📦 Assembly and operating instructions

K2 **Buddy** BaseBox

TopBox and BaseBox installation

K2 systems

Connecting Strength

k2-systems.com

Content

Tested quality - multiple certifications
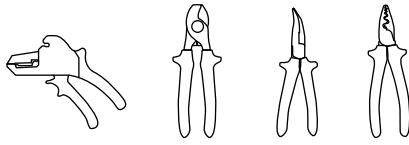
K2 Systems stands for secure connections, top quality and maximum precision. Our customers and business partners have known this for a long time. Independent bodies have tested, verified and certified our competencies and components.

You can find our quality and product certificates at k2-systems.com.

Tool overview
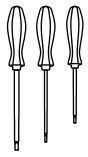
Small electrician's screwdrivers (PH 0)

Standard electrician's tools

General information

What it does

K2 Buddy is a system for measuring the snow load on solar modules.

- Two sensors are permanently mounted onto the mounting system underneath a selected module and measure the snow load.
- The snow load is displayed as a percentage of the permitted load in an app.

About these instructions

These installation and operating instructions of the K2 Buddy describe the functions and electrical characteristics of the product, as well as the activities required for its commissioning, maintenance and disposal. It is aimed at both installers of the mounting system and specialist electrical personnel.

The person(s) carrying out the work must be authorised to carry out electrical work on the control cabinet or the building's electrical system, must comply with the relevant safety regulations when accessing the roof and must have read and understood these installation instructions in full.

Downloading and setting up the associated app or using the Web view is also part of this product and a prerequisite for monitoring and the early warning function. The use of the app or the Web view is aimed at both the responsible installer and the end customer.

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General safety instructions

Assembly instructions

- The K2 Buddy is installed as part of a K2 mounting system. The same safety instructions apply.
- The K2 Buddy does not pose any special dangers.

Personnel

Systems may only be installed and put into operation by persons who are able to ensure that the work is carried out in accordance with the regulations due to their professional suitability (e.g. training/certification as an electrical specialist).

Disclaimer

K2 Systems GmbH accepts no liability for damage to property, personal injury or malfunctions and their effects resulting from non-compliance with these operating instructions.

Instructions

These installation and operating instructions are an integral part of the K2 Buddy and must be read, observed and kept accessible or available at all times.

In addition to these installation and operating instructions for the electronic devices, the respective assembly instructions for the mounting system with which the K2 Buddy is mechanically installed on the roof also apply. During the entire installation period, it must be ensured that at least one copy of the relevant Buddy assembly instructions is available at the construction site.

Warranty

If all safety instructions are observed and the system is installed correctly, the mounting systems installed together with the K2 Buddy are covered by a 20-year product warranty.

Please note our warranty conditions, which can be viewed at
k2-systems.com/en/warranty-terms-and-conditions/

Modifications are not permitted

The power supply unit, TopBox and BaseBox may only be used in accordance with the information in the enclosed documentation.

- If the devices are used in any other way, this may result in damage to property or personal injury. The K2 Buddy, consisting of hardware and software, must not be modified for safety reasons.
- It is forbidden to open the housing or to remove or install components.
- The intended use is described in these instructions in the "What it does" section. Any other use of the devices is prohibited and is considered improper use.

Product and warning notices for the owner, operator and installer

Special product and warning notices apply to the K2 Buddy, which must be observed by both the installer and the owner or operator. They can be found at:
k2-systems.com/en/digital-services/k2-buddy/
product-warning-notices/

Safety instructions for target groups

Safety instructions for owners and operators

As an owner or operator, this device belongs to you, and you are responsible for it. You are responsible for the intended use and therefore the safe use of the device.

- Please keep these operating instructions in a safe place so that they are available for all activities in connection with the product.
- If you do not have specialised electrical training yourself, you may only carry out activities that do not require an electrical specialist. National rules and regulations are to be observed.
- Under no circumstances should you work on the devices yourself or open the housing.
- The device may only be operated in accordance with its intended use; see "What it does".

Safety instructions for electrical specialists

All wiring work and work on the control cabinet in connection with the devices may only be carried out by qualified electrical specialists. You are qualified if you have a recognised electrical engineering qualification and are therefore permitted to carry out the electrical engineering work required in these instructions. You must have knowledge of general and specific safety and accident prevention regulations, as well as the ability to recognise risks and avoid potential hazards.

- Electrical work may only be carried out in compliance with the 5 safety rules of electrical engineering.
- A lack of knowledge and qualifications can lead to serious accidents or even death when working in electrical engineering.

- Only install intact devices with a complete scope of delivery.
- Do not modify the device in any way.
- The BaseBox may only be installed with the power supply unit included in the scope of delivery. We recommend using the fuse recommended by the power supply unit manufacturer.
  You can find this at meanwell.com (type HDR-15). There is also an excerpt of this in the technical specifications of these instructions (see p. 17 in the power supply unit section).

National and electrotechnical regulations must be observed by the electrical specialist for all work associated with the product. Observe the lightning and surge protection regulations applicable in your country.

> **Tip:**
> We recommend that you have a printout of the Buddy TopBox and BaseBox installation instructions on site during initial installation.

Structure and function
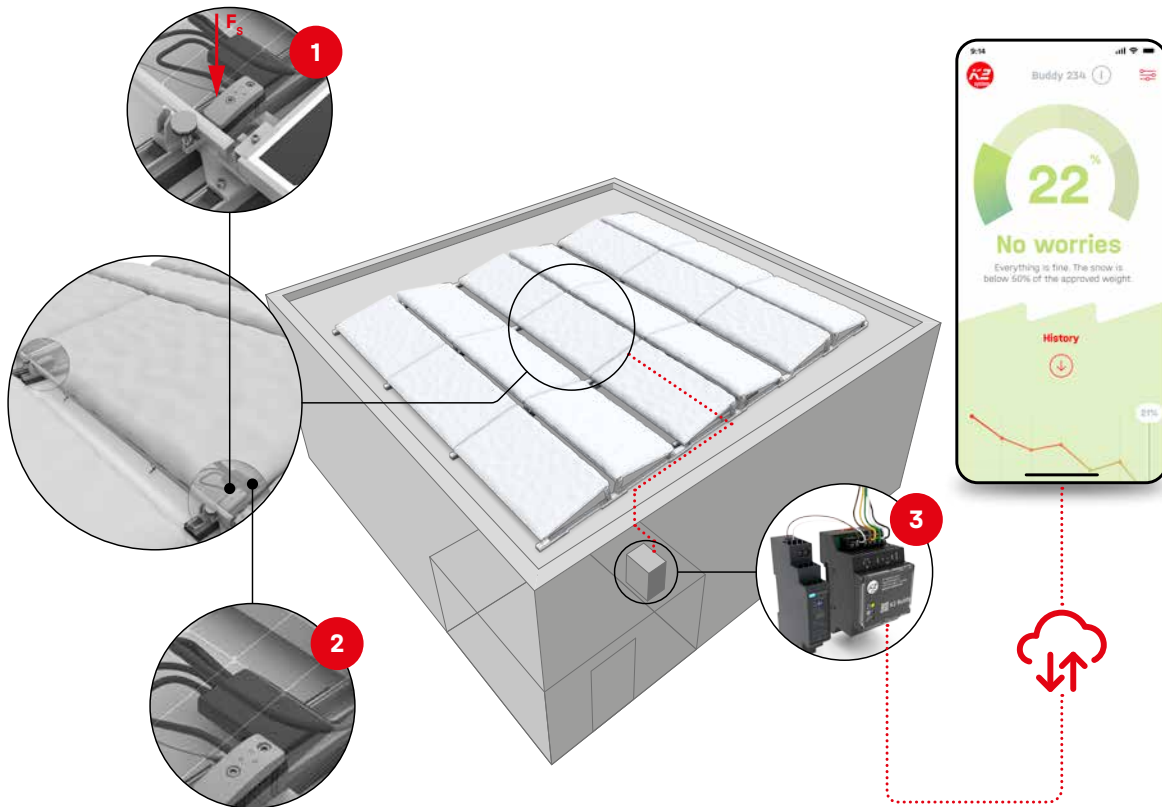
Snow sensor	**1**	The system contains two snow sensors. The snow sensors measure the weight on the PV module. Both snow sensors are permanently connected to the TopBox via cables. The snow sensors are installed on the left and right at the bottom end of a PV module.
TopBox	**2**	The TopBox processes the measured values and sends them to the BaseBox via cable. The TopBox is supplied with power via the cable.
BaseBox	**3**	The BaseBox periodically (every 10 minutes) queries the measurement data from the TopBox and sends it to a cloud via the building's internet connection. The BaseBox controls the power supply to the TopBox and switches it off in the event of a fault. The BaseBox must be installed inside the building in a control cabinet (power + Ethernet).
Power supply unit		The 24-V top-hat rail power supply unit is used to supply the TopBox and BaseBox and provides galvanic isolation for the downstream components. It is supplied with 230 V via the control cabinet electronics.
IEC 60664-1 Overvoltage category III		The K2 Buddy with the power supply unit, BaseBox and TopBox components are assigned to overvoltage category III in accordance with the IEC 60664-1 standard. The power supply unit and the BaseBox are connected to the power supply network and can therefore potentially have direct contact with the main voltage (230 V). The TopBox may also be exposed to surges on the roof due to lightning strikes and other environmental conditions. In this regard, please also refer to the section on lightning and surge protection to avoid damage to the building's electrical system.

Information symbols to be found on the devices
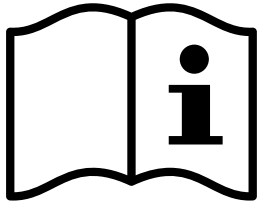
Follow the operating instructions.

Hazard posed by the risk of electric shock.

IP67
Degree of protection against the ingress of foreign objects and protection against water. Due to the moulded electronics inside the housing, the device is dustproof and protected against temporary immersion in water.

IP20
Degree of protection against contact with live components. The device is protected against contact with solid foreign objects larger than 12 mm; i.e. the device can be touched safely with the fingers. There is no protection against water, which is why the appliance is only intended for dry indoor areas.

Devices are labelled with the CE mark, as the devices described are in compliance with the aforementioned directives and their relevant provisions, as well as the essential requirements.
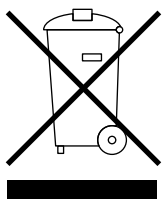
The devices must not be disposed of in the household waste.

Scope of supply

K2 TopBox snow set (1000003)

1× TopBox with:
- Snow-weighing sensors (cable-connected)
- Cable section with wire-end ferrules

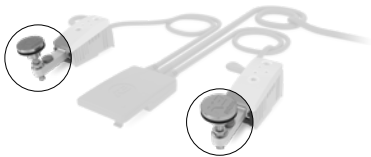1× cable connector, including 2 spare screws

2× knurled screws for preventing the module from being lifted

K2 Buddy BaseBox set (1000097)

1× Power supply unit (left)
1× BaseBox (right)

Device description
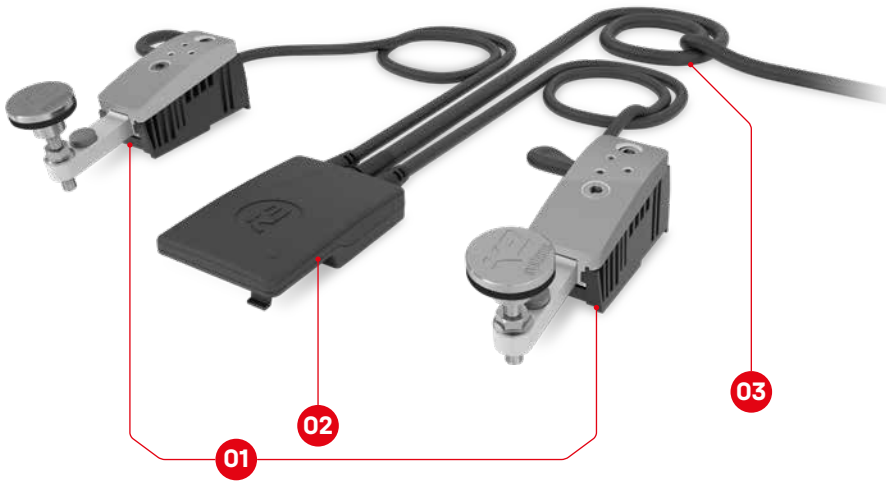
TopBox snow set

01 Snow sensors for installing in the K2 mounting systems

02 TopBox for snap-in attachment to K2 mounting rail

03 Connecting cable for attachment to the enclosed cable connector

BaseBox

01 +24 V DC supply inputs

02 GND supply inputs

03 +24 V DC supply for TopBox

04 RS485-B connection for TopBox

05 RS485-A connection for TopBox

06 GND supply for TopBox

07 Shielding connection cable for TopBox

08 Power LED

09 Network LED

10 TopBox LED

11 LAN connection

Power supply unit
BaseBox

12 +V: +24 V DC output BaseBox

13 -V: GND output BaseBox

14 AC/N: 230 V N-conductor input

15 AC/L: 230 V L-conductor input

Installation of the snow sensors and the TopBox in K2 mounting systems
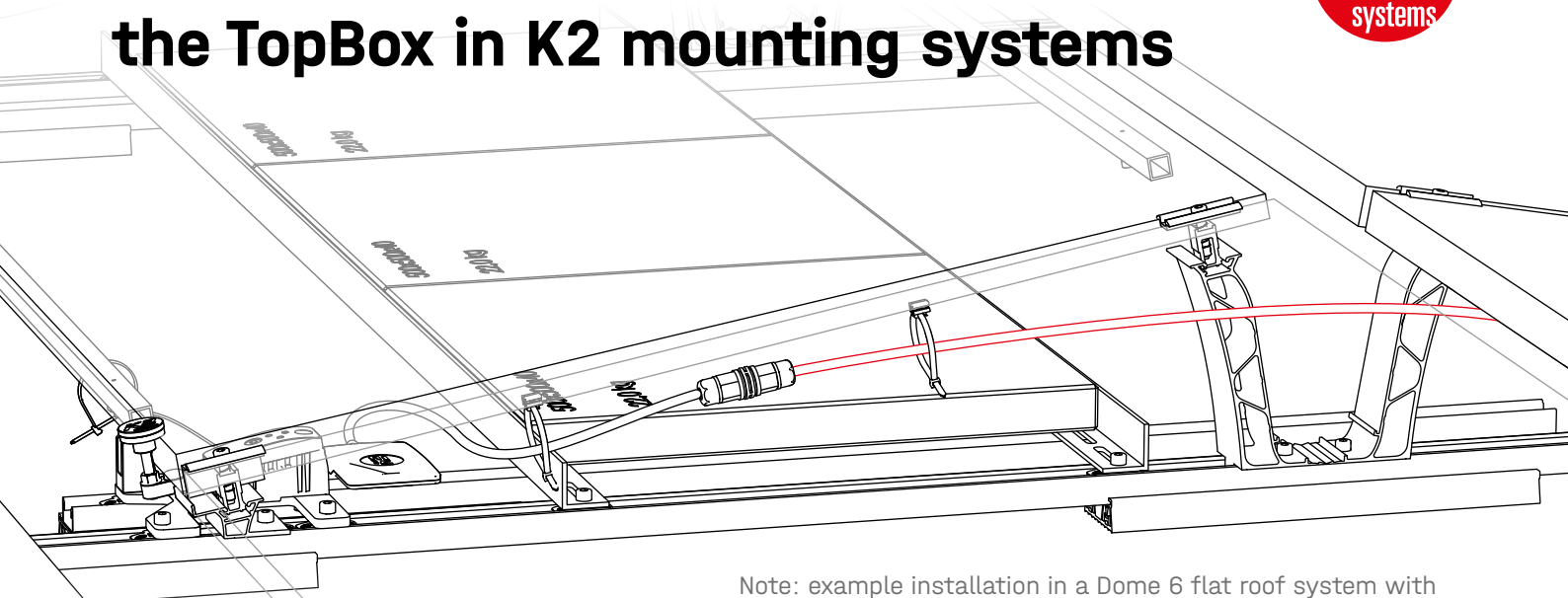
Note: example installation in a Dome 6 flat roof system with an extension (red) to the BaseBox

Planning in the K2 Base design tool

The positioning of the snow sensors and the associated components in the module field is output by our K2 Base calculation tool.

Follow the mounting system instructions

For the correct installation of the snow sensors, follow the instructions for the respective mounting system. The snow-weighing function of the K2 Buddy can only be guaranteed if it has been installed correctly in accordance with the instructions.

Extension of the cable to the BaseBox

The cable (red; see above) for connecting the cable connector to the BaseBox is not included.
We recommend using the following cable:

- UNITRONIC® LiYCY (TP) BK 2 × 2 × 0.5 mm² from LAPP
- If you want to use a different cable, see the appendix (alternative cable).

Connect the cables to the cable connector.

Note when tightening:
First tighten the centre part and then the cable gland, otherwise the cable may be twisted and damaged.

Link to the assembly instructions

k2-systems.com/en/digital-services/k2-buddy/
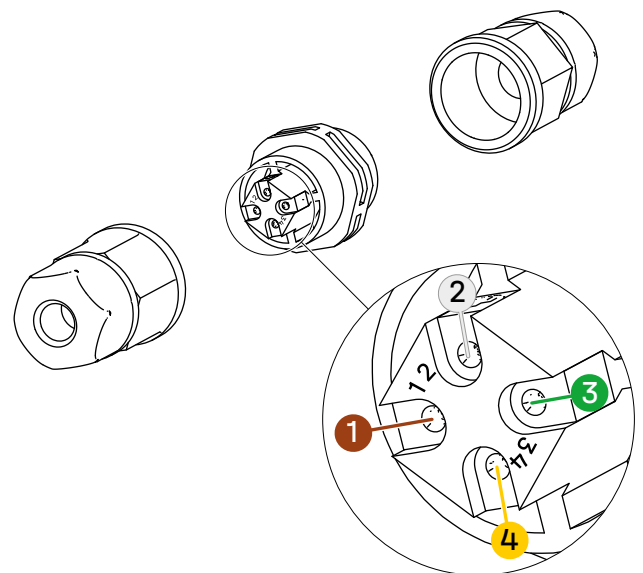
Assignment

Name	Colour		Number
+24 V DC	Brown	●	1
GND	White	○	2
RS485-A	Green	●	3
RS485-B	Yellow	●	4
Shield			Do not connect!

Only connect shield on one side

IMPORTANT: This cable has a shield that is only connected on the side of the BaseBox.
The shield must not be connected to the cable connector!

Additional explanation: This shield is only connected on one side (at the BaseBox) to prevent a loop, which could cause the cable to act as an antenna for interference signals.

Due to the pair stranding of the cores in the cable, the cable offers differential signal transmission and thus protection against electromagnetic interference.
The differentiated decoupling through shielding means that it is possible to connect the shield on one side.

The "Lightning and surge protection" section must be observed for entry into the building.

Lightning and surge protection

Check whether there is an external lightning protection system on the building. When it comes to surge protection, which standard is to be followed is determined by whether the building has an external lightning protection system (lightning conductor) or not.

- For buildings with lightning conductors, VDE 0185–305 applies and requires a surge protective device at the building entrance point for all cables (regardless of whether they are power supply or data cables).
- For buildings without external lightning protection, protection of the supply line in the main distribution board/meter distribution board is mandatory and for all other lines, including those that are routed to the roof, there is only a recommendation for surge protection.

In both cases, we recommend installing a surge protection switch at the building entrance point; i.e. between the cable connector and the BaseBox. At the building entrance point, all high overvoltages are intercepted and discharged via the equipotential bonding. If these overvoltages were able to enter the building via cables, all nearby cables could also absorb this overvoltage and all devices in the vicinity could be destroyed.

Whether a lightning current can flow via the sensors to the PCB of the TopBox depends on whether the separation distance (please determine this beforehand) between the lightning protection system and, for example, the electrical installation has been maintained. The exact distance must be individually calculated and planned by a lightning protection planning contractor.

If the separation distance is maintained, no lightning current can flow via the mounting frame, but the full magnetic field of the lightning current and thus coupling into the electrical systems on the roof and the building must be expected.

If the separation distance is not maintained, the surge protective devices must be capable of carrying lightning currents and therefore be type-1 arresters. Otherwise, type-2 arresters will suffice.

More details about this:
- Type-1 arresters: These devices are usually installed at the main power supply point to protect the entire building or system from external overvoltages caused by lightning discharges. Type-1 arresters are able to handle very high surge currents.
- Type-2 arresters: These devices are installed in sub-distribution boards or on critical electrical devices to protect against the effects of overvoltages within the building. They provide protection against most types of surge currents, including those caused by switching operations in the system.

Circuit breakers recommended by us:

Article	• Circuit breaker type • Application BaseBox	Amount
Dehn BXT ML2 BD HFS 5 Art. No. 920271	• RS485 • RS485-A and RS485-B	1×
Dehn BXT ML2 BE S 24 Art. No. 920224	• Voltage 24 V, GND and shielding	1×
Dehn BXT BAS Art. No. 920300	• Base part (for top-hat rail) • for item no. 920271 and 920224	2×
Dehn SAK BXT LR Art. No. 920395	• EMC spring terminal for shield contacting • For shielding	1×

The instructions for the respective circuit breaker must be observed for correct installation.
The Dehn SAK BXT LR spring terminal (Art. No. 920395) must be connected to the Dehn BXT ML2 BE S 24 surge circuit breaker (Art. No. 920224) with indirect shielding. Follow the instructions for the Dehn spring terminal.

For countries other than Germany, the installer must comply with the respective national and international regulations for lightning and overload protection.

Installing the BaseBox and power supply unit on the top-hat rail

The BaseBox must be installed and connected indoors. A control cabinet with top-hat rail is particularly suitable for installation.
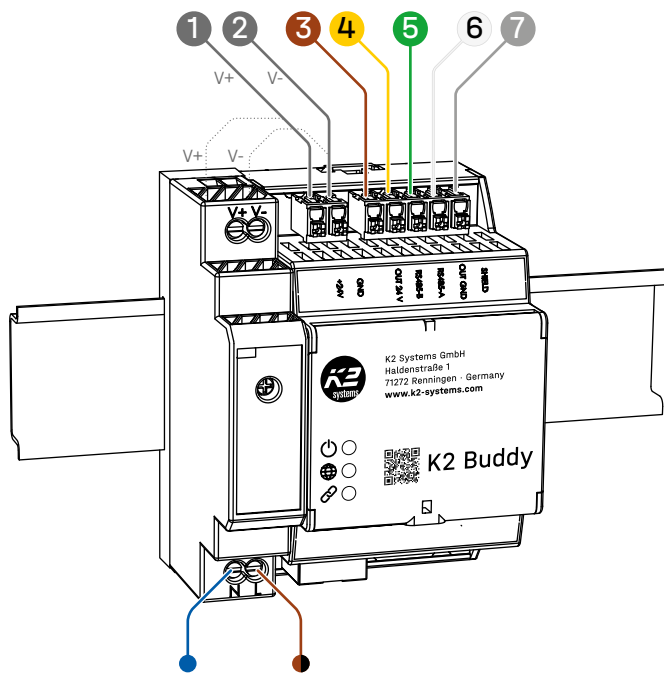
The following are required:
- 230 V supply cable
- Ethernet connection; e.g. router

Connecting the power supply unit and BaseBox

Attach the power supply unit and BaseBox to the top-hat rail in the control cabinet.
Connect the power supply unit and BaseBox, see table.
Connect cable from the roof, see table.

No.		Function	Description/colour
1		24 V	Power supply unit +V
2		GND	Power supply unit -V
3	●	OUT 24 V	Brown core
4	●	RS485-B	Yellow core
5	●	RS485-A	Green core
6	○	OUT GND	White core
7		SHIELD	Twisted shielding braid

Power and Ethernet connection
You must adhere to the sequence during connection!

1. Ethernet connection
Connect the BaseBox at the lower RJ45 connection with an Ethernet cable to a router or an Ethernet socket.
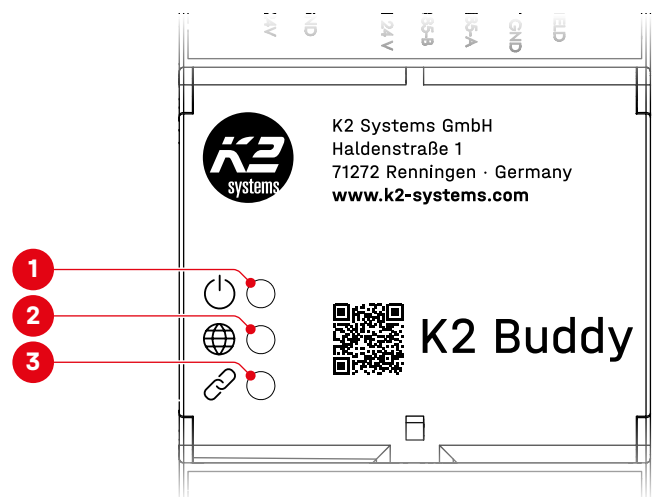
2. Power supply unit voltage connection
Connect the power supply unit with a 230 V supply cable.

No.	Core		Colour
1	◐	L	Brown/black
2	●	N	Blue

Function check

All three LEDs of the BaseBox should light up permanently.

LED		Lights up permanently	Flashes
1	Power	Power supply OK	BaseBox is not configured
2	Network	Connection to server established	No connection to server
3	TopBox	Communication with TopBox established	TopBox communication faulty or short circuit

If an LED does not light up or flashes: see the "Notes on troubleshooting" below.

End of installation

- The K2 Buddy is now installed:
- Sensors and TopBox are mechanically installed.
- The units are connected via cable.
- The BaseBox is connected to the Internet.

For commissioning, the app must now be set up on a smartphone.

Appendix

Routing cables from the roof to building services

To connect the Buddy (TopBox) on the roof to the cable connector with the BaseBox in the building services, we recommend the following cable:
UNITRONIC® LiYCY (TP) BK 2 × 2 × 0.5 mm² from LAPP

Maximum length: 100 m!

If a different cable is used, please ensure that it has the following properties:
- Data line (low frequency)
- Twisted pair (TP)
- Shielded (with braided shield)
- 2 × 2 × 0.5 mm² (2 × 2 twisted pair)
- UV-resistant to EN 50525–1
- Flame-retardant to IEC 60332–1–2
- Ozone-resistant
- Suitable for outdoors
- Temperature range: -40° C to 80° C

If you use a cable other than the one recommended by us to connect the cable connector to the BaseBox, please pay attention to the core colour coding when connecting to the cable connector and BaseBox.

Notes on troubleshooting

If errors occur during installation or operation,
you can investigate as follows.

K2 Systems GmbH
Haldenstraße 1
71272 Renningen · Germany
www.k2-systems.com

Power

Network

TopBox

K2 Buddy
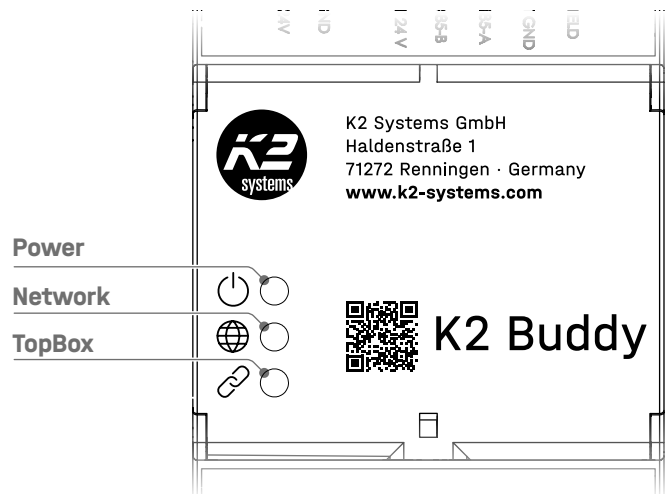
Fault information	Troubleshooting
Power LED lights up continuously	Normal status; Power supply OK.
Power LED does not light up	Fault state; voltage supply not connected / defective. Check the voltage supply: 230 V present? Power supply unit working? 24 V present? BaseBox connected properly to power supply unit?
Power LED flashes quickly	Provisioning mode; the BaseBox is in provisioning mode: Bluetooth is activated to set up the network configuration. • If one configuration is already running: close configuration. • Restart configuration.
Network LED lights up continuously	Normal status; connection to server established.
Network LED does not light up	Initialisation of the network connection: In this phase, the BaseBox tries to establish a connection to the network. The network LED should then light up continuously.
Network LED flashes slowly	Fault state; no connection to the server possible. • Check that DHCP is active on the router. • If DHCP is not active, you must manually set the network data in the app; see K2 Buddy app instructions at k2-systems.com/en/digital-services/k2-buddy/. • Check the firewall settings of the server router: • Allow connection to ''k2.openremote.app''. • The following ports must be enabled: MQTT:8883; HTTPS:443
Network LED flashes quickly	Fault status; no connection to the network possible / no Internet connection possible. • Check that the Ethernet cable is correctly connected. • Check if the Ethernet cable is defective.
TopBox LED lights up continuously	Normal state; communication with the TopBox established.
TopBox LED does not light up	Initialisation of the TopBox–BaseBox connection. In this phase, the BaseBox tries to establish a connection to the TopBox. Wait until the LED lights up continuously.

TopBox LED flashes slowly	Fault state; short circuit at the BaseBox output (on the supply cable to the TopBox).
	• First disconnect the cable between the BaseBox and the TopBox to avoid further damage.
	• Check the cable for damage.
	• Check that the cable is correctly connected to the BaseBox; see section ''Connecting the power supply unit and BaseBox''.
	• Check the cable connector:
	  - Connected correctly?
	  - Contact

TopBox LED flashes quickly	Fault state; communication with the TopBox faulty. • Check the cable TopBox–BaseBox cable connection: • Are all the cables connected correctly?

Technical data

BaseBox	
Dimensions H × W × D	3 HP width 86.4 × 49.7 × 16.2 mm (fitted)
Temperature range	-0°C to 55°C
Power supply	24 V AC
Connection to the TopBox	+24 V DC voltage supply for TopBox (max. 90 mA) RS-485 A / RS-485 B
Ethernet	3 Mbit/s (10/100 Mbit/s)
Bluetooth LE	Yes
Indicators	Power LED Network LED TopBox LED
Installation	Installation on top-hat rail
Power supply unit	
Type	Meanwell HDR-15
Dimensions H × W × D	1 HP width
Operating temperature	-30°C to +70°C
Special feature	Internal galvanic isolation
Protective measures	Short circuit, overload, overvoltage
Input voltage	115 V AC 0.5 A 230 V AC 0.25 A
Output voltage	24 V DC
Operating current	0.63 A
Nominal power	15.2 W
Installation	Installation on top-hat rail
Power supply unit installation instructions	Download at meanwell.com (type HDR-15)
Fuse	HDR-15: T2A/L250V
Measuring interval	Every 10 mins
TopBox	
Dimensions H × W × D	64 × 40 × 12 mm (fitted)
Protection class	IP67
Special features	Hardwired with: • 2 weighing sensors (cable length each 2.5 m) • 1 cable for connecting to the BaseBox (cable length approx. 0.8 m)
BaseBox-TopBox cable length	Max. 100 m
Snow sensors	
Special feature	In housing and hardwired with TopBox
Measurement range	Weight: -43.9 kg to +359.7 kg (±10 kg) Temperature: -40 to +85°C (± 2°C)
Protection class	IP67

Firmware updates

Regular updates are necessary to ensure that the device functions properly.
- The updates require a one-time approval by the user. All further updates will then be installed automatically.
- A corresponding consent form is displayed when the K2 Buddy app is installed.
- Further installation of the app and data display is not possible without the user's consent.
- The updates are installed automatically OTA (over the air) by K2 as required.

Notes on disposal

The transport packaging can be recycled at your local waste disposal centre.

After use, the TopBox and BaseBox and all associated electronic components must be disposed of as electronic waste in accordance with the laws applicable in your country.

Under no circumstances should electronic waste be disposed of with household waste. Please take the old device to a collection point in the city or municipality for recycling.

EU declaration of conformity

We, K2 Systems GmbH, hereby declare that the K2 Buddy Monitoring System, consisting of hardware and software, complies with the following directives when used as intended and in accordance with the installation and operating instructions:

Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (recast) (short form: EMC Directive).

Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast) (Text with EEA relevance).

Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

Directive 2011/65/EU (RoHS) of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast) (Text with EEA relevance).

You can find the full EU declaration of conformity in our downloads area at: k2-systems.com.

Notes
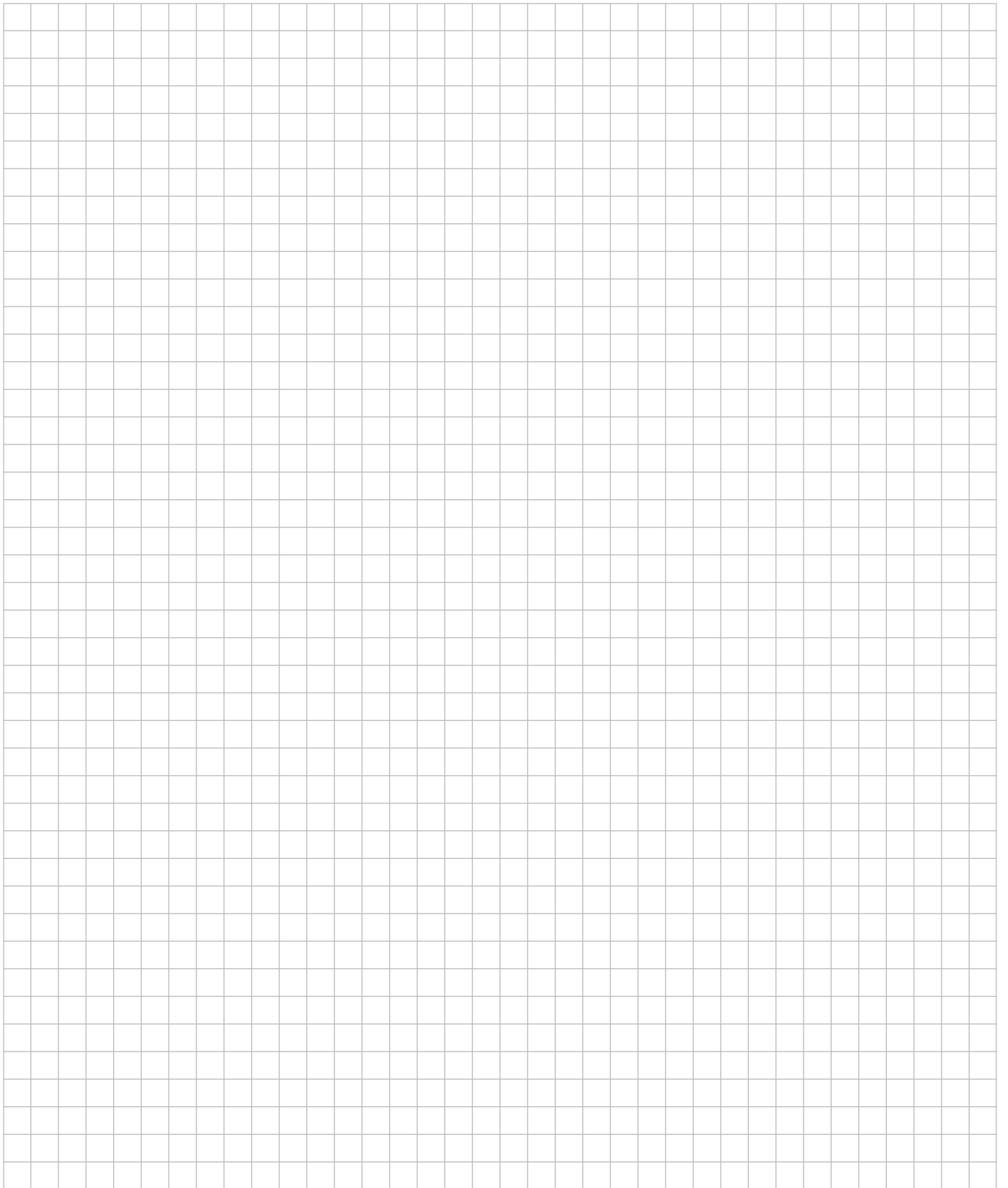
Thank you for choosing a
K2 mounting system.

Systems from K2 Systems are quick and easy to install.
We hope that these instructions have been of help to you.
Please do not hesitate to contact us if you have any suggestions,
questions or ideas for improvements. All contact details can be found
at:

- **k2-systems.com/en/contact/**

- **Service hotline: +49 (0)7159 420 590**

Our General Terms and Conditions of Delivery apply and can be found
at: k2-systems.com

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