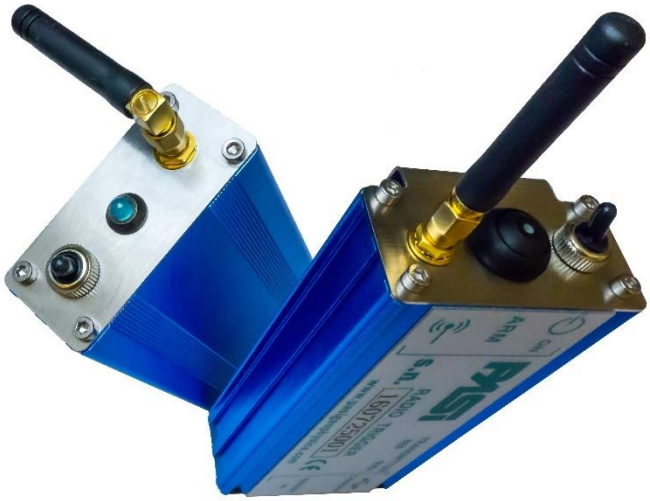
PASI

User Guide



RADIO TRIGGER

869Mhz

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2.Important Notice

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This guide refers to “Radio Trigger” HW version 2.0 and SW version 2.1

Torino, ITALIA 2016

3.Restrictions on use

Radio Trigger has been designed to operate in European band 869.4÷869.65MHz free licensed with no government taxes.

The user of the radio module must take care that the exact use is different from one region and/or country to another and a specific permit from authorities to operate in band of 869Mhz could be needed.

More detailed information is available from the local frequency management authority

4.Warranty and safety instructions

Read these instructions carefully before using the product:

- The radio module “Radio Trigger” can be used only if usage of the frequency band of the module is permitted by the local authorities and without exceeding the given maximum allowed output power ratings. P.A.S.I. and its distributors are not responsible if any of their product manufactured are used in unlawful ways.
- Warranty will be void, if the product is used in any ways that is in contradiction with the instructions given in this manual.
- Warranty will be void if the radio module has been tampered with.
- The device must be used only according to the instructions described in this manual. Faultless and safe operation of the device can be guaranteed only if the transport, storage, handling and operation of the device is appropriate.
- To prevent damage both radio modules must always be switched off before connecting or disconnecting the device to the seismograph.
- When a suitable location has been selected for the radio modules, it must be ensured that no water can get into the device under any conditions. Direct sunlight is also to be avoided. It is not recommended that the Radio Trigger is installed on a strongly vibrating surface.

5.Introduction

The Radio Trigger is a device designed and assembled by P.A.S.I. srl, a leading company in Italy in the production of instruments for geology and geophysics.

The Radio Trigger is a versatile and easy to use device designed to trigger wireless acquisitions transmitting in European band 869.4÷869.65MHz free licensed with no government taxes.

The key features include:

- Long distance transmitting range upto 3Km;
- 7 User selectable channels;
- Multi receiver mode;
- 2 User selectable levels of transmission power;
- Full compatibility with all P.A.S.I. seismographs;
- Wide range of input signals: piezoelectric sensor, geophone, TTL signal, Open circuit, closed circuit;
- Lithium-Polymer rechargeable battery;
- Micro USB interface for recharging;
- High brightness LED indicator.

This guide details the technical specifications and how to use the device. Please follow these guidelines.

6.Technical specifications

Specification for Radio Module device

	Receiver	Transmitter
Frequency Range	869.4÷869.65MHz	869.4÷869.65MHz
Communication Mode	Half-Duplex	Half-Duplex
Modulation	GFSK	GFSK
Sensitivity	-116dBm	-116dBm
TX Power	21-27dBm	21-27dBm
Power Consumption	150mW during transmission	1.6W during transmission
Operating Voltage	3.3V	3.3V
Output signal type	TTL	-
Input signal type	-	Analog Voltage, TTL, Open circuit, closed circuit

Specification for battery and Charging

Subject	Value
Battery type	KEENsTONE k011003, 3.7v 720MaH 20c 2.7Wh Lythium-Polimer
Operating Voltage	3.7V
Charging Time	Empty to Full 1.5Hrs (20C°)
Charging / Discharging Cycles	>500 times
Charging Temperature	0C° … +45C°
Operational Temperature	0C° … +60C°
Charging Voltage	5V uUSB standard connector
Charging Current	500mA

To charge the battery use a standard micro USB charger with an output current of at least 500mA. When the battery is charging the red LED near the USB connector will be ON. When it turns OFF the battery is completely charged.

We suggest you do not use the device while charging from very low battery levels. Wait at least 15-20 minutes for the battery level to pick up.

When not in use, we suggest you store the device with a partially charged battery, not completely discharged.

The device is shipped with a partially charged battery. We suggest you charge the battery before use.

NOTE:

When the battery is discharged the main LED on the top panel will blink. It will be impossible to use the device in that condition because the radio transmitter will be off to prevent damage.

1.Device description

FIGURE 1 – RADIO TRIGGER, RECEIVER ON LEFT, TRANSMITTER ON RIGHT

The device is as shown in Figure 6, on the left the receiver, on the right the transmitter.

The front label gives you the information on the function of the connectors, LED indicators and buttons.

The On/Off switch is positioned on top right of the device. The device is ON when the switch is towards the word ON, on the frontal label.

Top Panel

FIGURE 2 - TOP PANEL TRANSMITTER

In Figure 2 the top panel of the transmitter is shown. On the right the On/Off switch. In the center the push button to activate communication with the receiver with a LED indicator in the middle which shows the state of communication and the state of the battery. On the Left The SMA connector for the antenna.

FIGURE 3 - TOP PANEL RECEIVER

Figure 3 shows the top panel of the receiver. It is almost identical to the top panel of the transmitter with the only difference that it does not have the central push button but only a LED indicator to signal the state of the connection and the state of the battery.

Bottom Panel

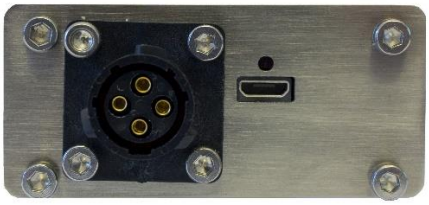

FIGURE 4 - TRANSMITTER BOTTOM PANEL

Figure 4 shows the bottom panel of the transmitter. There are two connectors: On the left the female shock sensor input; On the right the micro USB input connector for charging the internal battery. Just above the micro USB connector there is a LED indicator which is ON during battery charging.

FIGURE 5 - RECEIVER BOTTOM PANEL

Figure 5 shows the bottom panel of the receiver. There are two connectors: On the left the male trigger out connector; On the right the micro USB input connector for charging the internal battery. Just above the micro USB connector there is a LED indicator which is ON during battery charging.

Connectors

Trigger connector

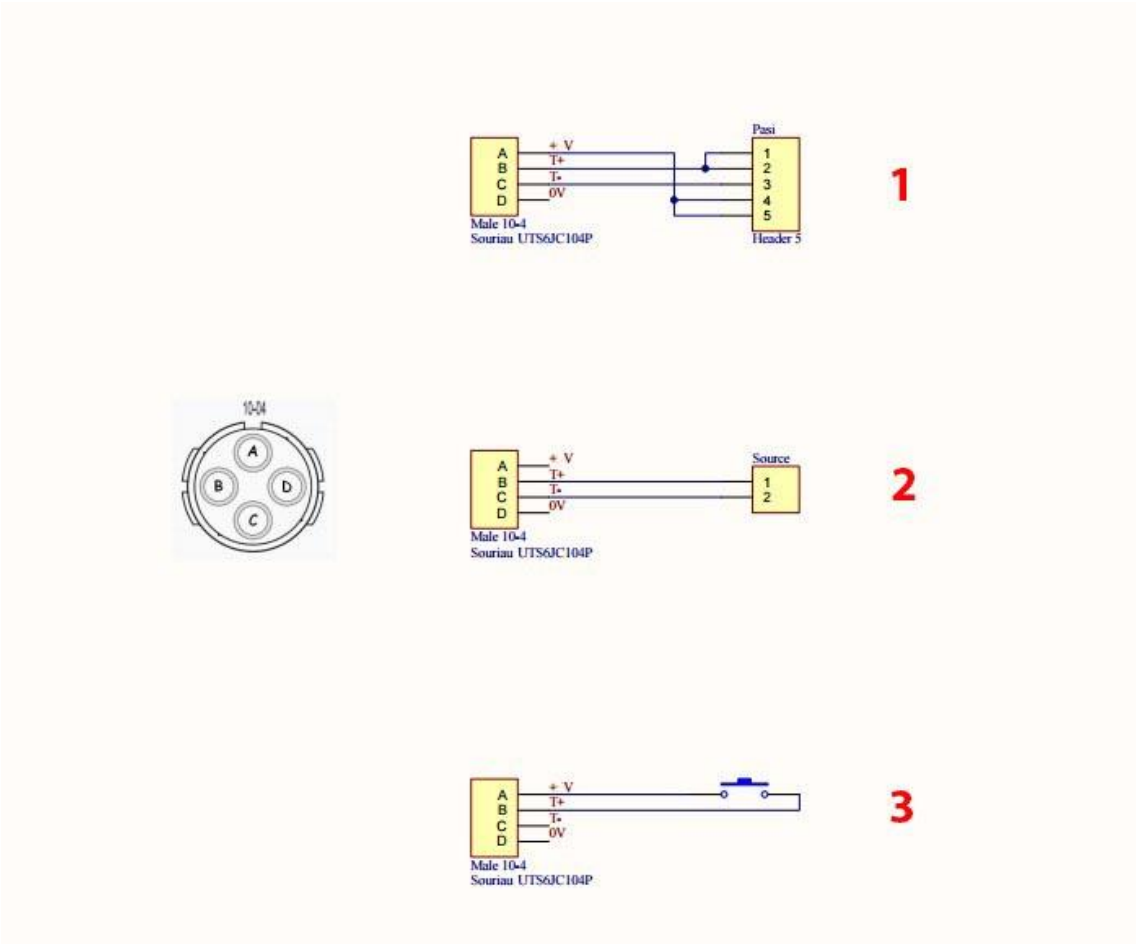

FIGURE 6 – TRIGGER CONNECTOR

Figure 6Figure 6 shows the electrical scheme for the trigger connector. In Figure 6.1 shows how to adapt the radio-trigger connector with older model P.A.S.I. seismic instruments.

Figure 6.2 shows how to connect a generic shock sensor (piezoelectric or geophone) to the radio-trigger transmitter.

Figure 6.3 shows how to connect a generic normally open or normally closed device to the radio-trigger transmitter.

NOTE:

The connector on the transmitter device is a female connector.
The receiver has a male connector and it only has pin B and C internally connected for the T + and T- outputs respectively.

Charger connector

The charger connector is a slot micro USB 2.0, type B, Female. It supports any standard USB 5V charger with at least 500mA of output current.

Antenna connector

The antenna connector is a standard SMA – 50Ohm female connector to which the appropriate antenna is fitted.

We recommend the antenna supplied by us to avoid any transmission problems. Any antenna with SMA-Male Straight Connector and able to cover 868 and 915 MHz bands should function correctly.

The antenna should always be connected and firmly screwed in when the power is on. Removing the antenna while the transmitter is on may damage the power amplifier inside the transmitter

2.Installation

Internal components

The "Radio Trigger" is composed of the following parts:

- Radio Trigger Transmission device;
- Radio Trigger Receiver device;
- Shock sensor with 3m cable and male connector, it must be connected to the Transmitter device;
- 60cm Connection cable to interface the receiver to the instrument. The male connector must be connected to the receiver and the female connector must be connected to the trigger input of the instrument.

Check List

The following points must be taken into account when installing and configuring the Radio Trigger:

1. All operating voltages of all the equipment concerned must always be switched OFF before connecting the interface cable between receiver and instrument;
2. When considering the exact placement of a Radio Trigger and/or its antenna, the following points must be taken into account to guarantee optimal results:
    a. The antenna should be installed in open space as far as possible from any possible sources of interference;
    b. The Radio Trigger should not be installed onto a strongly vibrating surface;
    c. The radio modem should be installed in such a way as to minimize exposure to direct sunlight or excessive humidity;
    d. Avoid obstacles such as buildings or walls, between the receiver and the transmitter to maximize both quality and transmission distance;
    e. If you are operating on a steep slope, try to keep the antennas as perpendicular to the ground as possible;
    f. Avoid positioning the devices if hidden by hills or dips. The best arrangement is when you can see the receiver from the transmitter. Figure 7 shows an

example of how to position the receiver based on the position of the transmitter.

3. The antenna must be installed according to instructions;
4. All radio triggers in the same system must be configured using the same settings (radio frequency channel and power transmission rate);
5. Make sure that the shock sensor has been properly placed (piezoelectric, geophone or a generic normally open or normally closed device). See Appendix A for instructions on how to place the piezoelectric shock sensor.

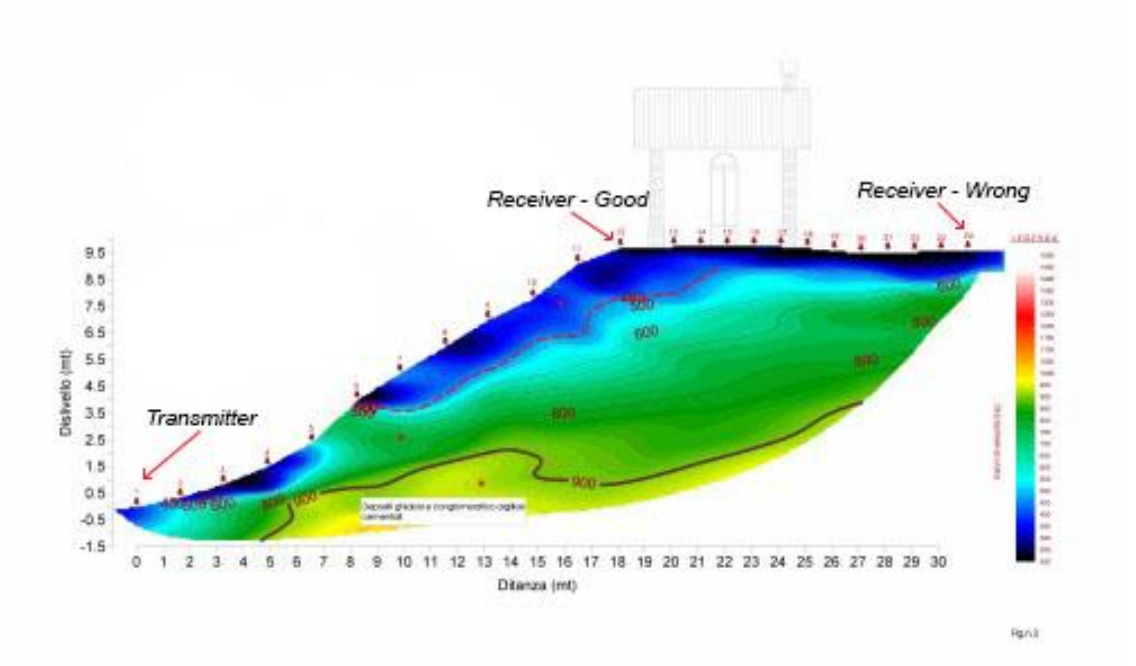

FIGURE 7 - POSITIONING OF THE DEVICES

3. Instructions for use

Performing an acquisition

Before proceeding with the use of the device, make sure you have carried out the steps described in the previous chapter “Installation”.

After successfully installing the receiver and the transmitter, turn on both devices.

The indicator LED will turn On for a second, then will blink rapidly several times. This procedure indicates that the device is ready to be armed.

Make sure that the instrument is ready for the trigger signal.

To avoid keeping radio communication open for too long communication should only be activated when you are ready to operate the trigger.

To activate the radio transmission, you have to press the “ARM” button on the transmitter. The LED indicator will turn On for two seconds. In this time the transmitter attempts to establish a radio communication with the receiver. After this phase the indicator will blink rapidly several times to signal the end of peering. If the receiver is not available the LED indicator will turn Off, this means that peering failed. If the LED indicator remains On it means that communication is properly established and it is ready to transmit the shoot signal.

On the receiver side, when it receives a radio request to establish communication the LED indicator will turn On for two seconds. In this time the transmitter, after receiving the request tries to send an answer. If the request and answer are being loaded correctly communication will be established and the LED indicator will remain On until the shot signal is received. Otherwise, if after the rapid blinking phase of the LED it remains Off, that means that peering failed.

When the devices are correctly paired the LED indicators on both units will be On. In this phase the transmitter is continuously sending the state of the trigger, and the receiver is focused on the change of state of the received signal.

When the shot occurs the transmitter sends the change of status of the trigger by radio signal.

When the trigger output signal has been received seismograph acquisition will start.

Soon after the shot the radio connection will be disabled.

When you need to move the equipment remember to turn off the Radio Trigger devices.

NOTE:

The radio module inside the Radio Trigger devices is On only when it is activated (LED indicator on the top Panel in On state).

To preserve battery charge we recommend activating transmission only when you are ready to opearate the trigger.

Step by step

1. Install the device properly (see chapter “Installation”);
2. Turn on the devices (transmitter and receiver);
3. When you are ready to shoot press the ARM button on the transmitter;
4. If the devices are correctly paired, shoot the trigger.

If you need to reiterate and perform several stacks, please repeat points 3 and 4 as many times as needed.

Changing Transmission Power and Channel

The device is equipped with 7 transmission channels and 2 levels of power transmission.

To change these parameters, open the top panel of the device to access the main board.

The top panel is equipped with four 2.5mm hex screws.

Figure 8 shows the device with top panel remouved.

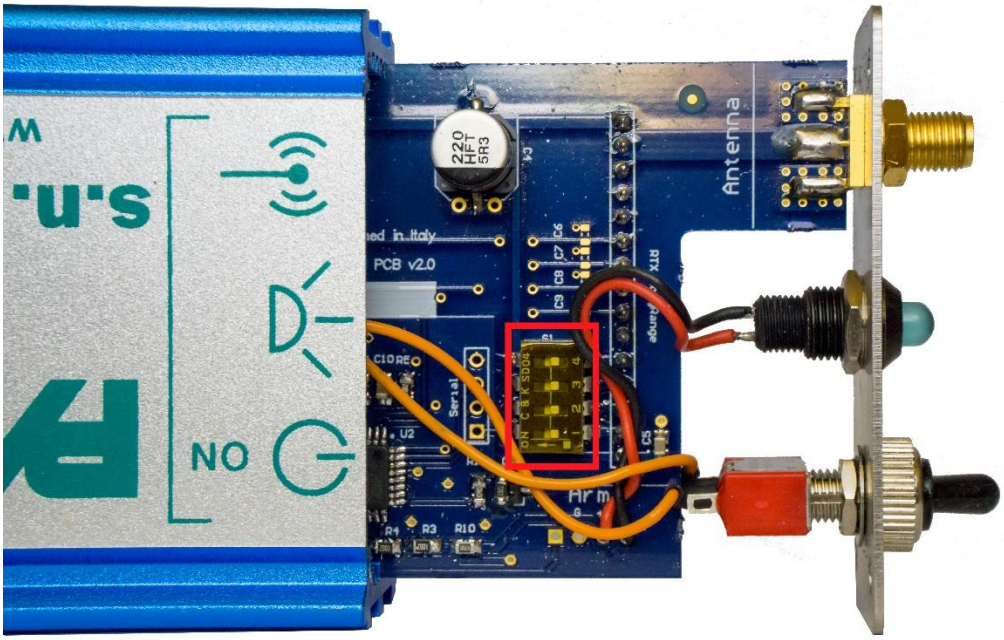

FIGURE 8 - SELECTOR FOR TRANSMISSION POWER LEVEL AND CHANNEL SELECTOR

Figure 8 shows the main board. The red rectangle indicates the selector for transmission power and transmission channel selector.

The switches on the selector are numbered 1 to 4.
Switch number 1 is used to change the transmission power:

- Off: Normal power;
- On: High power.

Switches number 2, 3 and 4 are used to change the transmission channel:

- 2=Off, 3=Off, 4=Off: channel 1;
- 2=Off, 3=Off, 4=On: channel 2;
- 2=Off, 3=On, 4=Off: channel 3;
- 2=Off, 3=On, 4=On: channel 4;
- 2=On, 3=Off, 4=Off: channel 5;
- 2=On, 3=Off, 4=On: channel 6;
- 2=On, 3=On, 4=On: channel 7.

NOTE:

By default, the devices are shipped with selector on Normal Power and channel 1.

Multi-receiver mode

You can perform acquisitions using a single transmitter and multiple receivers connected to as many seismographs.

The operations to perform are the same as with a single receiver and they are indicated in the previous paragraphs.

Make sure that:

- Transmission channel, must be the same for transmitter and receivers;
- Transmission Power level, must be the same for transmitter and receivers;

After activating the transmission procedure by pressing the ARM button on the transmitter make sure that all the receivers are correctly paired. Not all the receiving devices might be correctly paired. In this case make sure that you have completed all the installation procedures correctly.

4.System layout

Factors affecting the quality and distance of the radio connection

- Transmission power;
- Sensitivity of the receiver;
- Tolerance of spurious radiations of the radio modulating signal;
- Amplification of the transmitting and receiving antennas;
- Antenna height;
- Natural obstacles;
- Interference caused by other electrical equipment.

Transmitter power of the internal radio module is 12dBm in normal power mode and 27dBm in high power mode. The sensitivity of the receiver is -116dBm. Thus in a flat area with no obstacles with a ¼ wave length antenna. The maximum transmission distance could reach 3km.

Distance may be considerably shorter in non-optimal situations where there are metallic walls or other materials inhibiting the propagation of radio waves.

Over long distances, increasing the height of the antennas can often solve problems caused by natural obstacles.

The Radio Trigger tolerates normal levels of interference that occur. However, exceptionally high levels of interference can break through the safeguards and thus cause errors in data transfer.

The best performance is obtained in open space. It must also be remembered that one open space can have different environmental and external factors to another, and that the effects on transmission quality must be taken into account when planning the system.

Ground, ground contours and buildings cause attenuation (loss of energy through absorption) and reflection of radio waves. Buildings reflect radio waves and therefore the effects of attenuation are not as acute when transmission is over a short distance.

5.Appendix A

How to place the piezoelectric shock sensor

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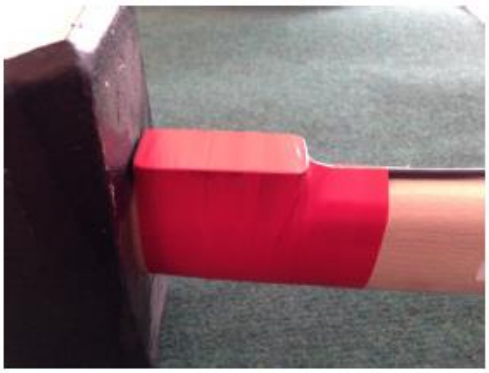
COME FISSARE L'HAMMER SWITCH (STARTER PIEZOELETTRICO) SULLA VOSTRA MAZZA
HOW TO FIX THE HAMMER SWITCH ON YOUR SLEDGE HAMMER

FISSARE LO STARTER AL MANICO DELLA MAZZA TENENDO LE 4 VITI DI CHIUSURA RIVOLTE VERSO IL MANICO. DURANTE LA BATTUTA MANTENERE LA MAZZA IN POSIZIONE COME DA IMMAGINE PER EVITARE EVENTUALI DANNEGGIAMENTI DELLO STARTER

BY USING ADHESIVE TAPE, FIX THE HAMMER SWITCH ON THE SLEDGE HAMMER HANDLE WITH THE 4 SCREWS TOWARDS THE HANDLE ITSELF. WHEN YOU HIT THE GROUND, KEEP THE HANDLE IN THE POSITION INDICATED IN THE PICTURE TO AVOID ANY POSSIBLE ACCIDENTAL DAMAGE OF THE HAMMER SWITCH



RICOPRIRE LO STARTER CON NASTRO ADESIVO E FISSARE IL CAVO LUNGO IL MANICO IN MODO CHE NON VENGA "PIZZICATO" DURANTE LE BATTUTE

WITH ADHESIVE TAPE, COVER THE HAMMER SWITCH AND ALSO FIX ITS CABLE ALONG THE HANDLE TO AVOID ACCIDENTAL BREAKING

6.Appendix B

How to connect an external Normally Closed Switch