ORBCOMM®

WHERE DATA DRIVES DECISIONS

RT 81xx

Installation and Operation Guide

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CONTACT AND LEGAL INFORMATION

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ABOUT THIS INSTALLATION GUIDE

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Purpose

This guide contains detailed installation information for and operation of the RT 81xx. Follow the instructions and recommendations of this guide for a proper installation. Improper installations will void the product warranty. The intended audiences for this guide include field support personnel, product evaluators and certified third-party personnel. It is particularly intended for personnel who are responsible for system installation and activation. In addition, and is appropriate, this guide may be used for customer training purposes.

Cautions and Safety Guidelines

IMPORTANT

READ ALL INSTRUCTIONS CAREFULLY BEFORE INSTALLING. FAILURE TO DO SO MAY CAUSE PERSONAL INJURY OR DAMAGE TO PRODUCT AND/OR PROPERTY.

• Review the product package and contents prior to beginning the installation. Take care when opening the packaging and removing items. If a return is needed, you will want to return the product in its original packaging if possible. • This instruction guide is provided as a GENERAL installation guide; some assets vary dimensionally and may require additional steps. • ORBCOMM has a policy of continuous development and improvements. Therefore, products, guides, and technical information are subject to change without prior notice. • The manufacturer and / or distributors do not accept responsibility for third-party charges, labor, and / or third-party replacement modifications that are not ORBCOMM approved. Some modifications may void the factory warranty. • ORBCOMM does not accept any responsibility for installations performed by installers / third parties not approved and / or authorized by ORBCOMM. Some installations may void the factory warranty. • Exercise due diligence when installing this product. ORBCOMM does not accept any responsibility for asset damage or personal injury resulting from the installation of this product. Careless installation and operation can result in serious injury or equipment damage. • All liability for installation and use rests with the owner / operator. • Always make sure you have a clean, dry, and well-lit work area. • Always ensure products are secure during disassembly and installation. • Always take steps to protect yourself when drilling, cutting, and grinding because this may create flying particles that can cause injury. • Thoroughly inspect the area to be drilled, on both sides of material, prior to modification, and relocate any objects that may become damaged. • Always route electrical cables carefully. Avoid moving parts, parts that may become hot and rough, or sharp edges. • Make sure to fully understand the product, its intended use, and operation prior to use.

CAUTION: While ORBCOMM provides mounting hardware to assist with installations, it is the responsibility of the installer to select the proper mounting hardware for the asset's surface material where an ORBCOMM device or accessory will be mounted.

CAUTION: DO NOT expose the RT 8110 (the inside) to rain or moisture during installation.

CAUTION: DO NOT expose the RT 8120 to rain or moisture.

CAUTION: DO NOT work on the installation when the recorder is connected to a power supply, except when connecting the antennas (see ESD warning for the RT 8120 installation instructions).

CAUTION: DO NOT modify the RT 81xx in any way.

CAUTION: DO NOT use the RT 81xx if it is physically damaged or shows signs of abuse.

CAUTION: DO NOT work on the installation when the RT 81xx is connected to an external power supply.

CAUTION: DO NOT work on the system or connect or disconnect cables during periods of lightning activity

CAUTION: DO NOT install near heat sources such as exhaust pipes.

CAUTION: Be aware of electrical circuitry hazards and be familiar with accident prevention standards.

CAUTION: Only use accessories specified by the manufacturer.

For information regarding liability, warranty, guarantee, and / or service, please refer to your signed (ORBCOMM Customer) Equipment Sales Terms and Conditions contract.

Battery Safety Warnings

CAUTION: The RT 81xx uses a rechargeable lithium battery. DO NOT try to charge with a higher current or a higher voltage than specified, discharge by force, or replace this battery.

CAUTION: Always follow local disposal guidelines to properly dispose of the Lithium-ion battery and the device.

CAUTION: Store in a cool, well-ventilated area. Elevated temperatures will result in shortened battery life.

CAUTION: DO NOT replace the battery. Changing the battery without ORBCOMM's permission could violate regulatory conformity.

CAUTION: DO NOT throw the internal battery or the device into fire.

Regulations

Only ORBCOMM trained and qualified personnel should install, replace, or service the RT 81xx. The ORBCOMM certified installer needs to perform the installation of the recorder complying with at least the following:

- This installation and operation guide and other relevant documentation provided by the manufacturer.
- EMC Directive 2004/108/EC
- Harmonized standards under Directive 1999/5/EC
- WEEE Directive 2012/19/EU
- Traffic regulations of the country of installation and countries in which the recorder will be used.
- Regulations and instructions described in the installation and operation manual of any supplementary device(s).

WEEE Statement

Disposal of this product should be handled according to all national laws and regulations.

The mark shown to the right is in compliance with Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE). The mark indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems according to local law.	

Document Conventions

CAUTION: Indicates an explicit message possibly resulting in injuries, unexpected behavior, or damaged hardware.

Alert
Indicates a message that requires special attention.

A note indicates information with no potential hazard. A note indicates points of interest or provides supplementary information about a feature or task.

Terminology

Term	Definition
Touch pad	The touch pad is the panel on the front of the RT 81xx with the colored buttons.
Mapping	Reading sensor from external source and processing as own sensor information.
OC	Open circuit.
p/n	Part number or article number
Protection guard	Cage to protect temperature sensors.
Recorder	The RT 81xx. It is the device intended to be used to make measurements, alone or in conjunction with supplementary device(s).
Refrigerator	A refrigerator connected to the recorder. Also referred to as reefer or fridge.
SC	Short circuit.
Temperature sensor	Element of a measuring instrument or measuring chain that is directly affected by the temperature.
Truck ID (tag)	The ORBCOMM IS 300 product.
Refrigerator / Reefer / Fridge	A refrigeration unit connected to the RT 81xx over serial (RS-232) or CAN bus.

Reference

The content of the following documents may be useful in conjunction with this guide. These documents are available from ORBCOMM.

[E0003]	DeviceManager User Guide

1 OVERVIEW

ORBCOMM's RT 8110 and RT 8120 temperature recorders enable temperature monitoring and proof of compliance from origin to destination for food, pharmaceuticals, and other temperature-controlled cargo. Using up-to-date cellular technology, multiple new connectivity options and BLE wireless support for temperature and door sensors, the RT 81xx underpin a comprehensive cold chain telematics solution that provides printed or electronic temperature recorders, real-time event-based alerts, advanced reports, geofences, and more.

1.1 Product Variants

The RT 8110 is suited for outdoor trailer installations, while the RT 8120 is compact and ideal for installations inside a truck cabin.

Figure 1: RT 8110

Figure 2: RT 8120

The RT 81xx include the following features and functionality:

- 10 x general purpose input/outputs
- 3 x CAN Bus
- 2 x RS-232
- 1 x RS-232/RS-485
- 1 x 1-Wire
- Wired and wireless sensor support
    - Support for up to eight wireless sensors
- Integrated printer
- High-capacity internal battery
- Accelerometer
- Bluetooth Low Energy (BLE)
- and more

2 INSTALLATION

2.1 Identify the Components

The RT 8120 is suitable for in-cabin installation and the RT 8110 for outside mounting on a trailer. On the rear of the recorder, the connectors are designed for 10 general purpose digital inputs / outputs, a power supply, three CAN bus, two RS-232 COM ports, and one RS-232/RS-485 port.

2.1.1 RT 81xx

The RT 8110 is ideal for mounting outside on a box body or trailer. The recorder s contained in a waterproof polymer plastic box. Cabling is installed through watertight cable glands, which are mounted in the recorder box.

The RT 8120 is ideal for mounting in a vehicle cabin. The recorder chassis meets the dimensions of a single DIN radio slot (according to ISO 7736) and can be easily mounted in an available slot.

The RT 81xx is boxed in environmentally friendly cardboard packaging and the contents varies depending upon the part number ordered. Refer to the order parts list for a complete list (installation kits include a 10 A fuse and screws/nuts/washers/terminal blocks etc. required for a standard installation).

2.2 Review the Installation Requirements

Ensure you have the following before you begin:

- Power supply 12 to 24 VDC, negative earth.
- For an RT 8110 installation, a mounting location on a trailer.
- For an RT 8120 installation, a radio slot and/or IP20 approved location.
- Tools for your specific type of installation.
- Supplementary mounting materials such as a kit (accepted by the food and pharma industry), cable trunking, and fixing materials for cable mounting.
- Latest version of the DeviceManager software with sufficient permissions for any installation.

2.3 Select the SIM Card for Communication

The RT 81xx includes an internal embedded SIM card and has an optional slot for an external SIM card.

To select the SIM card used for communication:

1. Connect the RT 81xx to the DeviceManager software.
2. In DeviceManager, select the **Configuration** menu, and then navigate to the **Communications** tab.
3. Select the **iGPRS** sub-tab, in the **SIM Source** field, select the SIM card to use.
    - Embedded SIM
    - External SIM = external SIM card; refer to section 2.4 for details on how to install and configure the device for an external SIM card.
4. From the **Install & Maintenance** menu, select the **Reboot Device** command to restart the RT 81xx.
5. From the **Device Information** menu, check the **Online Info** box to verify that the RT 81xx has a connection to the server.

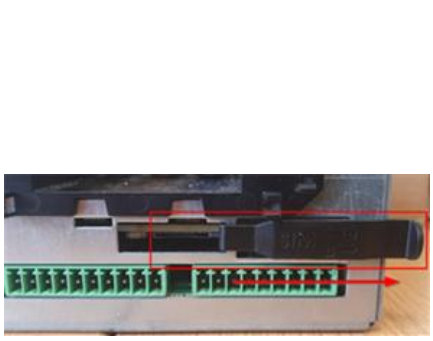
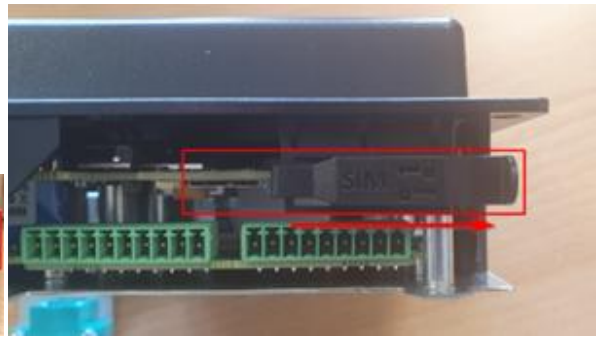
2.4 Install and Configure the SIM Card

To establish online communication for the recorder, follow the steps below to install and configure the SIM card.

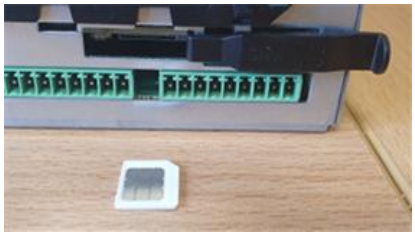
Make sure the following information is available and checked.

- **Have an activated SIM card that supports GPRS data.**
- **Verify that the SIM card works before installing it.**
- **Have the specific APN settings for the SIM card and if applicable, the correct PIN code.**

1. Unlock the SIM card slot on the back of the device (radio slot model) or the top of the device (trailer box model) by sliding the SIM protector to the right.

2. Install the SIM card in the orientation shown below (with the chip facing upwards, and the notch at the top and on the same side as the SIM protector).



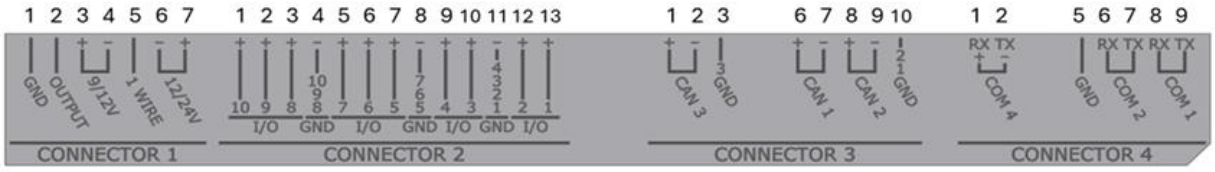

3. Lock the SIM card slot by sliding the SIM protector to the left.
4. Connect the RT 81xx to the DeviceManager software.
5. In DeviceManager, select the Configuration menu, and then navigate to the Communications tab.
6. Select the iGPRS sub-tab, and then select SIM Source "External SIM".
7. In the APN server field, select the APN server that corresponds to the SIM card you are installing. • Verify that the information in the APN Server Address, APN Username, and APN Password match the information provided by the SIM card supplier.
8. (optional) If your desired APN server is not available from the drop-down list, or if the settings from the APN server preset do not match with the settings provided by the SIM supplier, manually enter the following (if applicable):

- APN Server Address
- APN Username
- APN Password

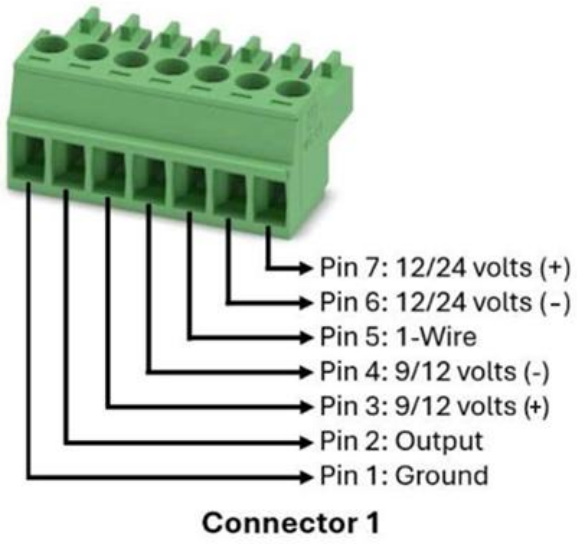
9. (optional) If your SIM card is locked with a PIN code, type the PIN code in the SIM PIN code setting.
10. From the **Install & Maintenance** menu, select the **Reboot Device** command to restart the RT 81xx.
11. From the **Device Information** menu, check the **Online Info** box to verify that the RT 81xx has a connection to the server.

2.5 Review the Connector Blocks and Pin Descriptions

On the back of the RT 81xx are four connector blocks.



2.5.1 Connector Block 1 (Power and Outputs)



Connector 1

Power supply

Connect the power supply on Pin 6 and Pin 7. The voltage is between 10 to 32 VDC (negative earth) and power consumption when printing is 26 W.

9 V / 12 V Output

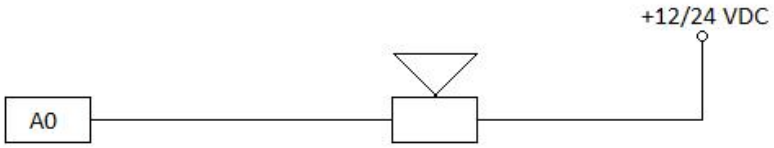
Pins 3 and 4 output a continuous (unswitched) output voltage, which is limited to 500 mA (0.5 A).

Alarm output (AO)

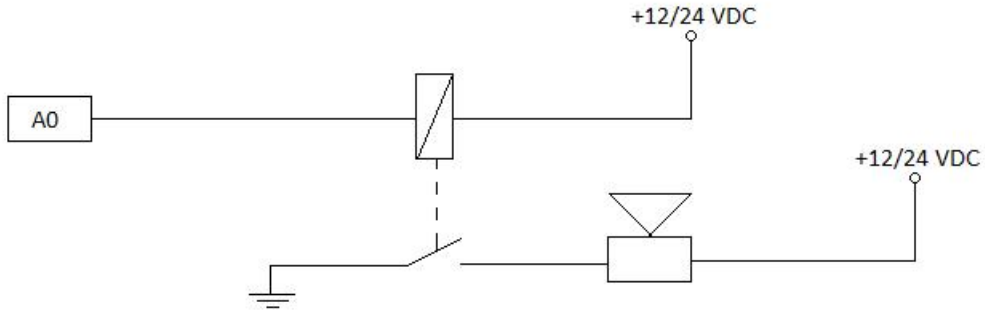
Pin 2 is a digital alarm output. The output switches to ground in case of an alarm situation and is limited to 1 A output current. Following are two examples of how you can connect the digital alarm.

Option 1 - Direct Connection

Note **The alarm output is only triggered when a temperature or digital contact alarm is triggered on the RT 81xx. The alarm output does not trigger on a low battery alarm or when relaying an alarm from a connected peripheral (for example, when a fridge registers an alarm event, alarm output is not triggered).**

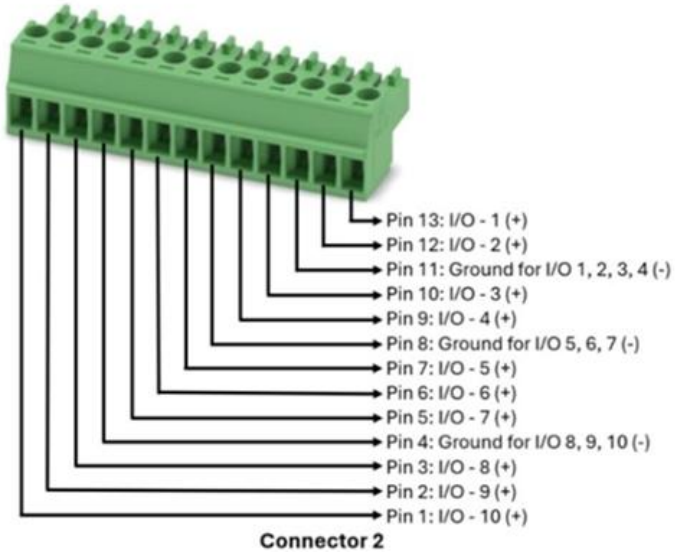


Option 2 - Toggle Connection



CAUTION: Option 2 is recommended when an alarm is chosen that has peak currents greater than 1 A.

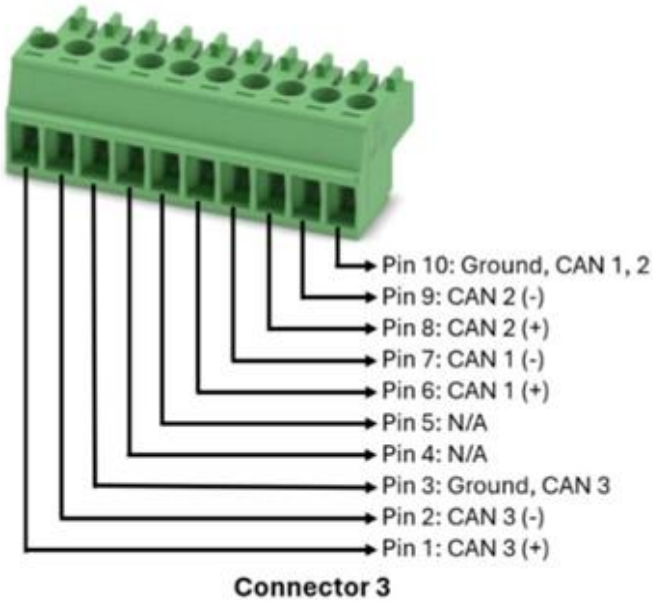
2.5.2 Connector Block 2 (Inputs)



The RT 81xx supports up to 10 assignable GPIO (General Purpose Input / Output), which allows connection to a maximum of 10 temperature sensors, or 10 digital contacts, or any combination of these up to 10.

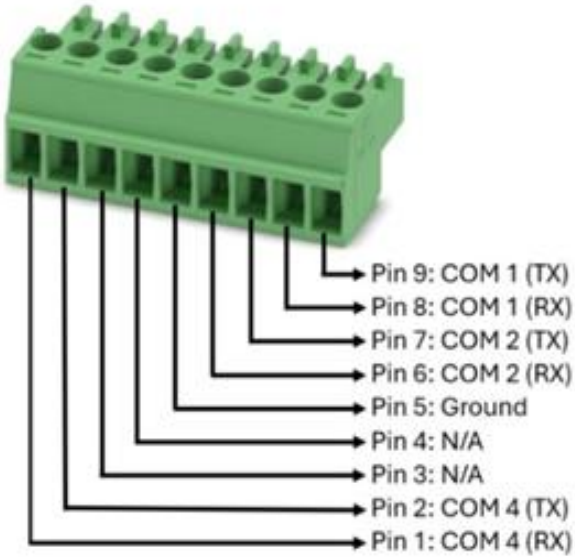
By default, I/O_1 to I/O_6 are analog and I/O_7 to I/O_10 are digital.

2.5.3 Connector Block 3 (CAN)



The RT 81xx offers three CAN options and two grounds.

2.5.4 Connector Block 4 (Serial)



Connector 4

The RT 81xx has three serial communication (COM) ports. Use these for a permanent connection with external devices.

The ground pin is shared.

Each COM port is by default pre-programmed as UCP Protocol.

Note **Change the protocol to match the communication protocol used by the external device.**

2.6 Review Mounting Guidelines and Accessory Requirements

CAUTION: Verify that wiring is free of obstacles, kinks, or dents. ORBCOMM recommends the use of wiring loom to prevent damage to the cable (due to vibration).

The various installation kits (APPENDIX A) contain most of the components required for a standard installation with some kits containing two temperature sensors. In addition, some general materials like a kit accepted by the food and pharma industry, cable trunking, and fixing materials for cable mounting are required. Use the existing cable trunkings for both outside and inside walls. If no existing cable trunkings are available, mount new ones.

CAUTION: DO NOT use self-adhesive cable trunkings as adhesion will not last due to extreme temperature fluctuations and peaks

CAUTION: Seal all drilled holes with a suitable sealant

2.6.1 Review the Power Supply Requirements (LVD)

Connect the power supply directly to the vehicle or refrigerator battery. The included 10 A floating fuse must be fitted in the +power line as close as possible to the power connection. RT 81xx are suitable for a voltage between 10 to 32 VDC. See guidelines below if using a Low Voltage Disconnect (LVD) for installation.

The RT 81xx Low Voltage Disconnect (LVD) device helps prevent the vehicle battery from over discharging by cutting off at a safe level. This preserves the health of the battery and allows for longer battery life. The RT 81xx LVD is available two variants for 12 V and 24 V battery vehicles.

Required Tools and Materials:

- RT 81xx Low Voltage Disconnect (LVD) device, either 12 V variant (p/n ST101724-001) or 24 V variant (p/n ST101724-002), includes:
    - 2 x Splice connector (manufacturer part number:0191640013)
- Wire strippers for 0.75 mm / 20 AWG wire
- Heat gun
- Crimping tool

Thresholds:

	Voltage
12 V nominal cutoff	12.10
12 V nominal re-connect	12.30
24 V nominal cutoff	23.42
24V nominal re-connect	23.75

PIN Connections:

The RT 81xx LVD device comes in an IPx protected, rectangular box with four blunt cut wires protruding from it. The four wires, with two on each side, are as follows:

Label	**Description**
Battery Power	Connect to vehicle (+12/24 V) battery power
Battery Ground	Connect to vehicle battery ground
RT8 Power	Connect to RT 81xx power
RT8 Ground	Connect to RT 81xx ground

To install an RT 81xx LVD:

1. Ensure that there is no connection to the vehicle battery.
2. Strip the ends of the wires LVD "RT8 Power" and "RT8 Ground", and then twist the wire strands together.
3. Slide the splice connector over one of the wire ends, and then twist the wire strands together.
4. Slide the splice connector over the twisted wire strands, crimp the connector to connect the wires, and then use a heat gun to insulate the connection.
5. Repeat steps 3 and 4 for the remaining wire.
6. Connect the LVD "Battery Power" and "Battery Ground" wires to the vehicle battery, and then if using a fuse, ensure it remains in-line with the LVD on the vehicle battery power side.

2.6.2 Review the Antenna Guidelines

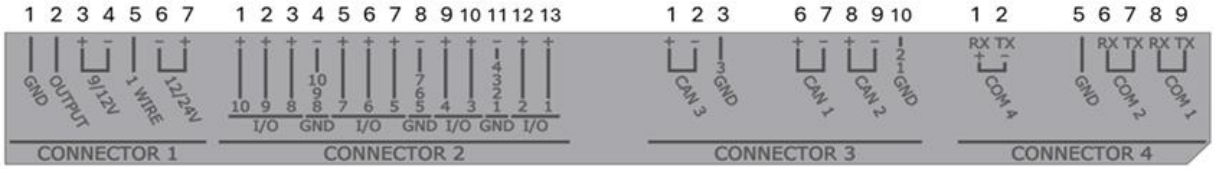
Consider the following when mounting the RT 81xx with an internal or external antenna:

- DO NOT choose a location covered by metal, metal containing components or paint. Also pay attention to windows with a metal film.
- Always mount horizontally with the reception surface facing up.
- Mount in a location that has a clear light of sight to the sky.
- Wiring should be free of obstacles, kinks, or dents. This could influence the performance of the reception antenna cable.
- Mount in an interference free location.

Do not compare the testing of the GPS signal to reception on smartphones. Smartphones use the assisted GPS technology in which location detection is used via cell towers and Wi-Fi.

2.6.3 Review the (Optional) Accessories

You can mount several accessories, described in this section, depending on your requirements. Accessories connect to the RT 81xx via one of the connector blocks.



2.6.3.1 Temperature Sensors

Use the RT 81xx only with approved ORBCOMM temperature sensors.

Type	Temperature Range	Accuracy	Length	Part Number	Price List Name
Temp. Standard	-50°C to +70°C (-58°F to +158°F)	0.1°C	6m	009.000.5106	TEMP. SENSOR 6M IN METAL HEAD 70 DEG C ACC. 0.1 DEG C
			15m	009.000.5115	TEMP. SENSOR 15M IN METAL HEAD 70 DEG C ACC. 0.1 DEG C
			22m	009.000.5122	TEMP. SENSOR 22M IN METAL HEAD 70 DEG C ACC. 0.1 DEG C
Temp. standard with connector		0.1°C	3m	009.000.5103	TEMP. SENSOR 3M IN METAL HEAD 70DEG C W CONN AND C.CONN
Temp. standard		0.2°C	6m	009.000.5006	TEMP. SENSOR 6M IN METAL HEAD 70DEG C
			15m	009.000.5015	TEMP. SENSOR 15M IN METAL HEAD 70 DEG C
			22m	009.000.5022	TEMP. SENSOR 22M IN METAL HEAD 70 DEG C
Glycerin probe		0.2°C	12m	009.001.0003	TEMPERATURE SENSOR GEL 12 MTR. METAL TUBE 70°C

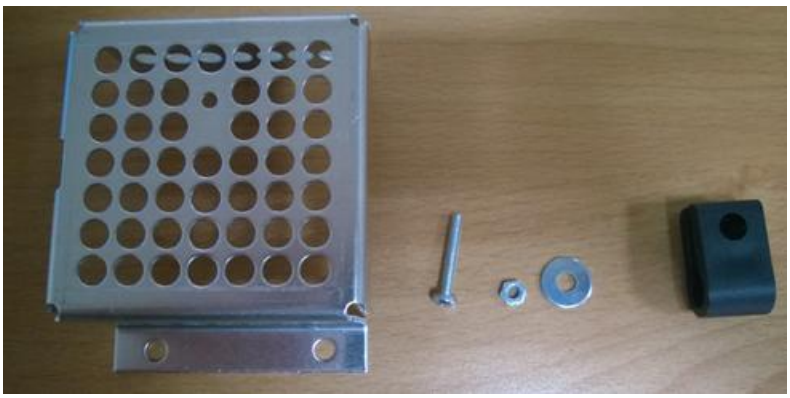
Before installation, determine how many measurement points are required to retrieve the desired information. Once you know the number and position of the sensors, you have more information about the air temperature in an entire compartment.

Observe the following before planning the installation of the temperature sensors:

- DO NOT mount the temperature sensor in a location without air circulation.

  CAUTION: The maximum temperature range of the sensor is at risk when mounting a sensor too close to the supply air. The range for the sensor is -50°C to +70°C (-58°F to +158°F).

- Protect the sensor position against bumping of load, doors, etc.
- Leave a minimum distance of 0.5 m (20 in) between the channel of the interior light and the sensors.
- ORBCOMM recommends at least one sensor per compartment and one sensor in the return air flow. The best position for a compartment sensor is in the middle, under the ceiling, at about 1/3 of the compartment length measured from the back.
- For future calibration requirements, it is advisable to allow enough spare cable to enable the sensor to be lowered to the floor.
- To prevent any damage to the wiring of the temperature sensor, make use of a spiral or loom around the excess wiring, coil and tie it up.
- Mount the compartment sensor with the ORBCOMM protection guard (p/n 002.000.0020), which allows sufficient air circulation around the sensor. To mount the compartment sensor:
  1. Verify that all the mounting materials are supplied (from left to right):
     - Sensor guard
     - M3x20 screw
     - M3 nut
     - M4 flat washer
     - Sensor cleat

  2. Place the isolation material of the sensor in the cleat.

3. Use the supplied screw, washer, and nut to mount the sensor cleat to the guard.

Possible installation locations:

Figure 3: Example Installation on a Truck

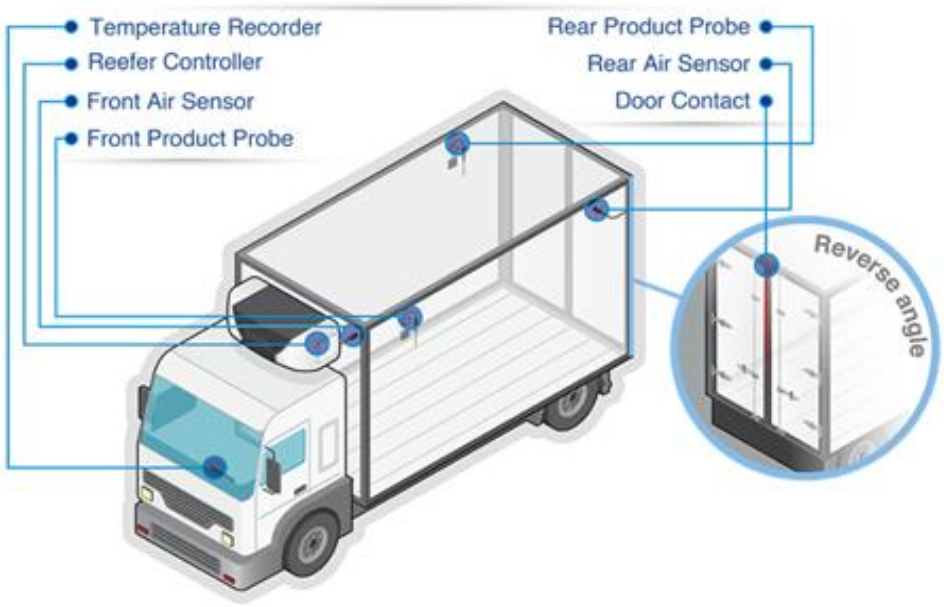
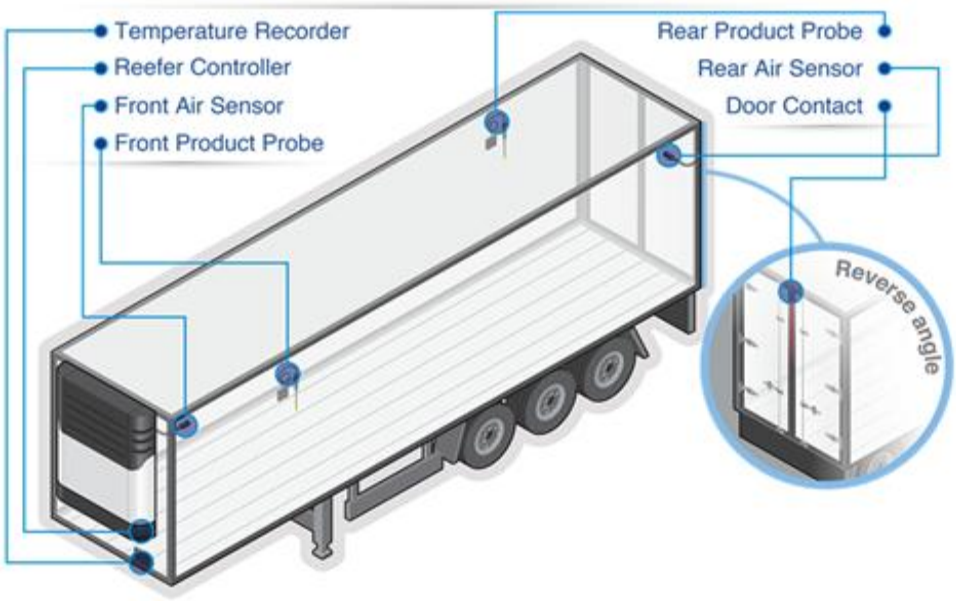


Figure 4: Example Installation on a Trailer



CAUTION: When cleaning the trailer, be careful with pressure washers and corrosive cleaning supplies, which may damage the temperature sensor. Damage to the sensor may lead to water ingress, which negatively impacts the life expectancy and temperature measurements of the sensor

2.6.3.2 Digital Inputs

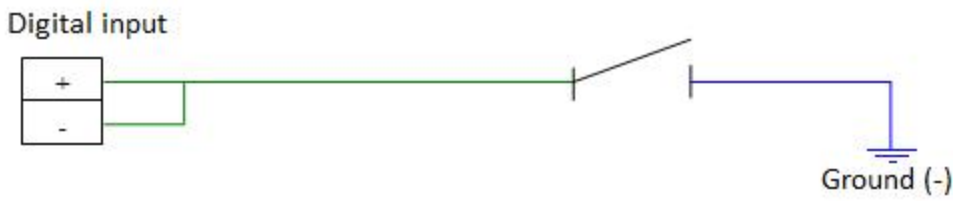
The digital inputs allow monitoring and registration of digital signals. Typical functions are defrost, refrigeration (ON/OFF), back and side doors (open/close), battery back-up, and compartment ON/OFF. You can distinguish the interpretation of the corresponding status by configuring the parameters.

There are three ways to connect door switches or other digital signals:

- Standard switch contact on digital input (low)

- Switched to battery (+) (high)

- Switched to ground (-) (low)



Digital input distinct between high levels and low levels around 5 V. A voltage level <0.495 V is low level, and >1.625 V is high level. The maximum voltage allowed for the 10 I/O pins is 32 V.

The following door switches work with the RT 81xx.

Type	Polarity	Length	Part Number	Price List Name
Back Door Switch	Naturally Open	22m / 72 ft	009.001.0050	BACK DOOR SWITCH KIT (MAGNETIC 22 M CABLE)
Side Door Switch	Naturally Open	22m / 72 ft	009.001.0060	SIDE DOOR CONTACT KIT MAGNETIC (N/O, 22 M CABLE)

2.6.3.3 Fridge Connection

You can connect the RT 81xx to several types of fridges from different suppliers. Prepare the fridge to communicate with a 3rd party (telematics) device so it can communicate with the RT 81xx.

Additionally, for successful communication, configure the correct communication protocol in the recorder's configuration.

The RT 81xx is compatible with refrigeration units from the following suppliers:

- Carrier
- Thermo King
- Mitsubishi
- Konvekta

Note **For more detailed information and requirements about connecting a fridge unit to the RT 81xx, please contact your distributor or Contact Support.**

2.6.3.4 Door Lock Connection

You can connect the RT 81xx to door lock controllers from several suppliers. Connecting a door lock controller may offer the possibility to remotely (un)lock and (dis)arm a door lock.

Remember to prepare the door lock controller to communicate with a 3rd party (telematics) device before it can communicate with the RT 81xx.

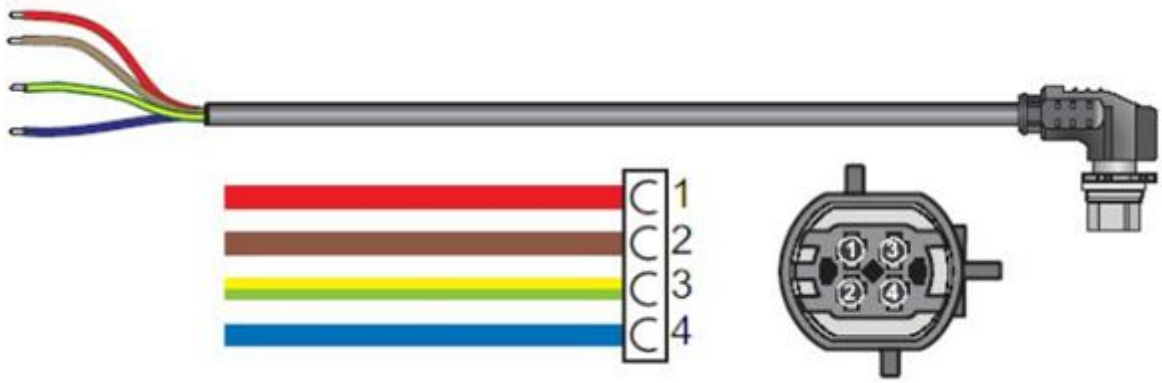
Additionally, for successful communication, configure the correct communication protocol in the recorder's configuration.

Note **For more detailed information and requirements about connecting a door lock controller to the RT 81xx, please contact your distributor or Contact Support.**

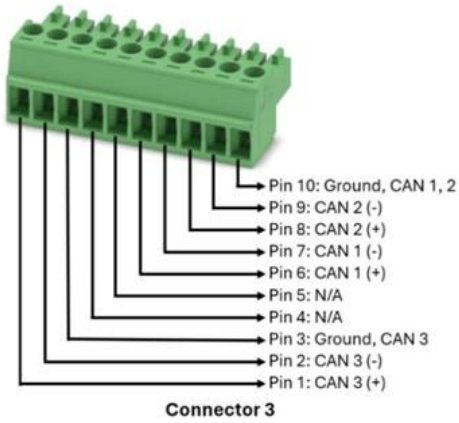
Depending on the door lock controller, the RT 81xx may require additional configurations settings.

2.6.3.5 EBS Connection

You can connect the RT 81xx to an EBS system from WABCO. Connecting an EBS system gives access to EBS related information on the ColdChainView platform. To connect the RT 81xx to the EBS WABCO system, you need an EBS WABCO GIO5 cable (p/n 004.000.0071).



You must connect the EBS WABCO GIO5 cable to connector block 3 as described in the following table.



Connector Block 3		**GIO5 Cable**
Pin 1	CAN 3 (+)	Cable (3) Yellow / Green - CAN Hi 5 V **OR** use Pin 6 **OR** Pin 8 on connector block 3
Pin 2	CAN 3 (-)	Cable (4) Blue - CAN Lo 5V **OR** use Pin 7 **OR** Pin 9 on connector block 3
Pin 3	Ground, for CAN 3	Cable (2) Brown - Ground if using Pin 6 **OR** Pin 8 on connector block 3
Pin 4	N/A	N/A
Pin 5	N/A	N/A
Pin 6	CAN 1 (+)	Cable (3) Yellow / Green - CAN Hi 5 V **OR** use Pin 1 **OR** Pin 8 on connector block 3
Pin 7	CAN 1 (-)	Cable (4) Blue - CAN Lo 5 V **OR** use Pin 2 **OR** Pin 9 on connector block 3

Connector Block 3		GIO5 Cable
Pin 8	CAN 2 (+)	Cable (3) Yellow / Green - CAN Hi 5 V **OR** use Pin 1 **OR** Pin 6 on connector block 3
Pin 9	CAN 2 (-)	Cable (4) Blue - CAN Lo 5 V **OR** use Pin 2 **OR** Pin 7 on connector block 3
Pin 10	Ground for CAN 1 and CAN 2	Cable (2) Brown - Ground if using Pin 1 on connector block 3

Note: The red cable (1) on the EBS WABCO GIO5 cable is not used.

Configure the correct communication protocol in the recorder's configuration for successful communication.

Note **For more detailed information and requirements about connecting an EBS WABCO system to the RT 81xx temperature recorder, please contact your distributor or Contact Support.**

2.6.3.6 TouchPrint Connection

You can connect the RT 81xx to a TouchPrint device from Thermo King. You can order this device from an external supplier. For communication with the TouchPrint device, connect the COM port of the TouchPrint device needs to one of the RT 81xx COM connections (connector block 4 on the RT 81xx).

On the TouchPrint device, ensure that a constant connection exists between Pins 2 (+) and 3 (Key) to avoid sleep mode on the device.

For more information, please refer to the installation guide for the TouchPrint device (available from Thermo King).

2.6.4 (Optional) Connect to Another ORBCOMM Recorder (Networked Setup)

You can connect the RT 81xx to other ORBCOMM temperature recorders to create a networked setup. With a networked setup, it is possible to provide features unique to one recorder to another recorder.

For example, by connecting an RT 81xx to an RT 8000, it is possible to use the printer of the RT 81xx to print out the values recorded by the RT 8000.

Note **For proper sharing of recorder specific features, the recorder must be configured correctly. For more detailed information, contact your distributor or Contact Support.**

You can connect ORBCOMM recorders to each other over a serial cable connection. Ensure you do the following:

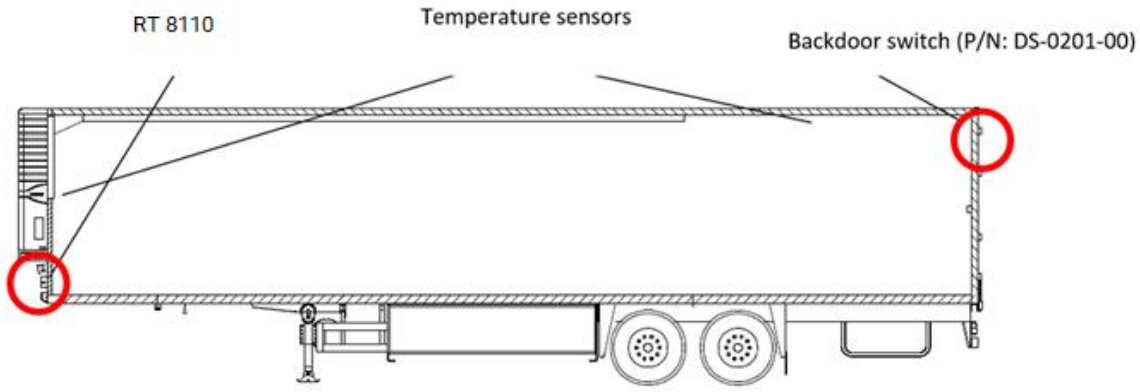
- Connect the TX output of each recorder to the RX input of the other recorder. For this, you can order an ORBCOMM (p/n 004.000.0070) cable.
- When connecting the recorders, power OFF both recorders.

2.7 Install the RT 81xx

Follow the installation instructions for your model of RT 81xx.

2.7.1 Install the RT 8110

The RT 8110 is for outside mounting directly on the body of an asset. Usually, it is fixed under the refrigeration unit on the front side of the body where it is easily accessible.



CAUTION: Install cables via watertight cable glands. This avoids humidity penetration into the box. For each cable use a separate gland unless you use a gland especially designed for additional cables.

CAUTION: All unused holes in the cable gland MUST be plugged using the included blanking plugs.

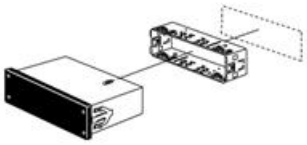
1. Mark four holes at the front of the body in an easily accessible location (usually underneath the refrigerator unit to the right or left-hand side), and then drill holes with a 10 mm drill.
2. Insert the four rubber mounting nuts. Mount the recorder using the four screws and washers provided (note metal washer is on the outside of the mounting lug fixed to the box). Ensure screws are screwed in tight. Use any available entrance for the temperature sensors. If no entrance is available, drill a hole large enough at a suitable location through the bulkhead in which to pass the temperature sensor. Make sure that the cable glands of the box point downwards.
3. Position sensor number 1 to the return air (RET.AIR), usually next to the refrigerator sensor, but only if good airflow is around it, otherwise locate the sensor onto the grill.
4. Position sensor number 2 at a high level usually to the roof, either in the center or to the side, 2 to 3 meters in from the rear doors.
5. Ensure all cables are installed neatly into plastic channels or similar. Ensure that there is at least 1 to 2 meters of spare cable in channels, this facilitates calibration.
6. Connect the power cable through the provided 10 A fuse, directly to the main vehicle or refrigerator battery. The recorder starts recording automatically.

   CAUTION: Ensure adequate power is supplied to the recorder at all times.

7. Ensure all holes drilled through the body are sealed with a suitable sealant.

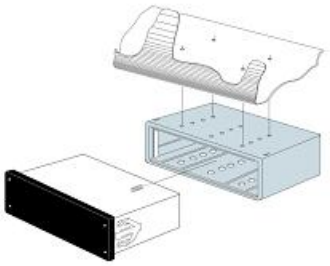
2.7.2 Install the RT 8120

Mount the RT 8120 within the cabin of a vehicle in a single DIN radio slot (according to ISO 7736).



Optional Mounting Kit

If no radio slot is available, mount the RT 8120 with the optional mounting kit (p/n 001.000.1202 - mounting frame nonmetal). This replaces a radio slot and can be fixed either on or under the dashboard and on the back wall. Ensure that the position chosen allows the driver to see the display and use the operator touch pad. Remember that access to the printer is required to replace the paper roll.



CAUTION: Prevent Electrical Static Discharges (ESD) damage by connecting the power before connecting the GPS + GPRS antennas.

1. Select a suitable position for the RT 8120, for example a free car radio slot in the dashboard, or above the driver. If there is no free slot, ORBCOMM recommends the optional mounting kit (p/n 001.000.1202 - mounting frame nonmetal). The mounting kit can be fitted on top, or underneath the dashboard.
2. Push the mounting frame into the slot and bend the metal flaps to secure its position.
3. Install the sensors from the body to the driver's cabin. Ensure you fit the cables along the chassis with the harness, so that they do not break when tilting the cabin.
4. Take the connector blocks off the back of the instrument and fix the cables according to the wiring diagram (see section 2.5).
5. Connect the power supply via the provided 10 A fuse, directly to the main vehicle battery, the recorder starts recording automatically.
6. Attach the GPS + GPRS antenna.

   CAUTION: Ensure adequate power is supplied to the recorder at all times.

7. Test the functionality and do a printout before pushing the instrument into the slot.

2.8 Install the Antennas

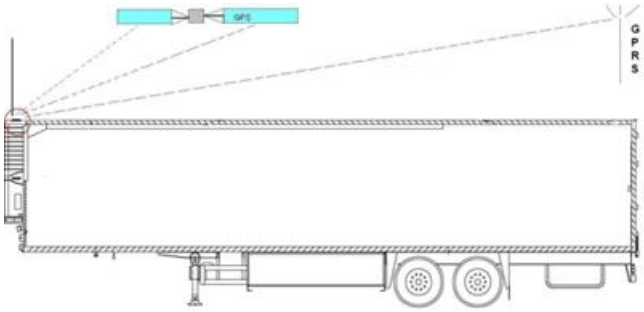
Before installing the antennas, ensure you review the antenna mounting guidelines in section 2.6.2.

BLE Antenna

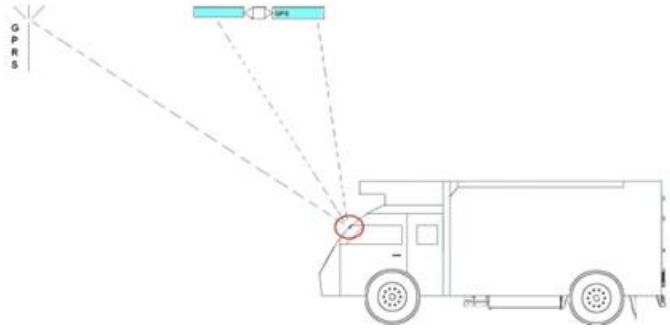
- Mount the BLE antenna (ST101496-00x) inside near the front of the reefer and near the roof.
- For RT 8120 installations on flip cab vehicles, there is a 12 m BLE antenna extension cable (p/n ST101723-001). For additional protection, add convoluted split loom to the cable anywhere it runs outside of the cab. Make sure that the ends are taped, and the cable ties are placed so that the cable does not rub.

Cell and GPS Antenna

- For RT8110-2500, mount the Cell and GPS antenna as shown, with a clear line-of-sight to the satellites.



- For RT8120-2500, mount the Cell and GPS antenna as shown, with a clear line-of-sight to the satellites.



Additional mounting guidelines:

- **DO NOT** let the antenna hang on the connection cable
- **DO NOT** mount the antenna and wiring close to a heat source (like heating channels or exhaust pipes)
- **DO NOT** cut or extend or make any changes to the cables
- **DO NOT** curl up cables
- **DO NOT** bend the cables in sharp angles as this might break the core of the wire
- **DO NOT** place the antenna too close to toll systems
- Make sure that the antenna has a clear view to the sky (towards the satellites)
- Place cables into a cable gutter
- Always install the antenna according to the installation standards (and not directly in the drivers view).

Connect the Antenna

CAUTION: ESD - Before connecting the antennas, make sure that the RT 81xx is connected to power.

Only for RT 8110

Make sure the antenna leads into the two holes of the cable gland, as shown in the figure, and then attach the cable gland to the trailer box.

Connect the antenna cables to the connections on the back (RT 8120) or left side (RT 8110) of the recorder.

RT 8110:

1. Put the recorder into the trailer box and fasten it inside the box with the four black screws and washers.
2. Tighten the cable gland, leaving enough wire (10 cm / 4 in) inside the trailer box to allow for easy access.

RT 8120

1. Put the recorder into the radio slot until it locks into place.

2.9 Install the Accessories

After reviewing the accessories in section 2.6.3, install those that meet your requirements.

3 CONFIGURE THE RT 81XX USING DEVICEMANAGER

Use DeviceManager to configure the RT 81xx. Refer to section 3.1 or document [E0003] for connection options.

Note **You can also remotely configure the RT 81xx using Account Manager if the RT 81xx is connected to the ColdChainView server. The menus and configuration options described in this section also apply for remote configurations when using Account Manager.**

Note **To correctly share recorder specific features, contact your distributor or Contact Support for configuration instructions.**

3.1 Select a Connection Method

There are several connection options available to connect the RT 81xx to DeviceManager.

3.1.1 Connect with a Field Program Cable over Serial

Use an RT 81xx RS-232 field programming cable (p/n 008.010.0042) to connect.

3.2 Connect over Bluetooth

The RT 81xx has a built-in Bluetooth module. With this communication option DeviceManager can wirelessly connect to it over Bluetooth.

To use Bluetooth, you require the following:

- A computer / laptop with Windows 7 or newer.

  Note **Computers with Windows 7 may need BLE specific drivers installed before you can establish a connection to the RT 81xx.**

- An ORBCOMM certified Bluetooth dongle (ORBCOMM p/n 009.002.0070).
- The latest version of DeviceManager.

While connected to the RT 81xx over Bluetooth, all other Bluetooth related communication is temporarily halted.

The connection between the RT 81xx and DeviceManager locks one of the eight available BLE channels on the RT 81xx. If the RT 81xx is configured with eight wireless sensors, then it cannot communicate with all eight sensors and DeviceManager over Bluetooth simultaneously.

Refer to the "Bluetooth Dongle Installation" chapter, and the "Connect DeviceManager to a Device" chapter in document [E0003] for more details.

3.3 Configure the RT 81xx

This section describes the parameters and functions you can set from the DeviceManager Configuration menu. Refer to section 3.4 to configure peripherals.

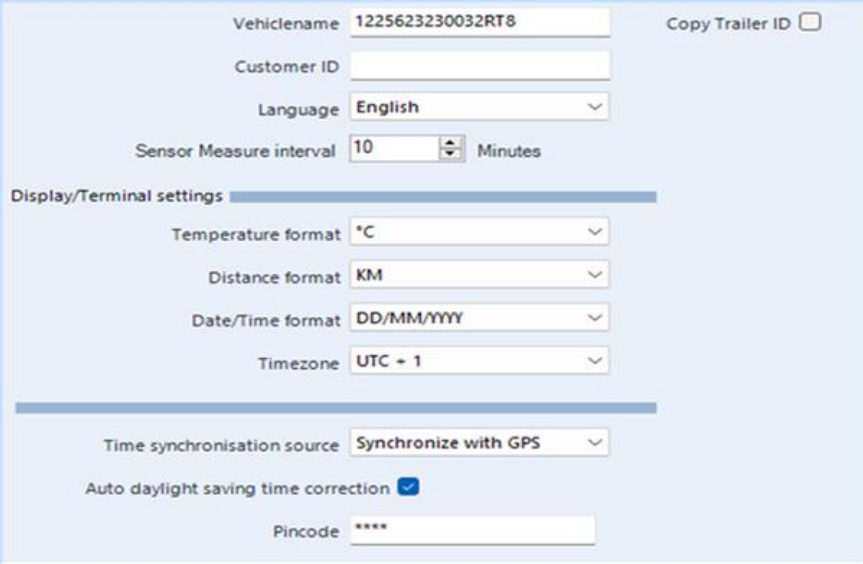
The DeviceManager Configuration menu includes the sub-menu items in the list below. To complete a basic configuration, check all underlined items before continuing with section 4 Installation Qualification.

- Main Settings
- Compartments

- Alarms
- Analog Sensors
- Virtual Temperatures
- Digital Sensors
- I/O
- Printer
- Fridge
- GPS
- Communication
- Fuel
- Battery
- EBS
- Wireless Sensors
- Door Lock

3.3.1 Main Settings

1. Click Change Configuration, and then Main Settings to edit general RT 81xx information and settings.



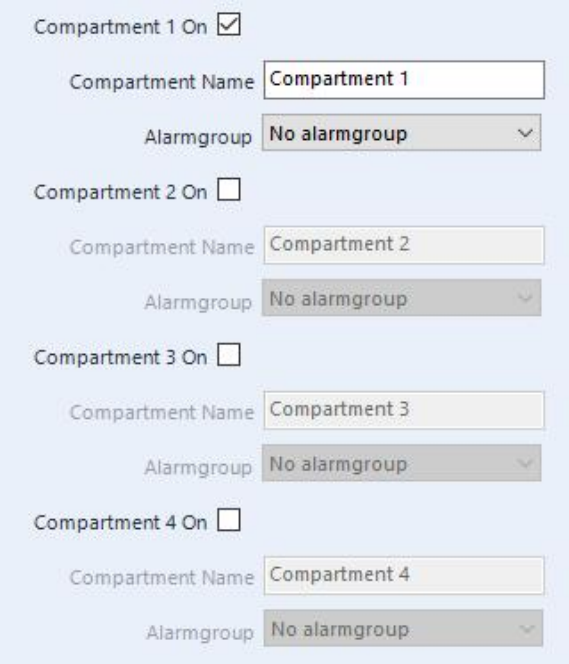
Vehiclename:	Identifies the RT 81xx. Edit this title with a better description to identify the RT 81xx. By default, the vehicle name is the serial number followed by the product type. For example, 1225623230032RT81.
Copy Trailer ID:	Automatically replaces the text in the Vehiclename field with the name of a connected peripheral. For example, replace the vehicle name with the name of a connected fridge unit.
Customer ID:	Allows you to assign an RT 81xx directly to a customer account on the ColdChainView server. **CAUTION: Ensure you have the correct 8-digit Customer ID before modifying this field.**
Sensor Measure interval:	The interval (between 1 and 60 minutes) between each temperature measurement.

Display/Terminal settings	
Note **Changing these settings only affects how the data is shown on the display and RT 81xx printouts.**	
Temperature format:	The temperature unit of measure for the display and RT 81xx printouts. Set the unit of measure to °C (Celsius) or °F (Fahrenheit).
Distance format:	The distance unit of measure for the display and RT 81xx printouts. Set the unit of measure to KM (kilometers) or MI (miles).
Date/Time format:	The date and time format for the display and RT 81xx printouts. Set the format to DD/MM/YYYY or MM/DD/YYYY.
Timezone:	The current time zone offset for the display and RT 81xx printouts. This field always shows the default offset without daylight saving time.
Time Synchronisation source:	The source that the RT 81xx uses to synchronize the internal clock.
Auto daylight saving time correction:	Enables or disables the automatic change of summer/winter time for a time zone.
Pincode:	Allows you to set the RT 81xx PIN code. You need the PIN code to access the parameter menu directly from the RT 81xx. Changing the PIN code enhances security. For more information, please refer to document [E0003].

3.3.2 Compartments

Compartments group various sensors together. From the compartment's menu, you can enable and disable compartments and assign alarm groups to a compartment.

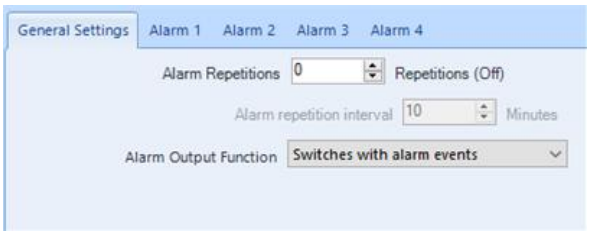
Note **The number of enabled compartments determines whether a single or multi compartment view displays on the recorder's display.**



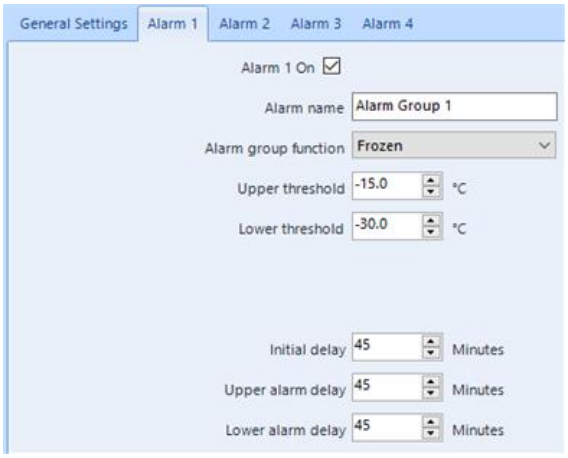
Compartment X On:	Allows you to enable or disable the compartment. **CAUTION: If the compartment is disabled; *Alarm monitoring is not active for the analog sensors in the compartment, even if an alarm group is assigned.***
Compartment Name:	Allows you to set the name of the compartment used on the ColdChainView server.
Alarmgroup:	Allows you to choose the alarm group assigned to the compartment. The alarm groups must be enabled and configured on the Alarms tab. Refer to section 3.3.3 for more information about alarm groups.

3.3.3 Alarms

Use alarm groups to set alarm thresholds for analog sensors connected to a compartment. The Alarms menu is divided into sub-tabs, General Settings covers settings for every alarm group, and multiple Alarm X tabs cover settings for individual alarm groups.



Alarm Repetitions:	This feature is not available for the RT 81xx.
Alarm repetition interval:	This feature is not available for the RT 81xx.
Alarm Output Function:	Allows you to set the function of the alarm output (AO): *-Switches with alarm events* activates an external device (sound or light) in case of an alarm. *- Switched with external commands* starts or stops a connected fridge unit.



Alarm X On:	Allows you to enable or disable an alarm group. **CAUTION: Even if the alarm group is enabled, you must assign the alarm group to a compartment to be monitored.** Refer to section 3.3.2 for more information about compartments.
Alarm name:	Allows you to add a name for the alarm group.
Alarm group function:	Allows you to select a general function for the alarm group (read-only).
Upper threshold:	Allows you to set the upper limit for temperatures before the activation of the alarm.
Lower threshold:	Allows you to set the lower limit for temperatures before the activation of the alarm.
Initial delay:	Allows you to set an initial delay before monitoring the sensors whether an alarm condition is fulfilled. This setting ignores alarms, for example, when an RT 81xx starts before the compartment reaches the Set Point temperature.
Upper alarm delay:	Allows you to set the time limit before the activation of an alarm when the upper threshold has been exceeded.
Lower alarm delay:	Allows you to set the time limit before the activation of an alarm when the lower threshold has been exceeded.

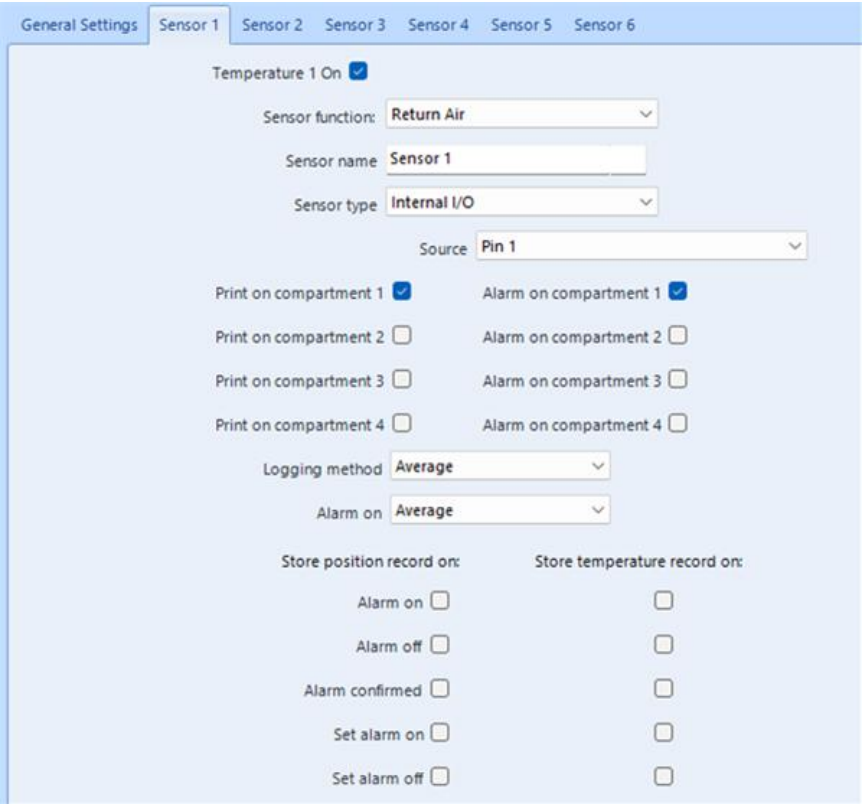
Note **For more information about temperature registration and alarms, refer to APPENDIX D.**

3.3.4 Analog Sensors

From the Analog Sensors menu, you can configure the analog sensors connected to the RT 81xx or map the temperature information from external sources to the RT 81xx.

For each temperature record written to the memory of the RT 81xx, it checks 20 temperature records and stores them based on the settings of the sensor. For example:

- Sensor measure interval = 1 minute: temperature sample taken every 3 seconds.
- Sensor measure interval = 5 minutes: temperature sample taken every 15 seconds.
- Sensor measure interval = 10 minutes: temperature sample taken 30 seconds.



Temperature X On:	Allows you to enable or disable a sensor. **CAUTION: Disabling a sensor stops recording, logging, and alarm monitoring for the selected sensor.**

Sensor function:	Allows you to select a general function for the sensor (read-only).
Sensor name:	Allows you to set the name of the sensor used on the ColdChainView server.

Sensor type:	Allows you to set the sensor type to function as data input. * Source: Retrieves the temperature data from an external device (for example, a Euroscan MX2 in a networked setup). * Fridge: Retrieves the temperature / humidity sensor data from a sensor connected to a fridge. *Internal I/O: Retrieves the temperature data from a general purpose I/O channel. * Wireless Sensor: Retrieves the temperature data from a wireless sensor channel.
Source:	The input from which the data is mapped. The available options depend on the selected sensor type. Note **Setting the sensor type to "Fridge" and the source to "Humidity Sensor" changes the unit of measurement from °C/°F to %.**

Print on compartment X:	Allows you to assign the compartment on which the temperature data of this sensor is displayed and printed. Note **If you do not select a compartment, then the information from the sensor is not shown on the recorder's display. You can still print the sensor values on a ticket by setting the printer setting in menu 1.1 to "All Sensors".**

Logging method:	Allows you to choose the temperature recording type. * Off: Does not log temperature records for this sensor. * Average (default): Logs the average of the 20 temperature values as a record.
Alarm on:	Allows you to set the temperature alarm condition type. * Average (default): Alarm condition based on the average of 20 temperature values. * Actual: Alarm condition based on the last measured temperature value.

3.3.4.1 Set Up an Alarm for an Analog Sensor

To set up an alarm for an Analog Sensor, verify the following settings:

- On the Analog Sensors menu:
  - The Analog Sensor is enabled, (*Temperature X On* is selected).
  - The Analog Sensor is assigned to a single compartment for alarm monitoring, (*Alarm on compartment X* is selected).
- On the Compartments menu:
  - The Compartment where the sensor is assigned is enabled, (*Compartment X On* is selected).
  - An Alarm Group is assigned to the Compartment (*Alarmgroup* should not be set to "No alarmgroup").
- On the Alarms menu:
  - The Alarm Group where the compartment is linked is enabled, (*Alarm X On* is selected).
  - Initial Delay, Upper Alarm Delay and Lower Alarm Delay are set to a value greater than 0 (zero).
  - Upper Threshold and Lower Threshold are set to the maximum and minimum allowed temperatures respectively.

If all above settings are correctly set up, an internal alarm triggers as soon as the temperature of the sensor is outside of the bounds (created by the alarm group thresholds) for the specified period (defined by either the upper or lower alarm delay, depending on the exceeded threshold), which is then sent to the ColdChainView server. This alarm is not audible from the RT 81xx.

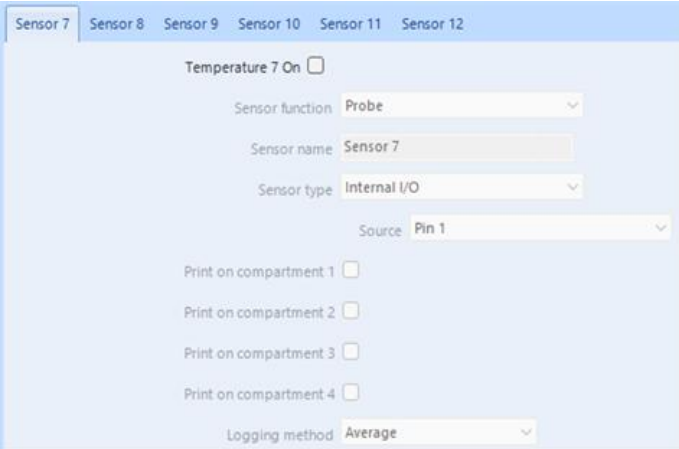
Note **For more information about temperature registration and alarms, refer to APPENDIX D.**

3.3.5 Virtual Temperatures

Virtual sensors allow you to map the temperature information of sensors connected via an external source to the RT 81xx.

CAUTION: You cannot monitor the data obtained from sensors mapped to the virtual sensor for alarm situations.

Note **As with the analog sensors, for each temperature record written to the memory of the RT 81xx, it checks 20 temperature samples, and then stores them based on the settings of the sensor.**



Temperature X On:	Allows you to enable or disable a sensor. **CAUTION: Disabling a sensor stops recording / logging data for the selected sensor.**

Sensor function:	Allows you to select a general function for the sensor (read-only).
Sensor name:	Allows you to set the name of the sensor used in ColdChainView.
Sensor type:	Allows you to set the sensor type that will function as data input. * Source: Retrieves the temperature data from an external device (for example, a Euroscan MX2 in a networked setup). * Fridge: Retrieves the temperature / humidity sensor data from a sensor connected to a fridge. * Internal I/O: Retrieves the temperature data from a general purpose I/O channel. * Wireless Sensor: Retrieves the temperature data from a wireless sensor channel.
Source:	Allows you to set the input from which the data must be mapped. Note **Setting the sensor type to "Fridge" and the Source to "Humidity Sensor" changes the unit of measurement from °C/°F to %.**

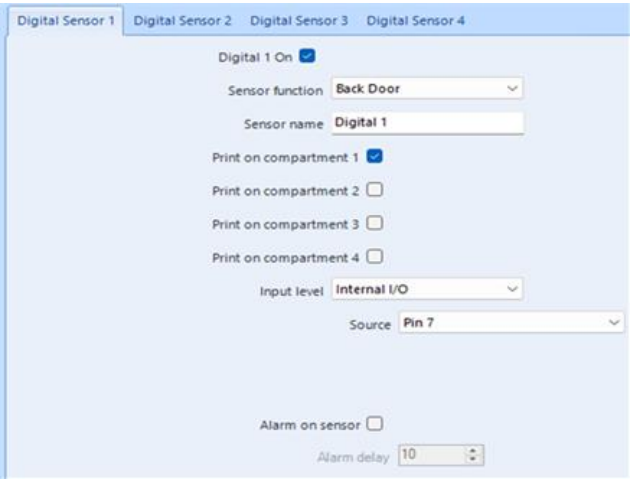
Print on compartment X:	Allows you to assign the compartment on which the temperature data of this sensor is displayed and printed. Note **If a compartment is not selected, then the information from the sensor is not shown on the display of the RT 81xx. The values from the sensor can still be printed on a ticket when the printer setting in menu 1.1 is set to "All Sensors".**

Logging method:	Allows you to choose the temperature recording type. * Off: Does not log temperature records for this sensor. * Average (default): Logs the average of the 20 temperature values as a record.

Note **For more information about temperature registration and alarms, refer to APPENDIX D.**

3.3.6 Digital Sensors

The Digital Sensors menu allows you to configure the digital sensors connected to the RT 81xx or map the digital information from external sources to the RT 81xx.



Digital X On:	Allows you to enable or disable a sensor. **CAUTION: Disabling a sensor stops recording / logging data and disables alarm monitoring for the selected sensor.**
Sensor function:	Allows you to select a general function for the sensor. By changing the function, the icon in ColdChainView changes accordingly.
Sensor name:	Allows you to set the name of the sensor used in ColdChainView.

Print on compartment X:	Allows you to assign the compartment on which the temperature data of this sensor is displayed and printed. Note **If a compartment is not selected, then the information from the sensor is not shown on the display of the RT 81xx. The values from the sensor can still be printed on a ticket when the printer setting in menu 1.1 is set to "All Sensors".**

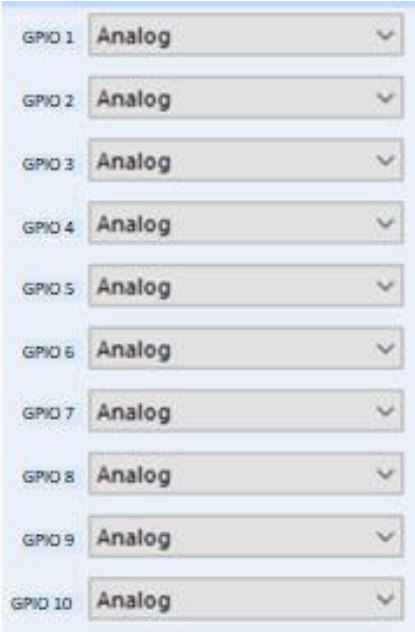
Input level:	Allows you to set the input level of the digital. The state of the digital can be compared to: * Sensor connected to the RT 81xx harness: Internal I/O * Wireless sensor connected to the RT 81xx via BLE: Wireless sensor * Copy the state of a digital input from an external device: Source * Copy the state of a digital input from a connected fridge: State of digital 1 to 4 (availability depends on fridge); pre-trip status or defrost status. * Copy the state of an input from a connected door lock: Door lock door state or door lock lock state.
Source:	Allows you to set the input from which the data must be mapped.

Alarm on sensor:	Allows you to enable or disable the alarm monitoring on a sensor.
Alarm delay:	Allows you to set a delay, in minutes, before the digital alarm activation.

3.3.7 I/O

The I/O menu allows you to configure the function of the 10 general purpose I/O (GPIO) channels of the RT 81xx harness cable.

Note **The GPIO number matches the label of the sensor cable on the harness. For example, "GPIO 1" refers to the cable with label "Sensor 1", "GPIO 2" refers to the cable with label "Sensor 2", etc.**



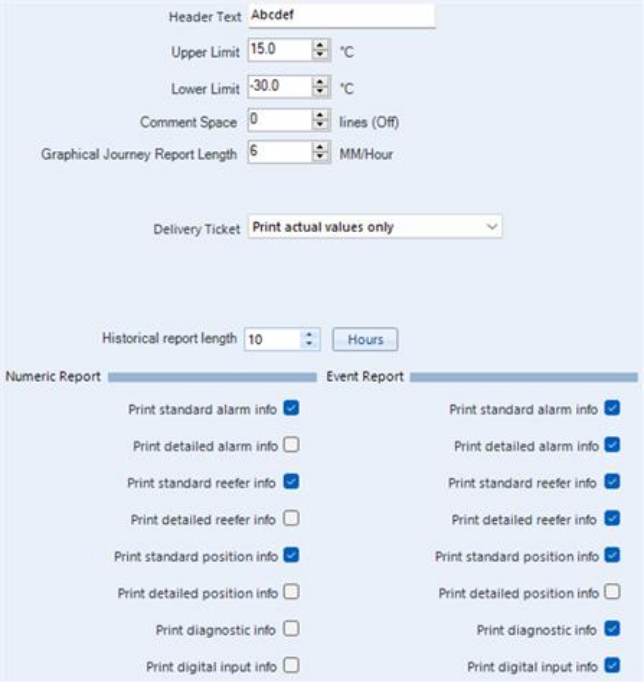
GPIO X:	Allows you to enable or disable a GPIO channel and assign its functionality. * None: Disables the general purpose I/O (GPIO) channel. * Digital Active on High: • Treats the GPIO channel as a digital input. • Digital contact closed = input active and open = input inactive. Alarm is switched on low level. * Digital Active on Low: • Treats the GPIO channel as a digital input. • Digital contact closed = input inactive and open = input active. Alarm is switched on high level. * Analog: Treats the GPIO channel as an analog input. * Keep display ON: • Treats the input as an ignition input signal. • Disables the built-in screensaver.

CAUTION: Using the display ON functionality increases the risk of permanent burn-in on the OLED display.

Only use this functionality if the display is expected to be active periodically as through an ignition signal. Do not continuously activate the display by providing a permanent 12 V supply.

3.3.8 Printer

The Printer menu allows you to configure the RT 81xx printer.



Header Text:	Allows you to set the header text at the top of a ticket.
Upper Limit:	Allows you to set the upper limit for graphs printed on tickets.
Lower Limit:	Allows you to set the lower limit for graphs printed on tickets. If you can divide the entire temperature range (between upper and lower limit) by 9, you achieve an optimal result for the printout.
Comment Space:	Allows you to set the amount of white space lines added at the end of a printed ticket for adding comments. Settings this to 0 (zero) removes the comment section from the printed ticket.
Graphical Journey Report Length:	Allows you to set the distance in millimeters between hours on a Graphical Journey ticket. Setting this to a higher number increases the space between the hours on the printed ticket. When printing a graphical ticket over a period longer than or equal to 2 days, to save on paper, the default is 2 mm/hour. Note A higher distance in mm/hour can influence the accuracy of the digital states on a printed ticket.

Delivery Ticket:	Allows you set which temperature values to print on a delivery ticket. - Print actual values only (default): Only prints the actual temperature values. - Print actuals + average values: Prints the actual temperature value and an average value calculated over the Historical report length (field) set. - Print actuals + average min/max values: Prints the actual temperature value, an average value calculated over the Historical report length (field) set, and the minimum and maximum temperature values within this period.
Historical report length:	Allows you to set how much information to use to create a historic ticket. Click the button after the numeric value to switch the control between hours or days. This setting is saved as "Print time period" in the recorder.

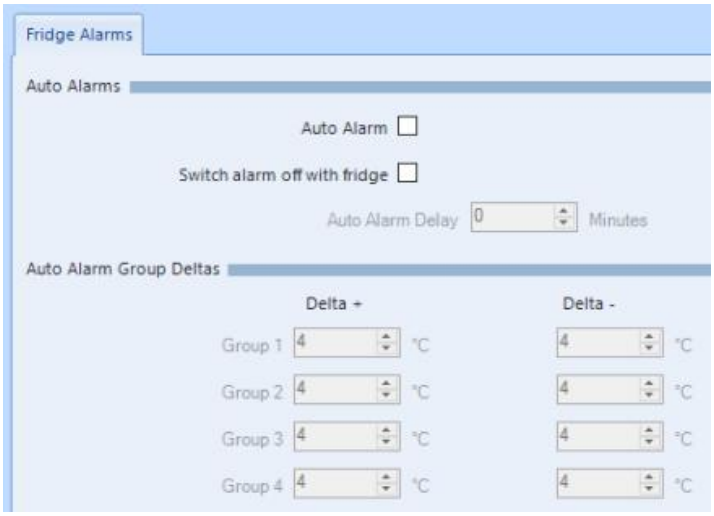
Numeric Report and Event Report	
Allows you to choose the extra information to add on the numerical and event tickets. If you do not select an option, only temperature values and (if configured to print) digital values are printed on the numerical tickets. The Numeric Report and Event Report offer the same options.	
Print standard alarm info:	Adds a line to the printout if: - the temperature / digital sensor was in an alarm state - a connected fridge had an alarm situation (also prints the alarm code)
Print detailed alarm info	Adds all the information from the standard alarm info (see above) and additionally: - Adds the alarm group information (upper/lower threshold; upper/lower delay; affected sensors) if an alarm group was assigned to a compartment.
Print standard reefer info:	Adds a line to the printout if: - a fridge connection is established or lost - a fridge compartment is turned ON or OFF - a setpoint changes - the power or run mode of the fridge changes
Print detailed reefer info:	Adds all the information from the standard reefer info (see above) and additionally: - Adds the current function of the fridge compartment - Adds fridge total and maintenance counter information - Adds fridge battery information - Adds fridge fuel level information - Adds fridge identification information (for example, fridge serial, ID, firmware version) - Adds fridge intelliset information Note The availability of fridge information is dependent on the fridge manufacturer and model. Not all information may be available.
Print standard position info:	Adds a line to the printout if the recorder starts or stops moving.
Print detailed position info:	Adds all the information from the standard position info (see above) and additionally: - Adds the position information stored by the recorder, which includes the latitude and longitude; speed; direction, and data age of the position. - Adds the mileage stored by the recorder

Print diagnostic info:	Adds a line to the printout if: - a PIN code is entered on the recorder to access a locked menu - the recorder logged an internal diagnostic record - the age of the last valid GPS position is too old or if it is valid again
Print digital input info:	Adds a line to the printout if: - a digital input state is changed - a digital input is in an alarm situation Note Digital input information is only printed if the digital contact is configured to print on a compartment.

3.3.9 Fridge

The Fridge menu allows to configure the alarm group thresholds based on the set points of a connected fridge.

CAUTION: To use this feature, ensure a fridge unit is connected to the RT 81xx.



Auto Alarms	
Auto Alarm	Allows you to enable or disable the linking of a compartment to an alarm group and setting the thresholds based on the deltas set in the Auto Alarm Group Deltas section based on the status of the connected fridge.
Switch alarm off with fridge	Allows you to unlink the alarm groups from the compartments in case the fridge turns OFF.
Auto Alarm Delay	Allows you to set a delay between the fridge turning OFF and the unlinking of the alarm groups from the compartments. **CAUTION: When using this feature, set the delay to at least 1 minute. Setting the value to 0 has a different behavior depending on the connected fridge model and can lead to unexpected behavior.**

Auto Alarm Group Deltas	
Delta +	The upper tolerance from the compartment set point. For example, if the set point is 8°C and the Delta + is 6°C, the upper threshold becomes 14°C. The Delta + can be set to a value between 1°C and 9°C.
Delta -	The lower tolerance from the compartment setpoint. For example, if the setpoint is 8°C and the Delta - is 6°C, the upper threshold becomes 2°C. The Delta - can be set to a value between 1°C and 9 °C.
Group x	The delta setting for compartment x.

3.3.10 GPS

The GPS menu allows you to configure when to write position and mileage records.

CAUTION: In configurations with an EBS system connected, GPS mileage is not used. In these systems, the platform only uses the EBS reported mileage. If the EBS system is disconnected, the last known mileage from this system is used.

Note **The mileage recorded is calculated based on the distance between successive GPS coordinates on a high frequency. Note that the recorded mileage value may differ from your vehicle's odometer value.**

Position Logging	
Loginterval (Time):	Allows you to set a time interval for logging the current position. 0 = disables logging on time interval.
Loginterval (Distance):	Allows you to set a distance interval for logging the current position. Setting this to 0 disables logging on distance interval.
Store position on Temperature:	Allows you to enable / disable the logging of the current position whenever a temperature measurement is stored

Start/Stop	
Stop Detection delay:	Allows you to specify the time period after which the RT 81xx is deemed to have stopped moving.
Start/stop detection distance:	Allows you to set the distance which the RT 81xx may move before detecting whether the RT 81xx is moving.

Mileage	
Distance record interval (Time):	Allows you to set a time interval for logging the current driven mileage. 0 = disables logging on time interval.
Distance record interval (Distance):	Allows you to set a distance interval for logging the current driven mileage. 0 = disables logging on distance interval.
Store mileage on stop event:	Allows you to enable / disable the writing of the current driven mileage after the RT 81xx has detected that it stopped moving.

3.3.11 Communication

The Communication menu allows you to set the functions of the RT 81xx communication ports and set the APN and UCP settings for connecting to ColdChainView.

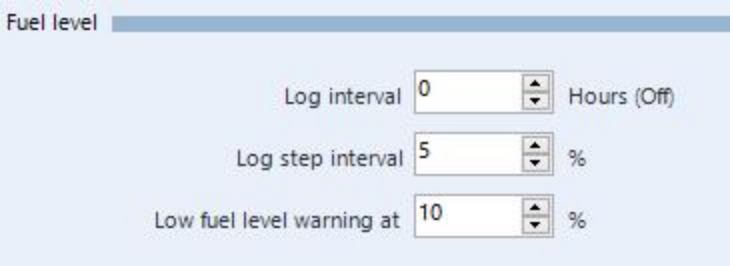
CAUTION: All settings in this menu are always available and are not matched against the variant of the connected RT 81xx. When changing the configuration in this menu, always perform an installation qualification to verify the expected behavior according to the selected configuration.

From the Protocols tab, you can set the communication protocol to use on the external communication port.

SIM Pincode:	Note **This configuration is only applicable when using an external SIM card.** Allows you to enter the PIN code to unlock the SIM card.
APN Server:	Note **This configuration is only applicable when using an external SIM card.** Allows you to select predefined operator settings for connecting to a GSM network. **CAUTION: Make sure you select the APN settings corresponding to the SIM card in the RT 81xx, or the RT 81xx may not be able to get a network connection.** **CAUTION: If your operator is not listed in the APN Server menu, manually add the:** *** APN Server Address** *** APN Username** *** APN Password** **obtained from the SIM card distributor and then verify that the RT 81xx connects to the network.**
UCP Server:	Allows you to select to which ColdChainView server the RT 81xx should connect to. Changing the server automatically uses the correct UCP Server Address and Port. **CAUTION: DO NOT manually enter a UCP Server Address and Port unless explicitly instructed. Incorrect settings can result in data being sent to the wrong server.**
SIM Source:	Allows you to select which SIM card to use to connect to a GSM network. * Embedded SIM: Uses the embedded SIM card on the RT 81xx. * External SIM: Uses the SIM card installed in the SIM slot of the RT 81xx.

3.3.12 Fuel

The Fuel menu allows you to set fuel level warnings and log intervals for the RT 81xx.

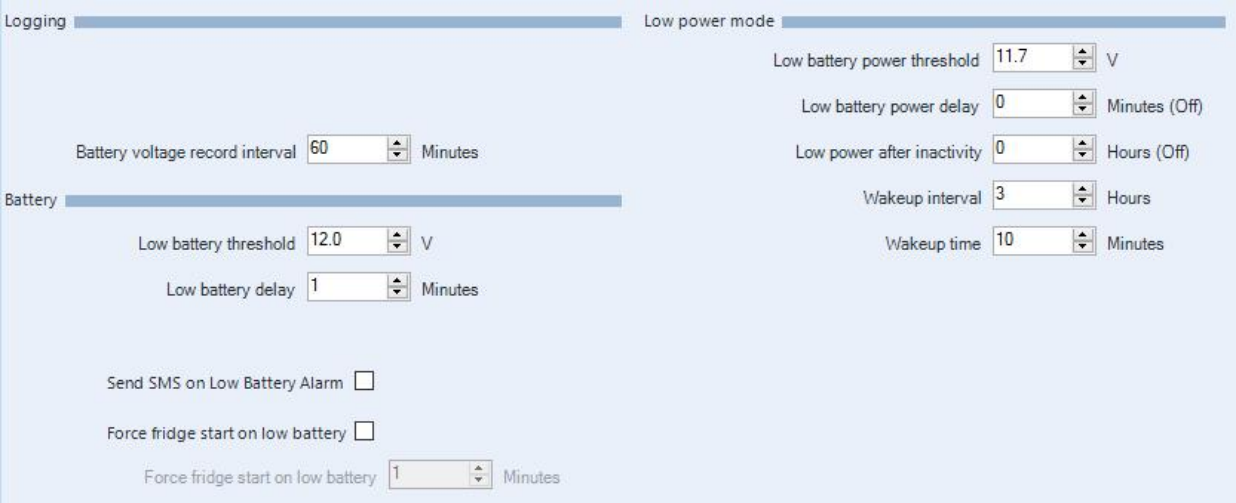


Log interval:	Allows you to set the time interval for recording the fuel level. Setting this value to 0 disables this functionality.
Log step interval:	Allows you to set the percentage for recording the fuel level. Setting this value to 0 disables this functionality.
Low fuel level warning at:	Allows you to set a threshold of remaining fuel in the tank before activating an alarm. Setting this value to 0 disables this functionality.

3.3.13 Battery

The Battery menu allows you to enable the logging of battery related information and set thresholds for a low battery alarm.

Note **The RT 81xx internal power manager measures and records the battery voltage.**



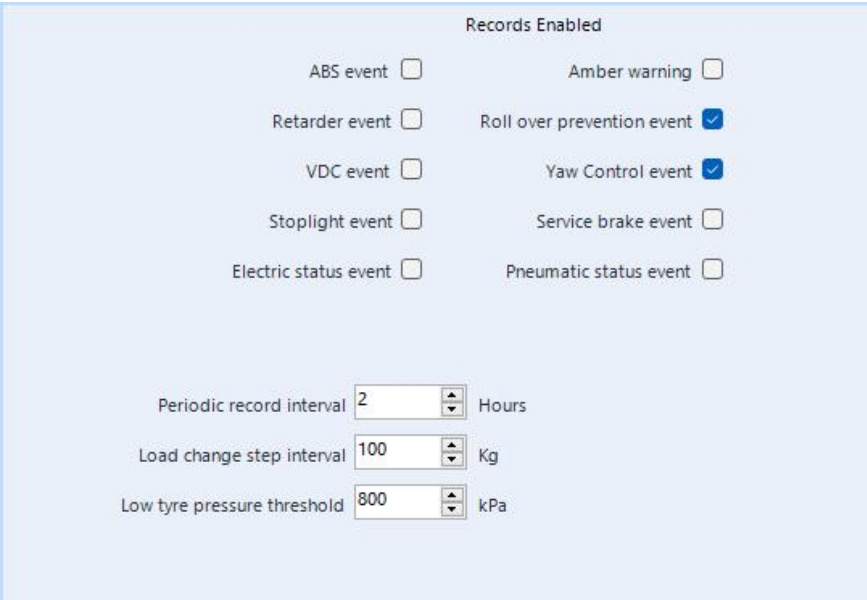
Position	
Enable Power Mode Records:	Allows the writing of battery voltage records, which contain information about the measured (internal) battery voltage and external power supply.
Battery voltage record interval:	Allows you to set an interval to log the current battery voltage. **CAUTION: Setting this to 0 disables this functionality.**

Battery	
Low battery threshold:	Allows you to set the lower limit for the voltage before the RT 81xx registers it as too low.
Low battery delay:	Allows you to set the time limit before the activation of an alarm when the threshold is exceeded. **CAUTION: Setting this to 0 causes the RT 81xx to immediately activate the alarm when it detects low power.**
Enable Battery Low Alarm Records	Determines whether to write the low battery alarm record to RT 81xx memory.
Initiates Data Transfer	Determines whether the low voltage alarm record immediately transfers to the server after it is written (option selected) or if the record is transferred with the next periodic data transfer (option not selected).

3.3.14 EBS

The EBS menu allows you to configure the information from a connected EBS unit, which you want the RT 81xx to store.

CAUTION: To use this feature, ensure that a suitable EBS unit is connected to the RT 81xx and the appropriate protocol is configured in the Communication menu.

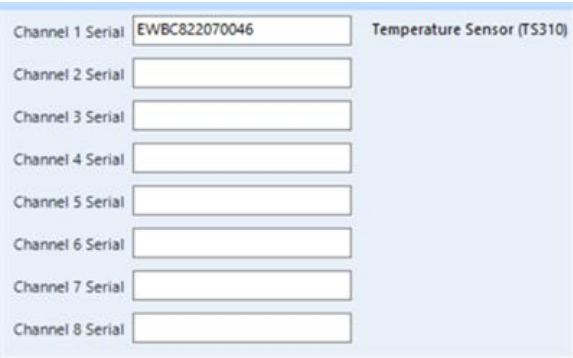


ABS event:	Allows storing an additional record when an ABS event occurs.
Retarder event:	Allows storing an additional record when an retarder event occurs.
VDC event:	Allows storing an additional record when an VDC event occurs.
Stoplight event:	Allows storing an additional record when an stop light event occurs.
Electric status event:	Allows storing an additional record when an electric status event occurs.
Amber warning:	Allows storing an additional record when an amber warning event occurs.
Roll over prevention event:	Allows storing an additional record when an rollover prevention event occurs.
Yaw Control event:	Allows storing an additional record when an Yaw control event occurs.
Service brake event:	Allows storing an additional record when an service brake event occurs.
Pneumatic status event:	Allows storing an additional record when an pneumatic status event occurs.
Periodic record interval:	Allows you to set a time interval (in hours) for logging all available EBS data from the EBS system. 0 = disables logging on time interval.
Load change step interval:	Allows you to set a weight interval (in kilograms) for logging the load data from the EBS system. 0 = disables logging on weight interval. Only when the delta between the last stored value and the new received value exceeds the value of this setting, is a record written.
Low tyre pressure threshold:	Allows you to set a pressure threshold (in kilopascal) for detecting low tire pressure from the EBS system.0 = disables detection of low tire pressure.

3.3.15 Wireless Sensors

The Wireless Sensors menu allows you to configure up to eight wireless temperature sensors (for example, TS 310) or wireless door sensors to the RT 81xx.

CAUTION: After configuring a serial number, assign it to an Analog Sensor/Virtual Temperature Channel (for Wireless Temperature Sensors) or to a Digital Sensors channel (for Wireless Door Sensors) in the respective Configuration menu.

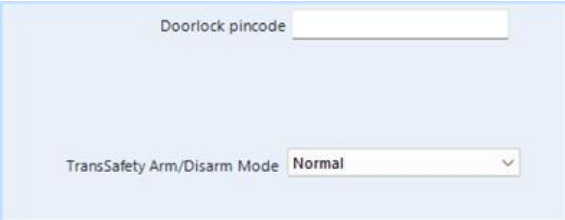


Channel X Serial:	Allows you to add the serial number of a wireless temperature sensor or wireless door contact. DeviceManager software automatically detects the type of sensor based on the serial number and displays this for the associated channel.

3.3.16 Door Lock

The Door Lock menu allows you to configure settings for door lock related communication.

Note **Only use these settings in combination with ORBCOMM approved door lock controllers (connected over either COM or CAN communication). Please contact your retailer for more information.**



Doorlock pincode:	Allows you to set the PIN code to (un)lock and (dis)arm the door lock.
TransSafety Arm / Disarm Mode:	Allows you to set the locking and arming behavior when using a Trans-Safety door lock controller. **For specifications on the behavior of each mode, Contact Support.**

3.4 Configure the Peripherals

This section describes the parameters and functions you can set from the DeviceManager Configuration menu when adding peripherals to the RT 81xx. Refer to section 1.1 to configure the RT 81xx or view sub-menus not shown in this section.

3.4.1 Perform Basic Network Setup Configuration

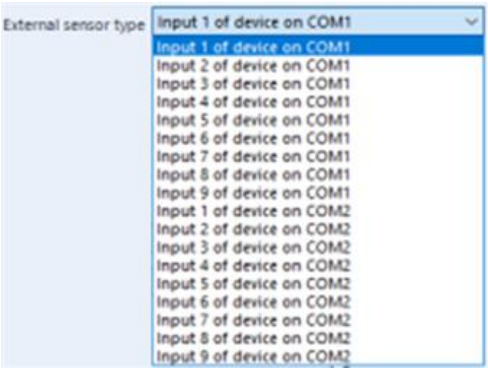
The DeviceManager Configuration menu (Configuration) includes the sub-menu items in the list below. To complete a basic networked setup configuration, check all underlined items before continuing with section 4 Installation Qualification.

- [...]
- Analog Sensors
- Virtual Temperatures
- Digital Sensors
- [...]
- Communication
- [...]

3.4.1.1 Analog Sensors / Virtual Temperatures Settings

To map the networked temperature sensor:

1. From the **Configuration** menu, select either **Analog Sensors** or **Virtual Temperatures** (sensors) depending on which applies to your setup.
2. Select the tab for the sensor you want to map.
3. Set **Sensor type** to **External Sensor**.
4. Use the **External sensor type** drop-down menu to select the appropriate option, where Input x is the sensor channel on the connected temperature sensor (for example, an MX2), and COMx is the communication port where you connected the RT 81xx.

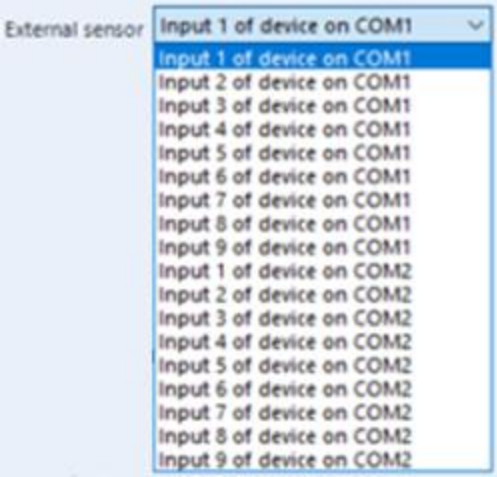


3.4.1.2 Digital Sensors Settings

To map the networked digital sensors:

1. From the **Configuration** menu, select **Digital Sensors**.
2. Select the tab for the digital sensor you want to map.
3. Set **Input level** to **External Sensor**.
4. Use the **External sensor** drop-down menu to select the appropriate option, where Input x is the sensor channel on the connected temperature sensor (for example, an MX2), and COMx is the communication port where you

connected the RT 81xx.



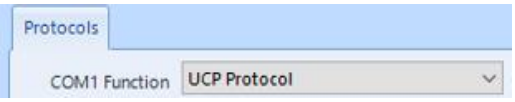
3.4.1.3 Communication Settings

From this sub-menu you can edit RT 81xx general information and settings.

1. From the **Configuration** menu, select **Communication**, and then on the **Protocols** tab, set the protocol for the COM port where you connected the networked device as per the following table.

External Device	COM Function
Euroscan MX1 / MX2 / X2-6 / X3	UCP Protocol
Carrier Datacold 600	UCP Protocol
Carrier eSolutions Box	UCP Protocol
Euroscan X2-4	Remote DC500/X1 Protocol
Carrier Datacold 500	Remote DC500/X1 Protocol
Transcan / Transcan-2	Transcan Protocol
Transcan Advance	Transcan Advance Protocol
Thermo King TouchPrint	TouchPrint Protocol

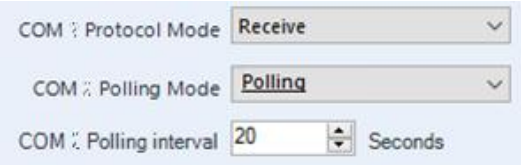
In the example that follows, a Euroscan X3 is connected to COM1 on the RT 81xx.



Note **By default, COM1, COM2, and COM3 are set to UCP Protocol for an RT 81xx.**

2. Select the **External Protocol** tab, for the temperature sensor's networked COM port, and set the **Polling Mode** to **Polling**. As per the earlier example, the Euroscan X3 connected to COM1 has the associated COM 1 Protocol

Mode set to Polling.



3.5 Reset the RT 81xx Configuration

You can reset the RT 81xx configuration either using DeviceManager or Account Manager (only when connected to a ColdChainView server).

3.5.1 Configuration Reset Using DeviceManager (Local)

To reset the RT 81xx using DeviceManager:

1. Connect the RT 81xx to a computer with a Bluetooth connection. For instructions, refer to section 1.1.
2. In DeviceManager, navigate to the **Install & Maintenance** menu, and click **Parameter Reset**. The configuration is reset to the factory default, except for:
    - I/O settings
    - Communication Protocol settings (only COM/CAN Port protocol selection is reset)
    - Calibration settings
    - Device specific settings (hardware version, serial number, and firmware version)

3.5.2 Configuration Reset Using Account Manager (OTA)

To reset the RT 81xx using Account Manager:

1. In Account Manager, select the RT 81xx in the respective customer account.
2. Navigate to the **Commands** menu, and then send the **Parameter Reset** command. The device resets the configuration to the factory default, except for:
    - I/O settings
    - All Communication settings (COM/CAN Port protocol selection and APN/TCP settings)
    - Calibration settings
    - Device specific settings (hardware version, serial number, and firmware version)

3.5.3 Configuration Reset Using the Display and Touch Pad

To reset the RT 81xx using the display and touch pad of the RT 81xx:

1. Hold down the Green (MENU) button for four (4) seconds until the display shows the prompt for the PIN code.
2. Type the PIN code obtained from your reseller / partner to access the menu.
3. Navigate to menu item **7.3 - Parameter reset**.
4. Press the Green (MENU) button twice to confirm the reset. The configuration resets to the factory default, except for:

- I/O settings
- All Communication settings (COM/CAN Port protocol selection and APN/TCP settings)
- Calibration settings
- Device specific settings (hardware version, serial number, and firmware version)

4 INSTALLATION QUALIFICATION

Before leaving the installation location, check all applicable tests below.

4.1 RT 81xx

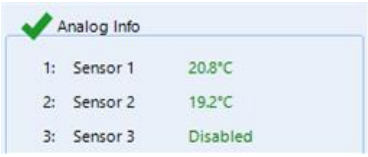
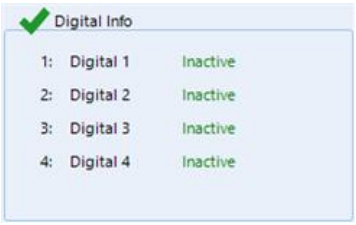
Test	
Is there a minimum of 25 W available over the power supply? *Print any ticket to check.*	
Is the RT 81xx running the most current firmware? *Check Menu 3.11 or the parameter printout.*	
A1	Contact your ORBCOMM sales partner or Contact Support if you are unsure what the latest firmware release version is. 
A2	If the displayed firmware version does not correspond to the latest available firmware release, connect the RT 81xx to a computer with DeviceManager, and the update the device according to the instructions in document [E0003].
Is the date and time on the RT 81xx correct? *Check the RT 81xx display.*	
B1	Check if the date and time on the RT 81xx matches the current time. 
B2	If the date and/or time is not correct, or the difference between the displayed and actual time is more than 5 minutes, connect the device to a computer with DeviceManager, and then correct the date / time or timezone according to the instructions in document [E0003].

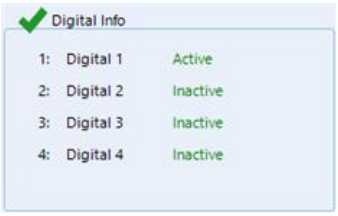
4.2 Communication

Test	
Does the RT 81xx indicate it is connected to a provider? *Press the Red (STATUS) button, and then press the Blue (PRINT) button to go to the Communication status screen.*	
A1	The status should indicate “NW: ” followed by the name of an operator and the frequency (2G / 4G). 

Is the current GPS location of the RT 81xx available? *Press the Red (STATUS) button, and then press the Blue (PRINT) button to go to the Communication status screen.*	
B1	The status should indicate “GPS: 3DFix, ×× SVs”. The number of SVs indicates the number of satellite vehicles in range, the higher the number the better. 

4.3 Sensors

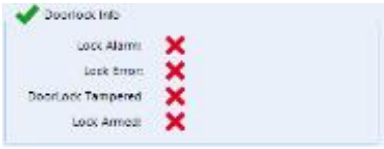
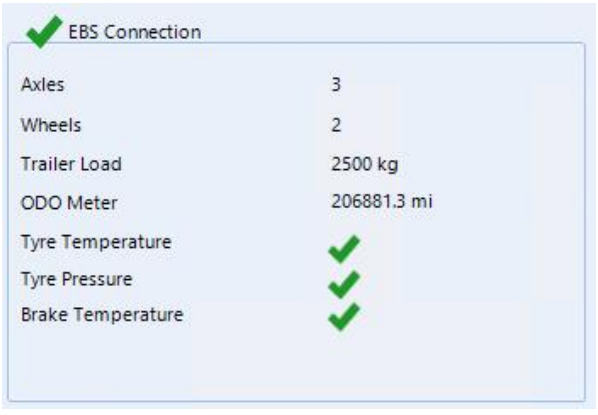
Test	
Are the connected temperature sensors working as expected? *In DeviceManager, check the Analog Info section of the Device Information screen, or observe the sensor information on the RT 81xx display.*	
A1	Check the status of the configured temperature sensor, and then verify that you see a (temperature) value.  
A2	Expose the sensor to a heat source, and then check that the (temperature) value of the sensor increased.  
A3	Expose the sensor to a cold source, and then check that the (temperature) value of the sensor decreased. If this test succeeds, the sensor is working properly.  
Are the digital contacts working as expected? *In DeviceManager, check the Digital Info section of the Device Information screen, or check the upper right corner of the compartment on the RT 81xx display.*	
B1	Close the circuit of the digital contact, and then check the status on the Device Information screen. The status should be either Active or Inactive, based on the configuration of the digital contact.  

B2	Open the circuit of the digital contact, and then click **refresh** to check the status on the Device Information screen. Verify that the status changed from Inactive to Active (or vice-versa). On the display, when active, the status is visible in the upper right corner of the compartment.  
B3	Close the circuit of the digital contact again, and then click **refresh** to check the status on the Device Information screen. If the status has changed back to the initial status in step B1, the contact is working properly.  

4.4 Peripherals

The provided installation qualification steps may depend on the RT 81xx firmware version. Ensure that your RT 81xx is running the latest version before performing the steps.

Test	
Does the RT 81xx indicate an active fridge connection? *Ensure the fridge is ON, and then check the status menu.*	
A1	Ensure that the RT 81xx and the fridge are connected properly, and that the fridge is turned ON.
A2	Press the Red (STATUS) button. The setpoint is shown, and the current status of fridge compartment 1 is shown as an icon in the upper right corner. 
A3	Change the setpoint of one of the enabled compartments. If the status in the status screen updates to the new setpoint, then the communication is working properly. 
Does the RT 81xx indicate an active door lock connection? *Requires a working door lock, and then in DeviceManager, check the Doorlock info panel.*	
B2	Ensure that the RT 81xx and the door lock controller are connected properly, and that the door lock controller is powered ON.

B2	Connect the RT 81xx to DeviceManager, and then verify that the Doorlock info panel is visible to the right of the Analog Info panel. 
B3	Ensure that the door lock is in a “locked” state, and then check the RT 81xx display to ensure that the lock icon is visible (to the right of the date and time). 
B4	Change the door lock to an “unlocked” stateand then check the RT 81xx display to ensure that the unlock icon is visible (to the right of the date and time). 
B5	Change the door lock back to a “locked” state, and then check the RT 81xx display to ensure that the lock icon is visible (to the right of the date and time). 
Does the RT 81xx indicate an active EBS connection? *Requires a functional EBS and can be checked in EBS info panel in DeviceManager.*	
C1	Ensure that the RT 81xx and the EBS modulator is powered and connected properly.
C2	Connect the RT 81xx to DeviceManager and verify that the EBS information panel is visible to the right of the Analog Info panel. 
C3	Check that the data displayed corresponds to the data generated by the EBS system.

5 OPERATE THE RT 81XX

RT 81xx recorders are developed and produced to conform to the applicable European and National guidelines, for the delivery of chilled and frozen transport goods in transport vehicles (EN12830:2018; Class 0.5 (-25°C to +7°C / -13°F to +45°F)).

The RT 81xx can provide evidence of correct temperatures for every trip in the form of a delivery ticket, numerical or graphical printout. All data is stored with a date / time stamp in flash memory. Data is not lost if power supply is disconnected. An internal back-up battery powers the real-time clock.

Although the RT 81xx recorders have been specifically designed and tested for use in a harsh vehicle environment, there are certain circumstances beyond ORBCOMM's control, for example, lightning strikes, high voltage peaks, theft, manipulation, where data loss could occur. Because the temperature data might be crucial to providing evidence in the case of transport damages, ORBCOMM strongly advises you to take the following precautions:

- Print or backup data to a computer on a *weekly* basis.
- For long-term data storage, ORBCOMM recommends *downloading* the data via DeviceManager. In addition to the Bluetooth connection, ORBCOMM offers the communication options for automated data transfer by use of a GPRS modem. For further information please contact your ORBCOMM Account Manager or visit https://www.orbcomm.com/.
- Check the functioning of the recorder frequently.
- Check the recording system every 12 months to see if the temperature measurement error is within the maximum permissible error. The annual test is obligatory, according to resp. EN 12830:2018 or EN 13486.
- DO NOT weld without disconnecting power from the RT 81xx recorder or the vehicle.
- DO NOT take the power supply from a generator system without extra filter protection against high voltage peaks. Preferably, always take power direct from the vehicle or refrigerator battery.

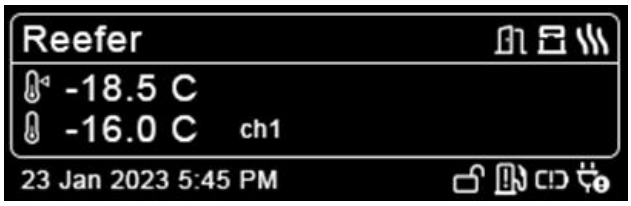
5.1 Control Panel

The control panel of the RT 81xx consists of three main components:

- OLED Display
- Touch Pad
- Printer

5.1.1 OLED Display

Single Compartment View



Multi-Compartment View

The organic light-emitting diode (OLED) display shows the RT 81xx user information and any connected peripherals (sensors, external devices, etc.). By default, you see the main screen, and other menus are accessed by pressing the buttons on the touch pad.

The main screen shows the current status of the available compartments, and any configure sensors. The following is shown on the main screen:

- Line 1
    - Active compartments
        - In the case of only one active compartment, the name configure in the Compartments menu (refer to section 1.1.2) is displayed.
        - In the case of multiple active compartments, the abbreviation Cx is shown, where x is the compartment number.
    - Rotating status of digital inputs configured for the compartment (a maximum of two contacts are shown at the same time).
    - Fridge compartment status (only shown when a fridge connection is active).
- Line 2
    - Compartment setpoint temperature (only shown when a fridge connection is active).
    - Alarm indication (only shown when a temperature alarm is active).
    - In the case of only one active compartment, the compartment upper temperature threshold (only shown when an alarm group is assigned to the compartment).
- Line 3
    - Rotating status of temperature inputs with sensor channel indication.
    - In the case of only one active compartment, compartment lower temperature threshold (only shown when an alarm group is assigned to the compartment).
- Line 4
    - Date and time with indication of summer/winter.
    - Fridge alarm indication (only shown when a fridge connection is active, and an alarm is present).
    - Door lock alarm indication (only shown when a door lock connection is active, and an alarm is present).
    - Internal battery alarm indication (only shown when the internal battery pack voltage is low).
    - External power supply indication (only shown when the RT 81xx is not connected to an external power supply and is running on the internal battery pack).

In every other mode, the content of the display is dependent on the user menu.

For more information on the user menus, refer to section 5.2.

5.1.2 Touch Pad

RT 81xx is completely menu controlled. Use the four colored buttons to operate the functions. On the main screen, the buttons allow you to access the user menus (refer to section 5.2).

PRINT **ALARM** **MENU** **STATUS**

When navigating through the user menus, the function of the buttons appears on the last line of the display. For example:

Button		Display	Function
	Blue		Previous item in the menu.
	Yellow		Next item in the menu.
	Green		Menu select, move one menu level down or enter Edit mode.
	Red		Move up one menu level.

5.1.3 Printer

Install the thermal printer on the right side of the recorder. For more information about operating the printer through the user menu, refer to section 5.2.

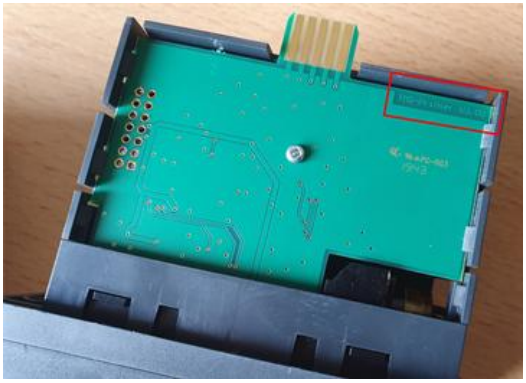
CAUTION: Tear paper only when printing has stopped to avoid damage to the printer mechanism.

CAUTION: Always tear a printout downwards over the edge of the bottom plastic part.

CAUTION: The thermal printer requires a minimum power supply of 3 A to work and can only operate in an environment with temperatures between -20°C to +70°C (-4°F to +158°F).
DO NOT operate the printer when the RT 81xx is running on its internal backup battery.

Note **The location identified below (bottom of printer and top corner) , shows the hardware version of the printer.**

The parameter printout shows the printer firmware version. Refer to section 5.2.1 (M - 1.4) for more information.



All printed tickets have the following information in the header (unless specified otherwise):

- OEM and device type
- Applicable Certifications of the RT 81xx (two lines)
- Programmed header text
- Programmed device name + serial number
- Date / time of printout
- Timezone offset + daylight saving setting indication
- Programmed sample rate (Sensor Measure Interval)
- Ticket type
- Ticket types' specific data

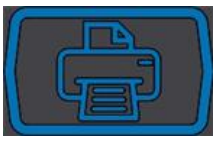
For more details about replacing the paper roll, refer to section C.3.

5.2 User Menu

The recorder provides a user menu, which is accessible via the touch pad.

5.2.1 (Menu - 1) Print Menu

From the main screen, press the Blue (PRINT) button on the touch pad to access the print menu.



Note When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.

(M - 1.1) Select compartment to print

Press Green (MENU) to confirm that you want to change the settings. Press Blue (PRINT) and Yellow (ALARM) to select an option, and then press Green (MENU) to confirm your selection.

The following options are available:

- Compartment 1*: Print all sensors configured to Compartment 1
- Compartment 2*: Print all sensors configured to Compartment 2
- Compartment 3*: Print all sensors configured to Compartment 3
- Compartment 4*: Print all sensors configured to Compartment 4
- Print all Comp.: Print all sensors configured to any Compartment
- All Sensors: Print all sensors, including sensors not configured to any compartment

* This option is only available if the compartment is enabled in the RT 81xx configuration.

(M - 1.2) Delivery Ticket

Press Green (MENU) to create a delivery ticket.

Note **When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.**

(M - 1.3) Journey Ticket NUMERICAL

Press Green (MENU) to create a numerical journey ticket.

Note **When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.**

(M - 1.4) Journey Ticket GRAPHICAL

Press Green (MENU) to create a graphical journey ticket.

Note **When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.**

(M - 1.7) Historical

Press Green (MENU) to enter the sub-menu to print a historic report.

(M - 1.7.1) Set start date

Press Green (MENU) to edit the start date for the historic report. Note that the start time is always midnight (00:00) of the selected date.

(M - 1.7.2) Print timeperiod

Press Green (MENU) to select the time period (between 1 hour and 10 days) for the end of the historic report.
For example, setting the time period to 2 hours creates a printout with data between 00:00:00 and 02:00:00 on the date selected in M - 1.7.1.

(M - 1.7.3) NUMERICAL

Press Green (MENU) to create a numerical historic report with the settings selected in M - 1.7.1 and M - 1.7.2.

Note **When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.**

(M - 1.7.4) GRAPHICAL

Press Green (MENU) to create a graphical historic report with the settings selected in M - 1.7.1 and M - 1.7.2.

Note **When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.**

Hold down the Blue (PRINT) button for more than 4 seconds to access the following sub-menu:

(M - 5.1) Print report PARAMETERS

PressGreen (MENU) to create a parameter report.
A parameter printout includes the following:

- Programmed header text
- Device name and serial
- Date/time of printout
- Time zone offset and daylight-saving setting
- "Parameter settings" header
- Device type and recorder firmware version
- Printer model and printer firmware version
- Followed by all programmed parameters

Note **When a sub-menu for printing a ticket is displayed on the screen, printing automatically starts after 4 seconds.**

5.2.2 (Menu - 2) Alarms Menu

From the main screen, press the Yellow (ALARM) button on the touch pad to access the alarms menu. If no alarms are active, the sub-menu M 2.0 screen appears, otherwise, the sub-menu M 2.10 screen appears.

Note When there is an active alarm on the RT 81xx, press the Yellow (ALARM) button to immediately open a detailed overview about the active alarm (menu M - 2.10), and allow you to confirm the alarm and disable the RT 81xx buzzer.

(M - 2.0) Alarms

Displays the current alarm monitoring state for compartment 1 and 2 and allows you to enable or disable the alarm group assigned.
Press the Blue (PRINT) button to enable / disable the alarm for Comp 1, or the press the Yellow (ALARM) button to enable / disable the alarm for Comp 2.

Press the Green (MENU) button to access the following sub-menus:

(M - 2.1) Compartment 1

See the assigned alarm group for compartment 1.
Press the Green (MENU) button to change the assigned alarm group for this compartment.

(M - 2.2) Compartment 2

Same as (M - 2.1) for Compartment 1. This sub-menu is only available if Compartment 2 is enabled in the configuration.

(M - 2.3) Compartment 3

Same as (M - 2.1) for Compartment 1. This sub-menu is only available if Compartment 3 is enabled in the configuration.

(M - 2.4) Compartment 4

Same as (M - 2.1) for Compartment 1. This sub-menu is only available if Compartment 4 is enabled in the configuration.

(M - 2.5) Digital 1

This sub-menu is only available if Digital 1 is enabled in the configuration.

Press the Green (MENU) button to enable or disable the alarm when the digital contact is in an active state for a certain duration. In DeviceManager, you can set the duration (delay time) up to a maximum of 60 minutes.

(M - 2.6) Digital 2

Same as (M - 2.5) for Digital 1. This sub-menu is only available if Digital 2 is enabled in the configuration.

(M - 2.7) Digital 3

Same as (M - 2.5) for Digital 1. This sub-menu is only available if Digital 3 is enabled in the configuration.

(M - 2.8) Digital 4

Same as (M - 2.5) for Digital 1. This sub-menu is only available if Digital 4 is enabled in the configuration.

(M - 2.9) Alarm output test

Press the Green (MENU) button to open the alarm output test menu.

While in the menu, press the Green (MENU) button to activate the alarm output for 10 seconds, allowing you to test if the peripheral connected to the alarm output of the RT 81xx is functioning as expected.

Press the Green (MENU) or Red (STATUS) button while the test is active to disable the alarm output.

(M - 2.10) Alarms

See the number of active alarms on the RT 81xx. These can include:

- Alarms on sensors connected to the RT 81xx (temperature and / or digital)
- Alarms on supported peripherals connected to the RT 81xx (for example, fridge alarms, door lock alarms, etc.)

Press the Green (MENU) button to open a detailed overview for each of the active alarms. Alarms display in the order that they became active on the RT 81xx.

- For temperature alarms, the compartment and sensor number appears along with the triggering temperature value and the configured upper and lower temperature thresholds.
- For digital alarms, the compartment and sensor number appears along with the configure alarm delay.
- For fridge alarms, the alarm code and severity rating appears.

Press the Green (MENU) button while on an active alarm to confirm the registration of the alarm and disable the RT 81xx buzzer.

Hold down the Yellow (ALARM) button for more than 4 seconds to access the following sub-menu:

(M - X.1) Journey marker

Use the journey market to set the start point of a journey ticket.

The printed ticket is never longer than the print time period defined in (M - 1.7.2) Print time period.

For example, the journey marker is set on the 13:00h and the print time period is set to 2 hours. If you print a ticket at 14:00h, the start time is 13:00h. If you print a ticket at 15:30h, the start time is 13:30.

5.2.3 (Menu - 3) Settings Menu

From the main screen, press the Green (MENU) button on the touch pad to access the settings menu. You can modify several settings for maximum user convenience.

Note Changing these settings only affects how the data is presented on the RT 81xx display.

Press the Green (MENU) button to access the following sub-menu:

(M - 3.11) Firmware version

See the current RT 81xx firmware version, including the firmware checksum.

5.2.4 (Menu - 4) Status Menu

From the main screen, press the Red (STATUS) button on the touch pad to access the settings menu.

Press the Red (STATUS) button to access the following sub-menus:

(M - 4.1) Compartment view

Press the Red (STATUS) button to change the display mode to the compartment view.

Press the Blue (PRINT) and Yellow (ALARM) buttons to access each activated compartment and see the sensors connected to the compartment.

If a fridge is connected, this view also shows the compartment mode, set point, and alarm settings for the compartment, if available.

(M - 4.x) Communication status

See the current network connection status (telecom provider and band) and GPS status (3D fix availability and number of satellites in use)

Hold down the Red (STATUS) button for more than 4 seconds to access the following sub-menu:

(M - 8.1) Legends

See a list of RT 81xx display icons with descriptions.

6 COMPLIANCE

CE MARK (Europe)

- RED 2014/53/EU
- EU Declaration of Conformity

  Hereby, ORBCOMM Inc. declares that the radio equipment types listed in this document comply with Directive 2014/53/EU.

  The full text of the EU declaration of conformity is available from http://www2.orbcomm.com/eudoc.

Regulatory Number

Regulatory Model Number	Order Part Number	Description
RT8110-1	RT8110-1500	RT 8110 Printer, outdoor, integrated CELL/GPS, external BLE, 3xRS/3xCAN/10xIO
RT8110-2	RT8110-2500	RT 8110 Printer, outdoor, external CELL/GPS/BLE, 3xRS/3xCAN/10xIO
RT8120-2	RT8120-2500	RT 8120 Printer, in-cab, external CELL/GPS/BLE, 3xRS/3xCAN/10xIO

EN 12830:2018[1]

- Class 0.5 (-40°C to +7°C / -40°F to +45°F)

E-13 type approval to 95/54/EEC

GAMP 5

Ingress Protection

- RT 8110: IP65 (trailer version for outside mounting)
- RT 8120: IP20 (cab version for inside cabin mounting)

WARNING:

- RF Exposure statement

  This equipment complies with the radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm (8 in.) between the radiator and any part of the human body.
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RoHS

- Restriction of Hazardous Substances (RoHS) [2]

[1] Certification is valid when using approved sensors connected via the RT 8000.

[2] European Union's (EU) Directive 2002/95/EEC "Restriction of Hazardous Substances" (RoHS) in Electronic and Electrical Equipment.

Environmental

Parameter	Description
Ventilation	No special requirements. The devices are designed for use in an automotive environment.
Humidity	RT 81xx meet the requirements of SAE J1455 4.2.3, Figure 4a, 90% relative humidity at 38°C (100°F)
Vibration	RT 81xx meet the requirements of SAE J1455, Sec 4.10.4.2, Figure 6-8; MIL STD 810H 514.8, Figure 514.8C-3, and Table 514.8C-II
Shock	RT 81xx meet the requirements of MIL STD 810 H 516.8, Figure 516-3, and Table 516.8-IV

APPENDIX A ORDER PART NUMBERS

Part Number	Description*
SM202791-001	RT 8110-1500 plus external antenna BLE
SM202791-002	RT 8110-1500 plus 6 m and 22 m SNSR
SM202791-003	RT 8110-1500 plus external antenna BLE and 2 x TS 310
SM202792-001	RT 8110-2500 plus external antennas Cell/GNSS
SM202792-002	RT 8110-2500 plus external antennas Cell/GNSS/BLE
SM202792-003	RT 8110-2500 plus external antennas Cell/GNSS and 6 m and 22 m SNSR
SM202792-004	RT 8110-2500 plus external antennas Cell/GNSS/BLE and 2 x TS 310
SM202793-001	RT 8120-2500 plus external antennas Cell/GNSS
SM202793-002	RT 8120-2500 plus external antennas Cell/GNSS/BLE
SM202793-003	RT 8120-2500 plus external antennas Cell/GNSS and 15 m and 25 m SNSR
SM202793-004	RT 8120-2500 plus external antennas Cell/GNSS/BLE and 2 x TS 310

* Kits include a 10 A fuse and screws / nuts / washers / terminal blocks etc. required for a standard installation.

Additional Parts and Accessories	Description
Harness and Cables	
004.000.0070	UCP 3-wire cable (for use when creating a networked setup with an RT 8000). This requires an additional connector block 5-way (005.000.0005) on the RT 8000.
008.010.0042	RS-232 serial cable for RT 81xx
ST101723-001	BLE antenna extension cable (12 m) for flip cab vehicle installations
004.002.0003	X2 3-wire cable, 3 m
Antennas	
ST101496-004	External BLE antenna (For RT 8110 variants 1500 and 2500, and RT 8120 variant 2500) adhesive mount, 2.4 GHz, beige FAKRA, 4.5 m, IP67
ST101087-004	External cell / GNSS antenna (For RT 8110 variant 2500) side, bordeaux/blue FAKRA, 5 m
ST101688-001	External cell / GNSS antenna (For RT 8120 variant 2500) Low profile, side tape mount, FAKRA, 2.4 m, IP67
Wireless Sensors	
Temperature Sensors	Refer to section 2.6.3.1
Door Switches	Refer to section 2.6.3.4
Wireless Sensors	Refer to section 2.6.3
002.000.0020	Temperature sensor bracket cable guard
Other	
ST101520-001	RT 8110 installation kit, includes a 10 A fuse and screws/nuts/washers/terminal blocks etc. required for a standard installation
ST101520-002	RT 8120 installation kit, includes a 10 A fuse and screws/nuts/washers/terminal blocks etc. required for a standard installation
009.002.0070	Mini USB Bluetooth dongle
ST101724-001	RT 8xxx Low Voltage Disconnect for 12 V vehicles, includes splice connectors
ST101724-002	RT 8xxx Low Voltage Disconnect for 24 V vehicles, includes splice connectors

APPENDIX B TECHNICAL SPECIFICATIONS

B.1 RT 81xx Mechanical

Dimensions shown in inches [mm].

Figure 5: RT 8110 Overall View

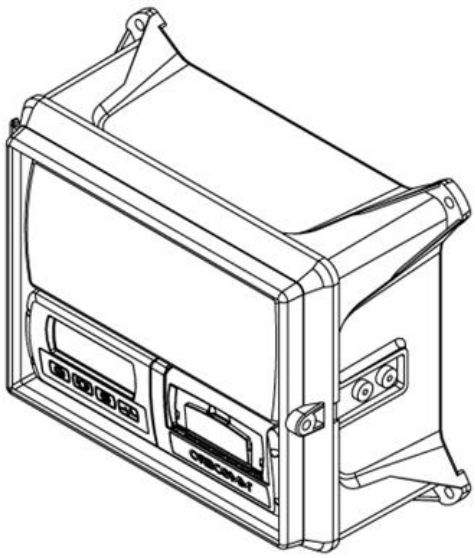


Figure 6: RT 8110 Side Views

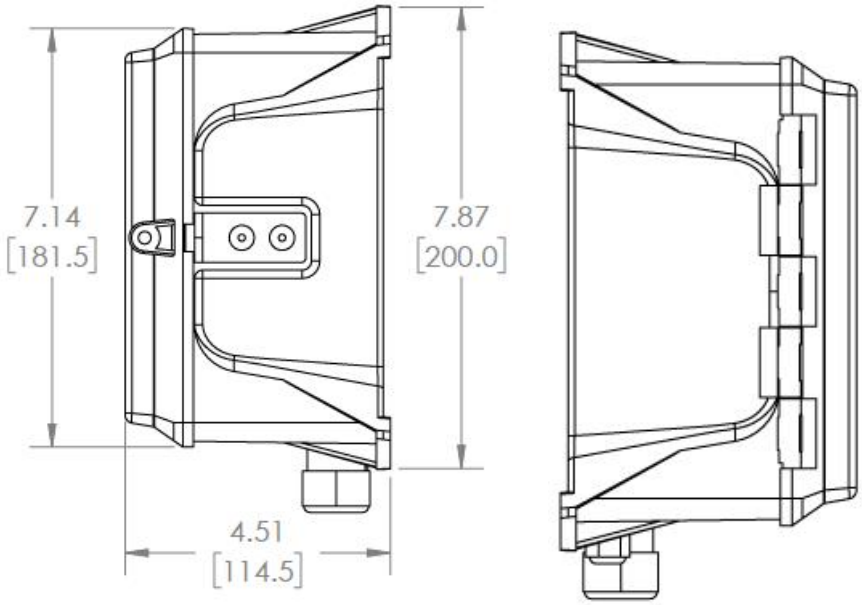


Figure 7: RT 8110 Front View

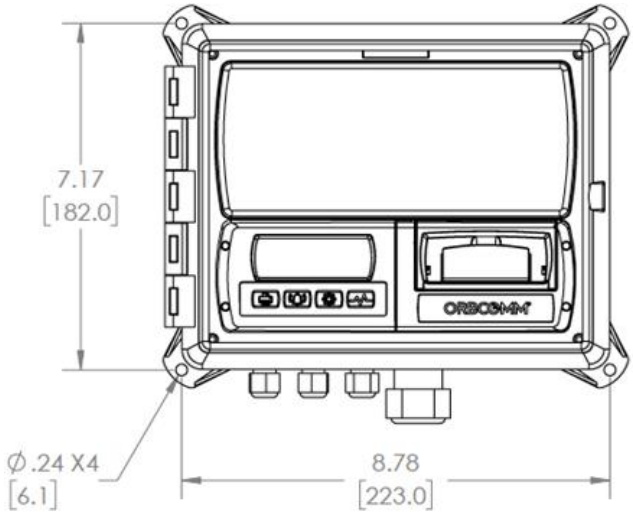


Figure 8: RT 8120 Overall View

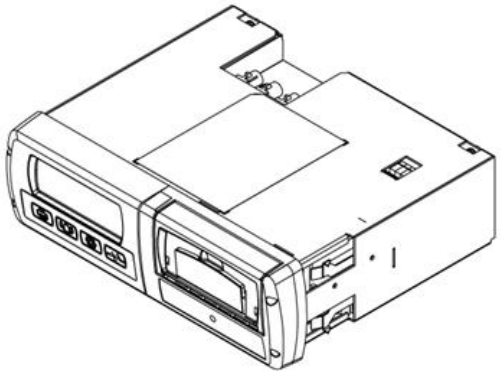


Figure 9: RT 8120 Top View

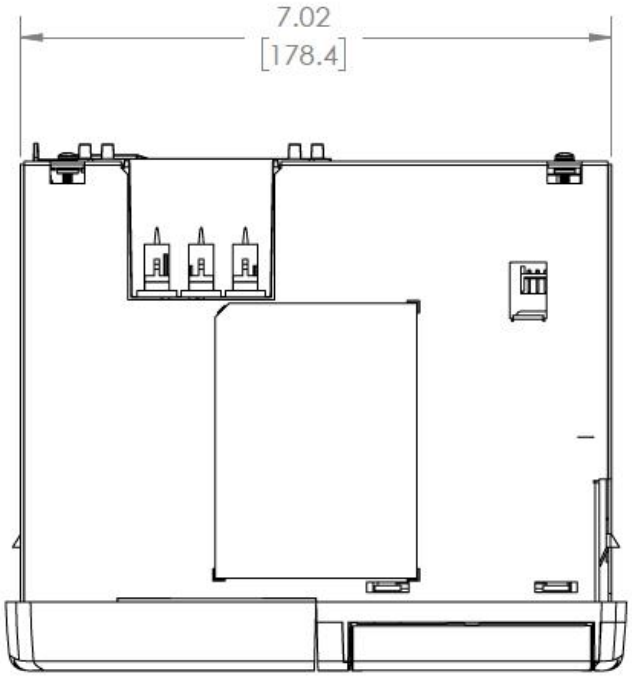


Figure 10: RT 8120 Front View

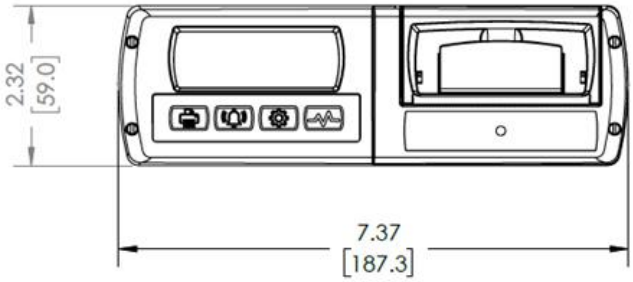
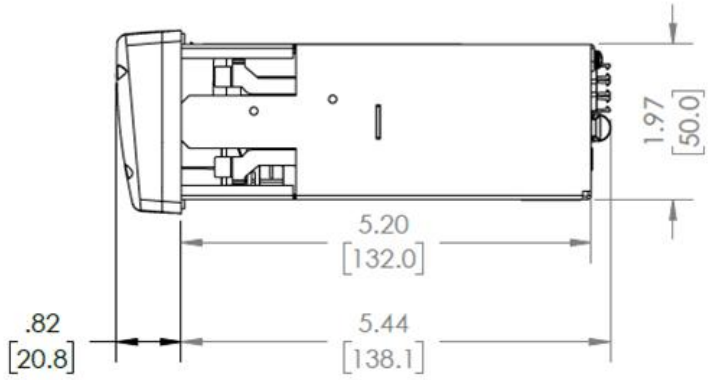


Figure 11: RT 8120 Side View



Parameter	Value
RT 8110 Weight	~1.5 kg (~3 lb)
RT 8120 weight	~1 kg (~2 lb)

B.2 RT 81xx Hardware Specifications

Parameter	Value
Operating Voltage	10 to 32 VDC (negative earth), protected against alternator load shedding
Nominal Power Consumption	1.75 W
	4.8 W maximum while charging the internal battery
Tx Power	+7.5 dBm
Operating Temperature Range	-30°C to +70°C (-22°F to +158°F)
Maximum Temperature Range	-40°C to +85°C (-40°F to +185°F)
Best printing Temperature Range	0°C to +50°C (32°F to +122°F)
Memory Size	8 MB, 1 year of temperature data retention
Interfaces	10 x General Purpose Input / Output 2 x RS-232 1 x RS-232/RS-485 3 x CAN Bus 1 x 1-Wire 1 x 3-axis accelerometer for shock detection up to 8G
Battery	Internal backup battery, lithium battery with a life expectancy of 10 years, 2000 mAh capacity
Circuit Protection	For protection, a 10 A floating fuse (provided in kit) must be fitted in the positive (+VE) power line as close as possible to the power connection.

Parameter	Value
Communications (modem / online functionality)	* CAT 1 4G LTE (3G/2G support GSM * EMEA: 2G (GSM/EDGE) B3/B8 3G (WCDMA) B1/B8 4G (LTE-FDD) B1/B3/B7/B8/B20/B28 * GNSS * Wireless connectivity: Bluetooth version 5.3
Bluetooth Low Energy	2.4 GHz, 40 channels
Internal Cellular Antenna	Cellular coverage: 2G/3G/4G/5G Temperature range: -40°C to +85°C (-40°F to +185°F) Frequency: (low) 698 to 960 MHz, (mid) 1710 to 2170 MHz, (high) 2300 to 2690 MHz Impedance: 50 Ohm Gain (total realized gain): 0.8dBi max. 698 to 960 MHz, 3.5dBi max. 1710 to 1910 MHz, 4.5dBi max. 1950 to 2170 MHz, 3.5dBi max. 2300 to 2690 MHz

B.3 External Cell / GNSS Antenna Specifications (RT 8120)

Use this antenna (p/n ST101688-001) with the RT 8120 variant 2500.

Parameter	Value
Dimensions	72 mm x 16 mm (3 mm x 0.6 in)
Operating Temperature Range	-40°C to +85°C (-40°F to +185°F)
Maximum Temperature Range	-40°C to +85°C (-40°F to +185°F)
Cable Length	2.4 m (8 ft)
Connector	FAKRA

The manufacturer's specifications are given in the table that follows.

GNSS Specifications

Parameter	BeiDou	GPS	GLONASS
Frequency (MHz)	1561	1575.42	1602
Efficiency (%)[1]	49.9	42.8	58.6
Peak Gain (dBi)[1]	1.2	1.3	1.4
Impedance (Ω)	50		

[1]Typical value

LTE Specifications

Frequency (MHz)		**698 to 960**	**1710 to 2700**
Efficiency (%)[1]	2.4 m	35.5% to 53.9%	25% to 35.2%
Peak Gain (dBi)[1]	2.4 m	-3.8 to 2.9	2.5 to 2.9
Impedance (Ω)		50	

[1]Typical value

APPENDIX C MAINTENANCE

C.1 Inspection

Perform a visual inspection of the recorder. Especially look for cracks of housing, rust, oxidation, cured rubbers, cut or broken cables.

C.2 Cleaning

Use a cleaning moistened duster, without alcohol or other volatile cleaning products.

C.3 Replace a Paper Roll

A colored line appears on the last meter of paper indicating that the paper roll needs to be replaced soon.You can order a replacement paper roll from ORBCOMM (part number 007.000.0401, PAPER ROLL THERMO - set of five replacement paper rolls).

CAUTION: ORBCOMM is not responsible for any damages to the printer when using paper rolls not obtained from ORBCOMM.

To change a paper roll

1. Pull down the clear plastic flap on the front of the printer. The printer compartment slides forward.

2. Remove the empty paper roll.
3. Put a new paper roll into the printer, and then feed the paper through.

4. Install the printer with the flap open.
5. Close the flap only after the printer is fully inserted.
6. Print a ticket to ensure the paper roll was replaced correctly.

CAUTION: Tear paper only when printing has stopped to avoid damage to the printer mechanism.

CAUTION: Always tear a printout downwards over the edge of the bottom plastic part.

C.4 Clear the Internal Memory of the RT 81xx

The RT 81xx internal memory stores temperature, position, and other information. This data can be used to print tickets and can be transferred to an ORBCOMM platform when internet connectivity is available.

To clear the internal memory:

Note **The RT 81xx configuration is not affected upon a memory reset.**

CAUTION: A memory reset is irreversible and clears all stored (historic) data from the RT 81xx. Ensure that you have a backup of the device's data created via the DeviceManager software, and/or all historic data is available on an ORBCOMM Platform such as the ORBCOMM Transportation Platform (OTP) or CCV.

1. Hold down the Green (MENU) button for four (4) seconds until the display shows the prompt for the PIN code.
2. Type the PIN code obtained from your reseller / partner to access the menu.
3. Navigate to menu item 7.4 - Memory reset.
4. Press the Green (MENU) button twice to confirm the reset. The RT 81xx begins the reset procedure, and the display shows "In Progress".
5. When the display shows "Successful", the RT 81xx memory is reset.

C.5 RT 81xx Calibration

The RT 81xx has an option to adjust the offset of the A/D converter with correction factors. These correction factors are fixed parameters used in the formula that converts the measured resistance into the corresponding temperature. This procedure is applicable for calibrating individual sensors. Note that the effect on the measured and displayed temperature is not linear.

It is recommended you repeat this procedure on a regular basis (that is, at the annual reference check) as recommended by the EN13486 standard.

CAUTION: Only ORBCOMM certified installers are authorized to execute a calibration procedure.

CAUTION: When executing the calibration procedure, ensure that the appropriate reference equipment is used according to the standards described in the EN13486.

CAUTION: When executing the calibration procedure, ensure that a defined procedure is set up and maintained.

Perform calibration using the DeviceManager software program, which allows an installer to define up to six calibration point values for each configured temperature input of the RT 81xx.

In the Calibration menu of DeviceManager, specify the amount of calibration points and the calibration temperature values in ascending order (starting with the lowest temperature).

The respective Calibration Point x tabs are available after selecting the number of Calibration Points. For example, when selecting 2 Calibration points, the tabs "Calibration Point 1" and "Calibration Point 2" become available.

The Calibration Point tab displays the calibration values entered on the Settings tab and the uncalibrated Sensor values for each configured temperature sensor.

In this menu, you can input the actual reference value and click **Calculate** to automatically determine the deviation for all selected sensors, or you can manually input the deviation.

After calibration, you can save the settings to the RT 81xx by clicking (**apply**). The following information is then stored in the RT 81xx:

- The number of calibration points used
- The (reference) value for each calibration point
- The deviation value for each sensor per calibration point
- The Unix timestamp when the calibration was performed.

CAUTION: If one of the sensors does not pass the test or the deviation is too large (>±2.0°C), the sensor should be replaced, and the test performed again. If the result is still negative, Contact Support.

C.6 Remove the RT 81xx

If you need to remove the RT 81xx from its casing, follow the steps below.

CAUTION: DO NOT apply any excessive force to remove an RT 81xx.

RT 8110

1. Loosen the four screws in the corners of the device casing.
2. Gently tilt the RT 8110 forward.
3. Disconnect the connectors at the back of the RT 8110.
4. Remove the RT 8110 from the casing.

RT 8120

1. Insert the keys provided into the keyways at each side of the front face of the recorder to release the locks.
2. Gently slide the RT 8120 forward.
3. Disconnect the connectors at the back of the RT 8120.

C.7 Error Codes

Possible display error codes:

OC	(I)	The input is activated but no sensor is connected.
	(II)	The sensor has an open circuit (sensor or wire failure).
SC	(I)	The sensor has a short circuit (sensor or cable failure).
---.-	(I)	The sensor is not available.

C.8 Return Materials Authorization

For any RMA issues, Contact Support.

APPENDIX D TEMPERATURE REGISTRATION AND ALARMS

D.1 Temperature Registration

Sampling and Registration

The RT 81xx constantly measures temperature data from the connected temperature sensors. This measurement data is used to calculate 20 equally spaced running average values over a specified period, set in the configuration of the RT 81xx (logging interval; default: 10 minutes).

This means that for a logging interval of 10 minutes, a new running average is calculated every 30 seconds using a sample value. The sample that is used is the current actual temperature value of the temperature sensor, which is measured by the RT 81xx.

When the logging interval is reached, the running average value calculated at that time is permanently stored in the memory of the RT 81xx as a temperature record with a resolution of 0.1°C. The value stored in this temperature record is the value that is sent to ColdChainView (in cases where the RT 81xx reports to a CCV server).

Example:

- Record Interval = 10 minutes

Time	T.Actual	R.Average	Event
10:00:00	5	5.00	Stored temperature value: 5.0°C
10:00:30	6	5,56	-
10:01:00	7	5,74	-
10:01:30	8	6,02	-
10:02:00	9	6,40	-
10:02:30	10	6,85	-
10:03:00	11	7,37	-
10:03:30	12	7,95	-
10:04:00	14	8,70	-
10:04:30	15	9,49	-
10:05:00	16	10,30	-
10:05:30	17	11,14	-
10:06:00	18	12,00	-
10:06:30	18	12,75	-
10:07:00	19	13,53	-
10:07:30	17	13,96	-
10:08:00	16	14,22	-
10:08:30	16	14,44	-
10:09:00	16	14,64	-
10:09:30	15	14,68	-
10:10:00	15	14,72	Stored temperature value: 14.7°C
10:20:30	12	9,29	-

Time	T.Actual	R.Average	Event
10:21:00	12	9,63	-
10:21:30	12	9,92	-
10:22:00	12	10,18	-
10:22:30	11	10,28	-
10:23:00	10	10,25	-
10:23:30	10	10,22	-
10:24:00	10	10,19	-
10:24:30	10	10,17	-
10:25:00	10	10,15	-
10:25:30	9	10,00	-
10:26:00	9	9,88	-
10:26:30	9	9,77	-
10:27:00	8	9,55	-
10:27:30	8	9,35	-
10:28:00	8	9,18	-
10:28:30	7	8,91	-
10:29:00	6	8,55	-
10:29:30	5	8,10	-
10:30:00	5	7,72	Stored temperature value: 7.7°C

The temperatures listed in column “T.Actual” are the actual temperatures measured by the RT 81xx. This is the sample value taken to calculate the new (running) average value.

The temperatures in column “R.Average” indicate the calculated running averages that are stored temporarily in the memory of the RT 81xx.

The R.Average calculated at the moment when the record interval is reached, is permanently stored in the memory of the RT 81xx as a temperature record with a resolution of 0.1°C. This is the value sent to ColdChainView (in cases where the device reports to a CCV server).

D.2 Alarms

Requirements

To set up an alarm for a temperature sensor, enable the following settings in the configuration of the RT 81xx:

- In the Analog Sensors menu:
  - The Analog Sensor is enabled, (Temperature X On is selected).
  - The Analog Sensor is assigned to a single compartment for alarm monitoring, (Alarm on compartment X is selected).
- In the Compartments menu:
  - The Compartment where the sensor is assigned is enabled, (Compartment X On is selected).
  - An Alarm Group is assigned to the Compartment (Alarmgroup is not set to No Alarmgroup).

- In the Alarms menu:
  - The Alarm Group where the compartment is linked is enabled, (**Alarm X On** is selected).
  - Initial Delay, Upper Alarm Delay and Lower Alarm Delay are set to a value greater than 0.
  - Upper Threshold and Lower Threshold are set to the maximum and minimum allowed temperatures respectively.

Detection Mechanism

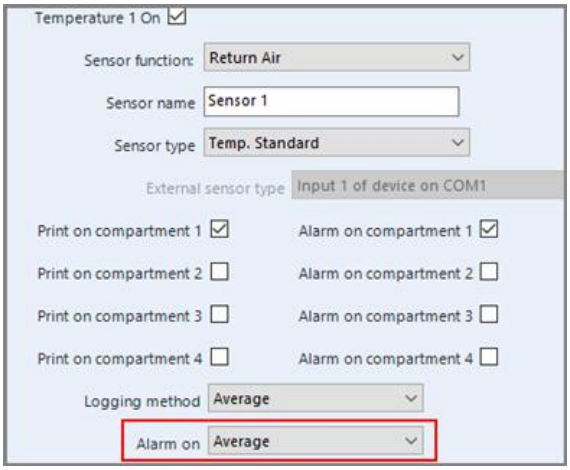
When a temperature sensor is assigned to a compartment and an alarm group is activated for the compartment, then the RT 81xx continuously monitors if the temperature is outside of the bounds created by the alarm group thresholds for a specified period (defined by either the upper or lower alarm delay, depending on the exceeded threshold).

This monitoring starts from the moment that the initial delay has passed and ends when the linking of the compartment and alarm group has ended.

The initial delay pauses the complete alarm check for the given time from the moment the alarm group is linked to the compartment. This delay can be used to allow a fridge to cool the load to the correct temperature just after cargo is loaded and can prevent unnecessary alarms within the cooling period.

If a temperature sensor is outside of the bounds specified by the alarm group thresholds over the specified time in the upper or lower delay, then the temperature recorder registers an alarm situation.

The RT 81xx can check for alarms based on either the “Actual temperature” or the “Running Average Temperature”. This is defined per-sensor in the configuration of the RT 81xx (parameter **Alarm on Average** (default) / **Actual**).



Examples:

Example 1 – Alarm on (Running) Average Temperature Values

- Initial delay = 0 minutes
- Lower delay = 3 minutes
- Upper delay = 3 minutes
- Record Interval = 10 minutes
- Lower limit = 0°C
- Upper limit = 10°C
- Sensor Alarm on = Average

Time	T.Actual	R.Average	Alarm	Event
10:00:00	5	5.00	-	Alarm group activated. No initial delay configured.
10:00:30	6	5,56	-	-
10:01:00	7	5,74	-	-
10:01:30	8	6,02	-	-
10:02:00	9	6,40	-	-
10:02:30	10	6,85	-	T.Actual above upper limit threshold.
10:03:00	11	7,37	-	-
10:03:30	12	7,95	-	-
10:04:00	14	8,70	-	-
10:04:30	15	9,49	-	-
10:05:00	16	10,30	-	R.Average above upper limit threshold; Upper delay timer starts running.
10:05:30	17	11,14	-	-
10:06:00	18	12,00	-	-
10:06:30	18	12,75	-	-
10:07:00	19	13,53	-	-
10:07:30	17	13,96	-	-
10:08:00	16	14,22	X	Upper delay timer reached, activating alarm.
10:08:30	16	14,44	X	-
10:09:00	16	14,64	X	-
10:09:30	15	14,68	X	-
10:10:00	15	14,72	X	Periodic stored temperature with value: 14.7°C
10:10:30	13	14,93	X	-
10:11:00	12	14,56	X	-
10:11:30	11	14,11	X	-
10:12:00	10	13,60	X	-
10:12:30	8	12,90	X	T.Actual within thresholds.
10:13:00	7	12,16	X	-
10:13:30	6	11,39	X	-
10:14:00	5	10,59	X	-
10:14:30	5	9,89	-	R.Average within thresholds, disabling alarm.
10:15:00	5	9,28	-	-

Example 2 – Alarm on Actual Temperature Values

- Initial delay = 0 minutes
- Lower delay = 2 minutes
- Upper delay = 2 minutes
- Record Interval = 10 minutes
- Lower limit = 0°C

- Upper limit = 10°C
- Sensor Alarm on = Actual

Time	T.Actual	R.Average	Alarm	Event
10:00:00	5	5,00	-	Alarm group activated. No initial delay configured.
10:00:30	6	5,56	-	-
10:01:00	7	5,74	-	-
10:01:30	8	6,02	-	-
10:02:00	9	6,40	-	-
10:02:30	10	6,85	-	T.Actual above upper limit threshold, Upper delay timer starts running.
10:03:00	11	7,37	-	-
10:03:30	12	7,95	-	-
10:04:00	14	8,70	-	-
10:04:30	15	9,49	X	Upper delay timer reached, activating alarm. **Note**: The average temperature value is still within the alarm bounds.
10:05:00	16	10,30	X	-
10:05:30	17	11,14	X	-
10:06:00	18	12,00	X	-
10:06:30	18	12,75	X	-
10:07:00	19	13,53	X	-
10:07:30	17	13,96	X	-
10:08:00	16	14,22	X	-
10:08:30	16	14,44	X	-
10:09:00	16	14,64	X	-
10:09:30	15	14,68	X	-
10:10:00	15	14,72	X	Periodic stored temperature with value: 14.7°C
10:10:30	13	14,93	X	-
10:11:00	12	14,56	X	-
10:11:30	11	14,11	X	-
10:12:00	10	13,60	X	-
10:12:30	8	12,90	-	T.Actual within thresholds, disabling alarm. **Note**: The average temperature value is still out of the alarm bounds.
10:13:00	7	12,16	-	-
10:13:30	6	11,39	-	-
10:14:00	5	10,59	-	-
10:14:30	5	9,89	-	R.Average within thresholds
10:15:00	5	9,28	-	-

Example 3 – Preventing Alarms Using Initial Delay

- Initial delay = 4 minutes
- Lower delay = 3 minutes

- Upper delay = 3 minutes
- Record Interval = 10 minutes
- Lower limit = 0°C
- Upper limit = 10°C
- Sensor Alarm ON = Average

Time	T.Actual	R.Average	Alarm	Event
10:00:00	20	20.00	-	Alarm group activated, initial delay timer starts running, and Fridge starts cooling.
10:00:30	16	19,94	-	-
10:01:00	11	18,82	-	-
10:01:30	6	17,22	-	-
10:02:00	5	15,69	-	Fridge reaches required T.Actual value
10:02:30	5	14,35	-	-
10:03:00	5	13,18	-	**Note**: If no initial delay was used, then an alarm would be activated.
10:03:30	5	12,16	-	-
10:04:00	5	11,27	-	Initial delay timer reached. R.Average (still) above upper limit threshold, upper delay timer starts running.
10:04:30	5	10,48	-	-
10:05:00	5	9,80	-	R.Average within thresholds. Stop and reset upper delay timer.
10:05:30	5	9,20	-	-
10:06:00	5	8,67	-	-
10:06:30	5	8,21	-	-
10:07:00	5	7,81	-	-
10:07:30	5	7,46	-	-
10:08:00	5	7,15	-	-
10:08:30	5	6,88	-	-
10:09:00	5	6,65	-	-
10:09:30	5	6,44	-	-
10:10:00	5	6,26	-	Periodic stored temperature with value: 6.3°C
10:10:30	5	6,58	-	-
10:11:00	5	6,38	-	-
10:11:30	5	6,21	-	-
10:12:00	5	6,06	-	-
10:12:30	5	5,92	-	-
10:13:00	5	5,81	-	-
10:13:30	6	5,83	-	-
10:14:00	5	5,73	-	-
10:14:30	5	5,64	-	-
10:15:00	5	5,56	-	-