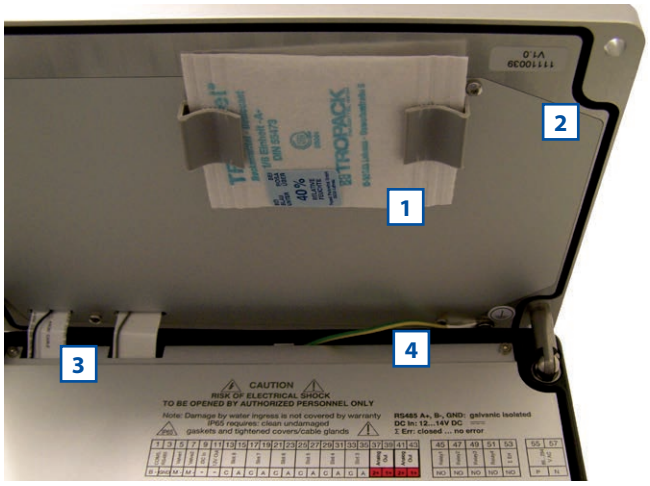
9 MAINTENANCE

9.1 Cleaning

The device housing is made of aluminium alloy. Only use a wet cloth tissue and drinking water and / or mild detergents (e.g. dish washing soap) for cleaning.

9.2 Desiccant Bag

To avoid malfunctions due to condensing humidity, one desiccant bag [1] is fixed on the cover of the con::cube (see picture on the right hand side). When the package has reached the maximum humidity absorption capacity (the blue-coloured label will turn pink in that case), it has to be exchanged. Before closing the con::cube, every time check the desiccant package.



The desiccant package is not intended for the continuous absorption of humidity but only for the reduction of humidity below the dew point in a completely closed case. For this reason, properly closed housing cover and tightly screwed cable bushings are a prerequisite for correct functioning. In case of damage to the cord gasket in the housing cover it has to be repaired.

Used desiccant packages can be regenerated using normal drying processes (e.g. drying chamber at max 60°C or nitrogen). In this context, care must be taken that the cartridges cool down and are stored in an absolutely dry environment after the drying process.

Desiccant Packages are also available as spare parts (see section 11.2.1)

9.3 Housing

To ensure IP 65 grade protection, gaskets and case edges must be checked for cleanliness, possible damage and dirt or foreign bodies before closing the housing cover every time. In case of damage to the cord gasket (marked with [2] in the picture above) in the housing cover it has to be repaired! Please ensure that the wires for the display (marked with [3] in the picture above) and the earth grounding (marked with [4] in the picture above) are positioned correctly (see picture above).

The cover must be tightly screwed (tightening torque 2.5 Nm) and the cable glands filled with cable or fitting plugs, must also be tight (tightening torque 2.5 Nm for 16 mm and 5 Nm for 20 mm). All sockets not in use (USB, MIL, etc.) must be covered with corresponding caps. Damage caused by intrusion of water will not be covered by the warranty.

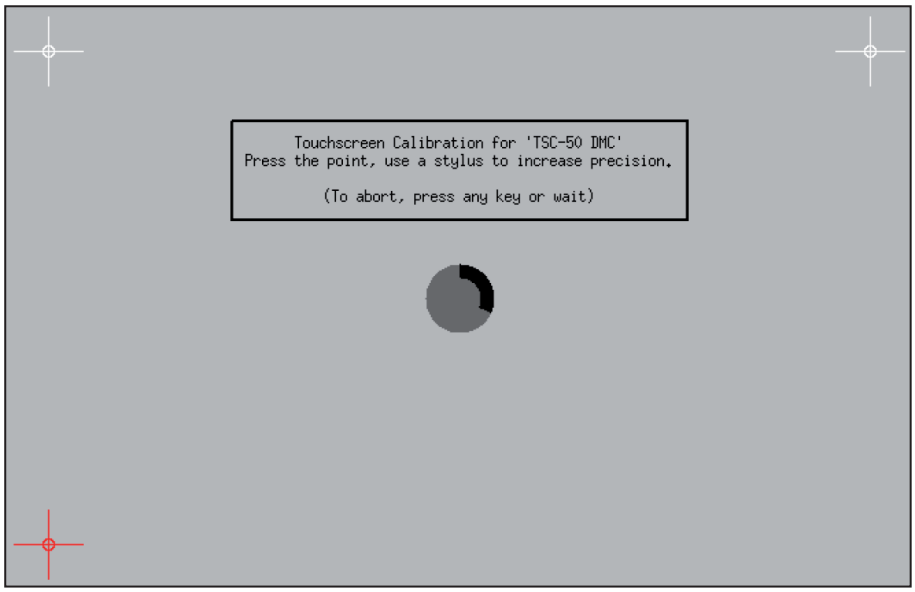
9.4 Calibration Touch Screen

Every touch screen requires calibration so that each point on the touch surface is assigned to the corresponding spot on the display as accurately as possible.

Calibration has to be repeated if necessary because the touch screen properties may change due to environmental impacts, in particular repeated temperature fluctuations and ageing.

The touch screen calibration programme can be started in the moni::tool menu *Service > Terminal > Display* via the button *Calibrate Touchscreen*.

If the con::cube can no longer be operated via the touchscreen, the calibration process can also be started remotely via a web browser or VNC viewer. The calibration itself must then be carried out via VNC Viewer or directly on the con::cube, possibly using a mouse connected via USB.



10 TROUBLESHOOTING

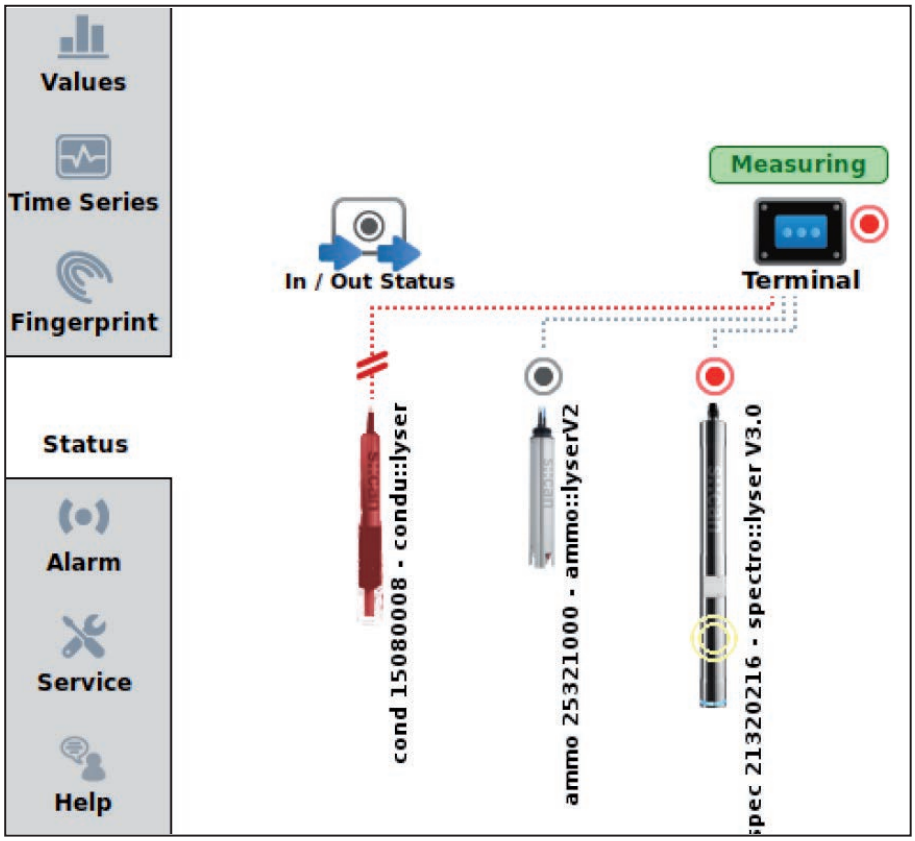
10.1 System Status

The Status screen provides an overview of the active monitoring system, including the terminal, all sensors, in- and output modules as well as other devices (e.g. camera) that are currently installed.

The current status of the individual components is shown with coloured rings (white/grey is OK, red is error, yellow means measurement active). A red connection between the controller for operation and a sensor in combination with a red sensor symbol indicates that no communication is possible.

Above the *Terminal* symbol the remaining time until the next measurement or *Measuring* is displayed.

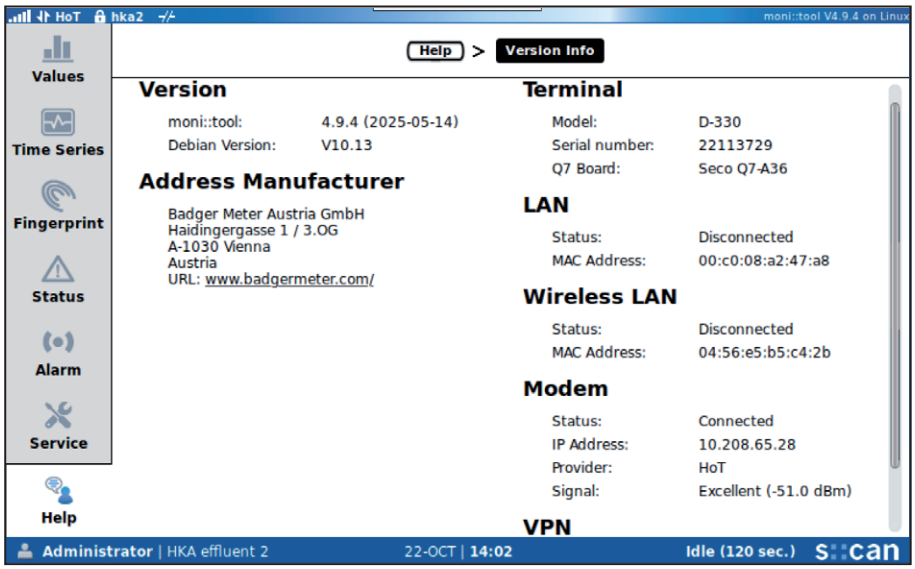
Further detailed information on each system component can be accessed by pushing corresponding icon.



The logbook of the con::cube is displayed via the menu *Status > Terminal > Logbook* and can be downloaded to a USB stick or a remotely connected device (PC / notebook) by pushing the *Export all* button.

Further details on the system status can be found in the manual for the moni::tool user software.

A general overview of the device properties (serial number, installed software version, etc.) and network connections can be found via the menu *Help > Version Info* or by clicking on the *s::can* logo at the bottom right of the screen.



10.2 Software Update

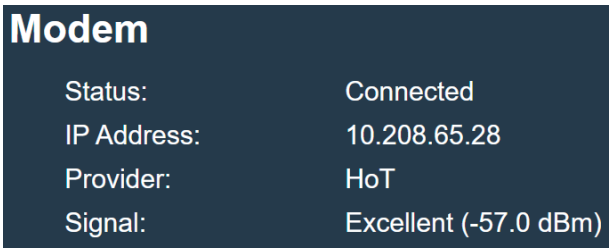
The moni::tool operating software can be updated in various ways.

- The simplest update option is a live update. This requires the con::cube to have a stable internet connection, and the update is performed via the Badger Meter Austria download server (see section 10.2.1).
- The update can be performed on site using a USB stick directly on the con::cube (see section 10.2.2).
- An update via a remotely connected PC/notebook is also possible (see section 10.2.3).

For the latter two options, the update package (concube-update_x.y.zip) must be downloaded from the Badger Meter Website (https://www.badgermeter.com/en-gb/products/water-quality-monitoring/terminals/concube-v3-iot).

⚠ Don't switch off the con::cube or close any progress windows while updating. The update procedure will stop operation of all moni::tool services. You will be informed about the updates progress via the remote browser and con::cube display. Once update has finished, the con::cube will restart moni::tool automatically. To update to a new major version of moni::tool (e.g. from V4 to V5), a reflash of the con::cube is required.

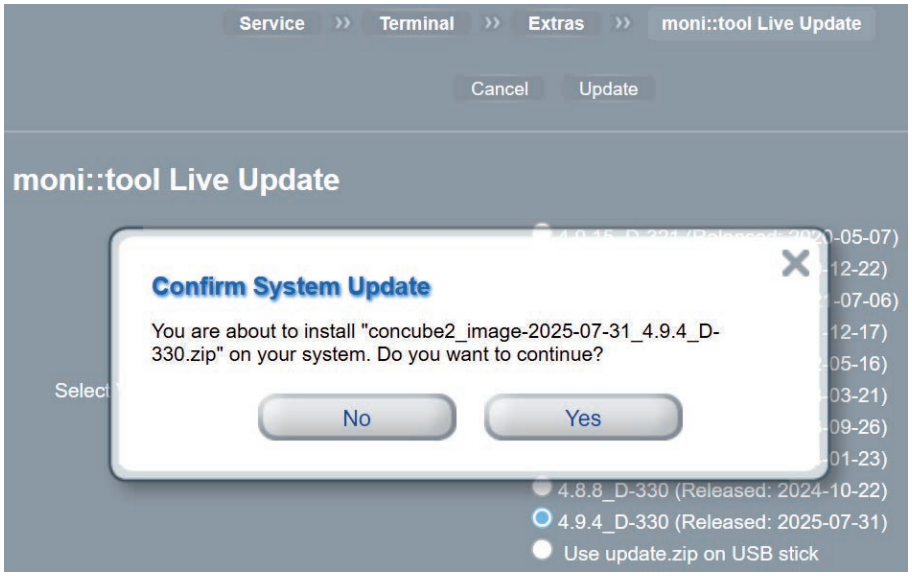
The actual installed moni::tool version is displayed in the upper right corner of the con::cube screen. After clicking on the *s::can* logo in the lower right corner of the con::cube screen, the version details are displayed (see section 10.1).



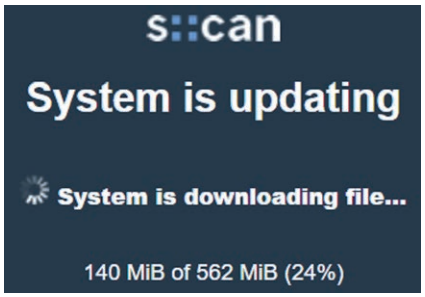
10.2.1 Live Update

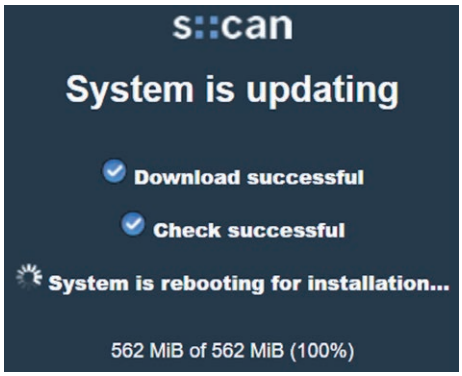
- Ensure to have a good *Signal* strength on the con::cube to the internet (see figure on the right).

- Push the *Service* Tab and select menu *Terminal / Extras / moni::tool Live Update*.
- Select the most actual update package with the newest Released date.
- Push the button *Update*.
- Confirm Update by pushing the button *Yes*.



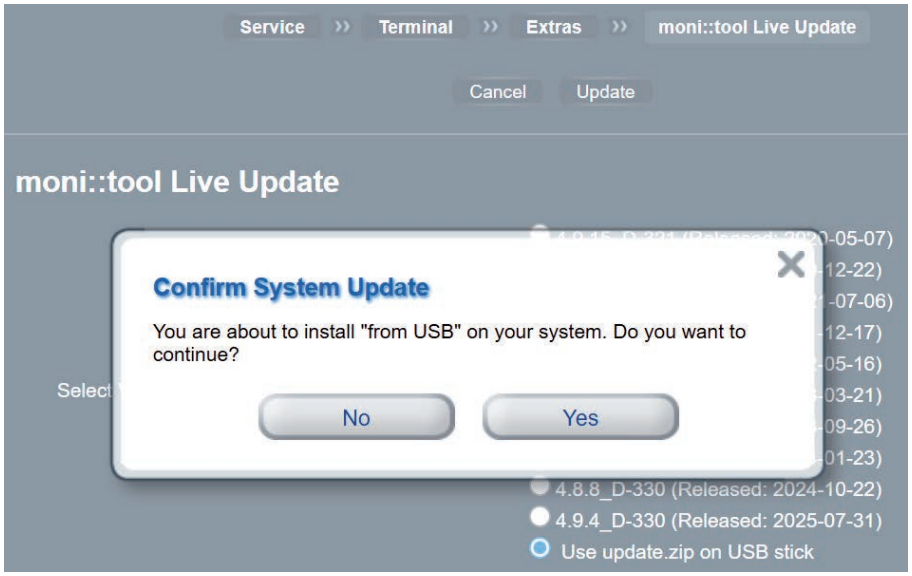
- Now the download of the update package starts. The needed time depends on the speed of the internet connection.
- After successful download of the update package, the system will reboot and install the new moni::tool version automatically.

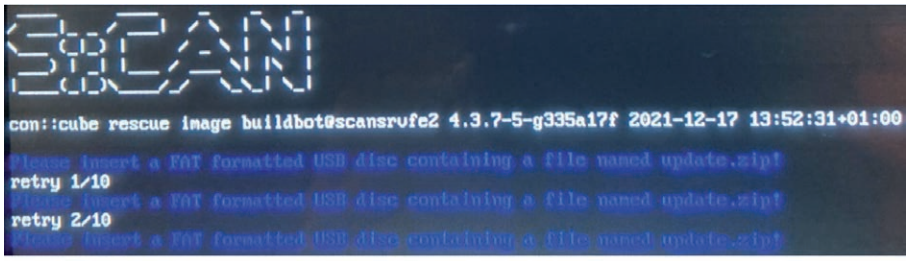


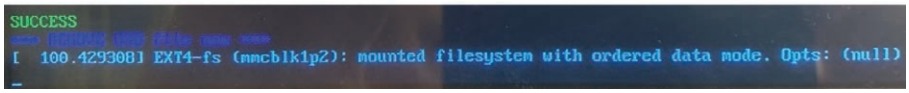


10.2.2 Update on Site with USB Memory Stick

- Copy the update package (zip-File) to the root directory of your USB memory stick.
- Rename the update package (zip-File) on the USB memory stick to *update.zip* but do not unzip the file.
- Push the *Service* Tab and select menu *Terminal / Extras / moni::tool Live Update*.
- Select the lowest entry *Use update.zip on USB stick*.
- Push the button *Update*.
- Confirm the procedure by pushing the button *Yes*.
- Now the con::cube will reboot.
- Wait until the message *Please insert a FAT formatted USB disc containing a file named update.zip!* appears in blue letters on the con::cube screen.
- Now insert your USB memory stick.
- Wait until the message *SUCCESS *** REMOVE USB file now **** appears on the con::cube screen.



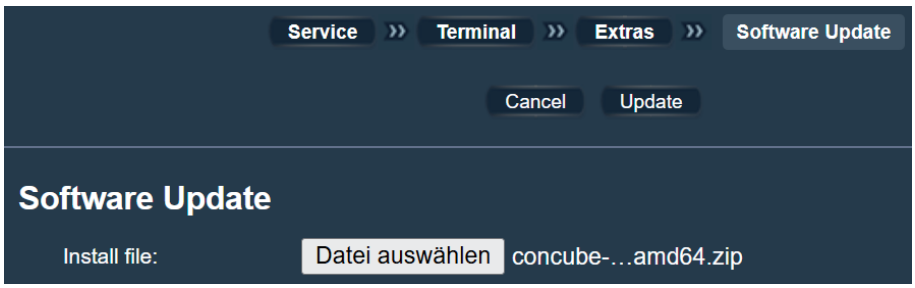


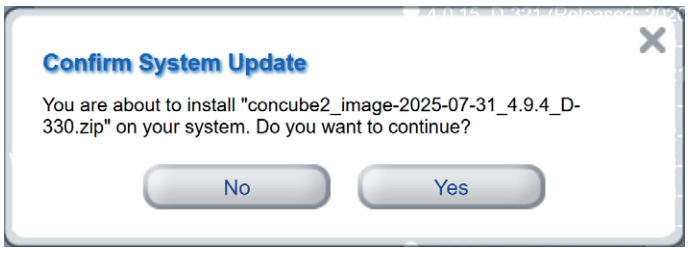


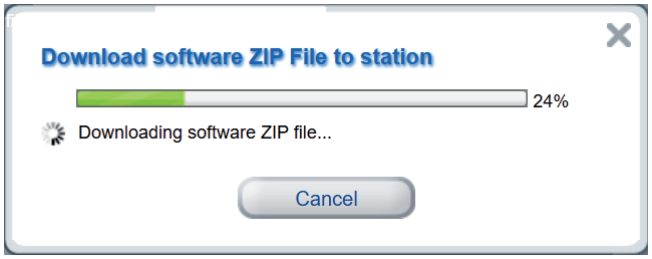
- Now remove your USB memory stick and wait until firmware update is finished.

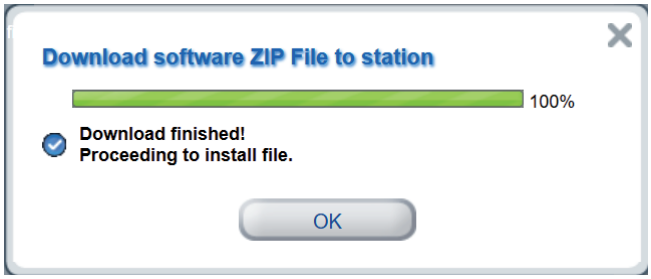
10.2.3 Remote Update from PC / Notebook

- Establish a remote connection to the con::cube and open moni::tool on the web browser of the PC / Notebook (see section 6.2).
- Push the *Service* Tab and select the menu *Terminal / Extras / Software Update*.
- Open the file selection field (*Install file*) and select the update.zip file on your PC / Notebook.
- Push the button *Update* to start the file upload.
- Push the button *Yes* to *Confirm System Update*.
- Now the download will start.

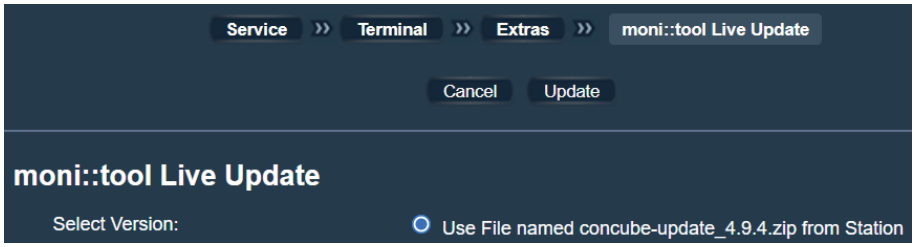




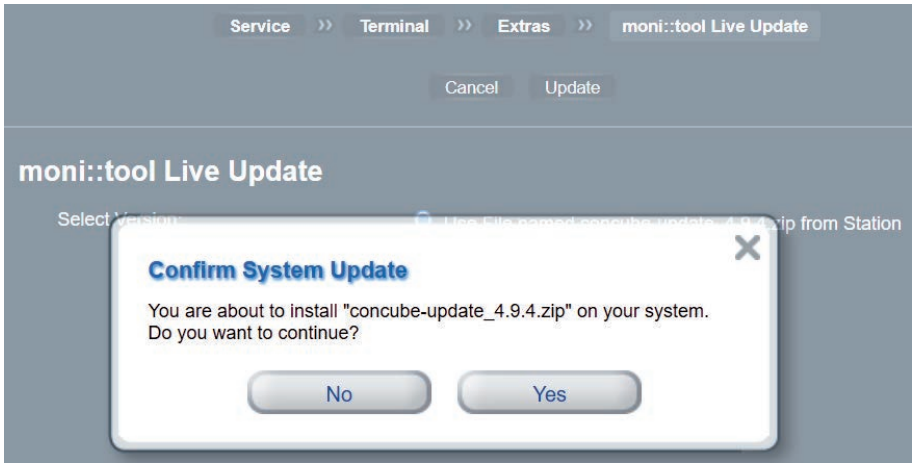




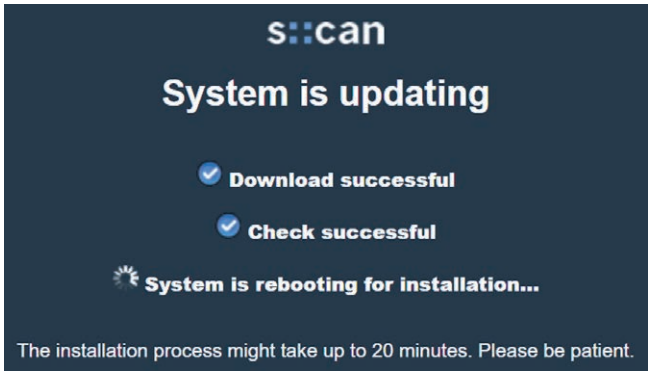
- Push the button *OK* when the download is finished.
- Tick the *Select Version* and push the button *Update*.



- Push the button *Yes* to confirm the update.
- Now the update procedure will start.



- Wait until update and the system reboot are finished. Then reconnect to the con::cube and check actual moni::tool version.



10.3 Return Consignment (RMA - Return Material Authorization)

Return consignments of the Badger Meter monitoring system, or parts of the system, shall be done in a packaging that protects the device (original packaging or protective covering if possible). Before returning a consignment, please contact your local Badgner Meter sales partner or Badger Meter Austria customer services (austriasupport@badgermeter.com). A RMA number will be assigned for each device, independent if the reason of the return consignment is service, repair, exchange or demo equipment.

The online RMA form to request your RMA number is available on the Badger Meter Website (https://badgermeter.my.site.com/partnercentral/s/submit-rma). Return consignments without an RMA number will not be accepted. The customer always has to bear the costs for return consignment.

Further details on return can be found in the RMA confirmation!

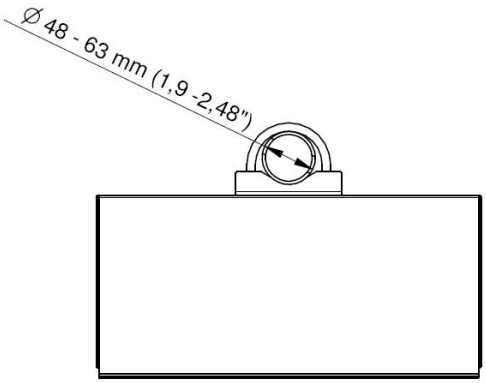
11 ACCESSORIES

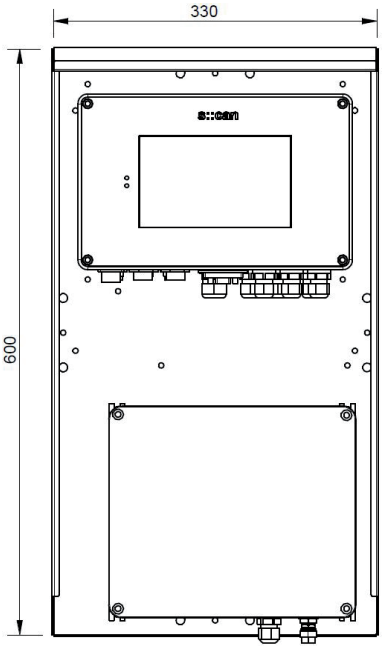
11.1 Installation

11.1.1 Weather Shield

For protection of the con::cube in case of outdoor installation and for easy mounting on walls or railings a specific housing is available.

Name	Specification	Remark
Part-no.	F-51	
Housing material	stainless steel (1.4301)	
Dimensions	363 / 553 / 170 mm	W / H / D
Weight	5 kg	
Mounting bracket	2 x M8 U-bolt with 8 screw nut and 8 spring washer 4 x M5 flange nut	included in delivery for mounting onto rails for mounting of con::cube and compressor





11.1.2 Power Supply Cord

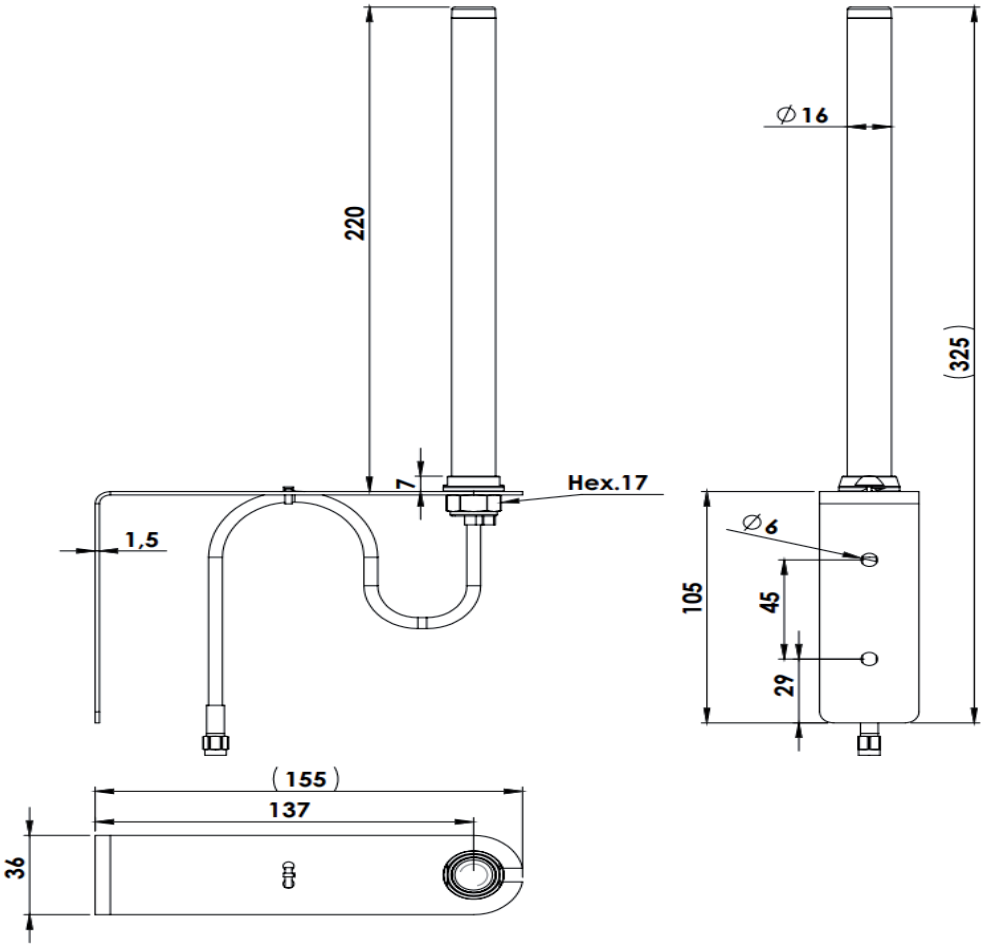
For connection of the device to the power supply, a power supply cable is available.

Name	Specification	Remark
Part-no.	C-31-EU or C-31-US	
Cable length / tpye	2 m / 3G 1.5 mm²	
Weight	approx. 300 g	
Material	PU	jacket
Process connection	CEE-7 shockproof plug NEMA 5-15 plug	C-31-EU C-31-US
Environment rating (IP)	IP 44 IP 55	C-31-EU C-31-US

11.1.3 External Antenna and Connector

For a con::cube equipped with internal modem an external antenna is available. To connect this antenna to the con::cube a seperate plug will be mounted.

Name	Specification	Remark
Part-no.	D-330-ANTENNA D-330-ANTENNA-PLUG	Antenna for 4G modem Plug for 4G modem
Cable length	3 m + 10 m	fixed + extension cable
Cable type	LL 195 Standard CFD200 (4.80 mm)	Antenna Extension cable
Dimension	325 / 36 / 155 mm 220 / 16 mm	W / H / D Length / diameter
Connection	RF-plug	
Frequency range	698 - 960 MHz 1710 - 2170 MHz 2500 - 2700 MHz	2G 3G 4G
Polarization	Linear	
Impedance	50 Ohm	
Environment rating (IP)	IP 67	
Operating temperature	-40 bis 85°C (-40 bis 185°F)	
Mounting	Wall mounting	stainless steel bracket



For any RF connector it is important to keep contacts clean. Gentle cleaning with isopropyl alcohol is allowed. Do not saturate connector with alcohol. Unused antenna connector should have a protective cap.

11.1.4 Connection Cable for Spectrometer Probe V2 to M12-Plug

For connection of the spectrometer probe V2 to a con::cube D-330 with M12-plug connection a specific adapter cable is available.

Name	Specification	Remark
Part-no.	C-32-MIL	
Cable length	0.3 m	
Assembling	ex works	
Material	polyurethane jacket with double screening	cable
Interface connection	M12 RSTS 8Y (IP 67), RS 485, Ethernet	to operator terminal with M12-plug

11.2 Spare Parts

11.2.1 Desiccant Package

To avoid condensing humidity inside the con::cube a desiccant package is built in. The desiccant packages are available as spare part.

Name	Specification	Remark
Part-no.	B-43-2	10 pieces
Dimensions	70 / 5 / 80 mm	W / H / D
Weight	approx. 10 g	

11.2.2 Touch Pen

For easy operation of the touch screen a touchscreen is included in delivery of the con::cube. Further touch pens can be ordered as spare part.

Name	Specification	Remark
Part-no.	D-312-PEN	3 pieces
Dimensions	87 mm	Length

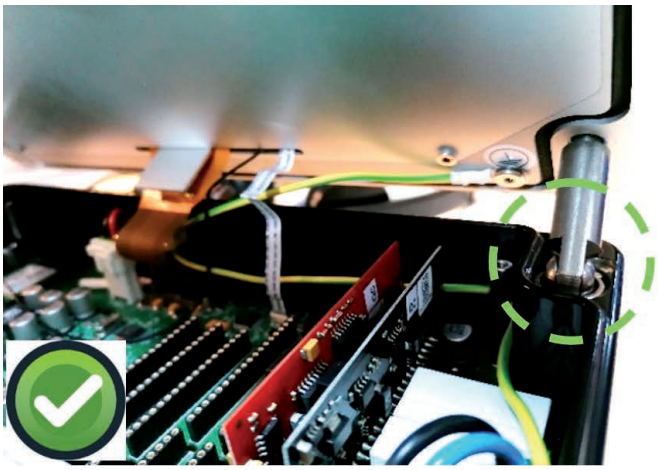
11.3 Optional Features

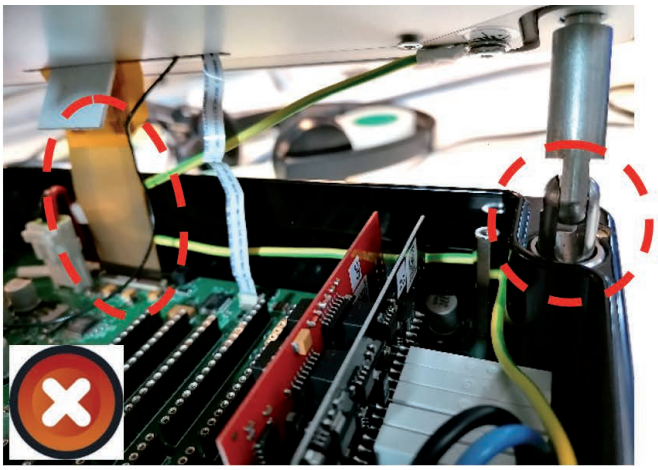
The con::cube can be equipped with several optional features explained in the sections below. Regarding detailed information of the optional features please refer to the technical specifications located at the end of this manual.

Installation of additional modules must be carried out by authorised persons only (see section 2) and after disconnecting the power supply!

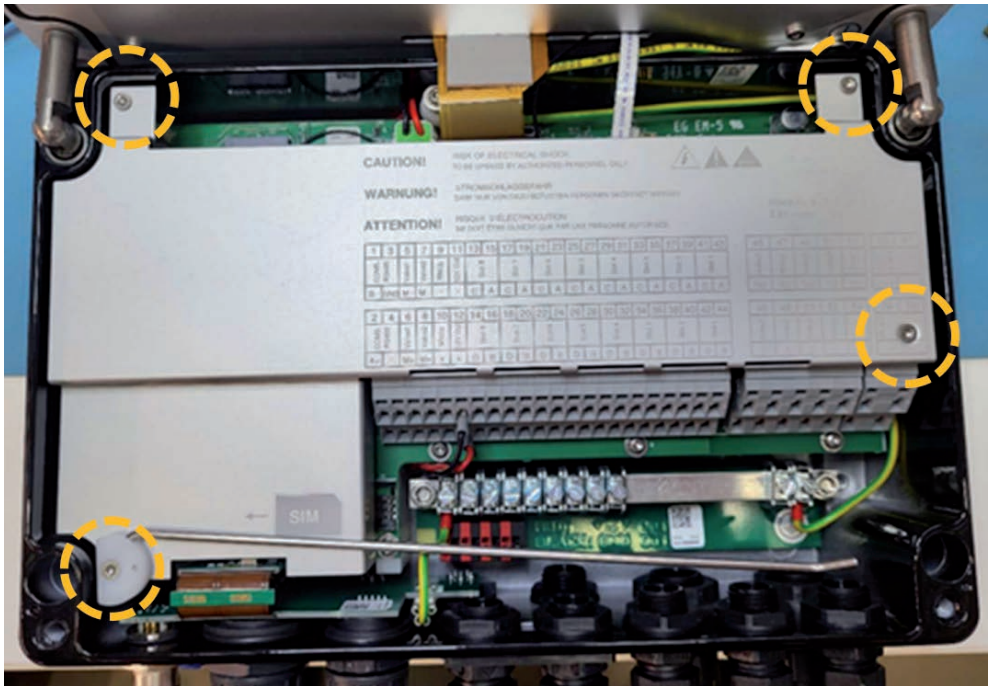
The installation of optional features is performed by the following steps:

- Power off the con::cube and ensure ESD protected environment.
- Loosen the four screws of the housing cover using a hexagon wrench size 5.
- Carefully lift up the housing cover a little bit. Do not lift too much to avoid pulling the flat ribbon cable out of the mounting bracket (see figure below).

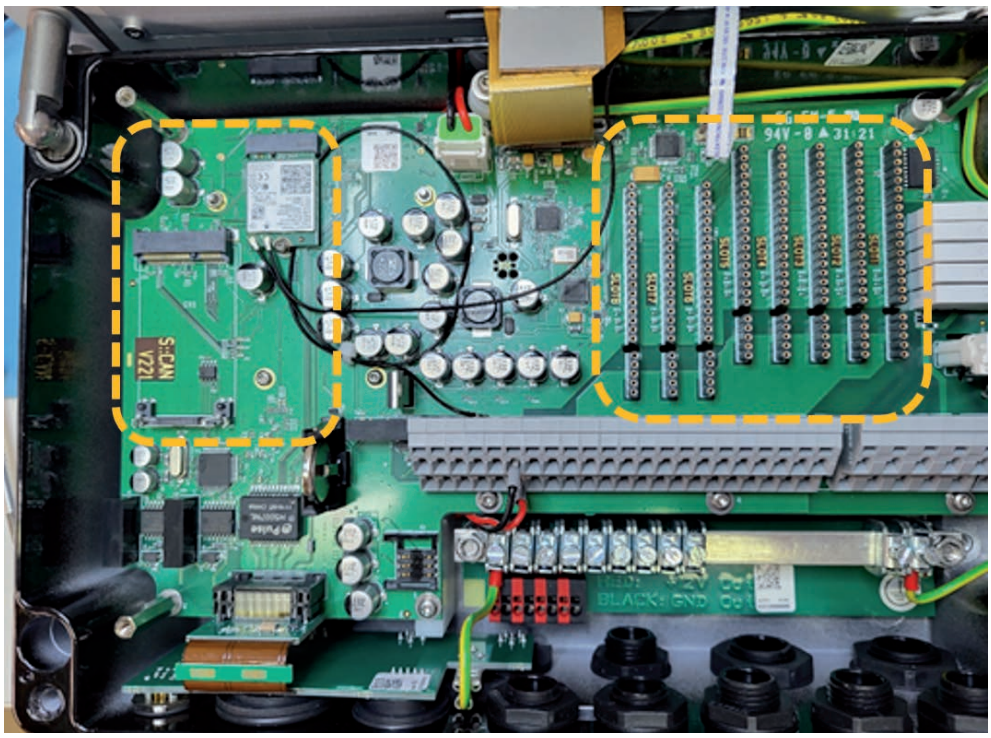




- Loosen the four Torx-T10 screws from the grey covering plate (see figure on the right).
- Carefully move off the covering plate including the retaining bracket. Take care not to loose any washers.



- Now the WLAN modem and the plug for the external 4G modem as well as the eight optional modules are visible (see yellow marking in the figure on the right).
- After performing the installation of the optional modules place the covering plate on the original position.
- Fasten the four Torx-T10 screws with max. 0.9 Nm.
- Close the housing cover and take special care not to pinch or buckle the flat ribbon cable or the grounding cable.



- Fasten the four screws of the housing cover.
- Power on the con::cube.

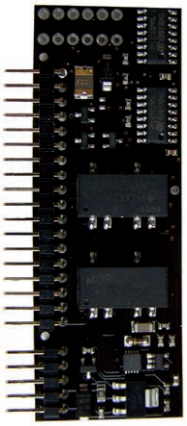
11.3.1 Gateway to 4G Modem

This optional available internal module provides wireless remote control and / or data transfer. The modem should be ordered at the same time as the con::cube to avoid later modification inside the con::cube.

Name	Specification	Remark
Part-no.	D-330-4GLX	4G modem
Assembling	ex factory or by qualified personal authorized by Badger Meter Austria	
Optional features	D-330-ANTENNA-PLUG D-330-ANTENNA	
WLAN	2.4 GHz Frequency 20 MHz Bandwith	
Modem Frequency bands	850, 900, 1800, 1900 MHz Band I, II, IV, V, VIII Band 1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 25, 26, 28 Band 38, 39, 40, 41	GMS UMTS FDD E-UTRA-FDD E-UTRA TDD
Maximum Transmit Power	33 dBm 23 dBm 23 dBm 23 dBm 17.5 dBm	GMS UMTS E-UTRA-FDD E-UTRA TDD WLAN

11.3.2 Analog Output Module

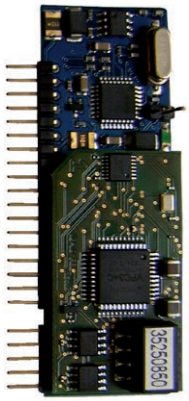
This optional accessory provides two analog outputs for data transfer to PLC systems.



Name	Specification	Remark
Part-no.	D-315-OUT-MA	
Output	2 x 0/4 - 20 mA	
Interface	AWG 28-12, stripped wire	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.1 for address mapping
Assembling	only by qualified personal authorized by Badger Meter Austria	con::cube can be equipped with max. 8 modules

11.3.3 Profibus DP Output Module

This optional accessory provides a Profibus DP interface for data transfer of system status and either up to eight parameter readings, incliding status information and measurement time stamp or 16 parameter readings only to a PLC systems.



Name	Specification	Remark
Part-no.	D-315-OUT-PROFIBUS_08 D-315-OUT-PROFIBUS_16	8 readings incl. status 16 readings excl. status
Output	Profibus DP	
Interface	Sub-D9, IP 67	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 7.5 and 12.2
Assembling	only by qualified personal authorized by Badger Meter Austria	con::cube can be equipped with 1 module at slot no. 8

11.3.4 SDI 12 Output Module

This optional accessory provides a SDI 12 interface for data transfer of up to eight parameter readings, incliding status information and system status, to a PLC systems.

Name	Specification	Remark
Part-no.	D-315-OUT-SDI12	
Interface		via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 7.6
Assembling	only by qualified personal authorized by Badger Meter Austria	con::cube can be equipped with 1 module at slot no. 8

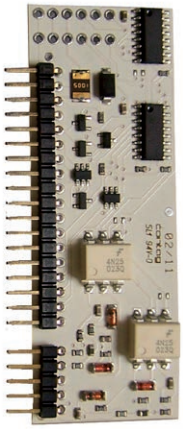
11.3.5 Analog Input Module

This optional module provides two analog inputs for integration of third party sensors into the Badger Meter monitoring system.

Name	Specification	Remark
Part-no.	D-315-IN-MA	
Input	2 x 0/4 - 20 mA	
Interface	AWG 28-12, stripped wire	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.1 for address mapping
Assembling	only by qualified personal authorized by Badger Meter Austria	con::cube can be equipped with max. 8 modules

11.3.6 Digital Input Module

This optional module provides two digital inputs for integration of third party sensors into the Badger Meter monitoring system.



Name	Specification	Remark
Part-no.	D-315-IN-RELAY	
Input	2 x digital in	
Interface	AWG 28-12, stripped wire	via terminal block, see section 5.1 for correct wiring
Configuration	via moni::tool software	see section 12.1 for address mapping
Assembling	only by qualified personal authorized by Badger Meter Austria	con::cube can be equipped with max. 8 modules

11.3.7 Connector Plug for external Antenna

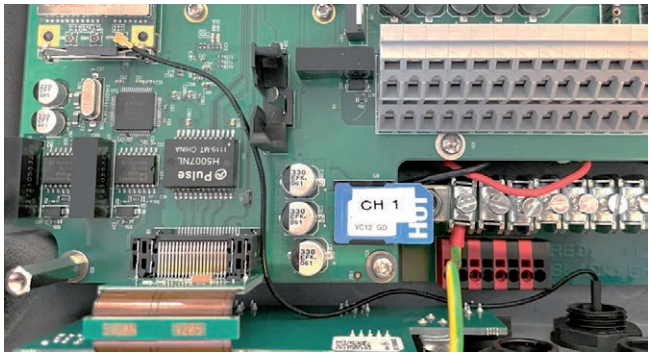
In case the con::cube is not equipped with the new SMA antenna plug (D-330-ANTENNA-PLUG) yet, it can be installed at a later time.

Name	Specification	Remark
Part-no.	D-330-ANTENNA-PLUG	
SCope of delivery	SMA cable (200 mm) with plug and internal connection to 4G modem O-ring 16.5x1.5 mm	
Assembling	only by qualified personal authorized by Badger Meter Austria	
Needed tools	hexagon wrench no.5 Torx-TX10 wrench open-end / ring wrench with 19 mm and 22 mm	houising cover cover plate cable gland

The antenna plug will be mounted instead of one cable gland. In the figure on the right is marked which cable glands can be used for mounting. Maybe the upper two cable glands are already blocked by the Profibus SUB D9 plug.

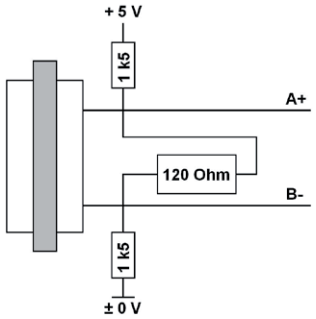
The installation of the antenna plug on the con::cube is performed by the following steps:

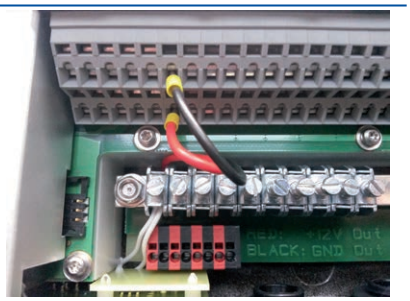
- See section 11.3. for how to open the con::cube.
- Remove one cable gland (see figure above) with help of a 19 mm and 22 mm wrench.
- Guide the SMA cable through the O-ring and place the O-ring in the groove of the antenna plug (see figure on the right).
- Mount the antenna plug in the free opening of the removed cable gland and fasten the M16 screw nut.
- Lay the SMA cable inside the con::cube as displayed on the right hand side and connect it to the 4G modem.
- Close the con::cube again properly (see section 11.3).



12 TECHNICAL SPECIFICATIONS

Name	Specification	Remark
Part-no.	D-330-230 D-330-024 D-330-XXX-NO-WLAN	con::cube with AC power supply con::cube with DC power supply con::cube without WLAN / WiFi
Dimensions housing	280 / 209 / 85 mm	W / H / D
Required space	290 / 280 / 240 mm	W / H / D
Weight	approx. 4 kg	
Operation temperature	-20 to 50 °C (-4 to 122 °F)	at max. temperature sun shield recommended
Storage temperature	-20 to 60 °C (-4 to 140 °F)	Acclimatised device to operation temperature before initial operation.
Humidity	5 to 90%	non-condensing
Material housing	Aluminium alloy, powder coated	
Environment rating (IP)	IP 65	see section 4.1
Environmental conditions	Altitude up to 2000 m Overvoltage category II Pollution degree 2	
Mounting	4 x M5 thread holes on backside 2 mounting brackets and 4 screws (included in delivery)	for direct mounting on panels (F-501) for wall mounting from front side
Power supply D-330-024	10 to 35 VDC	
Power supply D-330-230	100 to 240 VAC +/- 10 % / 50 to 60 Hz	wide range power supply unit
Power supply cable	outside diameter 5 - 12 mm single cable wires 1.5 - 2.5 mm^2	min. 80°C min. 300 VAC
Required galvanic isolation of power input	3.0 kV 1.5 kV	D-330-230 D-330-024
Power consumption	1.5 W (typical) 10 W (typical) / 20 W (max.) 30 W (typical) / 60 W (max.)	in sleep mode no I/O ports fully equipped
Electric potential	Grounding for D-330-024 and D-330-230	max. 0.1 Ohm PE power supply to site's earth grounding max. 0.5 Ohm PE power supply to process medium; see section 5.5
Conformity - ECM	EN 301 489	
Conformity - Electrical safety	EN 61010-1 UL 61010-1:2004 R10.08 CAN/CSA-C22.2 NO. 61010-1-04+GI1 (R2009)	
Conformity – RF Exposure / Human safety	EN 62311	
Conformity – Radio equipment / RED	EN 301 908-1 (LTE), EN 301 511 (GSM 900 / 1800) EN 300 328 (2.4 GHz: 2400–2483.5 MHz), EN 301 893 (5 GHz: 5150–5350 MHz, 5470–5725 MHz), EN 300 440 (5725–5850 MHz), EN 303 687 (5945–6425 MHz) ETSI EG 203 367	Cellular technologies WLAN / Short range devices Multi-radio operation

Name	Specification	Remark
Fuse	internal	replacement by BM Service only
Internal battery	CR2032, 3V Lithium battery	for real time clock (RTC)
Connection of s::can spectrometer probe	1 x M12, IP 67 (RS485, 12 VDC, Ethernet), galvanically isolated 1 kV internal network terminat. 120 Ohm	
Connection of ISE probes or sensors	4 x sys plug connector, IP 67 (RS485, 12 VDC), galvanically isolated 1 kV, internal network termination 120 Ohm	
RS485	galvanically isolated 1 kV internal network termination 120 Ohm	
Display	VGA TFT color display (800x480), 9 inches, (approx. 197 x 110 mm)	
User interface (on device itself)	USB (keyboard, mouse) Touch screen	
User interface (remote control)	Webbrowser (TCP/IP) VNC (TCP/IP)	
Network connection (TCP/IP)	WLAN / WIFI 802.11n a/b/g (300Mb/s) Ethernet LAN (100 Mb/s, RJ45) 4G modem (optional)	 D-330-4GLX
USB	USB connector (type A, 2.0)	for data transfer, software update, keyboard, mouse
Operating system	Linux	installed ex works (D-303-LX)
Main memory	2 GB RAM	from 2026: 4 GB RAM
Onboard memory	16 GB	1.8 GB of which for data base
Function display (LED)	4 x LED (blue / yellow / red)	blue = OK yellow = Servicemode active red = sum error red rotating = boot process blue or red flashing = sleep mode
Interface to SCADA	Modbus RTU Modbus TCP	max. 32 parameters max. 32 parameters
Interface to SCADA (optional)	Profibus DP for 8 parameters + status Profibus DP for 16 parameters (Slave according IEC 61158, up to 11 Mbit/s, DPV1, Baudrate up to 12 Mbaud) SDI 12 OUT for max. 8 parameters Analog OUT (4 to 20 mA active) Resolution = 12bit (5 µA) Accuracy = 30 µA Max. load = 500 Ohm, Galvanic isolation = 1 kV	D-315-OUT-PROFIBUS_08 D-315-OUT-PROFIBUS_16 (blue module), address = 1, see section 11.4.4 D-315-OUT-SDI12 see section 11.4.5 D-315-OUT-MA (black module), see section 11.4.2

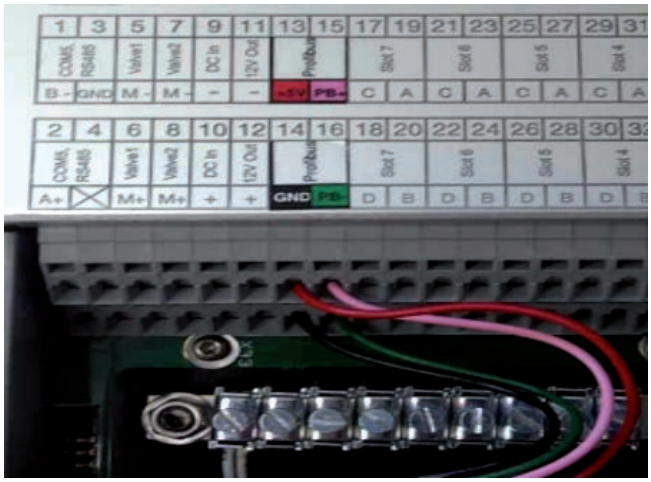
Name	Specification	Remark
Interface to third party devices (optional)	Analog IN (4 to 20 mA) Input resistance = 100 Ohm Galvanic isolation = 1 kV Resolution = 12 bit (5 µA)	D-315-IN-mA (red module), see section 11.4.6
Digital OUT (relay on)	Max: 230 V / 500 VA (AC 15) 24 V / max. 2 A (DC 1) Min: 5 V / 100 mA	4 modules normally open COM-3, address 33
Digital OUT sum error (relay on)	Max: 230 V / 500 VA (AC 15) 24 V / max. 2 A (DC 1) Min: 5 V / 100 mA	1 module normally open COM-3, address 33 LED: red = open, blue = closed
Digital IN	Logic levels: low < 5 V high > 10 V Max. voltage = 14 V Galvanic isolation > 1 kV	D-315-IN-RELAY (white module), see section 11.5.7
Digital OUT (relay change)	13.5 V out max. 1 A per Digital OUT	for 2 cleaning devices
Power supply output 12 V	12 VDC, max. 8 W via red (+12 V) and black (-12 V) terminal block on bottom which are connected to the terminals 11 and 12 see picture on the right	
Warranty	2 years	
Guarantee	2 years	https://badgermeter.widen.net/s/fgkmlct2gr

12.1 Terminal- and Address Assignment for optional I /O Modules

Slot	Terminal number for In- / Output 1 and 2	mA Output Address	mA Input Address	Digital Input Address
Slot 1	43 (+) / 44 (-) and 41 (+) / 42 (-)	49 and 50	17 and 18	33 and 34
Slot 2	39 (+) / 40 (-) and 37 (+) / 38 (-)	51 and 52	19 and 20	35 and 36
Slot 3	35 (+) / 36 (-) and 33 (+) / 34 (-)	53 and 54	21 and 22	37 and 38
Slot 4	31 (+) / 32 (-) and 29 (+) / 30 (-)	55 and 56	23 and 24	39 and 40
Slot 5	27 (+) / 28 (-) and 25 (+) / 26 (-)	57 and 58	25 and 26	41 and 42
Slot 6	23 (+) / 24 (-) and 21 (+) / 22 (-)	59 and 60	27 and 28	43 and 44
Slot 7	19 (+) / 20 (-) and 17 (+) / 18 (-)	61 and 62	29 und 30	45 and 46
Slot 8	15 (+) / 16 (-) and 13 (+) / 14 (-)	63 and 64	31 and 32	47 and 48

12.2 Pin Assignment for optional Profibus DP connector (Sub-D9)

Pin	Specification
1	not connected
2	not connected
3	PB +
4	not connected
5	Profibus GND
6	Profibus 5 V
7	not connected
8	PB -
9	not connected



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