Eltek TU 1007 - User Instructions for RP250GD and RP250GDS repeater

Introduction

The RP250GD repeater is a self contained mains operated data packet (GenII protocol only) repeater.
The RP250GDS repeater additionally includes a built switchable loudspeaker for survey applications.

RP250GD Repeater quick summary

- An LCD to view activity and status of transmitters in operation
- Received Signal Strength Indication (RSSi) of incoming transmitter data (chevron bar)

Using the RepConf, Repeater Configuration software you can:

- Authorise transmitters you want to be repeated
- Compensate for systems requiring multiple repeaters
- Conduct a radio survey

Power requirements

The repeater requires permanent AC mains connection. Use only the AC power supply provided. When powered the red LED on the top of the unit will flash. Built-in Ni-Mh batteries provide up to 3 days standby in the event of power failure. A fully discharged battery is normally charged in 72 hours.

- When you first receive the RP250GD the display will read *OFF*
- The display will switch to working mode when the MP12U power supply is connected or by activating the concealed switch if the batteries are suitably charged.
- If you remove the MP12U power supply the unit will stay in working mode until the internal rechargeable batteries are exhausted. The display will then read *OFF*.

The repeater can be turned off by removing the MP12U power supply, then activating the concealed switch accessed by inserting, for instance an unfurled paper clip, through the small hole on the back of the unit. The red LED will stop flashing and the display will read *OFF*.

Product Specification

AC supply:	100 to 250V AC (Use only Eltek power supply type MP12U)
DC input:	12.5VDC Maximum current <70mA
Battery endurance:	typically 72 hours
Freq. UHF (Europe):	default is 434.225Mhz (other frequencies available – refer to Eltek)
Freq. US:	default is 914.5Mhz (other frequencies available – refer to Eltek)
Rx sensitivity:	-117dbm (one chevron on signal strength bar)
Tx RF power:	10mW
Antenna connection:	SMA socket
Antenna - standard:	¼ wave whip (shipped with product)
Antenna - alternative:	Indoor/outdoor dipole, lead length 5M standard, accessory from Eltek Ltd type LW-ANT/sma. The maximum recommended lead length is 10M.
Transmitter spec:	to European spec EN300-200
Temperature Range:	-10 to +55ºC
Humidity:	95% non condensing
Environment:	Indoor use only IP40. A secondary enclosure must be used for outdoor use

User Controls

There are no user controls

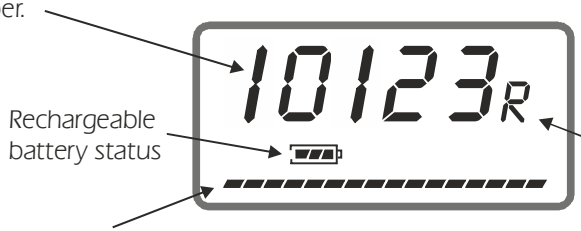
Connectors

DC supply:	2.1MM concentric jack (male)
Comms (serial):	3.5mm stereo jack (applicable up to serial number 8480) – use with lead type LCTX3 6 pin mini din (applicable to serial number 8481 to current) – use with lead type LC68

Indicators

LCD

TX serial number: 5 digits for any valid transmitter being received. Note: the TX serial number will "hang" for 4 seconds unless over-written by a more recent TX serial number.



4 digit display fitted up to serial number 15072

Rechargeable battery status

indicates transmitter configured to repeat

16 x chevron "Received Signal Strength Indication".
6 chevrons is –100dBm, recommended minimum target signal strength

LED

Regular Short Flash: receiver active
Occasional Long Flash: indicates the receiver has successfully received a valid data packet.

Locating the repeater

The repeater and antenna should be located clear of sources of interference, especially that generated by I.T. equipment, and away from surfaces that can compromise RF performance, e.g. heavy steel or damp or reinforced walls. Use the optional dipole antenna to maximise coverage.(see also Page 9)

Principle of operation

A repeater works by first receiving a data 'packet', verifying it and then re-transmitting it – if configured to do so.

Terminology used

Packet:	A transmitted set of data.
Hop Statistic:	Is the total number of packets received from the transmitter (e.g. from a GenII transmitter or repeater). Its purpose is to reconcile the number of actual to expected packets (transmissions) in the period since the list was last cleared.
Hop:	the movement of a transmitted packet between two devices, e.g.
Hop 1:	the transmission of a packet from a GenII transmitter to a repeater
Hop 2:	the first repetition of a packet from a repeater to another repeater
Hop 3:	the second repetition of a packet from that repeater to the next repeater
Delay:	A repeater will repeat a transmission immediately the packet is validated. Repeat must be delayed on one (or more) repeaters to prevent two repeaters operating simultaneously if configured to repeat packets from a common transmitter e.g. where a transmitter is mobile. Delay is configured in second increments. If delay is not required the default value is 0.

Using RepConf, the Repeater Configuration Software

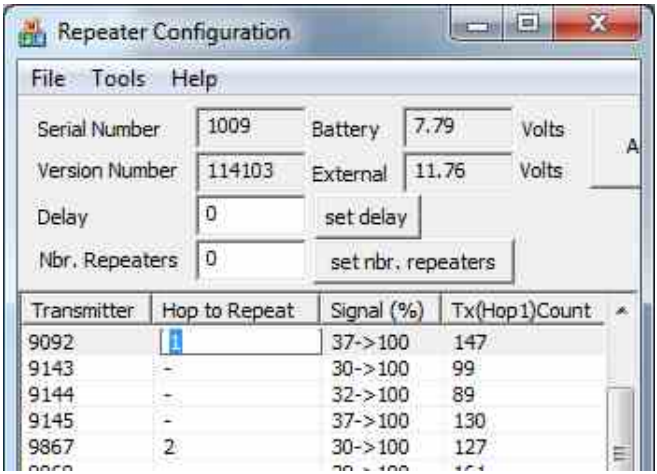
Install the program on your PC – it will try to find an existing Eltek folder.
To program the repeater, use the LCTX3 or LC68 lead provided. One end show be connected to the serial port of the PC and the other to the "Comms" connector situated on the top panel of the RP250GD.

Repeater Configuration Program

File	Properties	Select PC serial Com Port for communication with RP250GD and set Timeout
	Exit	Exits the program
Tools	Clear options	Clear list/unconfigured transmitters/hop counts/hop count for Tx
Serial Number		Displays serial number of the connected RP240GD
Version Number		Hardware and firmware version number is displayed after the Refresh button is clicked.
Delay		Set to 0 unless more than one repeater is repeating transmission from a common transmitter. Delay value is in seconds.
SET Delay		Click to confirm if Delay value changed
Nbr. Repeaters		Enter number of repeaters in the system relevant to the repeat you are configuring. Default is 1
SET Nbr. Repeaters		Click to confirm if number of repeaters is changed
Add Tx		Input a transmitter Serial Number to the Transmitter list together with the Hop Count to Repeat value
Delete Tx		delete a transmitter from the Transmitter list
Refresh		Click to get data (hop and signal strength statistics) from repeater. The table is refreshed to include any further TX serial numbers since previous refresh.
Battery		indicates actual battery voltage
External		Voltage from external supply – range 11.5V to 12.5V

Operation

- Plug MP12U to AC outlet (100-250VAC) and connect to **12VDC** regulated socket on top panel.
- Connect LC-TX3 or LC68 cable to the PC serial port and to **comms** connector on top panel.
- Run "RepConf" (RepConf and RXConfig is bundled with all Darca S/W).
- If RepConf is not on your Darca CD, download from http://www.eltekdataloggers.co.uk/updates.shtml
- Select **File** > **Properties** and set the **Com Port** number to the serial port of the PC. **Timeout** default is 1 second. Communications across a network may require **Timeout** increasing, e.g. 3 seconds.
- Ensure **Show Transmitter** is set to **All**
- Wait for a period corresponding to at least two transmission intervals (five is preferred) to allow the Repeater time to receive and accumulate data from all the transmitters. Note: the test button on the rear of a transmitter can be used to speed up the waiting time.
- Click **Refresh** and check that the serial numbers of all the transmitters appears in the "Transmitter" (left hand) column.

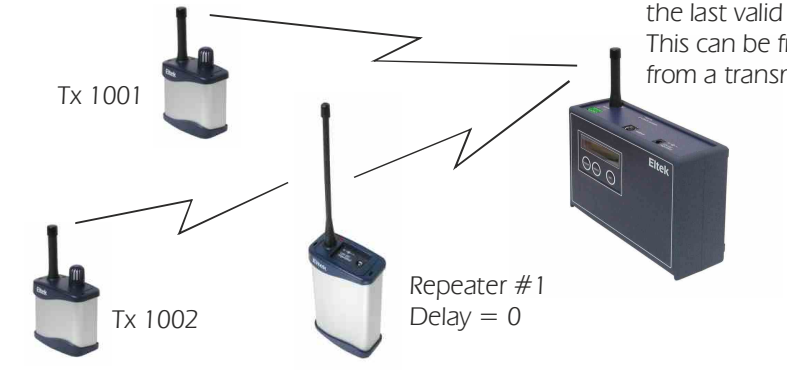


- A **-** (dash) in the **Hop To Repeat** column indicates a transmitter is NOT configured to repeat.
- To repeat data from a transmitter, click the **Hop To Repeat** cell next to the selected transmitter and enter the required **Hop to Repeat number** (see following pages). Press ↵ to confirm. To deselect, enter **0** and press ↵ to confirm.

Basic system where there is one RP250GD only

Do not repeat transmitters unnecessarily!

Note: the RX250AL will store the last valid packet received. This can be from a repeater or from a transmitter directly.

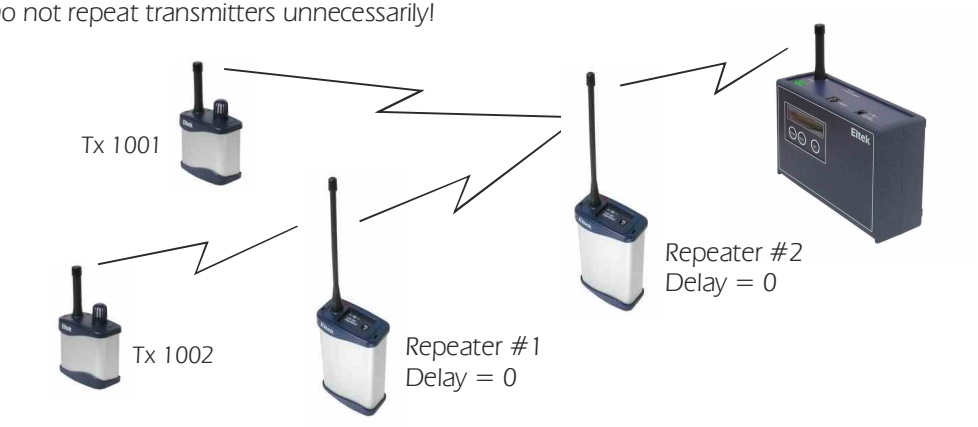


Repeater #1 repconf configuration:

Transmitter	Hop to Repeat number
1001	- (not repeated!)
1002	1

A system where are there are two or more RP250GD

Do not repeat transmitters unnecessarily!



Repeater #1 repconf configuration:

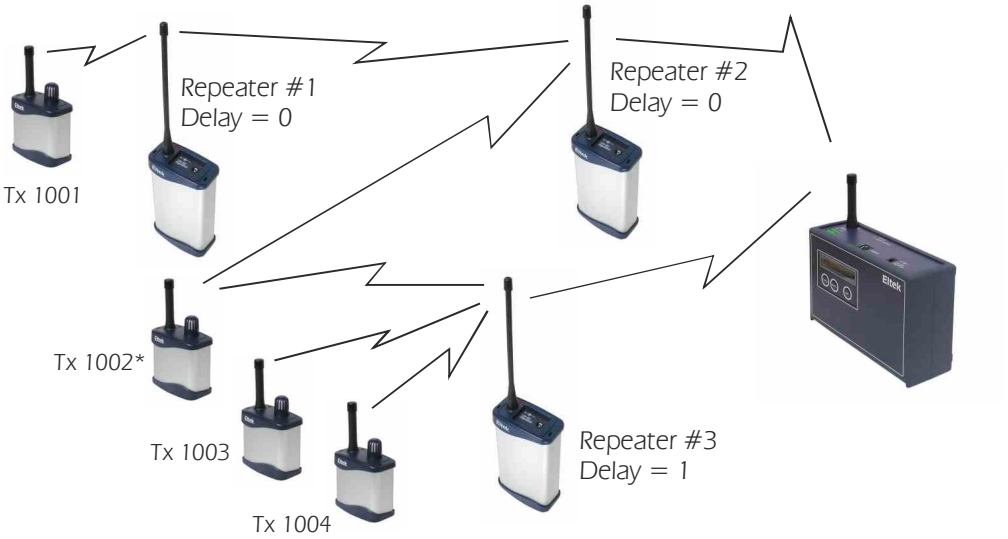
Transmitter	Hop to Repeat number
1001	- (not repeated by this repeater)
1002	1

Repeater #2 repconf configuration:

Transmitter	Hop to Repeat number
1001	1
1002	2

For a system where multiple (tandem and radial pattern) RP250GD used:

Do not repeat transmitters unnecessarily!



Repeater #1 repconf configuration:

Transmitter	Hop to Repeat number
1001	1
1002	-
1003	-
1004	-

Repeater #2 repconf configuration:

Transmitter	Hop to Repeat number
1001	2
1002	1
1003	-
1004	-

Repeater #3 repconf configuration:

Transmitter	Hop to Repeat number
1001	-
1002	1
1003	1
1004	1

- *Tip: Make a proposed system schematic as this will assist set up for the various repeaters in the system.*
- **TX1002 could be roving (mobile) around an area of coverage e.g monitoring a pallet on a fork lift truck, such that Repeater 2 or Repeater 3 would repeat its transmission.*

Once the transmitters have been configured for a repeater

- Change **Show Transmitter** to **Configured** and check that the transmitters to be repeated appear in transmitter column.

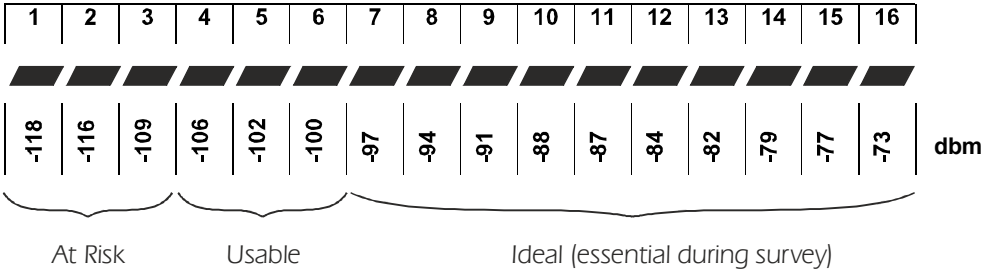
Adding a transmitter that is not visible in RepConf

If you want to add a transmitter but it is not in radio range of the repeater then:

- Ensure **Show Transmitter** is in **Configured.**
- Click on **Add Tx**
- In **Add Transmitter** dialogue box:
  - Enter transmitter serial number in **Serial Number** box.
  - Enter **Hop To Repeat number** in **Repeat** box
  - Click on **OK**

RSSI indicator (calibrated from serial number 7925 to current)

The 16 chevrons indicate the following Received Signal Strength Indication:



At Risk: Insufficient margin of safety to guarantee year on year performance

Usable: Signal with a margin of safety to compensate for year on year changes in the environment that could affect range i.e temperature and battery condition. This is not a satisfactory signal level when surveying.

Ideal: During survey, received signal must be in 'Ideal' range. This allows for fluctuations in signal level in the future.

Radio coverage survey

Overview

Typically a system will consist of transmitters distributed across various floors and rooms of a building reporting to a receiver (RC250) or receiver logger (RX250AL/SC250 etc). Range can be extended by means of repeaters that provide both tandem and/or radial coverage patterns.

Systems can be linked by repeater links, enabling communications across roadways or car parks.

Use of an external antenna on the receiver, repeater or individual transmitters can be used to optimise range.

Care should be exercised in positioning the GenII receiver logger antenna. Connection from the GenII receiver logger to the PC can be direct using the leads supplied or via Ethernet if available or GSM where appropriate. Always site the GenII receiver / logger clear of the PC so that PC RF generated emissions do not interfere or desensitise the receiver (which leads to reduced range). If necessary use an external antenna on the receiver logger (e.g. LWANTsma) if installation permits or distance the receiver from the PC using an RS232 extension lead.

Understanding noise floor and interference using a scanner

It is very important that there is no interference at the receiver location. To check this you will require a scanner (e.g. the Icom IC-R5):

- With the scanner set to the system survey frequency (usually 434.225Mhz) in FM (not WFM) mode, you should hear white noise only with squelch open. To hear an example of the white noise you should be listening for, take the scanner to an open area outside and remove the antenna. A clear and steady rushing noise (and no other type of sound) should be heard.
- Now connect the antenna back to the scanner and check that the same noise is being heard at the proposed receiver logger location. The RSS1 bar on the scanner should be at 0 with or without the antenna fitted. If this is not the case then investigate. Noise (interference) can be generated by nearby electronic equipment. If the interference is from a nearby telemetry system operating legally then an alternative frequency for the final installation may be necessary. The survey can proceed with such interference but the interference can slow up the survey process.
- Interference presence can be quickly checked using the scanner. With the scanner in FM mode progressively check frequencies up to 400Khz above and below the survey frequency and listen for any interfering signals.
- Finally ensure that equipment nearby is not generating any interfering signals. Set the scanner to WFM mode, the frequency to survey frequency (usually 434.225Hz) and put it in unsquelched mode (refer to the scanner operating manual). Hold the scanner near electrical equipment and ensure the white noise signal is not being modified. (Experience indicates older PCs and electronic equipment can be a major source of interference).

Should interference be detected and the origin can not be found then advanced interference detection equipment will have to be used, e.g a radio frequency spectrum analyser. Refer to Eltek.

Survey option for your RP250GD/scanner or RP250GDA

When a valid GenII signal is received by the RP250G/RP250GDS repeater, the serial number and RSSI (signal strength) will be displayed. When this happens, The scanner loudspeaker or RP250GDS loudspeaker unsquelched audio will be white noise (rushing sound), the white noise will be interrupted by a short bark or croak - it is quite distinctive! If the signal is strong the bark is clean and as the signal weakens the bark will become dominated by the white noise. Use a scanner to hear the white noise and signal if using the RP250GD only.

Before installation a survey should be conducted.

Surveying using the RP250GD or RP250GDS and a GenII transmitter e.g. a GD10 with standard stubby antenna

- *The RP250GD/RP250GDS signal strength bar is calibrated (see page 8). Set the transmitter interval to 1 second.*
- *Determine where the receiver will be located after conducting the interference tests and place* ***a single transmitter*** *in this location – clear of the PC!*

Do not group or cluster transmitters adjacent to each other. as the close proximity of a number of transmitter antennae can create spurious and non representative results.

- *With the RP250GD/RP250GDS battery charged and a standard 7" antenna (1/4 wave whip) fitted, proceed to walk to the various rooms and test from the position the transmitter(s) could be placed.*
- *Note: the RP250GD/RP250GDS will flash up the serial number of the transmitter (or any other Eltek transmitters within range). Referencing only the transmitter at the receiver location check that the signal is in the Good band ("Ideal" band, which is > 6 bars), at the various locations for the final placement of the transmitters.*
- *Inevitably for more distant transmitters a direct path (transmitter to receiver) will not be viable:*
    - *Note the physical location "A" where the signal is "Usable" only.*
    - *Now move the transmitter that was at the site of the receiver location to the physical location "A".*
    - *Now, with the RP250GD/RP250GDS proceed to the location of the distant transmitter. If there is a satisfactory signal then the location "A" could be the place where a repeater could be installed. There may be some practical issues to reconcile – can it be sited there? Is AC power available? Is it secure? Could an external antenna be used to further extend the signal? etc.*
- *Repeat this methodology keeping accurate notes of location and signal strength as you move across the site.*

- At the end of the survey you should have sufficient information to make a plan. There may be an opportunity to rationalise the plan (and perhaps reduce the number of repeaters) by possibly relocating repeaters. If this is the case the survey must be repeated to assure performance.

What can you expect in terms of range?

Our experience indicates communication across two floors (wood or reinforced concrete – and vertically inline separated) will be reliable.

On the same floor expect more than 100M if simple prefabricated walling is used, more if the floor is open, and considerably less if steel or panelling of mesh lined chambers is present.

Expect 500M for a repeater located in a window which is revealed to another repeater in a similar location.

Always configure the repeater to pass the transmitter signal of those required and inhibit those not required. This reduces on-air activity leading to best system reliability.