# DATASHEET

## TRAFFIC MANAGEMENT ACCESSORY

J-Boxes (Junction Boxes)

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# CONTENT

# 1 USER SAFETY WARNING

Please read the entire document carefully before using the device.

## INSTALLATION

Please pay attention to the details below before installing and connecting the device:

- Only use provided or approved equipment for the operation.
- Only skilled and instructed people shall install and connect the device.
- All connectors are pin-coded and fit in only one position.
- Be cautious when using the device on or around active roadways and pay attention to moving traffic.
- Make sure that test procedures are in accordance with local safety policies and procedures as well as company practices.

## OPERATION

Please note that the device is not waterproof unless it is attached to a sensor. Take care of proper rain coverage when working outside. Do not operate the device if the device itself or any cables are damaged.

Do not dispose waste electrical and electronic equipment in household trash.

## TECHNICAL SERVICE

Only use provided or approved equipment for operation.

Do not attempt to service or repair this device:

- No user-maintainable parts are contained in the device.
- To avoid electrical shock, do not remove or open the cover.
- Unauthorized opening will void all warranties.
- smartmicro is not liable for any damages or harms caused by unauthorized attempts to open or repair the device.

# 2 PRODUCT SPECIFICATION

The smartmicro Junction Box (J-Box) offers a universal and easy-to-use field installation for connecting and surge protecting one of the following sensors to the home run cable.

- UMRR-12 Type 48 (TRUGRD, TRUGRD Stream)
- UMRR-12 Type 49 (TRUGRD LR)
- TOPGRD
- UMRR-11 Type 44, Type 45, Type 132

## 2.1 FEATURES

A J-Box offers the following features:

- Easy-to-use universal electrical interface through a terminal block
- Field installable: A simple screwdriver is sufficient to install the J-Box.
- Surge and lightning protection on all power and data lines compliant to IEC-61000 (see details below)
- Compatible with smartmicro brackets
- Robust: The J-Box is watertight (when attached to the sensor with the supplied O-ring) and almost unbreakable.
- Captive screws
- Signal names printed on the circuit board

# 3 SIMPLE J-BOX

The Simple J-Box features a terminal block for RS485 and Power lines. It allows for RS485 connection, but no CAN connection and no Ethernet connection. If such other data links are required, please use the Full J-Box.

The terminal block has only 6 terminals allowing greater wire gauge compared to the Full J-Box.


*Figure 1: Simple J-Box*

## 3.1 SIMPLE J-BOX VARIANTS

The following variants are available:

| J-Box Variant | Compatibility |
|---|---|
| Simple J-Box for TRUGRD Products[1] | TRUGRD<br>TRUGRD Stream<br>TRUGRD LR |
| Simple J-Box for UMRR-11[2] | UMRR-11 Type 44<br>UMRR-11 Type 45<br>UMRR-11 Type 132 |
| Simple J-BOX for TOPGRD | UMRR-A4 Type 171 |

*Table 1:SimpleJ-Box variants*

[1] Current hardware: J-BOX-020502 Previously referred to as JBOX-020501.
[2] Current hardware: J-BOX-020402 : Previously referred to as JBOX-020401.

## 3.2 SIMPLE J-BOX SPECIFICATIONS

| Parameter | Details |
|---|---|
| **Mechanical** | |
| Weight | 180g \| 6.34oz (excluding cable) |
| Height | 79.8mm \| 3.14in (excluding cable outlet)<br>ca. 116mm \| 4.56in (including cable outlet) |
| Width | 84mm \| 3.30in |
| Depth | 29mm \| 1.14in |
| **Supported Cables** | |
| Supported cable diameter | 9-13mm \| 0.35-0.51in (smaller diameter available on request) |
| Supported conductor cross section range | 0.13-2.5mm² \| 0.0002-0.0038in² |
| Recommended cable | Draka Cable UC300, Draka Cable UC900, Lapp UNITRONIC BUS YV COMBI IBS type 2170217 |
| **Surge Protection** | |
| Surge protection of power lines | Compliant to IEC 61000-4-2 (ESD) and<br>IEC 61000-4-4, Class 4 (fast transients) |
| Surge protection of data lines | Compliant to IEC 61000-4-2 (ESD) and<br>IEC 61000-4-4, Class 4 (fast transients) |
| **Further Information** | |
| Operating temperature | -40…+80°C \| -104…+176°F |
| Vibration | 0.015 in DA (Nema TS2-Standards) |
| Shock | 10 g's (Nema TS2-Standards) |

*Table 2: Simple J-Box specifications*

## 3.3 SIMPLE J-BOX JUMPERS J1 AND J2

The jumpers J1 and J2 are bridges between pins 1 and 3 / pins 2 and 4 of the terminal block. Those bridges must be **open for full-duplex RS485** operation.

Note: Half-duplex RS485 is no longer used.

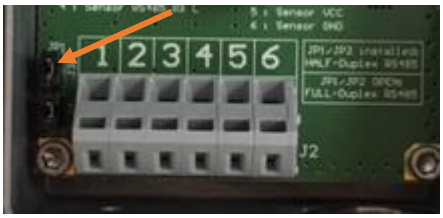


*Figure 2: J3 and J4 determine RS485 full-/half-duplex operation*

### 3.4 SIMPLE J-BOX PINOUT

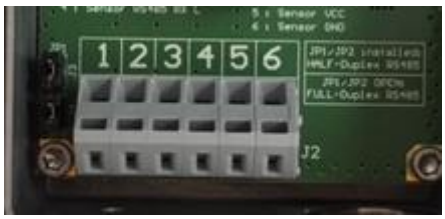


*Figure 3: Terminal block with pin numbering on PCB*

| Pin No. | Function |
|---|---|
| 1 | Sensor RS485 TX H[3] |
| 2 | Sensor RS485 TX L[4] |
| 3 | Sensor RS485 RX H |
| 4 | Sensor RS485 RX L |
| 5 | VCC |
| 6 | GND |

*Table 3: pinout of terminal block connector*

[3] In half-duplex mode the pins 1 and 3 have to be hard-wired connected, use J1 and J2

[4] In half-duplex mode the pins 2 and 4 have to be hard-wired connected, use J1 and J2

# 4 FULL J-BOX

The Full J-Box features 2 terminal blocks: one for RS485 and Ethernet and the other for power.

Therefore, the terminal block for the communication bus has 8 terminals (4 for RS485 and 4 for Ethernet) allowing only smaller wire gauge compared to the Simple J-Box. However, the separate terminal for power has 2 terminals and can be wired with greater wire gauge.


*Figure 4: Full J-Box*

## 4.1 FULL J-BOX VARIANTS

The following variants are available:

| J-Box Variant | Compatibility |
|---|---|
| Full J-Box for TRUGRD Products[5] | TRUGRD<br>TRUGRD Stream<br>TRUGRD LR |
| Full J-Box for UMRR-11[6] | UMRR-11 Type 44<br>UMRR-11 Type 45<br>UMRR-11 Type 132 |
| Full J-BOX for TOPGRD | UMRR-A4 Type 171 |

*Table 4:Full J-Box variants*

[5] hardware with CAN: JBOX-010501. Current hardware: J-BOX-030100
[6] hardware with CAN: JBOX-010401 Current hardware: J-BOX-030000

## 4.2 FULL J-BOX SPECIFICATIONS

| Parameter | Details |
|---|---|
| **Mechanical** | |
| Weight | 180g \| 6.34oz (excluding cable) |
| Height | 79.8mm \| 3.14in (excluding cable outlet)<br>ca. 116mm \| 4.56in (including cable outlet) |
| Width | 84mm \| 3.30in |
| Depth | 29mm \| 1.14in |
| **Supported Cables** | |
| Supported cable diameter | 9-13mm \| 0.35-0.51in (smaller diameter available on request) |
| Supported conductor cross section range | 0.08-0.5mm² \| 0.00012-0.00077in² |
| Recommended cable | MEDI #KU110C12J002 |
| **Surge Protection** | |
| Surge protection of power lines | Compliant to IEC 61000-4-2 (ESD) and<br>IEC 61000-4-4, Class 4 (fast transients) |
| Surge protection of data lines | Compliant to IEC 61000-4-2 (ESD) and<br>IEC 61000-4-4, Class 4 (fast transients) |
| **Further Information** | |
| Operating temperature | -40…+80°C \| -104…+176°F |
| Vibration | 0.015 in DA (Nema TS2-Standards) |
| Shock | 10 g's (Nema TS2-Standards) |

*Table 5: Full J-Box specifications*

## 4.3 FULL J-BOX PINOUT

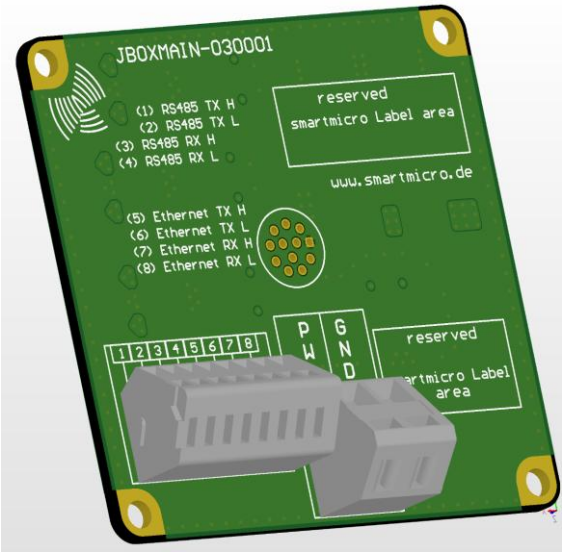


*Figure 5: Terminal blocks with pin numbers*

| Pin No. | Function | Wire Color (MEDI type #KU110C12J001) |
|---|---|---|
| **1** | **Sensor RS485 TX H** | **white** |
| **2** | Sensor RS485 TX L | pink |
| **3** | **Sensor RS485 RX H** | **gray** |
| **4** | Sensor RS485 RX L | brown |
| **5** | Sensor Ethernet TX H | gray / red |
| **6** | **Sensor Ethernet TX L** | **red / blue** |
| **7** | Sensor Ethernet RX H | black |
| **8** | **Sensor Ethernet RX L** | **purple** |
| | | |
| **GND** | Sensor GND | blue |
| **PWR** | **Sensor VCC** | **red** |

*Table 6: Pinout of 2 terminal block connectors*

# 5 PLC J-BOX

## 5.1 PLC J-BOX (GEN 4)

The GEN4 PLC J-Box contains a 4th generation PLC chip. It allows high-bandwidth Ethernet communication over power lines and is sometimes also called "BPL". A 4th generation chip set is used, allowing communication based on HD-PLC Quatro (IEEE1901-2020) with lower power consumption, higher data rate and longer cables compared to older generations.

In a PLC network, use only PLC J-Box of the same type and the same generation. A master-slave system topology must be maintained, where the COM HUB is always a master. It is not allowed to have more than one master in one PLC network.

Up to 4 slaves are possible in a single master-slave network. When using 4 slaves, the cable lengths of each of the cables master-slave must not exceed 650ft (200m).

The PLC J-Box converts the standard 4-wire Ethernet communication to a high- definition (HD) Power Line Communication (PLC).

Using the recommended cable, it provides PLC connectivity for a single sensor over a cable length of up to 300m (984ft). The Gen 4 PLC J-Box is always supplied with +48V DC from the cabinet side. It allows large wire gauges and is very easy to install, with only 3 wires to connect (power+, power, Earth).

The standard configuration of the existing PLC J-Box today does not feature any encryption on the PLC communication. Encryption is, however, available on demand using a separate software configuration.

**Important: The 3rd generation PLC chip is end-of-life; 3rd and 4th generation PLC chips should not be mixed in a system.**


Figure 6: PLC J-Box (GEN4)

### 5.1.1 SPECIFICATIONS

| Parameter | Details |
|---|---|
| **Mechanical** | |
| Weight | 192g \| 6.38oz (excluding cable) |
| Height | 79.8mm \| 3.14in (excluding cable outlet)<br>ca. 116mm \| 4.56in (including cable outlet) |
| Width | 84mm \| 3.30in |
| Depth | 29mm \| 1.14in |
| **Supported Cables** | |
| Supported conductor cross section range | 0.5-1.5mm² \| 0.00775-0.02325in² / 26-16 AWG |
| Recommended cable | Advanced Digital Cable PVC/Nylon 18AWG, Part Number 6803SD or similar, shielded for best signal quality<br>with ferrite (Würth snap-on ferrite 74275815)<br>See section 5.2 |
| **Other** | |
| Norm | IEEE 1901-2020 'Nessum/FCW-OFDM' - ITU 9905 'CMSR' (a.k.a. Multihop) |
| Speed: Data Rate | < 90Mbps |
| Surge protection of power lines | Compliant to IEC 61000-4-2 (ESD) and<br>IEC 61000-4-5 (power surges and lightning) |
| **Further Information** | |
| Operating temperature | -34…+74°C \| -29…+165°F |
| Vibration | 0.015 in DA (NEMA TS2 Standards) |
| Shock | 10 g (NEMA TS2-Standards) |

*Table 7: PLC J-BOX Gen 4 specifications*

### 5.1.2 PINOUT

Compared to the GEN. 3 PLC J-Box, the connector is changed to a screw connector.

The following picture explains the pinning of the PLC connector


Figure 7:Terminal block with pin numbers

| Pin No. | Function |
|---|---|
| 1 | Power + |
| 2 | Power – (Ground) |
| 3 | Earth |

*Table 8: Pinout of terminal block connector*

### 5.1.3 VARIANTS

The following variants are available:

| J-Box Variant | Compatibility |
|---|---|
| PLC J-Box for TRUGRD Products[7] | TRUGRD |
| | TRUGRD Stream |
| PLC J-Box for UMRR-11[8] | UMRR-11 Type 44 |
| | UMRR-11 Type 45 |
| | UMRR-11 Type 132 |
| PLC J-BOX for TOPGRD | UMRR-A4 Type 171 |

*Table 9: PLC J-BOX GEN. 4 VARIANTS*

[7] Current hardware: J-BOX-040702 ,.
[8] Current hardware: J-BOX-040602 .

### 5.2 WIRING RECOMMENDATION

The cables between PLC J-Box (gen 3 and 4) and COM HUB PLC should be Advanced Digital Cable PVC/Nylon 18AWG, Part Number 6803SD or similar. The cable should be shielded for best data quality.

On the cable next to the PLC J-Box (see picture below), one snap-on ferrite Würth 74275815 should be used, in order to reduce the cable radiated emissions.


*Figure 8: Ferrites on the PLC J-Box side*

## 6 GENERAL INFORMATION

### 6.1 J-BOX GROUNDING REQUIREMENTS

Neither the housing of the smartmicro sensor nor the J-Box is electrically floated but connected to the negative supply voltage instead.

Due to the nature of the sophisticated radio frequency circuits inside the sensor, all internal circuits of the sensor have ground-connections to the sensor housing. Please note that the housing of the sensor is not electrically floated. **In the PLC-J-Box there is a direct (galvanic) connection between the sensor-housing and negative supply line and Earth.**

Therefore, an “all grounded” wiring concept is adopted for sensor installations.

The following ***general rules*** apply:

- If the sensor is mounted to a metal object like a pole, mast arm or streetlamp, this structure will almost certainly be grounded / earthed due to general safety rules. Make sure that the sensor is mounted to the supporting structure in a way that provides a good electrical connection between the sensor housing and the supporting structure. **Usually, it is sufficient to mount the smartmicro sensor bracket with metal straps to the metal pole for good grounding. However, especially for metal poles which are painted or powder-coated, a separate low impedance grounding sensor-pole is required.**
- The negative pole of the sensor power supply shall be connected to ground / earth.
- Use shielded cable to connect the remotely mounted sensor to a central cabinet.
- Always connect the shield of the homerun cable to ground / earth within the traffic cabinet.

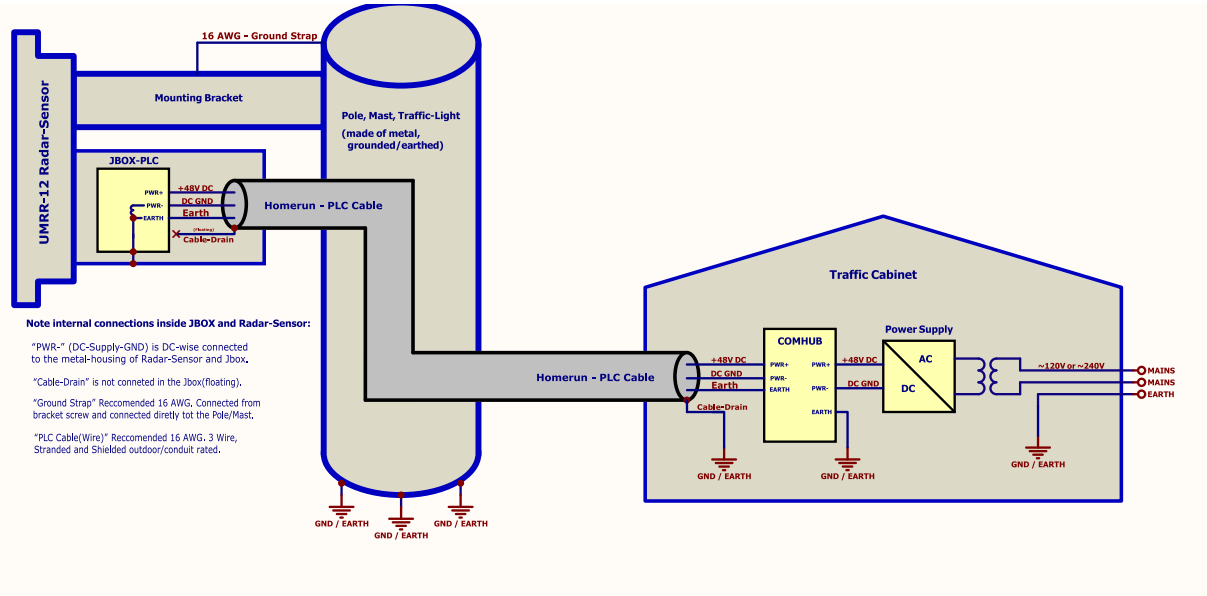


Figure 9: Recommended Grounding-Scheme for PLC J-Box

For detailed information on grounding, please read the application note ‘PLC J-Box Mounting, Grounding and Wiring recommendation’

## 6.2 ATTACHMENT TO SENSOR

Any type of J-Box is attached to the sensor using the threaded holes on the **back** of the sensor. Please consider this in case you design your own bracket or integrate the sensor into another housing.

Note: The threaded holes on the sides of the sensor are intended for the attachment of the sensor to the bracket, not the J-Box. The following picture explains the position of all threaded holes available on the rear side of the sensor.


*Figure 10: Threaded holes on the rear side of the sensor*

**Please note:** The top of the sensor is indicated on the label as you can see in the figure above. Please ensure that both the sensor and the J-Box are aligned before attaching. Please do not turn or twist the J-Box as this may damage the connector. Using the hex screwdriver, tighten all the screws with a torque of 0.5 Nm.

To ensure a waterproof and IP67 please ensure that the following conditions are fulfilled.

-The screw between sensor and J-Box are tightened with 0.5 Nm Torque

-the sealing O-ring is correctly placed in the groove of the JBOX

-JBOX Cable inlet is properly sealed. if the cable diameter is incorrect (too small) or the cable inlet seal is not tightened, water may ingress into the J-Box

-Use recommended cables which are waterproof, UV proof, shielded

# 7 COMPLIANCES

The PLC J-Box and J-Box complies with the following EU directives:

- EMC 2014/30/EU
- Safety 2014/35/EU
- RoHS 2011/65/EU
- EC 1907/2006 REACH

Applied standards:

- EMC:
  - EN IEC 61000-6-2:2005
  - EN IEC 61000-6-3:2007+A1:2011 + AC:2012
- Health and Safety:
  - EN 62368-1: 2014 + AC: 2015

According to the surge protection, the COM HUB PLC complies also with the following regulations:

- IEC 61000-4-2 (ESD)
- IEC 61000-4-4 (fast transients)
- IEC 61000-4-5 (Surges)

With regard to operating conditions like temperature, vibration etc., the COM HUB PLC was tested and certified by independent test labs to comply with:

  - NEMA TS-2

Regarding spectrum usage, this sensor model was tested and certified by independent test labs (formally approved by a test lab or notified body):

- EU EMC directive
- 47 CFR FCC Part 15 B
- ICES 003

**Note:** This statement of compliance means that the PLC J-Box allows operation compliant to the listed standards. However, not all standards are certified through test labs. Formal frequency approval or

registration is not accomplished for all countries. In certain countries or regions, a customer-specific local frequency approval is reasonable. smartmicro supports customers throughout this process.

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