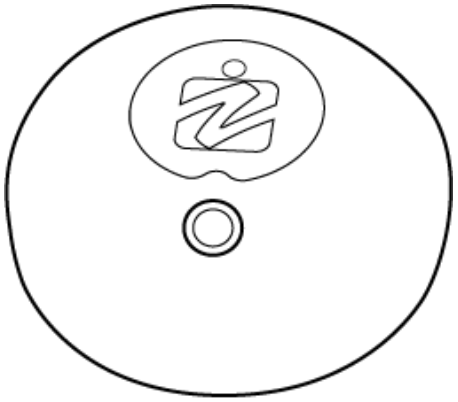
tele radio®
wireless solutions

safe
smart
strong

INSTALLATION INSTRUCTIONS

Repeater: D5-21



IM-ANC-DX101-EN-v03
Language: English (original)

D5

©Tele Radio AB

Datavägen 21

SE-436 32 Askim

Sweden

Phone: +46 (0)31 748 54 60

CHAPTER 1: INTRODUCTION **4**
1.1 About this document 6
1.2 About D5 repeater & active antenna 7
CHAPTER 2: SAFETY **8**
2.1 Warnings & restrictions 8
CHAPTER 3: FUNCTIONAL SAFETY **11**
CHAPTER 4: TECHNICAL DATA **12**
4.1 Current consumption 12
CHAPTER 5: PRODUCT GENERAL DESCRIPTION **13**
5.1 Repeater description 13
5.2 Mounting dimensions 16
CHAPTER 6: STATUS AND ERROR INDICATIONS **17**
6.1 Indication when in radio session 17
6.2 Indication of operation outcome 17
6.3 Fatal start-up error indication 18
CHAPTER 7: OPERATION **19**
7.1 General information 19
7.2 Registry management mode 19
7.3 Replace transmitters in the repeater 22
7.4 Erase all 22
7.5 Configuration mode via radio 23
CHAPTER 8: WARRANTY, SERVICE, REPAIRS, AND MAINTENANCE **24**
CHAPTER 9: REGULATORY INFORMATION **25**
9.1 Europe 25
9.2 North America 25
ANNEX A: DETAILED INFORMATION ABOUT REPEATERS AND REPEATER TECHNOLOGY **28**
A.1 Concepts used in this document 28
A.2 How to arrange repeaters physically 29
ANNEX B: INDEX **34**

CHAPTER 1: INTRODUCTION

Thank you for purchasing a Tele Radio AB product

Tele Radio AB's product range is composed of transmitters, receivers, and accessories intended for use together as a system.

Tele Radio AB systems are mainly intended for the industrial, lifting, hydraulic and mobile equipment markets.

READ ALL INSTRUCTIONS AND WARNINGS CAREFULLY BEFORE MOUNTING, INSTALLING, CONFIGURING AND OPERATING THE PRODUCTS.

These Installation instructions have been published by Tele Radio AB and are not subject to any guarantees. The Installation instructions may be withdrawn or revised by Tele Radio AB at any time and without further notice.

IMPORTANT! These instructions are intended for installers and authorized service and distribution centers. The instructions containing information about the installation and configuration of the radio remote control unit on the machine are NOT intended to be passed on to the end user. Only information that is needed to operate the machine correctly by radio remote control may be passed on to the end user.

Tele Radio AB remote controls are often built into wider applications. It is the responsibility of any such users or integrators to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use. Tele Radio AB shall not be responsible or liable for misuse of the information contained herein.

Always refer to the applicable local regulations for installation and safety requirements relating to cranes, hoists, material handling applications, lifting equipment, industrial machinery, and/or mobile hydraulic applications using Tele Radio AB products, e.g.:

- applicable local and industrial standards and requirements,
- applicable occupational health and safety regulations,
- applicable safety rules and procedures for the factory where the equipment is being used,
- user and safety manuals or instructions of the manufacturer of the equipment where Tele Radio AB remote control systems are installed.

Tele Radio AB Installation instructions do not include or address the specific instructions and safety warnings of the end product manufacturer.

Tele Radio AB products are covered by a warranty against material, construction, or manufacturing faults. See "Chapter 8: Warranty, service, repairs, and maintenance".

1.1 About this document

Before installing or operating the product, read the corresponding documentation carefully.

Tele Radio AB's product range is composed of transmitters, receivers, and accessories intended for use together as a system.

These Installation instructions cover main technical specifications, standard installation, configuration and operating instructions, as well as general troubleshooting.

Please report any error or omission in this document, as well as any improvement or amendment suggestion to td@tele-radio.com.

1.1.1 COPYRIGHT

Information in this document is subject to change without notice. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, photographic, mechanical (including photocopying), recording or otherwise for any purpose other than the purchaser's personal use without the written permission of Tele Radio AB.

1.1.2 TERM AND SYMBOL DEFINITIONS

The capitalized terms and symbol used herein shall have the following meaning:

- WARNING: indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- CAUTION: indicates a hazardous situation which, if not avoided, will result in minor or moderate injury.
- IMPORTANT: is used for information that requires special consideration.
- NOTE: is used to address practices not related to physical injury.

This symbol is used to call attention to safety messages that would be assigned the signal words "WARNING" or "CAUTION".

1.2 About D5 repeater & active antenna

Depending on the application and/or the environment, repeaters or active antennas can be installed in all Puma and Panther systems to optimize data transmission.

D5-21 is a combined repeater / active antenna that can be used to extend transmissions so that the signal can cover greater distances or be received on the other side of an obstruction.

D5-21 repeaters are configured by default for Puma systems but can easily be set for a Panther systems. Contact your representative for assistance.

An active antenna is recommended whenever strict control distances are required or when the receiver is mounted in close proximity to unintentional electronic emitters, e.g. a truck alternator, welding machine or a variable frequency drive. If needed, the active antenna can be used together with one or more repeaters. When used as an active antenna, D5-21 is connected to the receiver via a bus-cable.

Each repeater is independent and has a range depending on the environment. A Puma system can have up to fifteen repeaters simultaneously, a Panther system can have up to eight.

1.2.1 SYSTEM RADIO FREQUENCY

D5-21 repeaters operate on the frequency band 2.4 GHz. The frequency band has been divided into 16 channels (11 to 26). Once the channel has been selected on the transmitter, the receivers and repeaters will automatically detect and switch to the same channel.

CHAPTER 2: SAFETY

This product is to be used together with a Tele Radio AB radio system including one or more transmitters and receivers.

2.1 Warnings & restrictions

Carefully read through the following safety instructions before proceeding with the installation, configuration, operation, or maintenance of the product. Failure to follow these warnings could result in death or serious injury.

This product must not be operated without having read and understood the Installation instructions, the specific technical documentation (for customized systems), and having received the appropriate training. The purchaser of this product has been instructed how to handle the system safely. The following information is intended for use as a complement to applicable local regulations and standards.

IMPORTANT! Tele Radio AB remote controls are often built into wider applications. These systems should be equipped with:

- **a wired emergency stop where necessary**
- **a brake**
- **an audible or visual warning signal**

2.1.1 INSTALLATION AND COMMISSIONING

IMPORTANT! Only licensed or qualified personnel should be permitted to install the product.

This radio system must not be used in areas where there is a risk of explosion.

Always switch off all electrical power from the equipment before installation procedure.

RISK OF UNINTENDED EQUIPMENT OPERATION

Only transmitters that are intended for use should be registered in the receiver.

Failure to follow these instructions could result in death, serious injury, or equipment damage.

- **The product must be securely attached and located where it will not be hit by e.g. any moving parts.**
- **Do not install the product in areas affected by strong vibrations**
- **Cable glands and vent plugs must face downwards to prevent water ingress.**
- **Ensure that the power supply is connected to the correct terminals.**
- **Ensure that flexible cords and cables are not damaged through friction or stress.**
- **Do not use damaged cables.**
- **Ensure cables and connectors do not hang loose.**

- The product is designed to withstand normal weather conditions but should be protected from extreme conditions.
- Mount the product in a location where the LED(s) are easily visible and the button accessible.
- Make sure to install available accessories inside or on the repeater before permanently installing the repeater . A permanent installation of the product must include fuse protection of the equipment and cables against short circuits.

2.1.2 OPERATION

The D5 repeaters are to be part of a system where operations are performed on the transmitter. The following warning and restrictions apply to a system.

- **Only qualified personnel should be permitted to access the transmitter and operate the equipment.**
- **Make sure that the user satisfies the age requirements in your country for operating the equipment.**
- **Make sure that the user is not under the influence of drugs, alcohol and medications.**
- **Make sure that the user knows and follows operating and maintenance instructions as well as all applicable safety procedures and requirements.**
- **The user should:**
  - **Never leave the transmitter unattended.**
  - **Always switch the transmitter off when not in use. Store in a safe place.**
  - **Keep a clear view of the work area at all times.**

2.1.3 MAINTENANCE

Before maintenance intervention on any remote controlled equipments:
• always remove all electrical power from the equipment.
• always follow lockout procedures.

- Keep the safety information for future reference. Always download the Installation instructions from our website, www.tele-radio.com, for the latest available version.
- If error messages are shown, it is very important to find out what caused them. Contact your representative for help.
- If the stop button is mechanically damaged, do not use the transmitter. Contact your supervisor or representative for service immediately.
- Keep contacts and antennas clean.
- Wipe off dust using a clean, slightly damp cloth.
- Never use cleaning solutions.
- Check the encapsulation, foils and cable for damages. If the encapsulation or foil is damaged, moisture can cause serious damage to the electronics.

CHAPTER 3: FUNCTIONAL SAFETY

NOTE: This section applies to repeaters used together with a Puma or Panther system with functional safety (safety-related stop function):

- R20, R21, T24, T26, T28 (Puma)
- R15, R23, T19, T25, T27 (Panther)

IMPORTANT! Adding one or more repeater(s) to a Tele Radio AB radio system (receiver + transmitter) does not modify the original safety level achieved by the system.

If the main radio system – receiver(s) + transmitter(s) – is configured to fulfill the safety level on the safety-related stop function, the safety level remains valid even when the radio protocol goes through the repeater.

If the main radio system – receiver(s) + transmitter(s) – is configured NOT to fulfill the safety level, there will be no safety level either when the radio protocol goes through the repeater.

NOTE: The safety level of the stop function on the complete end-user system depends on other subsystem(s) and needs to be calculated by the manufacturer of the complete system.

For more information about the safety-related stop function, please refer to the corresponding receiver or transmitter Installation instructions.

CHAPTER 4: TECHNICAL DATA

REPEATER	D5-21
Power supply	12 ... 24 VDC (-50% ... +35%)
Current consumption	max. 100 mA
Frequency	2405 – 2480 MHz
Connector	M12 5-pin male
Radio communication	Duplex
Radio frequency output power	EIRP: < 10 dBm (10 mW)
Range	100 m (328 ft), adjustable depending on configuration
IP code	IP67
Operating temperature	-20...+55 °C / -4...+130 °F
Cable length	~ 1.8 m / 5,9 ft
Dimension	~ Ø62 x 37 mm / ~ Ø2.44 x 1.46 in
Weight (typical)	~ 137 g / 0.3 lbs

4.1 Current consumption

Input power	D5-21	
	Min.*	Max.**
12 V DC	28 mA	35 mA
24 V DC	16 mA	20 mA

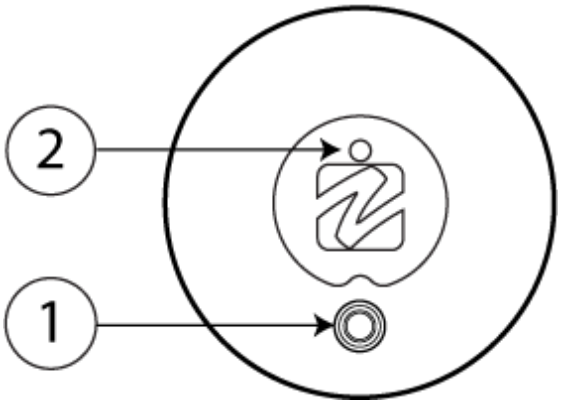
*Minimum current consumption = repeater powered, no radio session established.

**Maximum current consumption = repeater powered, radio session established.

CHAPTER 5: PRODUCT GENERAL DESCRIPTION

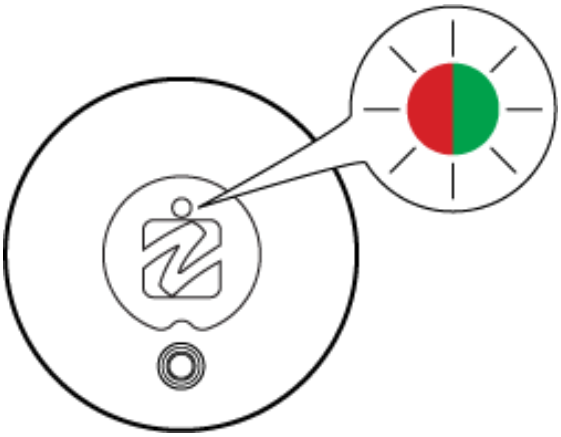
NOTE: The pictures shown in this chapter are for illustrative purposes only. Depending on the configuration, the actual product appearance may differ from the basic model used for reference.

5.1 Repeater description



1. Function button
2. Indication LED

5.1.1 LED INDICATOR



The repeater is equipped with one bi-color LED. This LED is used to give status and error indications about the repeater and operations (see "6.2 Indication of operation outcome").

Flashing type	Time LED is on	Time LED is off
Fast	200 ms	200 ms
Slow	700 ms	700 ms

5.1.2 CAP SENSOR BUTTON ACTIONS

The repeater is equipped with one **Cap sensor** button with two possible user interfaces allowing for different actions, e.g. accessing the **registry management mode** and enable the registration, replace, and erase functions.

Tapping actions

Tap the function button ...	**Action**
10 times within 10 s	Erase all registered receiver/ transmitter IDs from the repeater. See "7.4 Erase all"

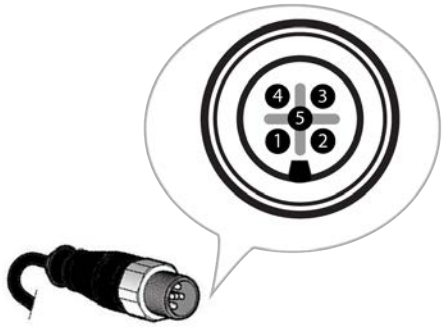
Touch and hold actions

Touch and hold the function button for ...	**LED indication**	**Action**
5 s < ... < 12 s	Red LED flashing slow	Enter **registry management mode**
≥ 12 s	Red LED lit steady	Enter **configuration mode** via radio[1]

[1]Only for Puma systems.

5.1.3 M12 CONNECTOR

The M12 connector is used for communication, and also for programming/flashing the unit when connected to a D2-17[1].



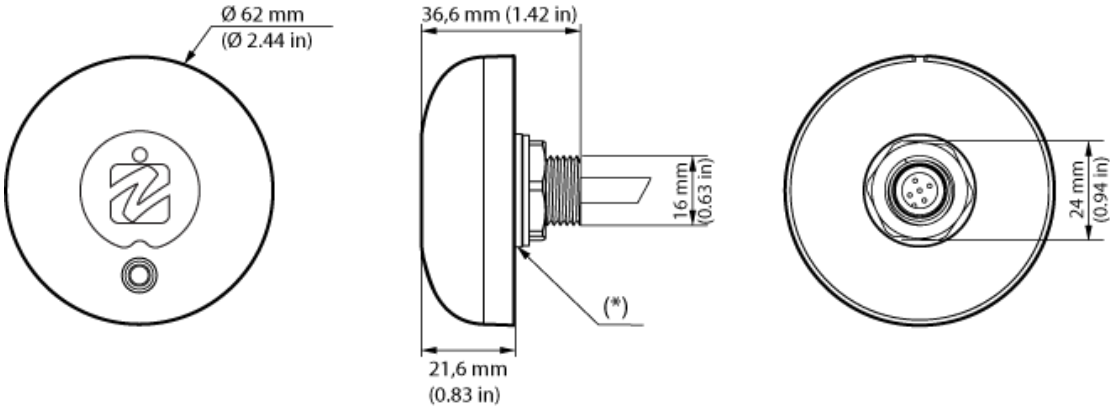
Male connector

Pin	Signal	Cable color[2]
1	RS485_SHLD	White-Brown
2	V+ (from power supply)	White-Blue
3	GND	Blue
4	RS485B	Brown
5	RS485A	Orange

[1]Do not use a D2-11 module for programming/flashing the unit, it will brick the device. Contact your representative for assistance.

[2]Connector on the repeater

5.2 Mounting dimensions



5.2.1 PRECAUTIONS FOR THE INSTALLATION OF THE REPEATER/ ACTIVE ANTENNA

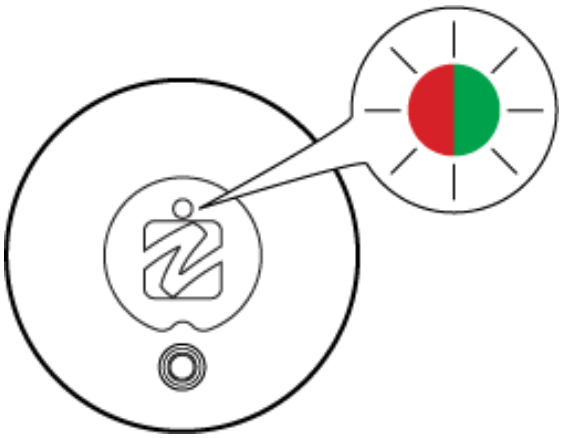
Before connecting the equipment, make sure that the power supply is switched off.

IMPORTANT! Only authorized personnel should install the product.

Only correct installation meets the safety levels for the product.

- Install the repeater/active antenna in a location where the LED and button can easily be seen and accessed.
- For optimum performance, place the repeater/ active antennas away from metal objects such as metal girders, high-voltage cables, and other antennas.
- Keep the longest distance possible between the repeater and e.g. engines, welding machines, power sources, inverters, x-ray devices and other radio transmitters.
- Any repeater that is mounted separately must be positioned in as open a space as possible. A hidden antenna significantly impairs the reception.
- Do not mount the repeater/ active antenna in a locker.
- Test the equipment before installing the repeater/ active antenna permanently.

CHAPTER 6: STATUS AND ERROR INDICATIONS



Repeater status and errors are indicated with the bi-color LED (indication LED).

6.1 Indication when in radio session

When the repeater is in session, the green LED flashes once, very briefly, for each packet received/sent.

6.2 Indication of operation outcome

Operation outcome ('Store success', 'Erase success' or failure) is indicated by the LED flashing according to following:

Designation	Description	LED color	Number of flashes	Type of flashes	Comments
'Store success'	Something was successfully stored in settings.	Green	3	fast	The three flashes may look like two flashes if the LED was previously lit.
'Erase success'	Something was successfully erased from settings.	Red/green alternatively	3	fast	The three flashes may look like two flashes if the LED was previously lit.
Failure	The procedure was not successful.	Red	7	fast	The seven flashes may look like six flashes if the LED was previously lit.

6.3 Fatal start-up error indication

The green LED flashes fast and the red LED is constantly lit, making it look like fast flashing between red and orange.

NOTE: The orange and red colors on the LED are very similar.

CHAPTER 7: OPERATION

7.1 General information

To control a receiver, the transmitter must be registered and logged in to the receiver. If another transmitter is already logged in to the receiver, it must be logged out before a different transmitter can be logged in.

More than one transmitter can be registered in the receiver, but only one transmitter can be logged in at a time.

7.2 Registry management mode

In this mode the repeater will either register a receiver-id (Puma systems), or a transmitter-id (Panther systems), if it has not been previously stored, or erase it if it has already been stored.

When the repeater enters **registry management mode** it will remain in that mode for 30 seconds.

- **Puma systems:**

If no receiver has responded to the registration/erase packets within 30 s, the repeater will exit **registry management mode** and indicate failure.

- **Panther systems:**

If no transmitter registration packets have been received within 30 s, the repeater will exit **registry management mode** and indicate failure.

7.2.1 ENTER REGISTRY MANAGEMENT MODE

NOTE: The repeater must not be in a radio session for this procedure to succeed.

1. Touch and hold the **Function** button for 5 s or until the LED starts flashing slow.
2. Release the **Function** button.
   *The repeater enters **registry management mode** (if it is not in an active radio session). It will remain in that mode for 30 seconds.*

7.2.2 REGISTER / ERASE PUMA RECEIVERS IN THE REPEATER

NOTE: Only for Puma systems.

Register

IMPORTANT! For the registration procedure to be successful:

- **The receiver must not have been previously registered in the repeater.**
- **The receiver must be in registration mode.**
- **The repeater must be in registry management mode.**

If a receiver responds and is successfully stored, the repeater exits **registry management mode** and indicates 'Store success' (see "5.1.1 LED indicator"). If no receiver has responded within 30 s, the repeater will exit **registry management mode** and indicate failure.

NOTE: The configuration ID set in the repeater must match the configuration ID in the receiver. If not, the receiver will not respond and the repeater will indicate failure.

Erase

IMPORTANT! For the erase procedure to be successful:

- **The receiver must have been previously registered in the repeater.**
- **The receiver must be in registration mode.**
- **The repeater must be in registry management mode.**

If a receiver responds and is successfully erased, the repeater exits **registry management mode** and indicates 'Erase success'[1] (see "5.1.1 LED indicator"). If no receiver has responded within 30 s, the repeater will exit **registry management mode** and indicate failure.

NOTE: The configuration ID set in the repeater must match the configuration ID in the receiver. If not, the receiver will not respond and the repeater will indicate failure.

[1] If the receiver was not registered in the repeater, the indication will still be successful as the outcome is be the same: the receiver in question is not stored in the repeater.

7.2.3 REGISTER / ERASE PANTHER TRANSMITTERS IN THE REPEATER

NOTE: Only for Panther systems.

Register

IMPORTANT! For the registration procedure to be successful:

- **The transmitter must not have been previously registered in the repeater.**
- **The transmitter must send registration packets.**
- **The repeater must be in registry management mode.**

If transmitter registration packets are received and the transmitter is successfully stored, the repeater exits **registry management mode** and indicates 'Store success' (see "5.1.1 LED indicator"). If no transmitter registration packets have been received within 30 s, the repeater will exit **registry management mode** and indicate failure.

NOTE: If there are no free memory in the repeater to store more transmitters, the repeater will indicate a general failure when trying to enter **registry management mode**.

Erase

IMPORTANT! For the erase procedure to be successful:

- **The transmitter must have been previously registered in the repeater.**
- **The transmitter must send registration packets. [1]**
- **The repeater must be in registry management mode.**

If transmitter registration packets are received and the transmitter is successfully erased, the repeater exits **registry management mode** and indicates 'Erase success'[2] (see "5.1.1 LED indicator"). If no transmitter registration packets have been received within 30 s, the repeater will exit **registry management mode** and indicate failure.

[1] Panther transmitter with menu option are not yet available.

[2] If the transmitter was not registered in the repeater, the indication will still be successful as the outcome is be the same: the receiver in question is not stored in the repeater.

7.3 Replace transmitters in the repeater

NOTE: Only for Panther systems.

NOTE: This instruction is intented for repeaters with software version **SW0043-04v01pre7** or higher.

IMPORTANT! For the replace procedure to succeed:

- **The transmitter to be replaced must have been previously registered in the repeater.**

NOTE: The transmitter that will be replacing the old transmitter can either be already registered in the repeater or not.

If transmitter replace packets are received and the old transmitter is successfully replaced, the repeater indicates 'Store success' (see "5.1.1 LED indicator"). If no transmitter replace packets have been received within 30 s, the repeater will indicate failure.

7.4 Erase all

1. Quickly tap the **Function** button 10 times within 10 seconds.
   All registered receiver IDs (Puma)/ transmitter IDs (Panther) have been erased from the repeater.

7.5 Configuration mode via radio

NOTE: Only for Puma systems.

IMPORTANT! To be able to communicate with each other, the repeater, the receiver and the transmitter must have the same configuration ID. The configuration ID is set in SM (V or higher).

IMPORTANT! It is strongly recommended to have only one repeater powered up and in range of the transmitter when performing configuration via radio.

The configuration mode allows to set the **slot id** [1] via radio, from a Puma transmitter.

Once the repeater has entered the configuration mode via the **Function** button, it will remain in this mode for 30 seconds, or until a transmitter starts sending configuration packets, and if so, it will remain in configuration mode indefinitely or until the transmitter terminates the configuration session.

7.5.1 ENTER CONFIGURATION MODE VIA RADIO

NOTE: The repeater must not be in a radio session for this procedure to succeed.

When the repeater enters **configuration mode** via radio it will remain in that mode for 30 seconds.

1. Press and hold the **Function** button for 12 seconds or until the red LED stops flashing and stays lit.
2. Release the **Function** button.
   The repeater enters configuration mode .

For more details on how to change the **slot id**, please refer to the *Configure repeater slot ID* instruction in the corresponding transmitter installation instruction[2].

[1]Correspond to the position number (0–14) of the repeater when used in a chain of repeaters. Where 0 corresponds to the first repeater in the chain and 14 is the last one.

[2]IM-PM-TX101 (T24) or IM-PM-TX102 (T26).

CHAPTER 8: WARRANTY, SERVICE, REPAIRS, AND MAINTENANCE

Tele Radio AB products are covered by a warranty against material, construction and manufacturing faults. During the warranty period, Tele Radio AB may replace the product or faulty parts. Work under warranty must be performed by Tele Radio AB or by an authorized service center specified by Tele Radio AB.

The following are **not** covered by the warranty:

- Faults resulting from normal wear and tear
- Parts of a consumable nature
- Products that have been subject to unauthorized modifications
- Faults resulting from incorrect installation and use
- Damp and water damage

Maintenance

Repairs and maintenance must be performed by qualified personnel

Only use spare parts from Tele Radio AB

Contact your representative for service or any other assistance

Keep contacts and antennas clean

Wipe off dust using a slightly damp, clean cloth

NOTE: Never use cleaning solutions or high-pressure washer.

CHAPTER 9: REGULATORY INFORMATION

9.1 Europe

Applies to:

D5-21

9.1.1 CE MARKING

Hereby, Tele Radio AB, declares that the radio equipment type(s) listed above is/ are in compliance with the Radio Equipment Directive 2014/53/EU.

The latest version of the complete EU Declaration of Conformity is available on the Tele Radio AB website, www.tele-radio.com.

9.1.2 WEEE DIRECTIVE

This symbol means that inoperative electrical and electronic products must not be mixed with household waste. The European Union has implemented a collection and recycling system for which producers are responsible. For proper treatment, recovery and recycling, please take this product to a designated collection point.

Tele Radio AB strives to minimize the use of hazardous materials, promotes reuse and recycling, and reduces emissions to air, soil and water. When a commercially viable alternative is available, Tele Radio AB strives to restrict or eliminate substances and materials that pose an environmental, health or safety risk.

9.2 North America

Applies to:

D5-21

9.2.1 FCC STATEMENT

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To satisfy FCC RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended.

9.2.2 IC STATEMENT

This product complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of device.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes :

1) l’appareil ne doit pas produire de brouillage;

2) l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in

this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Gain of antenna: 3.0 dBi max.

Type of antenna: 50 ohm, Omni-directional

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous ayant le gain admissible maximal et l'impédance requise pour chaque type d'antenne indiqué. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Gain d'antenne: 3.0 dBi maximum

Type d'antenne: 50 ohm, omnidirectionnel

To satisfy IC RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended.

Afin d'assurer la conformité aux exigences de la IC en matière d'exposition aux RF, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toute personne à proximité pendant le fonctionnement de l'appareil. Pour assurer le respect de ces exigences, il n'est pas recommandé d'utiliser l'appareil à une distance inférieure à celle-ci.

9.2.3 FCC/IC LABELS

The FCC ID and IC numbers can be found printed on the product label, as per below.

ANNEX A: DETAILED INFORMATION ABOUT REPEATERS AND REPEATER TECHNOLOGY

The diagrams used in this document are for illustrative purposes only.

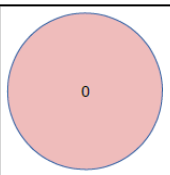
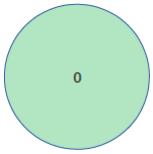
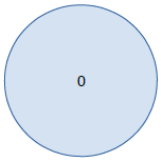
A.1 Concepts used in this document 28

A.2 How to arrange repeaters physically 29

A.1 Concepts used in this document

This chapter presents the different symbols used for transmitters, receivers and repeaters and explain how the diagrams used later on in this document should be interpreted.

A.1.1 SYMBOLS AND THEIR DESCRIPTIONS

			
Color	Red	Green	Blue
Description	Transmitter	Receiver	Repeater
The big circle represents	The coverage area of the transmitter when it's sending	The coverage area of the receiver feedback radio signal	The coverage area of the repeater radio signal.
The "0" in the center represents	the physical transmitter.	the physical receiver.	the physical repeater[1]

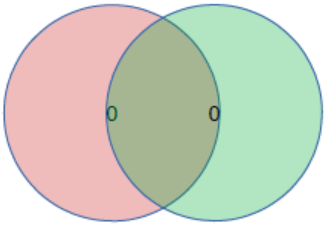
NOTE: All symbols presented above presume that there is balance between the transmission power of the transmitter, receiver and repeater.

A.1.2 BASIC COMMUNICATION DIAGRAMS

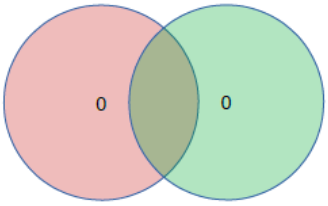
For a transmitter and receiver to be able to communicate, the red area of the transmitter must overlap the green area of the receiver and include the receiver itself.

[1]When there is another number than "Zero", it represents the repeater SlotID.

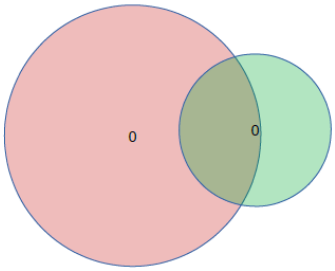
In the diagram below, the radio coverage is just enough to allow the two units to communicate.



In the following diagram however, the two units are unable to communicate, the red area does include the receiver, and vice versa.



The following diagram shows what happens if the transmission power of the transmitter and the receiver is not balanced. Here, the transmission power of the transmitter is superior to that of the receiver: the receiver will be able to hear the transmitter, but the feedback from the receiver (if any) cannot reach the transmitter.



NOTE: All the assumptions above are simplified. The area covered by an RF device is not only determined by the transmission power of the sending device, it also depends on the sensitivity of the receiving device. As an example, installing a better antenna on the receiver will allow to have the transmitter positioned further away, while keeping the same transmission power. But for the sake of simplicity, this is kept out of the scope of this document.

A.2 How to arrange repeaters physically

There are a few simple rules that repeaters follow:

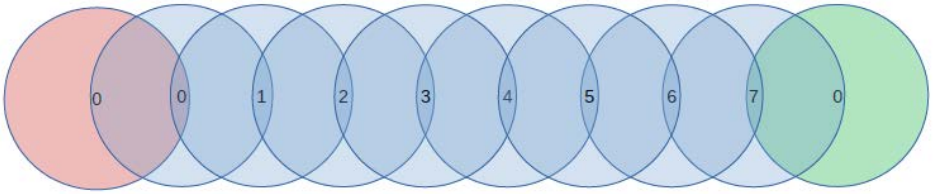
1. Each repeater will repeat packets in its own timeslot, and only in this particular timeslot.
2. Each repeater must have a unique timeslot.
3. The closer a repeaters is to the transmitter, the earlier its timeslot will be available and the closer a repeater is to the receiver, the later its timeslot will be available (counted from when the transmitter sends its packet).

The consequence of these rules is that repeaters must be arranged in a virtual line, from TX to RX, where the highest slot corresponds to the repeater closest to the receiver. When covering a large area rather than a physical line, repeaters must still be in a virtual line.

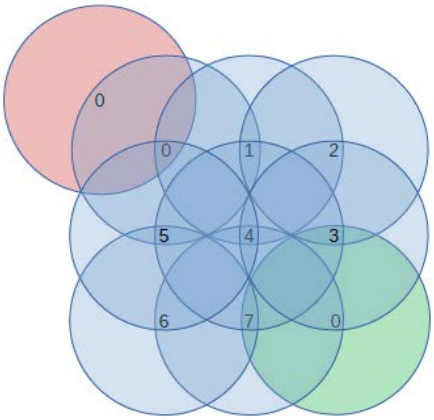
A.2.1 GOOD EXAMPLES OF HOW TO ARRANGE REPEATERS

Below are some good examples of how to arrange repeaters. Each repeater has its slotId written in the middle of the circle:

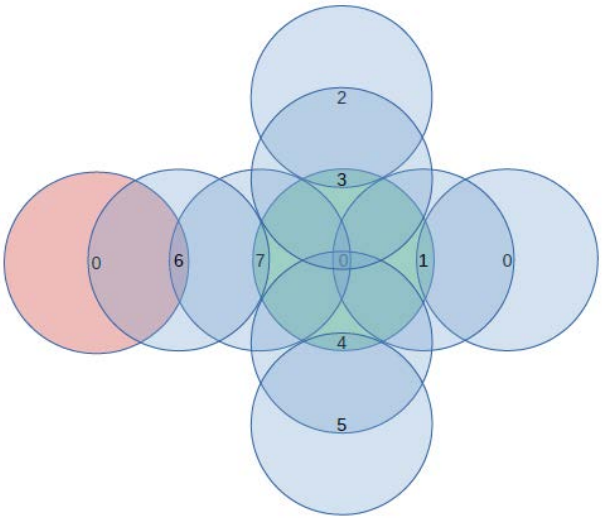
All repeaters in one line



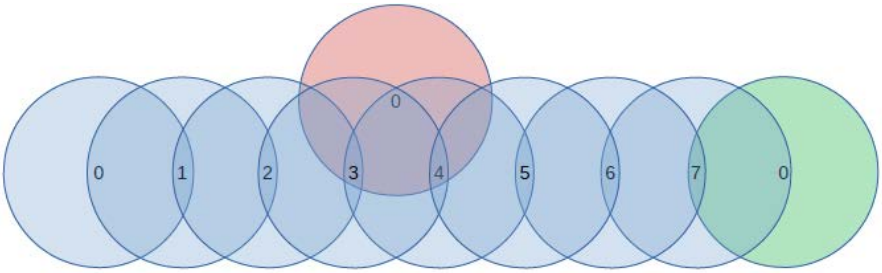
Covering an area



Covering four shorter lines from a receiver positioned in the middle

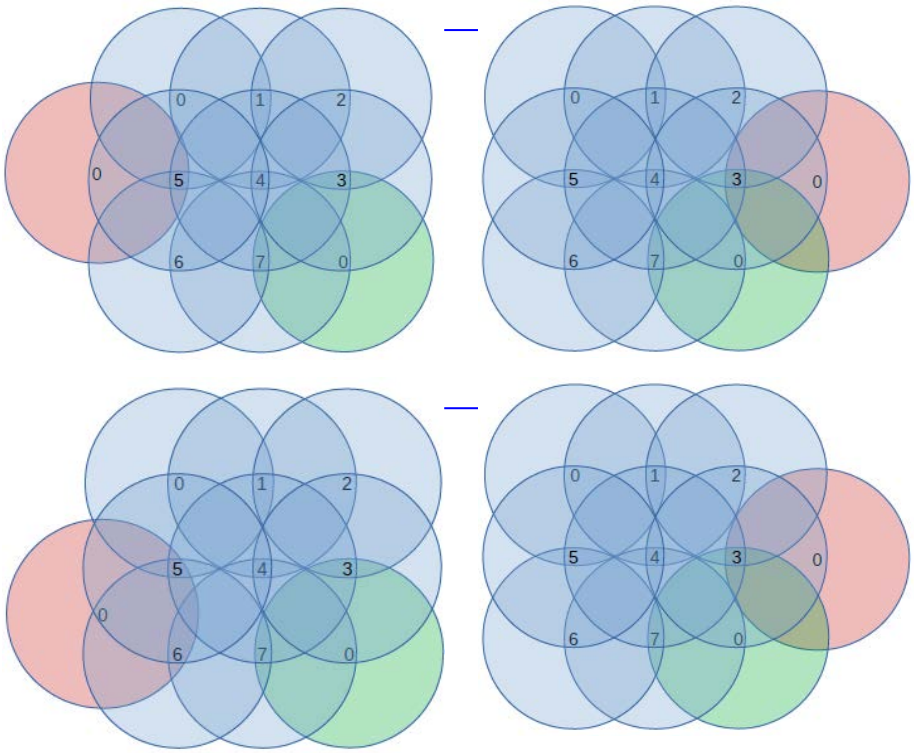


Covering a line with different transmitter positions

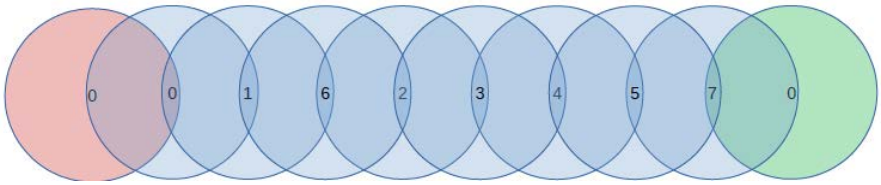


Good as well. Repeater 0, 1 and 2 will never send anything, but it does not matter, the packet is still repeated all the way from the transmitter to the receiver. (The reason for having 0,1 and 2 there, is of course to offer coverage when the transmitter is moved around).

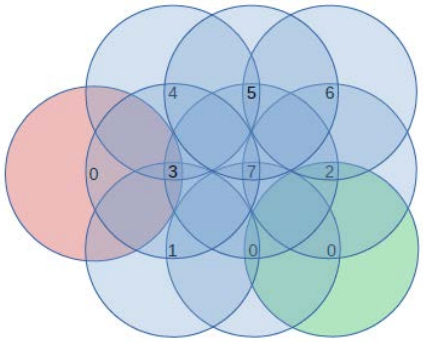
Covering areas with different Transmitter positions



A.2.2 BAD EXAMPLES OF HOW TO ARRANGE REPEATERS



In this example, the packet is repeated through repeater 0, 1 and 6 but when repeater 2 hears the packet from repeater 6 it cannot repeat it. The reason is that repeater slot 6 comes after repeater slot 2 and the timeslot of repeater 2 has already elapsed when repeater 2 will hear repeater 6.



In this arrangement, the packet will be repeated by repeater 3, 4, 5, 6 and 7, but not by repeaters 0, 1 and 2 so nothing will reach the receiver.

NOTE: If the receiver is also moving around, things become more difficult. The general rule is that **there must always be a virtual line of repeaters from the transmitter to the receiver**, where slotIds are decreasing as repeaters get closer to the transmitter and increasing as repeaters get closer to the receiver.

ANNEX B: INDEX

A

Active antenna 7

C

Cap sensor button 14

Configuration mode 23

Current consumption 12

D

Description 13

E

Erase all 22

Erase success 17

Error indications 17

F

Failure 17

Fatal errors 18

FCC statement 25

FCC/IC labels 27

Function button 14

I

IC Statement 26

Installation precausions 16

IP code 12

L

LED indicator 13, 17

M

M12 connector pinout 15

Maintenance 24

Mounting dimensions

Repeater 16

O

Operating temperature 12

Operation outcome indications 17

P

Power LED 13

R

Radio communication 12

Radio frequency output power 12

Register/erase receivers 20

Register/erase transmitters 21

Registration mode 19

Registry management mode 19

Repeater 7

Replace transmitters 22

S

Status indications 17

Store success 17

W

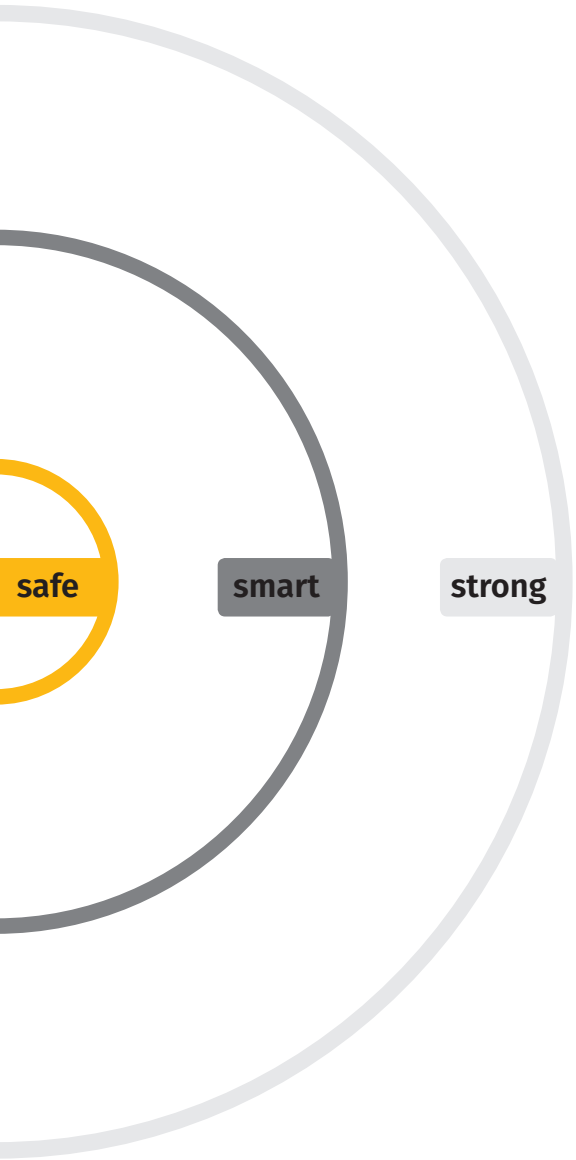
Warnings & restrictions 8

Installation and commission 8

Maintenance 10

Operation 9

WEEE directive 25



tele radio®
wireless solutions

These Installation instructions are subject to change without prior notice.

Download the latest Installation instructions from *www.tele-radio.com* .