testo Saveris

Measurement data monitoring system

UltraRange

Application information

Contents

1 Introduction

Radio transmission of data is used in the Saveris system in many different ways.

Testo UltraRange is a robust transmission system with fault-tolerant, long-range radio technology which reliably transmits measurement data and alarms within the Saveris system.

This document is intended to help you maximise the capabilities of UltraRange and to avoid system design and installation errors that can result in communication errors and alarm failures.

Due to the significant performance enhancements in terms of radio range with UltraRange and the increased scaling options in the Saveris V3.0 system, there may be differences in the system design or installation compared with its predecessor Saveris V2.0, which must be taken into account.

1.1 Definitions

To facilitate reading, the following definitions apply in this document:

- Base = testo Saveris Base V3.0
- Gateway = testo UltraRange Gateway
- Logger = testo 150 data logger module with testo UltraRange communication module

2 System design

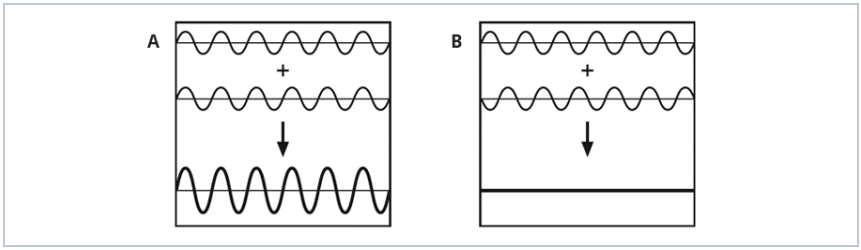
2.1 Limitations

- The system can process a maximum of 3000 measurement or status channels (monitoring contacts). Each individual measurement parameter represents a channel.
- The system can manage a maximum of 400 loggers (recommendation).
- Up to 75 UltraRange gateways are supported, each of which can be assigned a maximum 40 loggers.
- Number of bases: must be determined within the context of the overall system.
- The testo 150 UltraRange system supports up to 5 different radio channels. Depending on regional and legal regulations, these are in the frequency ranges 868 MHz, 915 MHz or 925 MHz.

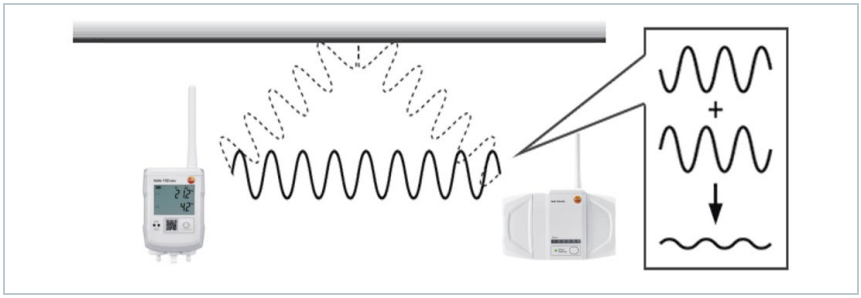
3 Basic principles of radio technology

3.1 Interference

Where two or more radio waves overlap, interference occurs. This means that the radio waves can either amplify each other or erase each other out.



Erasure is often caused by a reflection of the radio wave on different surfaces. The reflected wave is out of phase or offset with respect to the transmitted radio wave, thus causing a erasure.



3.2 Reflections and interference

The radio signal does not always reach the receiver directly, but is also reflected off different surfaces. The direct signal is then superimposed on the reflected radio signals and this causes what we know as interference.

Depending on the position of the transmitter and the receiver, the radio signals could erase each other out, so the receiver receives nothing even though the transmitter is working.

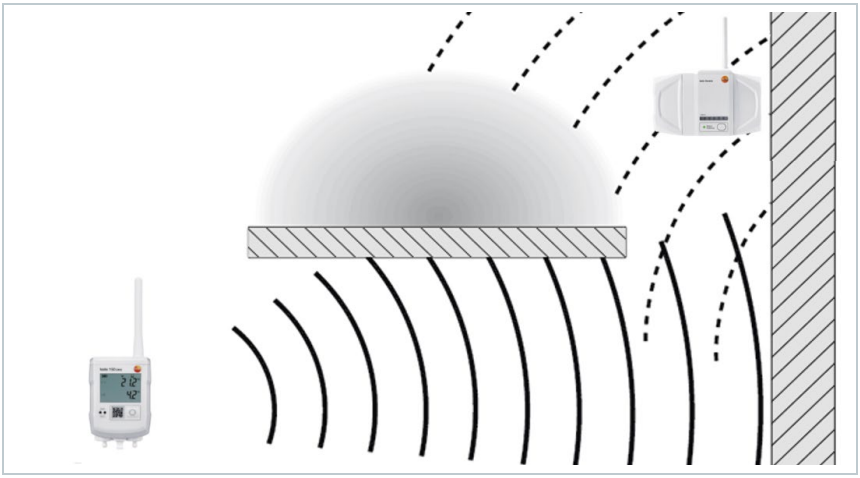
Moving the logger and gateway could improve radio reception.

3.3 Radio shadows (dead spots)

Metallic objects or parts of buildings deflect the radio waves completely, creating what's known as a radio shadow or dead spot behind them.

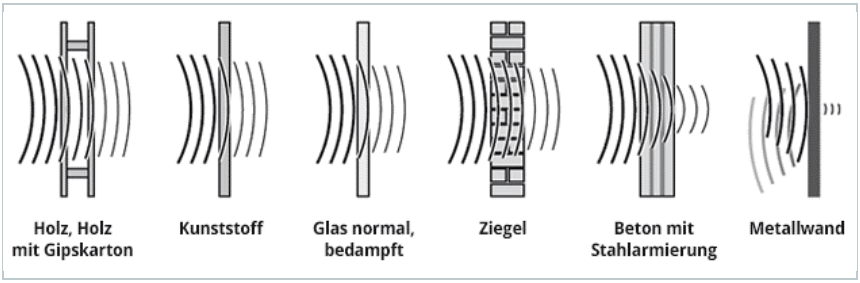
If the receiver is located behind these objects, direct reception of the signal is not possible.

To achieve good radio performance without radio shadows, the transmission path should be tested at the affected objects or parts of the building before installation.



3.4 Range in buildings

The radio range is largely dependent on the building materials.



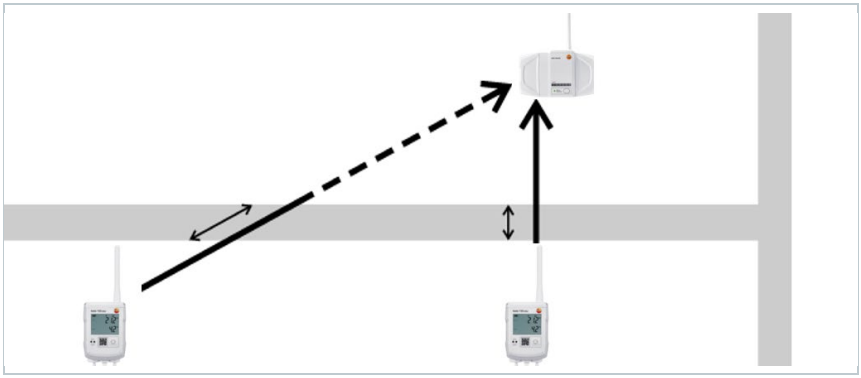
Material	Penetration
Wood/wood with plasterboard	Very good
Plastic	Very good
Normal glass	Good
Metallised/coated thermal insulation glass	Average/poor
Bricks	Average
Concrete with steel reinforcement	Poor

Material	Penetration
Metal wall	Very poor

3.5 Influence of wall thickness

The angle at which the radio waves penetrate an obstacle has a significant influence on the transmission range.

Wherever possible, the logger and gateway should be positioned so that the transmission path does not pass through walls or ceilings at an angle.



Other impairments are caused by:

- People
- Fixtures and fittings, e.g. refrigerators, tiling, metal tanks
- Plants
- Metallic surfaces such as fire doors
- Reinforcements
- Metal grilles or metal shelving
- Floor coverings

3.6 Distance from sources of interference

Besides wall thickness and metallic objects, there are also other sources of interference when it comes to radio transmission.

In order to prevent interference, the greatest possible distance from the following devices and equipment should be maintained:

- Microwave oven
- Computer
- Mobile phone
- Electronic transformers

- Audio and video equipment
- Ballasts for fluorescent lamps
- Transmitting antennas from other radio systems (e.g. audio transmission by radio or cordless telephones)

3.7 Helpful installation tips for improving the transmission range

- Before mounting the individual components, make a precise plan taking into account all interfering factors.
- Logger and gateway/base should be in their definitive mounting position in order to measure the transmission path.

  Two loggers with test firmware can also be used to measure the transmission distances. However, the test loggers must be placed at the respective mounting location. See chapter 11.
- Damping and absorption can significantly interfere with the transmission path. When installing, the fewer objects and materials there are between the transmitter and receiver, the better the reception of the radio signal.
- Please make sure not to have any metal objects or components, such as a metal cabinet or PC housing, in the transmission path. The receiver should not be installed in a switch cabinet or metal cabinet.
- The radio elements must be as far away as possible from any electronic consumers, power lines, lamps or mobile phones.
- Take the wall thicknesses into account, ensuring that the radio signal does not pass through a wall at an angle.
- Metallised thermal insulation glass can strongly attenuate or even completely reflect the radio signal. The same applies to insulation wool coated with an aluminium or metal foil.
- Fine-meshed underfloor heating or metal-coated impact sound insulation for laminate or parquet flooring will restrict the radio signal and should not be located in the transmission path.
- For door frames and walls made of metal, we recommend installing loggers and/or gateways with a minimum spacing of 10 cm.
- Any alterations to the fixtures and fittings or installation of a new shelf made of metal can have an influence on the installed radio system and weaken it.
- Interference is also caused by electrical machinery or other radio systems.

4 Radio channels

The testo 150 UltraRange system has 5 separate radio channels to prevent overlapping/interference. Depending on regional and legal regulations, these radio channels are located in the frequency ranges 868 MHz, 915 MHz or 925 MHz.

In Europe (and some other countries), the 868 MHz L-band can be used.

Example of the radio channels available for Europe:

- Channel 1: 868.5 MHz
- Channel 2: 866.1 MHz
- Channel 3: 866.7 MHz
- Channel 4: 867.3 MHz
- Channel 5: 867.9 MHz

5 Radio channel selection

Each gateway only transmits on one of the 5 radio channels. The radio channel selection is not configurable.

The radio channel is selected automatically by the gateway/base according to the following logic:

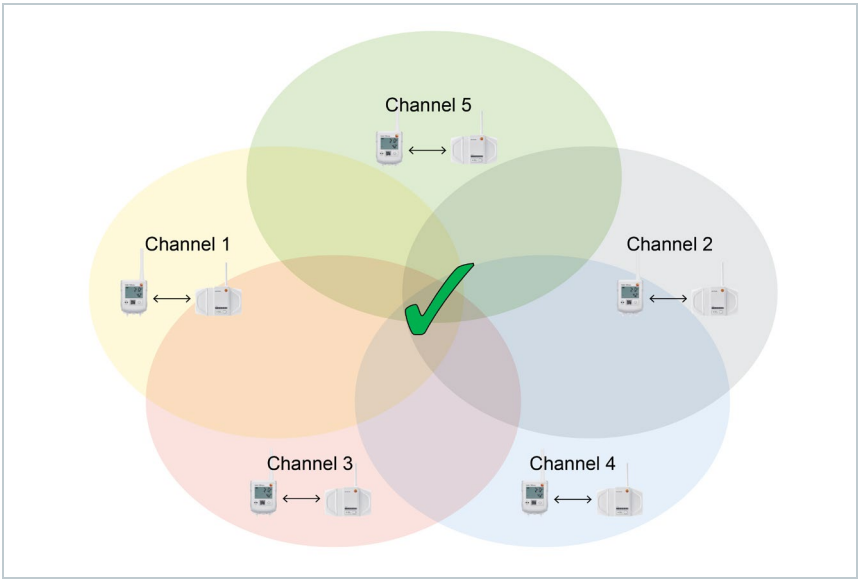
1. Gateway/base is newly registered.
2. No logger is registered with the gateway/base yet.
3. The gateway/base selects a channel according to an internal algorithm.
4. The gateway/base checks whether a gateway/base is operating with the same channel within radio range.

5.1 Channel is not being used by another gateway/base.

▸ Channel selection is confirmed.

5.2 Channel is already being used by another gateway/base.

▸ Gateway/base selects the next channel and checks again.



5.3 If all 5 channels are already in use, the gateway/base selects the channel that the channel selection started with.

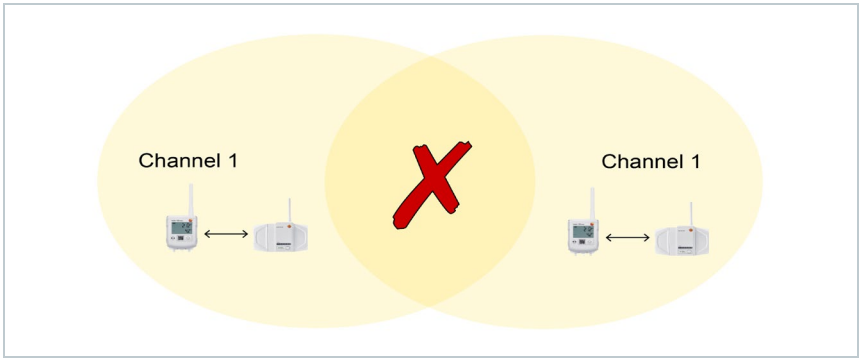
▸ In this event, at least two gateways/bases use the same radio channel.

If the gateways with the same radio channel are installed within radio range of each other, there will be a channel overlap, which entails the risk of communication disruptions. For more information, please refer to the following section.

6 Channel overlap

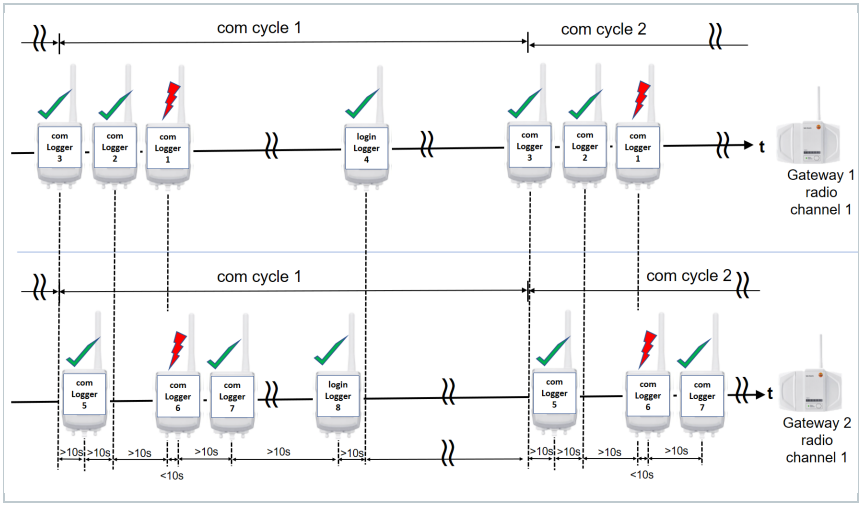
In the testo 150 UltraRange system, channel overlap is when at least two gateways/bases use the same radio channel and are within radio range of each other.

If these loggers then communicate at the same time, interference can occur.



The more loggers communicate on the same channel within radio range, the higher the probability of radio communication interference, which can result in "connection missing" alarms.

In the event of unavoidable radio channel overlaps, the communication times of loggers registered at different gateways with the same radio channel should have a minimum time interval of 10 seconds.



For reliable radio communication, a maximum 90 loggers per radio channel may be within the radio range. This is independent of logger assignment to the respective gateways with the same radio channel.

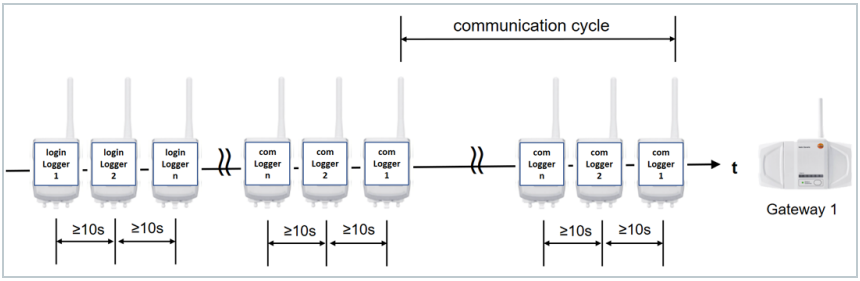
7 Logger registration

When registering loggers with the gateway/base, the points described in the following sections must be observed.

7.1 Initial logger registration

Where possible, all loggers that are intended for a gateway should be registered in a single pass within one communication cycle.

This means that as soon as the gateway is in connection mode, all loggers should be registered to the gateway one after another, in intervals of minimum 10 seconds, by pressing the connect key.



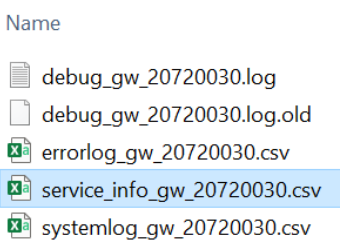
8 Radio channel analysis

The radio channel used by the gateway/base can, in each case, be ascertained by reading the "USB Service Export" data via a USB stick connected to the gateway.

1. Insert the USB stick into the right USB interface of a gateway.

- The green LED will flash for a few seconds.
- All data is now copied to the USB stick.

2. Open the file "service_info_gw_serialnumber_x.csv".



- The radio channel used is listed in the file.

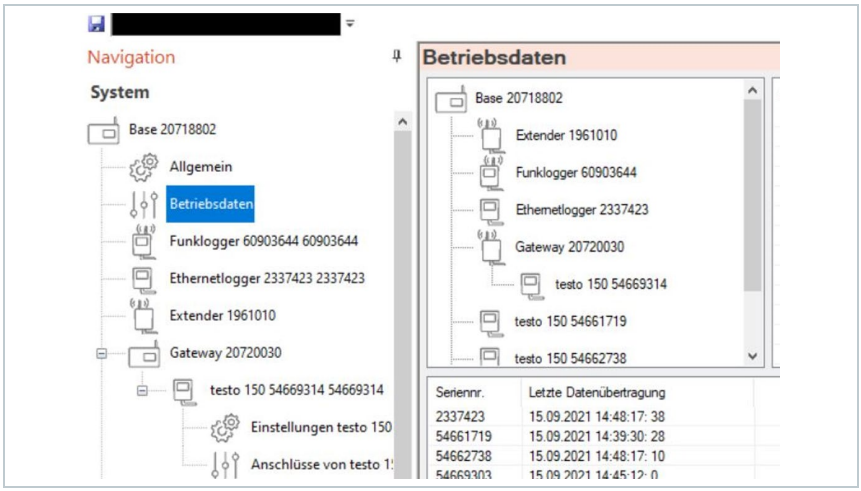
export_data	15.09.2021 12:56
Gateway model co	0572 9310
serial number	20720030
firmware version	1.0.17
production date	Wed Dec 11 10:47:16 2019
base ip	192.168.2.202
network type	NetworkInterfaceType.ETHERNET
use DHCP	True
radio_model_code	0554 9311
radio_channel	1
current netstate	UP
current ip	192.168.2.115

8.1 Communication time analysis

The communication times of the individual loggers can be determined in the software or via the support analysis tool.

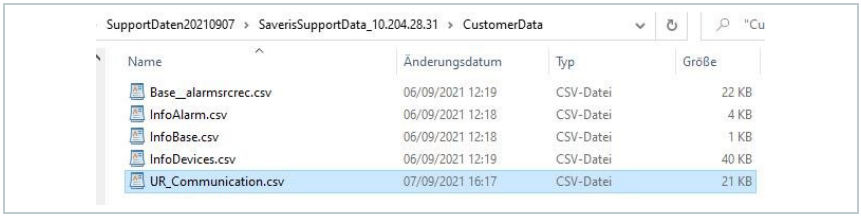
8.1.1 Software

The times of the last data transmission are indicated in the main menu **System**, under **Operating data**.



8.1.2 Support analysis tool

The communication times for each logger can also be determined in the file "UR_communication.csv", which is generated by the support analysis tool.



UR_Communication.c	Created on:	2021.09.06 10:19:38 utc			
Serial Number	Radio Host	Rad	Communication time		
54688939	20833368	0	Mon Sep 6 11:14:58 2021	Mon Sep 6 11:29:57 2021	Mon
54689746	20804511	0	Mon Sep 6 11:15:08 2021	Mon Sep 6 11:30:08 2021	Mon
54684710	20836115	0	Mon Sep 6 11:15:09 2021	Mon Sep 6 11:30:09 2021	Mon

9 Pre-commissioning (not on site)

If the bases or the gateways and/or loggers are commissioned at a different location prior to installation at the final site, the system behaviour, in particular the radio channel selection, must be taken into account!

9.1 Gateway configuration with no logger assignment

A gateway will only store a radio channel if at least one logger has been registered with the gateway.

If this does not happen, pre-configuration has no influence on the radio channel selection.

In this event, radio channel selection is only carried out on site in the application as per the section "Radio channel selection".

9.2 Base/gateway configuration with logger assignments (number of bases/gateways ≤ 5)

It is important to ensure that gateways which are within radio range of each other in the application are also in radio communication during pre-commissioning.

This means that the relevant gateways must be put into operation one after the other, without a gateway being switched off, before the logger assignments have been completed on the last gateway. This ensures that the selected radio channels for the gateways will no longer change upon a restart.

The following procedure is recommended:

1. Configure and start all gateways that will be within radio range of each other in the application.
2. Press the control key twice on the first gateway to activate connection mode.

▶ The gateway flashes green.

3. Assign the loggers to the gateway continuously (with a minimum interval of 10 seconds).
4. Exit connection mode.

5 Assign the loggers to all other gateways in the same way.

Assign at least one logger to each gateway.

6 Then switch off all gateways.

9.3 Base/gateway configuration with logger assignments (number of bases/gateways > 5)

If the number of bases/gateways that are in radio communication is greater than 5, the effect of channel overlap must be taken into account.

The following procedure is recommended:

1 Configure and start all gateways that will be within radio range of each other in the application.

2 Determine the channel selection for each individual gateway by exporting the service data of each gateway.

3 Identify the two gateways with the same radio channel.

4 Press the control key twice on the first of the two gateways with the same radio channel to activate connection mode.

▶ The gateway flashes green.

5 Assign the loggers to the gateway continuously (with a minimum interval of 10 seconds).

6 Exit connection mode.

7 Immediately afterwards, put the second of the two gateways with the same radio channel also into connection mode and, as before, assign the loggers to the second gateway continuously with a minimum interval of 10 seconds.

Assign at least one logger to each of the two gateways.

8 Exit connection mode again.

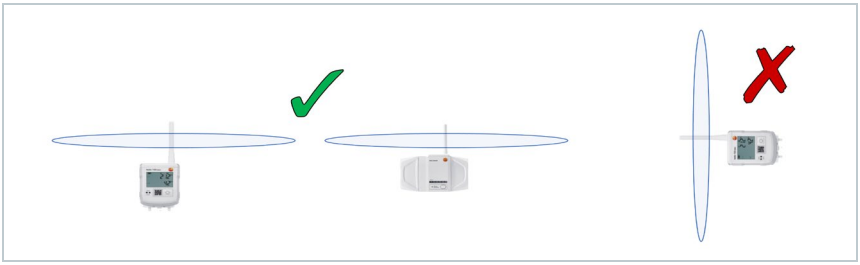
Doing this ensures that all loggers communicate with the same radio channel at staggered intervals.

9 Repeat this procedure with the remaining gateways, although the chronological order is less critical due to the different radio channels for the remaining gateways.

10 Mounting

10.1 Logger and gateway position

- Wherever possible, do not mount gateways or loggers directly on metallic objects/surfaces.
- Avoid objects with strong radio attenuation in the line of sight of the loggers (concrete walls/ceilings, coated multiple glazing, large metallic surfaces or metallic constructions).
- As far as possible, align the antenna in an active plane with respect to the gateway antenna.



- If loggers are mounted directly on metallic surfaces, please make sure that the antennas are not shielded by any metallic areas.

Incorrect mounting position	Correct mounting position
	

Incorrect mounting position	Correct mounting position
	

10.2 Position of the antenna

- Do not mount the antenna directly on metallic objects/surfaces.
- Avoid objects with strong radio attenuation in the line of sight to the outdoors (concrete walls/ceilings, coated multiple glazing, large metallic surfaces or metallic structures).
- Avoid using magnets as mounts.

11 Ultra Range Mapping with two testo 150 loggers

To update to the latest firmware, please contact your local Testo representative or our helpdesk (saveris-support@testo.de).

1. Update two testo 150 loggers with the special range test firmware.
   Put in batteries and wait until “no conf” is shown in display.
   Connect logger to USB(PC) via config-cable.
2. The mass storage memory of the logger opens. Copy the firmware-bin-file into this and remove the config-cable.
   Wait until installation process is complete.
3. Install the wireless module on the logger.
4. On first logger: Push the button twice, the display shows the module type in the upper row and the test mode “read” in the lower row.
   The logger detects the radio module and show the type on the Display.
5. Push logger button > 3 sec. Now the logger is in the receiving mode and shows “COnr”.
   If step 5 is done the signal strength in dBm and the lost data packets are shown.
6. On second logger: Push the button once, the display shows the module type in the upper row and the test mode “send” in the lower row.
   The logger detects the radio module and show the type on the display.
7. Push logger button > 3 sec. Now the logger is in the transmitting mode and show “COnt”.
8. Signal strength (S), lost (l), sent (S) and received data packets (r) are now being displayed.

9 After measurement:
Remove at least one battery to avoid unnecessary power consumption due to continuous transmission.

Reference values for test setup:

- Maximum signal strength: -8 dBm (100%)
- Minimum signal strength: -105 dBm (0%)
- Threshold for stable connections: -80 dBm (approx. 30%)

Testo SE & Co. KGaA
Celsiusstr. 2
79822 Titisee-Neustadt
Germany
Phone: +49 (0)7653 681-0
E-mail: info@testo.de
www.testo.com

0970 2504 en 03 - 01.2024