

Operation and Maintenance

TPL 310D Mini



TABLE OF CONTENTS

1. Preface	3
2. Introduction & Technical Features.....	5
3. Operation test	11
4. Operation for search & Location	13
5. Troubleshooting chart	16
6. System components	17
7. Assembly of TPL	18
8. Electronic Connection Diagram	19
9. Storage instructions	20

1. Preface

1.1 The TPL 310D Series is a new extremely efficient rescue tool, using leading edge technology. It is based on many years of field experience and successful rescue results obtained with our TPL 310 A,B and C models.

The new system is very compact, is task- oriented and therefore much easier to be efficiently applied and efficiently operation, even by operators with very little training.

1.2 The system is designed so that only one operator can operate the system easily.

The design and operation of the system is planned and implemented according to the rules of "human engineering".

1.3 Typical applications range from detecting and pinpointing the location of trapped persons below and above ground, in locations to which there is no normal access, like collapsed buildings and structures, collapse caused by natural or manmade disasters.

1.4 It is assumed that the trapped persons are alive and are able to provide a minimal response to calls or knockings.

1.5 The new system has a very high sensitivity and a low noise figure, thereby considerably improving the chances of detecting survivor-generated signals.

1.6 The system's task oriented design provides two basic tasks, which are: "SURVEY" and "LOCATE".

1.7 The "SURVEY" mode of operation, which should be used on the first approach to most rescue sites, should establish, if any living and conscious survivors are under the rubble. The system provides means to communicate with these trapped persons. The acoustic sensor functions as a loudspeaker/ microphone, which can be inserted into crevices and allows to talk and listen to the trapped persons.

1.8 The "LOCATE" mode should be established once some kind of communication has been made with the trapped persons. It serves to provide information about the location of the person, in or below the rescue site, so as to guide the rescue team to this location.

In this mode the detection is done by seismic sensors, using a method of seismic noise detection.

1.9 The system has a LCD display, which graphically shows all essential indications, and guides the operator through the above-mentioned tasks.

For night time operation backlighting is available.

1.10 With the selection of each task, optimum signal filtering is automatically performed for each mode of operation, i.e. seismic and/ or acoustic listening, thereby assuring optimum signal detection capabilities.

1.11 The system uses sensitive geophones for seismic detection.

1.12 The system provides manual and automatic gain adjustments. The automatic gain adjustment is a unique feature, which enables detection of trapped person signals in high man-made noise.

1.13 The above new features, and others, have been made possible by the design of the system around a modern microprocessor, which serves as a central controller of the system.

1.14 The instrument is very compact (approx. 6.12x3.36x8.93 inches or 15.5x85.5x22.7 cm), it holds eight alkaline AA cells, which provide 50 hours of operation (or with backlighting switched on 25 hours).

It can also be operated from an external 12 Volt battery.

It can also use 8 Ni-MH (1.2V AA - 1000mA) batteries.

1.5 Two analog output signals are provided for recording of seismic signals by external strip chart recorder, printer, data logger or tape recorder. (not included).

1.6 The system is designed to be operated in rain and harsh weather conditions and will not be affected by nearby mobile transmitters.

2. Introduction & Technical Features

2.1 TPL 310D Case

The TPL is housed in a splash- proof, beige colored drawn- aluminum housing with a robust handle, this also serves as a tilting aid. The carrying case keeps all the TPL 310D elements safely

The housing conforms with IP 67 weatherproofing.

The system is designed to operate at a temperature range of -4° F – 140° F (-20° C to +60° C) at a relative humidity of max. 95%.

During operation of the system, a carrier vest (fig. 2) is used in which all components of the system are assembled.



Figure 1: CARRYING CASE



Figure 2: Vest

2.2 AMPLIFICATIONS & FILTERING

The amplification of the two seismic sensors channels is 60dB Manu-able or automatic switchable in 10dB steps and 45dB additional amplification in the sensors preamplifiers.

In the TWO WAY sensor channel, additional 18dB amplification are provided by the active filters, in the signal path, in the frequency range of approx. 300-3000 Hertz, and a loss of 18dB in the frequency rang below approx. 150 Hertz.

In the SEISMIC sensors channels an additional 18dB amplification are provided by the active filters, in the frequency band of approx. 150-1000 Hertz, and loss of 18dB in the frequency band above approx. 1800-3000 Hertz.

The intercom microphone amplifier provides a SPL from the acoustic sensor of 70dB measured at a distance of 1 meter.

The listening amplifier gains are controlled by a front panel volume control in the headphones and provide an additional maximum voltage gain of 10dB.

2.3 INPUT/OUTPUT IMPEDANCES

The output impedance of the listening amplifier allows to drive one or two 32 Ω headphones.

Sensor channels input impedances: approx. 1K Ω (each).

Left and right channels analog outputs of at least 0.5 volt are provided on the D type connector (left - pin 5; right - pin 3; GND – pin 1) on the rear panel of the instrument. The outputs are individually adjustable by two rotary level controls OUT L and OUT R, on the rear panel. The signals at these outputs are the analog signals after sensor amplifiers and filtering. The source impedance at this output is ~ 200 Ω . The signals are provided for an external strip- chart recorder, printer or data logger.

2.4 SENSORS

Mechanical data: Both types, seismic and acoustic sensors are assembled into an anodized aluminum enclosure, made out of solid material, in a waterproof construction. The cable connector is of the BNC type.

Both seismic and two way sensors include preamplifiers powered from the TPL through the connection cable.

The seismic sensors (TPL 3108) output signal is amplified by the enclosed preamplifier provides a voltage gain of 45dB.

The sensor resonance is at 10Hz and the overall sensitivity exceeds the requirements.

The TWO - WAY sensor (TPL 3111) acts both as microphone and loudspeaker.

The both sensors types may be immersed into water to a depth of 1 meter.

When functioning as a microphone, the transducer has sensitivity of 1.1 mV/ Pa at 1Khz.

The output of the transducer is amplified by a preamplifier in a similar way as in the seismic sensor.



Figure 3: Two-Way Sensor (Red) to Left Side



Figure 4: Seismic Sensor (Red) to Left Side



Figure 5: Seismic Sensor (Yellow) to Right Side

2.5 CABLE DISPENSERS

The dispensers hold 33 ft. (10 meter) of coaxial, polyethylene insulated PVC covered, cable type RG 58C/U terminated with male and female BNC connectors.



Figure 6: Cable Dispensers Left&Right



Figure 7: Cable Dispensers and Sensor Connections

2.6 POWER SUPPLY

Power is provided by eight type AA alkaline batteries, held in two battery holders accessible from the rear of the TPL.

It can also use 8 Ni-MH (1.2V AA - 1000mA) batteries.

To open the battery holders, press simultaneously on the two side holders in the arrow direction, (to the center) and pull out the battery holders.

Alternatively power can be supplied to the TPL through a power cable, connecting an external 12 volt battery to the D type connector.

The Operating voltage of the TPL is 12 volt. It will function properly from 8.8 volt up to 16 volt. A voltage monitor will indicate the battery condition.

The current drain with no input signal is ~40 Ma and with backlighting ~80 mA.

The positive terminal of the external battery should be connected to pin 9 and the negative terminal to pin 1.

The external 12 volt battery should not be connected to a charger or a vehicle while the TPL is in use. The cable is available as an accessory.

The device is protected from reverse power connection.

2.7 CONTROL UNIT - TPL 310D

2.7.1 Front View

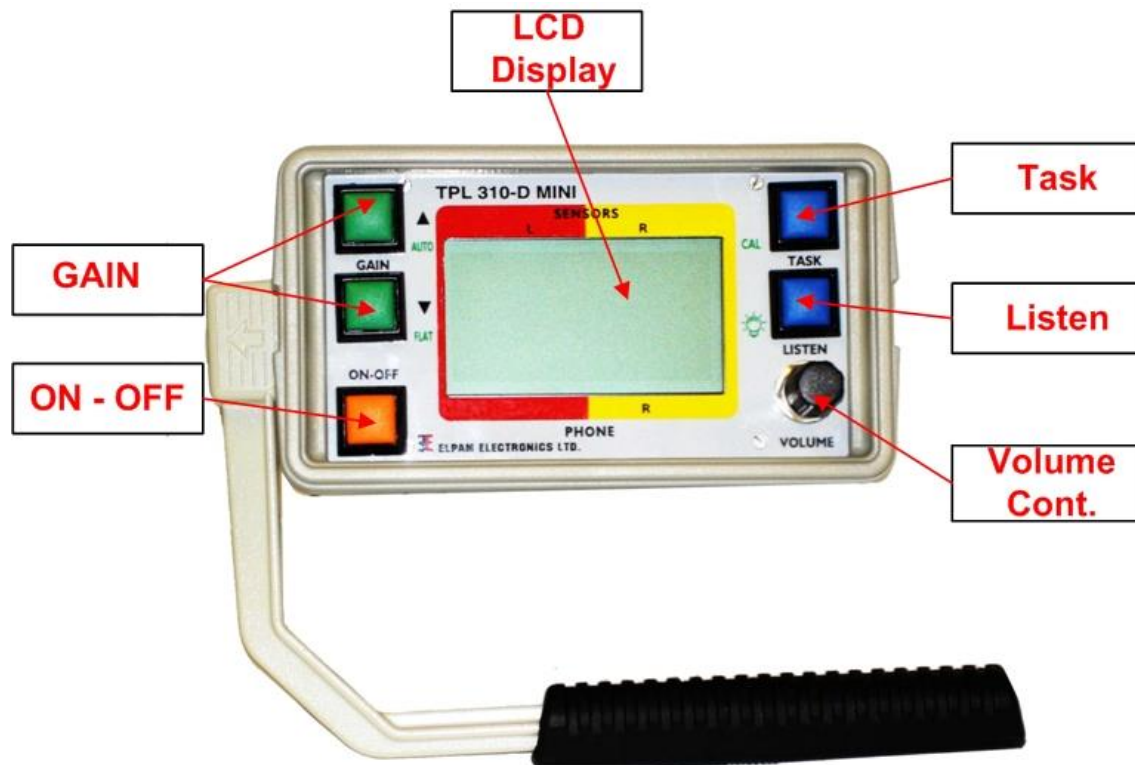


Figure 8: Control Unit - Front View

2.7.2 Rear View

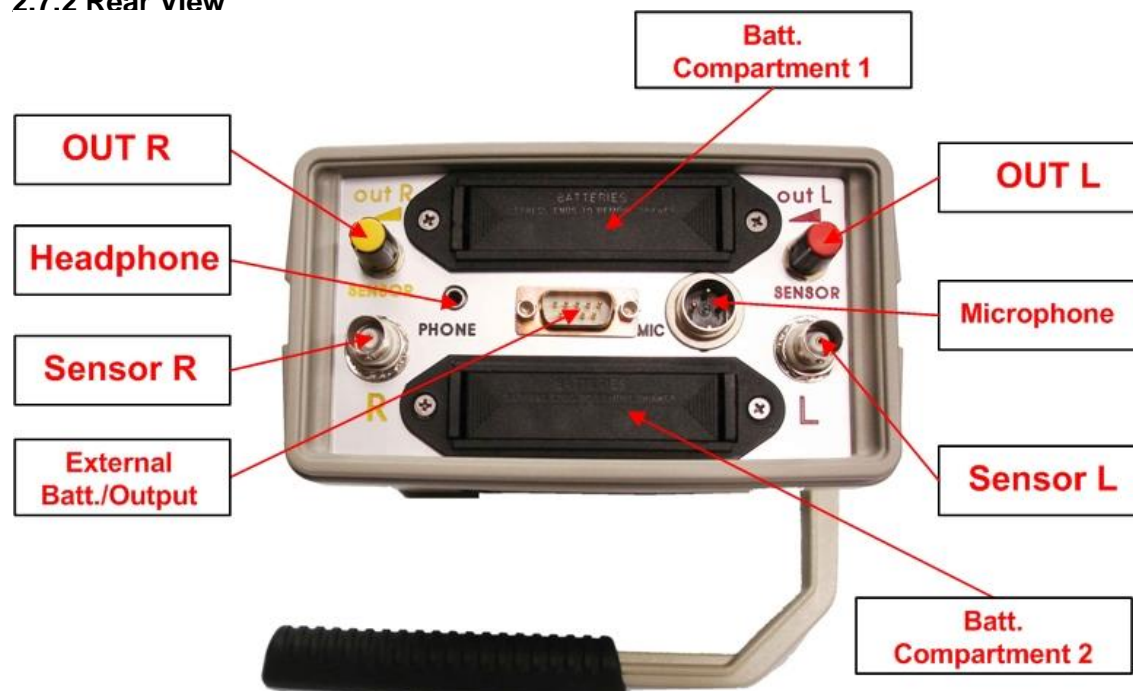


Figure 9: Control Unit - Rear View

3. Operation Test

3.1 Insure that the TPL has new 8 AA Alkaline batteries in the battery holders.

3.2 Press the ON - OFF push button, the display will show “ON” momentary and then “SURVEY”.

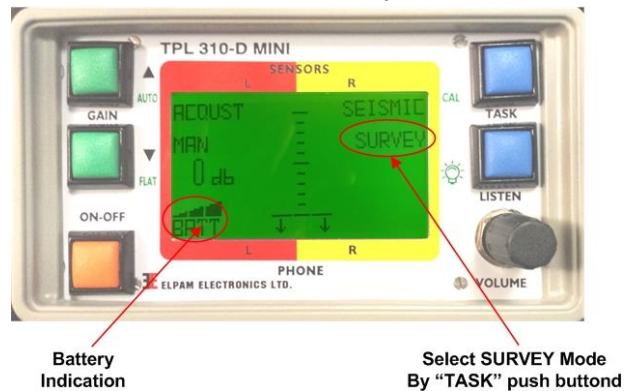


Figure 10

3.3 Connect TWO WAY sensor to “L” (Red) connector using the 1m. red coax cable and the fully unspooled red cable dispenser.

3.4 Connect the Microphone to “MIC” connector.

3.5 Connect the Headphones to “PHONE” jack.

3.6 Put the TWO WAY sensor about 10 meters from the TPL.

3.7 Press the push to talk switch and speak into the microphone, the TWO WAY sensor should provide a clear signal.

When the push to talk is not pressed, the TWO WAY sensor acts as a microphone and can be listened to by the headphone.

3.8 Disconnect the red cable dispenser and the 1m. red coax cable from the TPL. Disconnect the TWO WAY sensor and roll the cable back into the cable dispenser.

3.9 Press “TASK” push button. The display will pass to “LOCATE” mode.

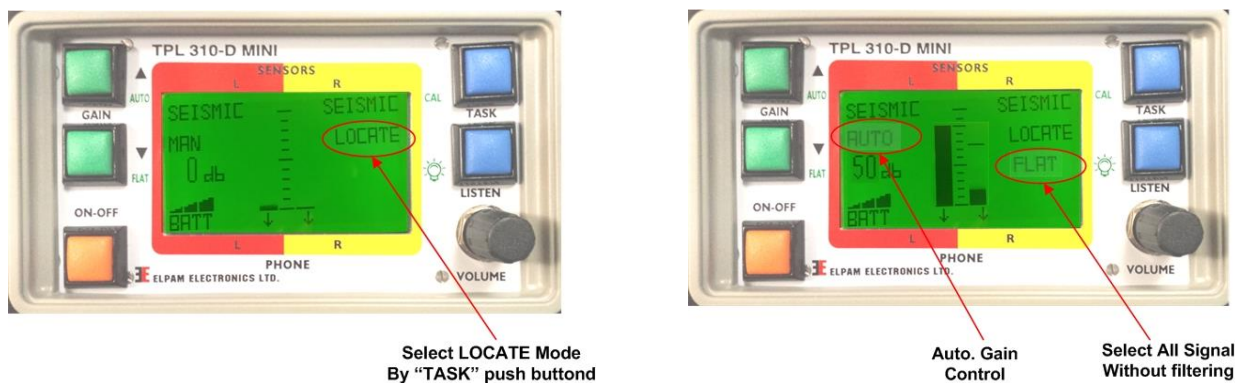


Figure 11

3.10 Connect red seismic sensor to “L” (Red) connector using 1m. red coax cable and red cable dispenser.

3.11 Connect yellow seismic sensor to “R” (right) connector using 1m. Yellow coax cable and yellow cable dispenser.

3.12 Knock slightly with your finger on the top of the red seismic sensor. The Knocking will be heard in the left earphone and showing graphically on the display. Increase GAIN as necessary. Insure the option to adjust the volume.

3.13 Repeat Para. 3.12 with the yellow seismic sensor.

3.14 Disconnect the red & yellow cable dispensers, the 1m. red & yellow coax cables and the red & yellow seismic sensors.

3.15 Press the light push button for a few seconds, the backlight of the display will operate. Press momentary again on the light push button, the backlight turns off.

3.16 Turn the TPL to OFF position by pressing the ON/ OFF push button.

4. Operation for Search & Location

4.1 General

Always use new batteries.

Replace batteries when the “BATT” flashing.

Silence rescue site as much as possible during “SURVEY” and “LOCATE” operation.

Always connect acoustic sensor to “L” (red) connector.

4.2 OPERATION IN THE SURVRY MODE

When a rescue team arrives to the disaster area and the location of the trapped persons is unknown, the search area should be divided to 10x10 meters squares (with marking tape) and then the location of the trapped persons should begin in the marked area (see the drawing below).

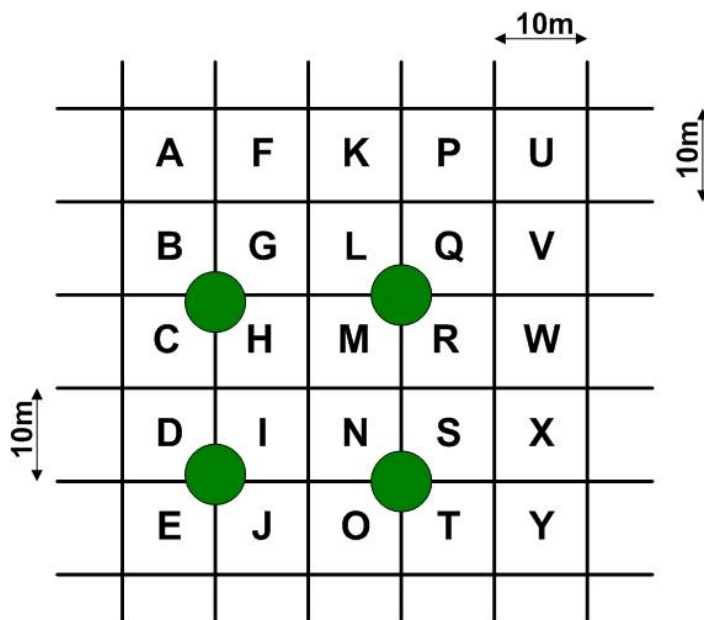


Figure 12: Searched area

4.2.1 Connect the TWO WAY sensor to “L” (red) connector using the red 1m. coax cable and fully unspooled cable dispenser.

4.2.2 Connect the SEISMIC sensor to “R” (yellow) connector using the yellow 1m coax cable and yellow unspooled cable dispenser.

4.2.3 Push “ON - OFF” push button to operate the TPL (the display will indicate “ON” momentary and then “SURVEY”).



Figure 13: Display for SURVEY Mode

4.2.4 Lower the TWO WAY sensor into crevices in the collapsed structure, call with hand held microphone and listen for replies from the trapped persons. At the same time, place or attach the SEISMIC sensor to vertical beams of collapsed structure, hit the structure with a metal rod and listen with the headphones to response by the trapped persons in both SEISMIC and TWO WAY sensors.

4.2.5 Adjust sensitivity with GAIN ↑ and ↓ push buttons. For more intensive listening to only one of the sensors, repeatedly press LISTEN push button, display arrows will indicate which sensor is listened too.

4.2.6 Listening volume is controllable by both GAIN and VOLUME control.

4.2.7 When a response is heard in the acoustic sensor, move the SEISMIC sensor location until the trapped persons tapping response is heard with the SEISMIC sensor too. Leave the SEISMIC sensor stationary at this location, increase GAIN until the knocking can be observed on the display.

Proceed to the "LOCATE" mode by pushing the task push button.

4.3 OPERATION IN THE LOCATE MODE

The LOCATE mode should find the location of trapped person or persons to direct their rescue by comparing the signals amplitude of both sensors.

4.3.1 Replace the TWO WAY sensor connected to the “L” with a second SEISMIC (red) sensor (as indicated on the display), place or attach the Sensor to an adjacent beam.

4.3.2 Increase GAIN until the tapping signal (by the trapped persons) of the “R” sensor are also heard and with GAIN adjustment, also seen in the display.

4.3.3 Move the red SEISMIC sensor (connected to “L”) to beams around the stationary sensor until a visible indication is also obtained from both sensors.

4.3.1 Signals of equal strength or are within two divisions one from the other, indicate the trapped person is below the middle between the two sensors.



Figure 14: Display for LOCATE Mode

Other location strategies can also be used.

4.4 REMARKS

4.4.1 At nightfall light push button should be pressed.

4.4.2 The TPL has an automatic gain control. This option enables automatic adjustment of the needed amplification and also location in noisy environment.

4.4.3 The maximum signal of each channel is memorized on the display for a few seconds.

5. Trouble shooting chart

<u>Observation</u>	<u>Cause</u>	<u>Remedy</u>
1. After TPL switched on, no response on the display.	<ol style="list-style-type: none"> 1. Empty batteries. 2. Batteries are installed not in the correct polarity. 3. Bad contact between batteries & battery holders. 	<ol style="list-style-type: none"> 1. Replace batteries. 2. Install batteries in the correct polarity. 3. Clean spring contacts in battery holders & batteries.
2. No listening in headphones even when GAIN Increased.	<ol style="list-style-type: none"> 1. volume control is in the minimum position. 2. Bad contact in headphone. 3. Headphones are out of order. 	<ol style="list-style-type: none"> 1. Turn Volume control in clockwise direction. 2. Push and pull several times the headphones plug into and out of the PHONE jack. 3. Replace headphones.
3. No listening in the right earphone.	<ol style="list-style-type: none"> 1. Yellow 1m. coax cable is damaged. 2. Yellow cable dispenser is damaged. 3. Yellow seismic sensor is damaged. 	<ol style="list-style-type: none"> 1. Replace yellow 1m. coax cable. 2. Replace yellow cable dispenser. 3. Replace yellow seismic sensor.
4. No listening in the left earphone.	<ol style="list-style-type: none"> 1. Red 1m. coax cable is damaged. 2. Red cable dispenser is damaged. 3. Red seismic/ Two Way sensor is damaged. 	<ol style="list-style-type: none"> 1. Replace red 1m. coax cable. 2. Replace red cable dispenser. 3. Replace red seismic/ TWO - WAY sensor.

6. System Components

TPL D SYSTEM COMPONENTS	PART NUMBER	DIMENSIONS (mm) & WEIGHT (gram/ Kg)	DIMENSIONS (ft) & WEIGHT (lbs)	QTY
TPL 310D & ACCESSORIES	499129793	52.37 X 20.6 X 42.85 cm ~12 Kg	20 ¾" X 8 5/8" X 17 ¼" 33 lbs	1
TPL 310D proper (With batteries)	499129807	15.5 X 85.5 X 22.7 cm 1.85 Kg	6.12" X 3.36" X 8.93" 3.85 lbs	1
Seismic sensor red (Geophone)	499129815R	60 X 91 mm 615 gram	2.36" X 3.58" 1.35 lbs	1
Seismic sensor yellow (Geophone)	499129815Y	60 X 91 mm 615 gram	2.36" X 3.58" 1.35 lbs	1
TWO - WAY sensor microphone/ speaker	499129823	60 X 91 mm 470 gram	2.36" X 3.58" 1.03 lbs	1
Cable dispenser with 33 ft (10m) long	499129831	139 X 70.5 mm 1000 gram	5.47" X 2.78" 1.46 lbs	2
Interconnection cable 3.3 ft (1m) long	499129840	1 meter 58 gram	3.3 ft 0.13 lbs	2
External battery cable 7 ft (2m) long	499129858	2 meter 145 gram	7 ft 0.28 lbs	1
Microphone hand held	499129866	66 X 86 X 38.5 mm 195 gram	2.6" X 3.4" X 1.5" 0.35 lbs	1
Headphones	499129876	200 gram	0.44 lbs	1
Vest for carrying TPL D accessories	499129882	650 gram	1.32 lbs	1
Black carrying case	499129890	52.37 X 20.6 X 42.85 cm 5.4 Kg	20 ¾" X 8 5/8" X 17 ¼" 9.89 lbs	1

7. Assembly of TPL

- 1 Carrying/Protector Case
- 2 Vest
- 3 TPL 310D Mini
- 4 Headphones
- 5 Microphone
- 6 Cable Dispensers
- 7 Two - Way Sensor Red
- 8 Seismic Sensor Red
- 9 Seismic Sensor Yellow
- 10 Coax Cables
- 11 Feed Cable



Figure 15

- 1 Carrying/Protector Case
- 2 Vest
- 3 TPL 310D Mini
- 4 Headphones
- 5 Microphone
- 6 Cable Dispensers
- 7 Two - Way Sensor Red
- 8 Seismic Sensor Red
- 9 Seismic Sensor Yellow
- 10 Coax Cables
- 11 Feed Cable
- 12 Battery charger with rechargeable batteries .
- 13 Headphone adapter
- 14 User Guide and Activation Page



Figure 16

8. Electronic Connection Diagram

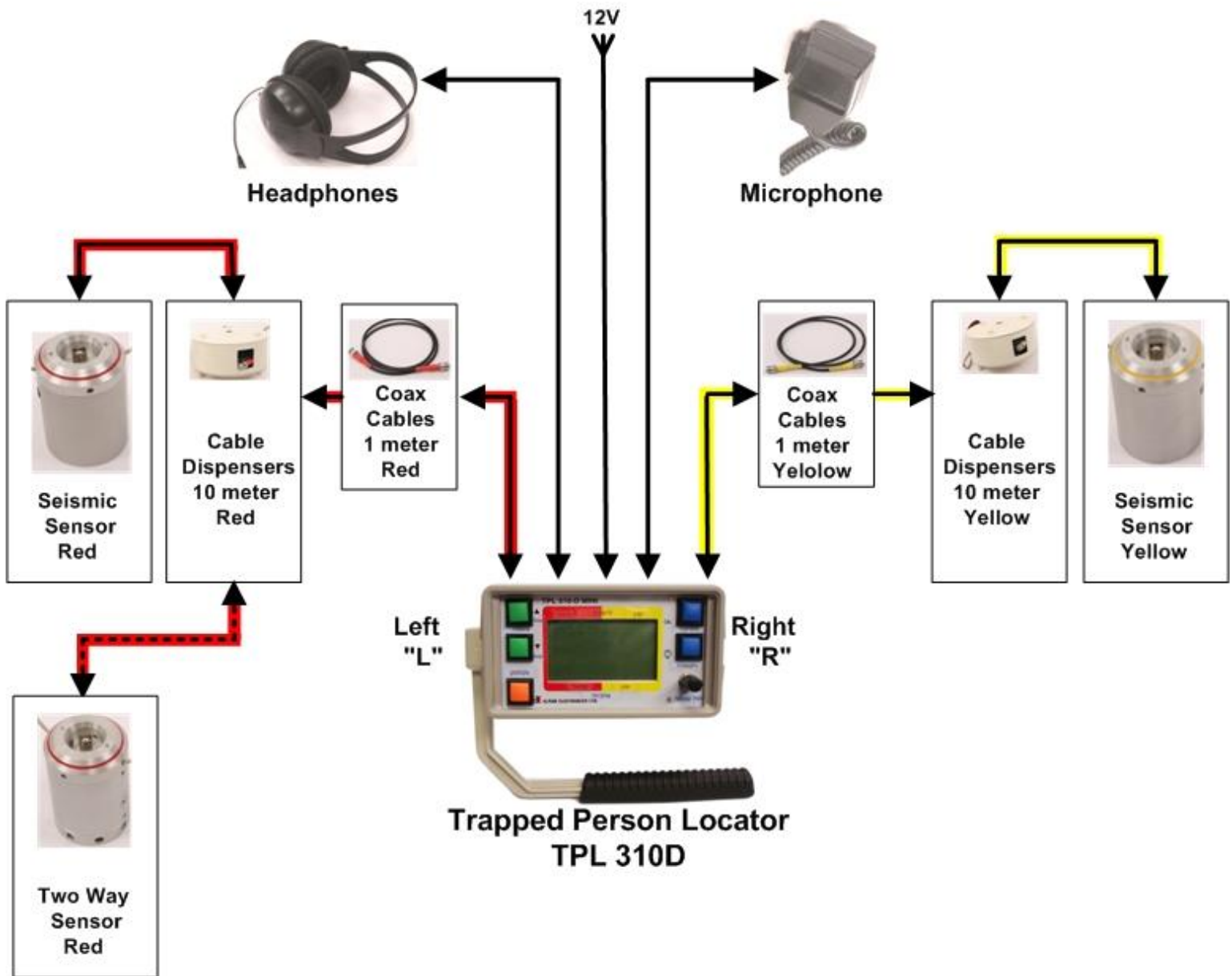


Figure 17

9. Storage Instructions

9.1 Remove batteries before storing the TPL.

9.2 Store the TPL in a dry place.

9.3 Test the stored TPL every 6 months and after each use.

9.4 Clean cables and connectors and perform visual inspection after every use.
Make sure to insert all the system components In an orderly manner into the system case.



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