The TX + RX swept system for the detection of paper labels and hard tags

IRIDIUM DUAL 8.2MHz

Technical documentation, installation manual

IRD 1042 V2

IRIDIUM ALPHA

Contents

Shoplifting protection system IRIDIUM Dual 8,2MHz

Shoplifting protection system IRIDIUM Dual 8.2 MHz (Dual) is designed to protect goods against shoplifting. It detects all kinds of tags from various producers (“hard”, “soft” tags and paper labels), which are used for radio-frequency systems with an operating frequency of 8.2 MHz. The Dual system consists of two or three autonomous mechanical frames: a transmitter – Dual TX (TX) and one or two receivers – Dual RX (RX). The transmitter and the receiver are connected by a four-core cable that provides power and synchronization to the RX module. Powering the Dual is possible through the 18V AC mains adapter or 24V DC power supply, the maximum power consumption is 20W. The source must be connected to the TX module. In the case of sufficient power, multiple Dual systems can also be powered from a single source. The Dual can be installed as a single system or in groups; in the case of group installation, synchronization among TX transmitters is necessary. The Dual operates in an unlicensed radio-frequency range of 7.4 - 8.8 MHz. The system contains automatic calibration of default broadcast range and thus does not require setting by external devices.

Technical specification:

Type symbol	**IRD 1042 V2**
Commercial name	IRIDIUM DUAL 8,2MHz
Producer, country of origin	IRIDIUM LTD, Slovak Republic
Range of operating frequencies	7,4MHz – 8,8MHz
Max. RF output EIRP	< 9 dBuA/m for 10m
Power supply adaptor	18V AC, 20W 50Hz/60Hz or 24V DC
Regulations	EN ETS 300 330-1:V1.3.2, EN ETS 300 683
Size	166,5x38,3 x9,6cm (height, width, depth)
Weight	10,3 kg (without line power adapter)
Detecting distance	depending on products, size and kind of tags, up to 180 cm between TX a RX
RX Alarm signalling	optical (LED diodes), acoustic (piezo-siren) relay contact 12V / 0.1A
TX Alarm signalling	optical (LED diodes)

General installation information

The IRIDIUM Dual system utilizes the principle of resonance, hence sizeable metal structures as plastic windows, metal doors and others in the vicinity of the Dual system can cause resonances, which are subsequently captured by the Dual system and lead to false alarms. For this reason it is of big importance to test the area, where the Dual systems are to be placed. The following paragraph contains general rules for the installation.

Do not install the Dual system closer than 2 metres from vertical network cables, irrespective of whether they are built in a wall or cable trays. Computers, neon bulbs, saving light bulbs and other electronic devices should be placed more than 1 meter away from the Dual system. Electrically controlled doors should not be closer than

0.7 metres from the space between the transmeter and receiver (TX and RX).. Doors situated in front of or behind the antenna area and opening inwards have to be (while fully open) at least 0.3 metres from the transmeter and receiver (TX and RX). Goods intended for protection have to be placed at least 0.8 metres from both the TX and RX, otherwise they might cause unwanted alarms.

Dual TX TRANSMITTER (TX)

The TX includes the electronics board – TX module, which uses the installed antenna in the TX antenna frame to broadcast high-frequency (HF) electric signal ranging from the smallest to the highest frequency set (min. 7.45 MHz to max. 8.75 MHz). The presence of the label is indicated optically.
Setting and control of the electronics is possible through four buttons and a four-digit LED display. The display works in two distinct modes – parameter input mode and parameter control mode. Parameter control mode is the default mode. In order to enter the parameter input mode, press the **SELECT** button. Input mode is terminated by pressing the **SAVE** button. The TX module can be reset in parameter control mode by pressing and holding the button for approximately 3 seconds.
After connecting the TX electronics to the supply voltage, the display shows introductory tests and currently set TX module mode (single, master, slave). Afterwards, the display enters the parameter control mode and begins to show values of the first controlled parameter (connected RX modules). While in the parameter control mode, the display shows the number of the controlled parameter for about 1 second and then shows the value of this parameter for about six seconds, repeating the whole process afterwards. The display enters sleep (turns off) after being idle (no buttons pressed) for approximately two minutes. To display the last shown controlled parameter, one only needs to press any button. Pressing the **SELECT** button leads to entering parameter input mode – first the parameter being set is displayed and after about 2 seconds the value of this parameter is shown.
Two green LED's to the left from the display inform about the presence of voltages for analogue and digital parts of the electronics. **NETWORK CONNECTOR** is used to connect remote control and monitoring of the Dual system.

Input parameters of the TX module

The buttons have the following use:

Select changes the mode, moves inside the Menu, displays the parameter being set

+ changes the value of the parameter being set, changes the parameter being controlled

- changes the value of the parameter being set, changes the parameter being controlled

SAVE saves the new value of the parameter, changes to the parameter control mode. Pressing the button in the control mode will display the software version number of the program and afterwards the TX module serial number.

The following parameters can be set on the TX module:

1. Transmitted power
2. Sweeping frequency
3. Maximum frequency of the HF signal
4. Minimum frequency of the HF signal
5. Mode of operation
6. TX modules synchronization in the Slave mode

Setting the Transmitted power parameter – Pout

Power is set in % from 0% to 100% with a step of 1%. The power set depends on the distance between the RX and TX, tags used and the noise present in the area of installation.

1. Press **SELECT** until **Pout** is displayed.
2. Using **+**,**-** buttons, set the desired power value.
3. Press **SAVE**, for about 2 seconds the display will show **rECo** (record) and the desired value of power is saved and set to the TX output. In case that the value is the same as the previous one, the display shows **UnCH** (unchanged) and after 1 second starts to show the last displayed parameter in the control mode.

Setting the Sweeping frequency parameter – SFr

Sweeping frequency is the speed of changing the HF frequency from the minimum to the maximum and back to the minimum value. It is set in Hz with a step of 1 Hz. Minimum value is 150.0 Hz, maximum value 400.0 Hz. Changing the sweeping frequency allows to minimize interference from other systems.

1. Press **SELECT** until **SFr** is displayed.
2. Using **+**,**-** buttons, set the desired value.
3. Press **SAVE**, for about 2 seconds the display will show **rECo** (record) and the desired value of sweeping frequency is saved and set to the TX output. In case that the value is the same as the previous one, the display shows **UnCH** (unchanged) and after 1 second starts to show the last displayed parameter in the control mode.

Setting the Maximum frequency of the HF signal – HIFr

Maximum frequency of the HF signal is the maximum frequency of the signal broadcast by the TX module. It is set in MHz with a step of 0.05 MHz. Maximum value is 8.75 MHz and is at least 0.1 MHz higher than the value of **Minimum frequency of the HF signal** parameter.

1. Press **SELECT** until **HIFr** is displayed.
2. Using **+**,**-** buttons, set the desired value.
3. Press **SAVE**, for about 2 seconds the display will show **rECo** (record) and the desired value of maximum HF frequency is saved and set to the TX output. In case that the value is the same as the previous one, the display shows **UnCH** (unchanged) and after 1 second starts to show the last displayed parameter in the control mode.

Setting the Minimum frequency of the HF signal – LoFr

Minimum frequency of the HF signal is the minimum frequency of the signal broadcast by the TX module. It is set in MHz with a step of 0.05 MHz. Minimum value

is 7.45 MHz and is at least 0.1 MHz higher than the value of **Maximum frequency of the HF signal** parameter.

1. Press **SELECT** until **LoFr** is displayed.

2. Using **+**,**-** buttons, set the desired value.

3. Press **SAVE**, for about 2 seconds the display will show **rECo** (record) and the desired value of minimum HF frequency is saved and set to the TX output. In case that the value is the same as the previous one, the display shows **UnCH** (unchanged) and after 1 second starts to show the last displayed parameter in the control mode.

Setting the Mode parameter – NodE

Parameter **Mode** is used to set the TX module mode of operation. The TX module can operate in three distinct modes.

SInG - Single mode. In this mode, one or two RX modules are connected to a single TX module and the TX module is not connected to any other TX module. This mode is suitable in the case where no other Dual system is installed nearby. The mode is the same as Master, but does not broadcast any signal for the slave TX modules and thus has lower energy consumption.

NASt – Master mode. In this mode, the module can be connected to one or more TX modules working in the Slave mode. One or two RX modules can be connected to the TX module, depending on the current topology of the installation

SLAu – Slave mode. In this mode, the module must be connected to another TX module working in the Master mode. One or two RX modules can be connected to the TX module, depending on the current topology of the installation

1. Press **SELECT** until **NodE** is displayed.

2. Using **+**,**-** buttons, set the desired mode.

3. Press **SAVE**, for about 2 seconds the display will show **rECo** (record) and the desired module mode is saved and set to the TX output. In case that the value is the same as the previous one, the display shows **UnCH** (unchanged) and after 1 second starts to show the last displayed parameter in the control mode.

Setting the Slave timing parameter – SLtI

Slave timing parameter is used to set the phase of HF signal between two TX modules. The parameter is important for the correct functioning of the RX module, which is situated between the two TX modules. The parameter values range from 0 to 7 with a step of 1.

1. Press **SELECT** until **SLtI** is displayed.

2. Using **+**,**-** buttons, set the desired value.

3. Press **SAVE**, for about 2 seconds the display will show **rECo** (record) and the desired phase value is saved and set to the TX output. In case that the value is the same as the previous one, the display shows **UnCH** (unchanged) and after 1 second it starts to show the last displayed parameter in the control mode.

Displayed parameters of the TX module

While in the control mode of the TX module, it is possible to display the values of the following parameters:

1. Communication with RX modules
2. HF transmitter temperature
3. HF amplifier source voltage
4. HF voltage at the antenna input

Parameter 01 – communication with RX modules

----TX module does not communicate with any RX module
--r0 TX module communicates with one RX module with the address 0
r1-- TX module communicates with one RX module with the address 1
r1r0 TX module communicates with two RX modules

Parameter 02 – HF transmitter temperature

The display shows the temperature in degrees Celsius of the power transistors in the output stage of the HF amplifier. If the temperature exceeds 100 °C, the software locks the HF transmitter (The display alternately shows “Err 4” and the measured temperature). After the temperature is lowered to 80 °C the transmitter starts to transmit again. During the HF blocking the RX modules (connected to TX Module) do not evaluate any alarms. If the TX module is in the Master mode, the TX modules operating in the Slave mode operate normally – they receive both the sync pulses and the HF frequency. Only the TX - Master module output stage is switched off.

Parameter 03 – HF amplifier source voltage

The display shows the value of DC voltage of the HF amplifier source in tenths of a volt. The voltage is directly related to transmitted power of the TX module. The higher the transmitted power, the higher the voltage value. If the voltage value does not match the set transmitted power, the module indicates Err 1 (The display alternately shows Err 1 and the deviation of the source voltage from the set value).

Parameter 04 – HF voltage at the antenna input

The display shows the effective value of the high-frequency voltage at the input to the antenna in volts. It is related to the transmitted power of the TX module. The higher the transmitted power, the higher the voltage value.

Dual RX RECEIVER (RX)

Receiver (RX) contains the electronics board – RX module, which, by means of the antenna installed in the RX antenna frame, receives and evaluates the radio signals emitted by the TX module. It uses these radio signals to detect labels in the vicinity of the TX, RX antennas. The presence of the label is indicated optically, acoustically or by means of electric signals from the electronics board connector.
Setting and control of the RX electornics can be managed by using three buttons and a four-digit LED display. The display operates in two modes – parameter input mode and parameter control mode. Parameter control mode is set as default, which means that after initial tests the module starts to display the first controlled parameter. To change from the parameter control mode to the parameter input mode, it is necessary to press the **SELECT** button. Input mode is always terminated by pressing the **SAVE** button.

After connecting the RX module to the power supply (from the TX module), initial display tests appear. In case the RX module does not establish communication with the TX module, flashing symbols **----** appear. After establishing communication with the TX module, the symbol **CoNU** (communication) appears, followed by the sweeping frequency and TX module transmitted power values. After this the display goes into control mode and starts displaying the first controlled parameter (input signal level in %). If the RX module cannot reach the parameter value, the display shows four flashing **-** symbols with the decimal point after the last **-** symbol. While in the parameter control mode, the display shows the number of the controlled parameter for about 1 second and then shows the value of this parameter for about 6 seconds, repeating the whole process afterwards. To display the last shown controlled parameter, one only needs to press any of the buttons **+**, **-** or **SAVE**; pressing the **SELECT** button always leads to entering the parameter input mode - first the parameter being set is displayed and after about 2 seconds the value of this parameter is shown. Two green LEDs located to the left of the screen inform you of the presence of voltage for analogue and digital parts of the electronics.

The buttons have the following use:

SELECT - changes from control to input mode, shows the parameter to be displayed or set

+ - changes the value of the parameter being set, changes the parameter being controlled

- - changes the value of the parameter being set, changes the parameter being controlled

SAVE - used to save and set a new parameter value, to move to the control parameter mode and to show the software version of the program. While in the parameter input mode, after pressing the **SAVE** button, the message **rECo** (record) appears for about 1 second and the desired value is set in the RX module and saved in the internal memory of the module. If the new value of the parameter is the same as the old one, the display shows **UnCH** (unchanged) and after approximately 1 second starts to show the last displayed parameter in the parameter control mode. Pressing the **SAVE** button in the control mode displays the program version for about 5 seconds, e.g. **Sr1** means software version 1.

Input parameters of the RX module

The parameter input mode of the RX module allows the input of the following parameters:

1. HF signal amplification
2. System sensitivity
3. Advertisement lighting
4. Light alarm signalling length
5. Sound alarm signalling length
6. Sound alarm signalling frequency
7. Sound alarm signalling volume
8. Alarm signalling via relay duration
9. RX module internal address

10. Label detection response time
11. External noise.

Setting the parameter HF signal amplification – GAIn

Amplification is set in % from 0% to 100% with a step of 0.5%. The set value of amplification depends on the distance between RX and TX, on the type of labels used and on the interference at the place of installation.

1. Press the **SELECT** button until the display shows **GAIn.**
2. Set the desired value of amplification using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter System sensitivity – SEnS

System sensitivity parameter allows to set the detection distance for the labels used. It is set in % from 0% to 100% with a step of 0.5%.

1. Press the **SELECT** button until the display shows **GAIn.**
2. Set the desired value of sensitivity using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Advertisement Lighting – AduE

Parameter allows lighting of the advertisement placed in the RX antenna while the alarm is not signalled. The possible states are ON or OFF.

1. Press the **SELECT** button until the display shows **AduE.**
2. Set the desired value **ON** or **OFF** using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Light alarm signalling length – L tI

Parameter Light alarm signalling length determines the light alarm signalling time, with a minimum of 1 second and a maximum of 50 seconds, with a step of 1 second.

1. Press the **SELECT** button until the display shows **L tI.**
2. Set the desired value using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Sound alarm signalling length – S tI

Parameter Sound alarm signalling length determines the sound alarm signalling time, with a minimum of 1 second and a maximum of 12 seconds, with a step of 1 second.

1. Press the **SELECT** button until the display shows **S tI.**
2. Set the desired value using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Sound alarm signalling frequency – S rP

Parameter Sound alarm signalling frequency determines the period of the repeating sound alarm signalling with a minimum of 0.1 second, a maximum of 1 second, with a step of 0.1 second.

1. Press the **SELECT** button until the display shows **S rP.**
2. Set the desired value using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Sound alarm signalling volume – S uo

Parameter Sound alarm signalling volume determines the volume of the sound alarm in % of the maximum value in the range of 0 - 100% with a step of 0.5%.

1. Press the **SELECT** button until the display shows **S uo.**
2. Set the desired value using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Alarm signalling via relay duration – r tl

Parameter Alarm signalling via relay duration determines the time in which the alarm is signalled at the connector pins (RELAY 5-NO normally open, 6-NC normally closed) minimum 0 sec, maximum 100 sec with a step of 1 second. The voltage on pins 5-NO, 6-NC is relative to the 10-GND pin.

1. Press the **SELECT** button until the display shows **r tl.**
2. Set the desired value using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter RX module internal address – N r0, **N r1**

Parameter RX module internal address is used to set the address of the module. The TX module can work together with one or two RX modules. In case the TX module works with two RX modules, each has to have a unique address to avoid collisions in communication. The internal address can take on two values – 0 or 1.

1. Press the **SELECT** button until the display shows **N r0** or **N r1.**
2. Set the desired value using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter Label detection response time – rESP

Parameter Label detection response allows the user to set the response to a label between the RX and TX. Short response time **rEHI** leads to a high speed of label detection and is more prone to external noise or noise from other RF systems or from the mains frequency 50 (60) Hz. Longer response time **rELo** spots the label more slowly, but the system is more stable and robust against external noise.

1. Press the **SELECT** button until the display shows **rESP.**
2. Set the desired value **rEHI** or **rELo** using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Setting the parameter External noise – nolS

Parameter External noise allows to set the sensitivity of label detection versus the external noise in the vicinity of the TX and RX. Together with the Label detection response time, the parameters ensure stability and robustness against noise from external environment. Low level of noise **noLo** allows a high detection distance, but

requires an environment with low noise levels, no RF systems in the proximity of the DUAL and low interference from other electrical devices. Moderate level of noise **noNE** allows a good detection distance and can be used in an ordinary environment. High noise level **noHI** is suitable in an environment with other RF systems in the vicinity of the RX and TX or a high number of interfering electrical devices.

1. Press the **SELECT** button until the display shows **noIS.**
2. Set the desired value **noLo**, **noNE** or **noHI** using the buttons **+**, **-**.
3. Press the **SAVE** button, the new value is set.

Displayed parameters of the RX module

The parameter control mode of the RX module allows to display the following parameters:

1. Evaluated signal value
2. HF signal value
3. HF signal interference level
4. Evaluated signal resonance value
5. Current value of label detection signal
6. Reference level of label detection signal
7. Maximum value of label detection signal
8. Number of alarms.

Parameter 01 - Evaluated signal value

The display shows the absolute maximum measured value of input signal in about 0.1 sec in % of the maximum possible value. The parameter is suitable for judging the noise level and setting the HF signal amplification – **GAIn**, system sensitivity – **SEnS**. Sensitivity and amplification enhancement leads to higher measured values. Short reaction time (**rEHI**) gives higher measured values than the longer one (**rELo**).

Parameter 02 - HF signal value

Display shows the absolute maximum and minimum measured value of HF signal in % of the maximum possible value. The parameter is suitable for setting the amplification of HF signal – **GAIn**. The minimum value is showed with a decimal point after the number. In most cases, it is necessary to set a value between cca 10% and 40%, while the difference between the minimum and maximum value should not exceed 5%.

Parameter 03 - HF signal interference level

The display shows the maximum value of interference of HF signal in % of the maximum possible value. The parameter is suitable for judging the external noise in the area of installation. A good value would be around 0, 1. The values 2 and above are mostly a result of interference with other RF systems in the vicinity of the installation. Interference lowers the label detection distance. Decreasing the influence of interference can be achieved by increasing the TX module transmitted power or setting a longer reaction time **rELo**.

Parameter 04 - Evaluated signal resonance value

The display shows the maximum value of detected signal resonance in % of the maximum possible value. Resonance is a permanent parasite signal which appears in the evaluated signal and increases the risk of false detection. It should never exceed the value of 30%, acceptable values are around 10%. The parameter value is directly influenced by the HF signal amplification – **GAIn** and system sensitivity – **SEnS**. Beware the forgotten labels in the proximity of the TX and RX, which cause big resonance.

Parameter 05 - Current value of label detection signal

RX electronics constantly evaluates the signal level and according to the signal value it detects the label (signals the alarm). The display shows the current maximum signal value in % of the value, where the alarm is signalled. The parameter enables the user to judge the interference at the installation area.

Parameter 06 - Reference level of label detection signal

The display shows the reference signal value in % of the minimum value where the alarm is signalled for the current electronics settings. The parameters serves to judge the interference at the installation area. Minimum possible value is 100%.

Parameter 07 - Maximum value of label detection signal

The display shows the maximum value of parameter 05 that has been measured after turning on the electronics or since the last change of the TX or RX module settings, which can influence the parameter. The parameter allows the user to judge the long-term interference at the installation site and to adjust the parameters of the system.

Parameter 08 - Number of alarms

The display shows the total number of label detections (alarms) since the connection of electronics to the mains or since the last change of TX or RX modules.

Installation of IRIDIUM Dual 8.2MHz system

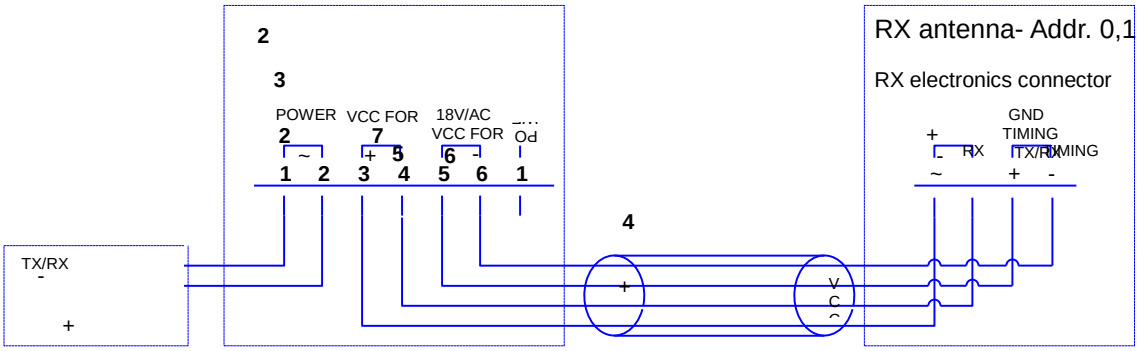
The Dual system can be installed in three ways:

1. Two-antenna installation
2. Three- antenna installation
3. Four (and more)- antenna installation

Two-antenna installation

A two-antenna installation consists of a one TX (transceiver) and one RX (receiver). The AC adapter must be attached to the TX, the connecting cable between the TX and RX must be connected according to figure 1. The most appropriate cable for data transmission is a shielded cable (FTP) with at least two twisted pairs, e.g. SYKFY 2x2x0.5. The shielding does not connect either on the side of the TX or the side of the RX. It is also possible to use a flat four-core cable (or two pair cables) with a

minimum cross section of 0,20mm². Flat cable has a slightly higher resonance (displayed parameter 04 in the RX module).



It is appropriate to perform the setting of the TX electronics without the RX electronic in the RX antenna. First, it is necessary to check the correct connection of the connecting cable to the RX and the TX s (without inserted electronics). Recheck for a short circuit between the line wires. Insert the TX electronics into the TX antenna and connect the AC adapter into an outlet. After the initial tests, the display shows the parameter 01 - communication with the receivers. Characters **----** appear, which indicates that the electronics is not connected to any RX module. Use the buttons to set up all the available parameters. Power should be adjusted according to the spacing of the f antenna s and the labels used.
When using only hard tags, it is possible to set lower power. With a spacing of 120 cm the transmitted power is around 90% to 100%. Set the sweeping frequency between 250Hz and 400Hz - for minimum interference from the mains (50Hz), use 360Hz. If there are other dual systems operating on that frequency installed nearby, use a different close frequency. To maintain minimum interference from the network, the appropriate frequencies are 253, 259, 269, 278, 282, 298, 301, 308, 311, 331, 350, 357, 367, 377, 380, 396 Hz. Considering the detection distance it is preferable to set higher frequencies, although the downside is that the higher frequencies are more sensitive to external interference.
Parameters Max. and Min. HF frequency must be set according to the nominal frequency of the labels so that the nominal frequency is midway between the maximum and minimum HF frequency. For tags with a nominal frequency of 8.2MHz it is possible to adjust the Min. HF frequency to 7.65MHz and the Max. HF frequency to 8.75MHz. Narrower interval reduces sensitivity to external interference but also reduces the detection distance of the labels with greater tolerance.

The **MODE** parameter has to be set to single – **SinG** because the TX is not connected to any other TX.

In this installation mode, Slave timing has no influence on the Dual system performance.

The following procedure is suitable for setting the electronics in the RX. It is first necessary to set the parameters for the TX module. After setting the parameters of the TX module, disconnect the AC adapter and insert the RX module into the RX antenna. Connect the AC adapter. After the initial tests, the display of the TX module shows flashing **----** if the modules are not communicating correctly. In this case it is

necessary to check for the correct connection of the connecting cable. If the communication is established without any problems, the TX module shows **--r0** or **--r1**, depending on the address set in the connected RX module. If the communication is okay, after the initial tests the RX module shows **CONU** and then displays the sweeping frequency and TX module transmitted power. Afterwards, the display shows **----** with a decimal point after the last **-**.

The modules are now okay but the calibration of the HF frequency of the TX module is not yet completed. After finishing the calibration, the RX module will display the parameter 01. If the RX module beeps and lights up successively twice, the RX module input circuits are saturated and it is necessary to reduce the RX module amplification.

Press **+** to display the parameter 02 (HF signal value). The signal should have a value of about 15% (+/- 5%). If it is different, use the **SELECT** button to set the **HF signal amplification - GAIn** to the desired value. Parameter 02 shows two values, one without and one with a decimal point – these numbers should not differ by more than 6.

Press **+** to display the parameter 03 (HF signal interference level), the interference should not be greater than 1. If it is greater, there is a mono or a dual system operating nearby.

Press **+** to display the parameter 04 (evaluated signal resonance value), the resonance should not be higher than 25 (usually 10 to 15). If the resonance is greater than 25, check whether there isn't a forgotten label near the antenna area. If not, modify the **System sensitivity** (**SEnS**) parameter until the resonance values are less than 25 and the sensitivity parameter value is higher than 25. If the resonance is still too high, it is necessary to lower the HF signal amplification value.

Then set the parameter **Label detection response time (rESP)** to longer detection time **rELo** and the parameter **External noise (nolS)** to medium interference level **noNE**. Set and adjust the parameters for optical and acoustic signalization according to customer's requirements. RX module **Internal address parameter N r0, N r1** can be set to 0 or 1 – the setting is relevant only when there are two RX (receivers) connected to the single TX (three-antenna installation). After setting the TX and RX modules, wait for approximately 1 min and recheck the detection distance.
The displayed parameter 06 (Reference level of label detection distance) shows the signal threshold, from which the label is detected. The value of 100% means that, given the actual modules' parameters, the detection distance is the highest possible. Higher value than 100% means that external interference comes into play and the detection distance is lower.
The displayed parameter 05 (Current value of label detection signal) shows the level of interference at the installation site. For instance, if the value is 40%, it means that the interference is at 40% of the reference level of label detection signal, which leaves a 60% margin until the alarm is started (label detected).
The displayed parameter 07 shows the history of the parameter 05 – the maximum value of the parameter 05 measured since the last change of parameters or since the connection of the RX module to the power outlet.

Three-antenna installation

A three-antenna installation consists of a single TX (transceiver) and two RX (receivers). The TX must be placed between two RX-s. The AC adapter must be attached to the TX, the connecting cables between the TX and RX must be connected in accordance with Figure 2. The most appropriate cable for data transmission is a shielded one (FTP) with at least two twisted pairs, e.g. SYKFY 2x2x0.5. The cable shielding does not connect either on the side of the TX or the side of the RX. For the connection, it is also possible to use a flat four-core cable (or two two-core cables) with a minimum cross section of 0.20mm². The flat cable has slightly higher resonance (displayed parameter 04 in RX electronics). The RX-s are connected to the TX in parallel.

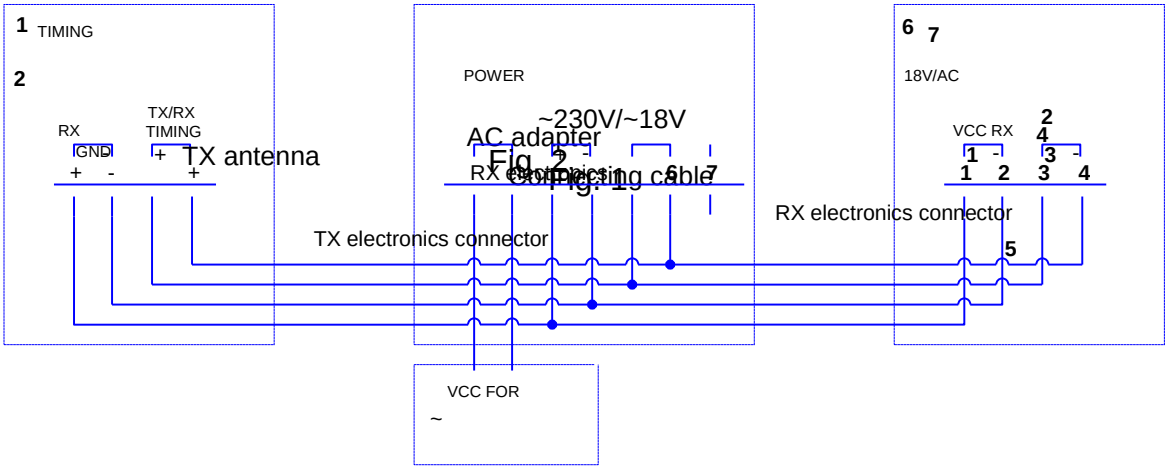


Fig. 2 Connecting cable

Fig. 1

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The connection procedure is identical to the two-antenna installation, only the RX modules' address setting is different. After checking the correct connection of connecting cables and setting the TX module's parameters, connect one RX module. The setting will be similar as for the two-antenna installation, but the parameter **Internal RX module address** is set to **N r1**. Connect the second RX module in the second RX and check the **Internal RX module address** – this has to be set to **N r0.** TX module electronics' displayed parameter 01 should read **r1r0**, meaning that the communication between the TX and RX modules is fine. All the other parameters are set in the same way as for the two-antenna installation.

MASTER-SLAVE installation

Master-slave installation is used when it is necessary to control more than two passages next to each other. The installation consists of at least two transmitting TX antennas and two receiving RX antennas (three passages side by side are controlled). With this type of installation, a principle holds, that one RX antenna must be placed between two TX antennas. In such an installation, always only one TX antenna is the MASTER and all other TX antennas must be SLAVE, which means that all the SLAVE TX antennas take the HF frequency and the sweeping frequency from the MASTER TX antenna and broadcast synchronously with the MASTER TX. Therefore, the installation requires a connection of the TX antennas. The most suitable way of wiring for installation is shown in Fig. 3, 4. For the interconnection of TX transmitting

antennas, it is advisable to use a data cable (shielded FTP) with at least two twisted pairs, for example SYKFY 2x2x0.5. Cable shielding in all TX frames connects to pin 7 - GND TX Com, alternatively the shielding can be connected only in the MASTER antenna – Fig. 5, 6. The cable shielding must not be conductively touching the metal parts of the TX or RX antennas. In case several TX antennas are powered from the same source, pin 7 - GND TX Com and pin 10 - GND cannot be mutually connected, otherwise the TX module can be destroyed!. TX module ‘s communication circuits have a galvanically isolated power supply, therefore multiple TX frames can be powered from one source (with sufficient power output).
The MASTER TX antenna must be physically located at the beginning (end) of the series of antennas, although one RX antenna can be placed in front of it, if the total number of antennas is odd. The most suitable way of cabling for the installation having an even total number of antennas (all TX and RX frames) is shown in Figure 3, the case of an odd total number of antennas is in Figure 4.
Connecting the RX antennas to the TX antennas is subject to the same set of rules as for the two- and three-antenna installation. In addition, MASTER-SLAVE installation requires the interconnection of all TX transmitting antennas. The most suitable cable for the TX interconnection is the shielded cable for data transmission (FTP) with at least two twisted pairs (twisted pair) e.g. SYKFY 2x2x0.5, cable shielding is connected to all TX antennas via 10 GND pin. Each TX frame must be powered by a separate power adapter! Violating this principle will lead to the destruction of the TX electronics board.

The procedure for setting the parameters and mode of operation of electronics boards in TX, RX antennas for MASTER-SLAVE installation is as follows:

1. Firstly it is necessary to check the correct connection of the connecting cables to the RX and TX antennas (without electronics inserted) according to Figure 3 or Figure 4 (depending on the total number of installed frames). Check the short circuit between the wires!

2. Insert the electronics into the TX antenna which will act as MASTER (first or last antenna in the series). Connect the AC adapter into an outlet. After initial tests, the display of the electronics shows the parameter 01 - communication with RX modules. Afterwards, ---- appears which indicates that there is no RX module connected to the electronics. Use the buttons to set up all the following parameters.

Power should be set according to the separation of the antennas and the type of used labels. When using only hard tags, the power can be set to lower performance. A separation of more than 120 cm means the transmitted power should be set between 90% and 100%.

Set the sweeping frequency between 250Hz and 400Hz - for minimum interference from the mains (50Hz), the 360Hz frequency is the most suitable. If there are other dual systems installed nearby, which operate on the same frequency, it is necessary to set a different, close frequency. To maintain a minimum amount of interference from the mains, the appropriate frequencies are: 253, 259, 269, 278, 282, 298, 301, 308, 311, 331, 350, 357, 367, 377, 380, 396Hz. In terms of the detection distance higher frequencies are preferable, though the downside is that higher frequencies are more sensitive to external interference.

Parameters Max. and Min. HF frequency must be set according to the nominal frequency of the labels in such a way that the nominal frequency is midway between the maximum and minimum HF frequency. For labels with a nominal frequency of 8,2MHz it is appropriate to set the Min. HF frequency to 7,65MHz and the Max. HF

frequency to 8,75MHz. A narrower interval reduces the sensitivity to external interference but also reduces the detection distance of the labels with greater tolerance.

The **MODE** parameter has to be set to master - **NASt** because there will be at least one other TX antenna operating in the SLAVE mode connected to the MASTER TX antenna.

In the MASTER mode, the parameter **Slave timing** is fixed and the pre-set value has no effect on the electronics operation. Disconnect the power adapter.

3. In order to minimize interference and for the correct operation of TX modules, it is necessary to terminate the TX module communication lines. Therefore it is necessary to insert the TX electronics into the last antenna, connect the network adapter and set the TX module parameter MODE to slave - **SLAu** and transmitting power to 0%. If the error message Er_3 is displayed on the TX SLAVE electronics, there is a fault on the wires connecting the MASTER SLAVE SYNC terminals (pins 8, 9). If the error message Er_2 is displayed, there is a fault on the wires connecting the MASTER SLAVE FREQ terminals (pins 11, 12). Red jumpers connecting the termination resistors of communication lines must be inserted on both modules. On all other TX modules the red jumpers must be taken out. The jumpers are only at the beginning and end of the TX-TX connection cable.

4. Insert the electronics into the RX antenna which is located between the TX MASTER antenna and the first TX SLAVE antenna. Electronics in the RX antenna must be connected to the TX MASTER antenna via a TX-RX cable. Connect the AC adapter to the TX MASTER antenna. If all is well the display on the TX MASTER electronics (after the initial tests) prints **--r0** or **r1--** depending on what address is set in the RX electronics.

After the initial tests, the RX electronics prints **CONU** and afterwards displays the sweeping frequency and transmitted power by the TX electronics. Then, the display shows ----. with a decimal point after the last minus. At this stage, the electronics are fine, but the calibration of the HF frequencies in the TX electronics is not yet finished. After the calibration, the RX module will display the parameter 01. If the electronics in the RX beeps and lights up twice consecutively, it means that the input circuitry of the RX electronics is saturated and the display shows a blinking **Er02**. In this case, it is necessary to reduce the gain of the electronics of the RX antenna (HF signal amplification – **GAIn**).

Use the **SELECT** button to set the parameter **HF signal amplification – GAIn**. Reduce the gain value until the **Er02** listing disappears from the display and the parameter 01 appears. Press + to display the parameter 02 (The HF signal value). Two values are displayed, one without and one with a decimal point - the numbers should not differ by more than 6, and they should not be higher than 20 (%). If larger, further reduce the gain value until the parameter 02 has the desired value.

Afterwards, press + to display the parameter 03 (HF signal interference level), the interference should not be greater than 1. If it is larger, there is a mono or a dual system operating nearby or there is major interference from the electronic equipment near the installation. Press + to display the parameter 04 (evaluated signal resonance value), the resonance should not be higher than 25, usually 10 to 15. If the resonance is greater than 25, it must be checked whether there isn't a forgotten label nearby. If not, modify the parameter **Sensitivity of the system (SEnS)** until the resonance is less than 25 and the parameter Sensitivity will have a higher value than 15. If the resonance is still too high, reduce the value of HF signal amplification.

Set the parameter **Label detection response time** (**rESP**) to **rELo** – longer detection time and the parameter **External noise** (**nolS**) to medium interference **noNE**. Set the parameters of visual and audio signalization according to customer's requirements.

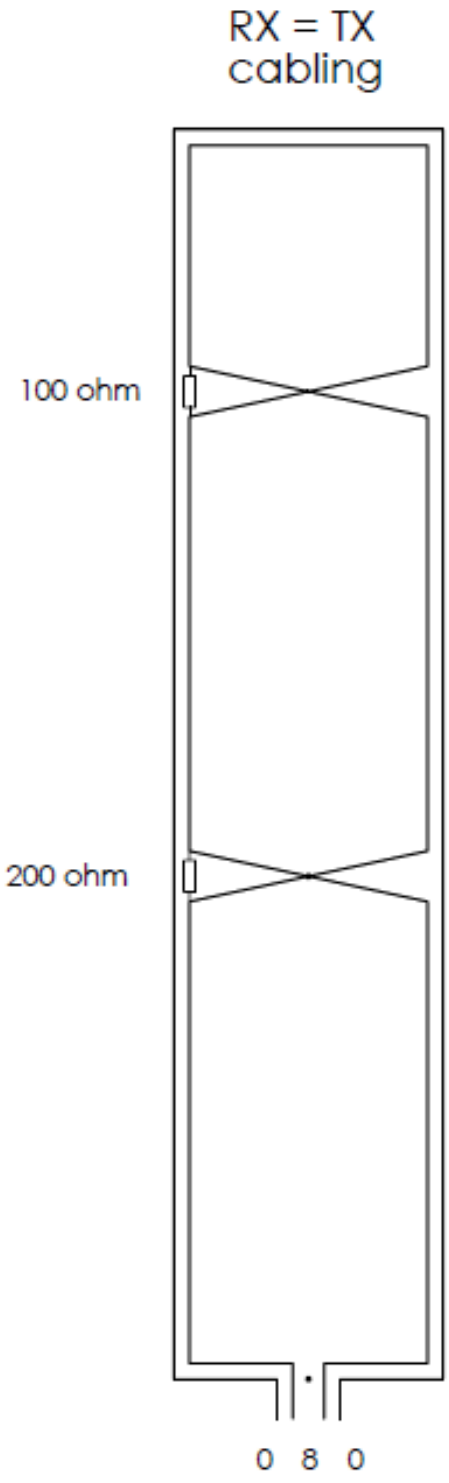
The parameter **RX module internal address N r0**, **N r1** can be set to 0 or 1 – the setting is relevant only if the TX antenna is connected to two RX antennas, hence if the installation has an odd number of antennas. When the number of antennas in the installation is odd, set the address to 1, all other electronics in the RX antennas are set to address 0 regardless of how many antennas is the installation comprised of. After setting the TX and RX modules, wait for cca 1 min. and check the detection distance. Displayed parameter 06 (Reference level of label detection signal) displays the signal level from which is the label detected. A value of 100% means, that given the set parameters at both modules, the distance is maximum possible. If the value is greater, interference plays a role and the detection distance is shorter. Displayed parameter 05 (Current value of label detection signal) indicates the interference in the installation area. For example, when the display shows a value of 40%, it means that the interference level is at 40% of the reference value of the label detection signal, which in this case leaves a 60% margin until the detection.

If the total number of antennas in the installation is odd, the series starts with an RX antenna. Disconnect the AC adapter, insert the RX electronics into the first RX antenna, connect the AC adapter and set the RX electronics. As the first parameter, set the **RX electronics internal address** to **N r0** and then set all the other parameters of the RX electronics.

5. Insert the TX electronics into the first TX SLAVE antenna (second TX antenna in the series). Connect the AC adapter of the TX antenna and adjust the parameters of the TX electronics. As the first parameter, set the parameter **MODE** to slave mode - **SLAu**.

If the display continues to show **----** everything is correctly set and the electronics in the TX MASTER and TX SLAVE antennas communicate. If the electronics in the TX SLAVE antenna shows an error message **Er_3**, there is a problem with the wires interconnecting the pins MASTER SLAVE SYNC. (pins 8, 9). If the error message is **Er_2**, the problem is with the wires interconnecting the pins MASTER SLAVE FREQ. (pins 11, 12). If all goes successfully, set the transmitted power of the TX SLAVE electronics to the same value as the TX MASTER electronics. After that, you need to set the parameter **Slave timing**.

Use the + or – buttons on the RX electronics to display the parameter 02 (The HF signal value). Use the TX SLAVE electronics buttons to set such a value of **Slave timing** at which the parameter 02 of the RX electronics exhibits the smallest difference between the two displayed values (with and without a decimal point), while only the difference is relevant, not the absolute values of the numbers. Afterwards, wait for approx. 1 minute and check the detection distance in both passages neighbouring the RX antenna. If everything is OK, disconnect the AC adapter of the TX SLAVE antenna and insert the RX electronics to a different RX antenna which is connected to the next TX SLAVE antenna. Connect the AC adapter and proceed as in paragraph 3 to set the parameters of electronics in the second RX antenna. After setting the RX electronics, connect another TX SLAVE antenna and repeat the procedure of paragraph 4. In this way, connect and set all the antennas in the installation.


RX = TX
cabling
100 ohm
200 ohm
0 8 0

Error messages

The error messages are indicated on the display. Two types of errors are displayed. The first type are errors that do not allow the program to run normally and therefore the processor is reset when an error is displayed. This type of error can only be removed by replacing the TX Module. These are the following errors:

Display	Error type	Method of removal
0	internal electronics board error	call service
1	internal electronics board error	if the error does not end within 5 min. call service
2	internal electronics board error	call service
3	internal electronics board error	call service
4	internal electronics board error	call service
5	internal electronics board error	call service
6	internal electronics board error	call service
7	internal electronics board error	if the error does not end within 5 min. call service
Er_3 to Er99	internal electronics board error	call service

The second type of error is shown by the display while the buttons are functional and the error can be removed in some cases.

Er_1 Incorrect supply voltage for output HF stage

The error display alternates with the voltage deviation value, the negative value indicates that the voltage is lower than the required value. The most common cause of the error is the low voltage on the AC adapter (low line voltage) and the output power at 90 to 100%. The error can be eliminated by reducing the output power to less than 80%. If the error is not rectified or the line voltage is within the permitted tolerance (230 + - 10%), the electronics must be replaced.

Er_2 TX module does not receive HF signal from TX MASTER module

Error display alternates with **SLFr** – Slave frequency. The error will only appear if the TX module is set to Mode **SLAu.** Is SLAVE mode required?. If so, check if the TX module that should work in MASTER mode has the **Mode NASt** - MASTER parameter set. If yes, then the fault is probably on the wires connecting MASTER SLAVE FREQ terminals (pins 11, 12), or in incorrect wiring (poor wiring in jumper cable). Check the correct connection of the wires.

Er_3 TX module does not receive synchronization signal from TX MASTER module

Error display alternates with **SlCo** – Slave communication statement. The error will only appear if the TX module is set to Mode **SLAu**. Is SLAVE mode required?. If so, check if the TX module that should work in MASTER mode has the **Mode NASt** - MASTER parameter set. If so, the error is probably on the wires connecting MASTER SLAVE SYNC terminals (pins 8,9), or in incorrect wiring (poor wiring in jumper cable). Check the correct connection of the wires.

Er_4 The maximum temperature of the HF output stage transistors has been exceeded

The error display alternates with the measured temperature of the transistors. If the temperature exceeds 100 °C, the software will lock the HF transmitter. After the temperature drops to 80 °C the transmitter starts functioning again. During the HF signal blocking, the RX modules (connected to the TX module) do not evaluate alarms. If the TX module is in Master mode, the TX modules operating in the Slave mode operate normally – they receive both the sync pulses and the HF frequency, only the TX Master module output stage is switched off.