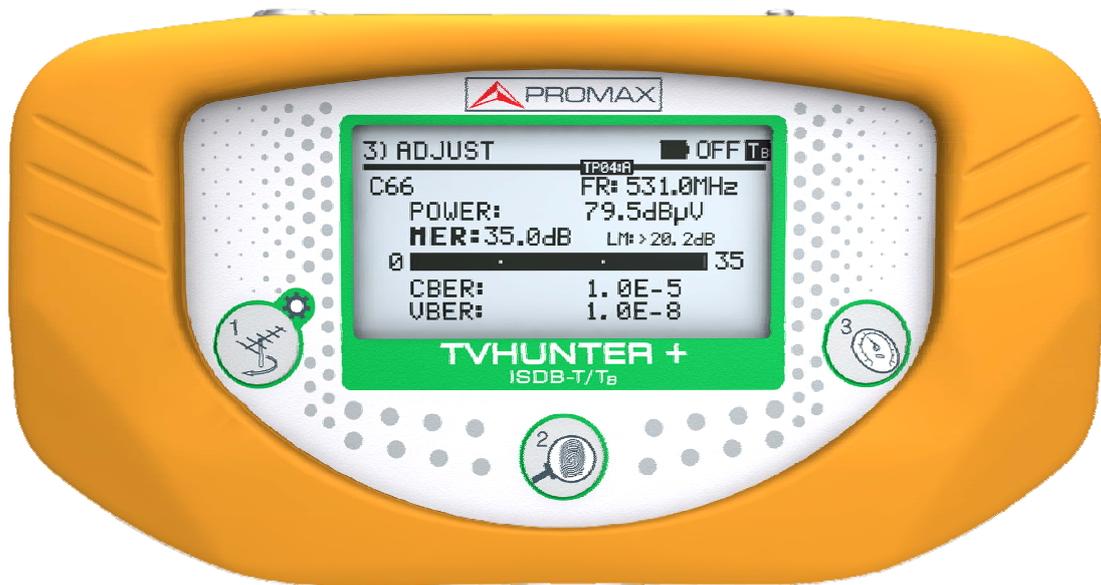


TVHUNTER+

TV HUNTER (ISDB-T/T_B)



SAFETY NOTES

Read the user's manual before using the equipment, mainly "**SAFETY RULES**" paragraph.

The symbol  on the equipment means "**SEE USER'S MANUAL**". In this manual may also appear as a Caution or Warning symbol.

WARNING AND CAUTION statements may appear in this manual to avoid injury hazard or damage to this product or other property.

USER'S MANUAL VERSION

Version	Date	Software Version
2.1	June 2024	V5.0 r3.0
1.3	May 2015	v1.04.02

SAFETY RULES

- * **The safety could not be assured if the instructions for use are not closely followed.**
- * Use this equipment connected **only to systems with their negative of measurement connected to ground potential.**
- * The mains adaptor is a **Class I equipment**. For safety reasons it must be plugged to supply power lines with their ground.
- * This equipment can be used in **Overvoltage Category I** installations and **Pollution Degree 2** environments.
- * The mains adaptor must be used only indoors. It can be used in **Overvoltage Category II** facilities and **Pollution Degree 1** environments.
- * When using some of the following accessories **use only the specified ones** to ensure safety:
 - Mains power adapter.
 - Car lighter adapter.
 - Mains cord.
- * Observe all specified ratings both of supply and measurement.
- * Remember that voltages higher than **70 V DC** or **33 V AC** rms are dangerous.
- * Use this instrument under the **specified environmental conditions**.
- * The user is not allowed to perform changes inside the equipment. Any change on the equipment must be done exclusively by specialized staff.
- * Do not obstruct the ventilation system of the equipment.
- * Use appropriate low-level radiation cables for input/output signals, especially on high level signals.
- * Follow the **cleaning instructions** described in the Maintenance paragraph.

CAUTION

The battery used can present danger of fire or chemical burn if it is severely mistreat.

Do not disassembly, cremate or heat the battery above 100 °C under no circumstances.

* Symbols related with safety:

	DIRECT CURRENT		ON (Supply)
	ALTERNATING CURRENT		OFF (Supply)
	DIRECT AND ALTERNATING		DOUBLE INSULATION (Class II protection)
	GROUND TERMINAL		CAUTION (Risk of electric shock)
	PROTECTIVE CONDUCTOR		CAUTION REFER TO MANUAL
	FRAME TERMINAL		FUSE
	EQUIPOTENTIALITY		EQUIPMENT OR COMPONENT TO BE RECYCLED
			

Descriptive Examples of Over-Voltage Categories

Cat I Low voltage installations isolated from the mains.

Cat II Portable domestic installations.

Cat III Fixed domestic installations.

Cat IV Industrial installations.

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DIGITAL TERRESTRIAL TELEVISION HUNTER (ISDB-T/T_B)

TVHUNTER+

1 GENERAL

1.1 Introduction

The implementation and consolidation of the digital TV has been a great improvement in television reception worldwide. In addition to increasing the quality of picture and sound, the digital standard has added a range of useful services to the user such as digital teletext, electronic program guide, subtitles, multiple audio languages, access to radio channels, etc. This has helped to create a more TV retroactive to the viewer.

This change requires adaptation and application of simple installation procedures, ensuring the quality of the signal received.

The TVHUNTER+ is the solution for the installers, because it allows making all necessary measurements in a quick way, achieving the best quality of reception.

The TVHUNTER+ guides the user through three steps: Detection of the transmitter, identification of the multiplex signal and fine-tuning adjustment in order to obtain the best quality signal.

The instrument can be adapted in order to work in any geographical area, because different test points can be configured according to the transmission parameters of each area. In this way, the installer can use the most appropriate configuration relating to the place where he is.

The equipment determines if the quality of the signal is enough for reception. The TVHUNTER+ processes all the information and gives to the installer **just the information he requires**, making his work as easy as possible. In the TVHUNTER+, the measurement that gives an approximate indication of the signal quality is the MER, which measures the proportion of noise with respect to an ideal signal. The instrument displays "VBER"/"LBER", "CBER" and "MER" in alphanumeric format and optionally, in a graphic bar.

The TVHUNTER+ has been specially designed to stand rough working conditions. It includes a back-light display and offers a long battery life.

2 INSTALATION

2.1 Power Supply

The TVHUNTER+ is a portable instrument powered by a Lithium-Ion rechargeable battery. The instrument is supplied with a mains adapter in order to connect it to the mains for its operation and battery charging.

2.1.1 Operation using the Mains Adapter

- 1 Turn the TVHUNTER+ off and connect the mains adapter to the external power connector  [4] (see Figure 6.-) at the right side panel.
- 2 The charging process starts automatically. The TVHUNTER+ emits an acoustic indication and on the screen shows information about the battery charging (see "3.1.3 Battery Charging"). When the battery is already charged, the instrument will automatically disconnect the charging process.
- 3 To stop the charging process, press any of these three keys  [1],  [2],  [3] for more than 2 s (the battery-charging screen will disappear).
- 4 Once the charging process stops, if you want to turn on the TVHUNTER+, hold any of the keys  [1],  [2],  [3] for more than 2 s. The battery charging process stops until the equipment starts up. The charging process is slower when the equipment is on.

CAUTION

Before using the mains adapter, make sure that is suitable for your electricity supply network: Mains power adapter model AL-101B.

The mains adapter is exclusively designed for indoor use.

2.1.2 Operation Using Batteries

The instrument is powered by a 7.4 V and 2.2 Ah Li-Ion battery.

In order to the instrument works using the battery, you should press any of these keys ( [1],  [2],  [3]), for more than 2 s.

With the battery fully charged, the TVHUNTER+ has an autonomy approx. of 5 hours in continuous operation (without powering any amplifier through the RF connector).

When the battery is flat, you will hear an acoustic indication and the screen will show the message "**LOW BATTERY**". Afterwards, if the battery is not in charging yet, it will show the message "**VERY LOW BATTERY**" and it will emit a warning acoustic indication. If it is not immediately connected to the mains, the instrument will automatically switch off.

2.1.3 Battery Charging

- 1 To fully charge the battery, connect the mains adapter to the external power supply input  [4] (see Figure 6.-) with the TVHUNTER+ switched off.
- 2 Then, connect the adapter to the mains. The charging process will start automatically. The instrument will emit an acoustic indication and the display will show the charge percentage and for how long the battery has been charging (figure 1).



Figure 1. Battery charging.

- 3 When charging is completed, the instrument emits a long acoustic indication, showing the message **"FULL BATTERY"** and it is automatically disconnected from the mains.

The charging time depends on the state of the battery. If the battery is completely flat, the charging process will take around 90 minutes. The charging process must be carry out in a range of temperatures between 5 °C and 40 °C.

IMPORTANT NOTE

At starting the battery charging process and using the instrument for a long period of time, it could be observed a heating of the instrument. This heating is normal in the power margin that must be dissipated, according to the battery charge status.

IMPORTANT NOTE

If the equipment is operating and the voltage adapter is connected, the charging process will be longer. It will depend on the consumption.

2.2 Starting-Up and Main Screen

Next, it is explained steps to follow when starting up the instrument:

- 1 Press any key ( [1],  [2],  [3]), for two seconds approximately.
- 2 The instrument will start up in *auto power off* mode. It means that the instrument will automatically switch off if you do not press any key for 5 minutes.
- 3 If you wish to cancel the automatic power off, you should keep pressing down the key  [1],  [2] or  [3] for eight seconds when starting up the instrument, until it appears the message *manual power off* on the display. At the top of the screen appears one icon for this mode.
- 4 On starting up, you will see the instrument presentation screen (Figure 2.).



Figure 2. Instrument Starting Screen.

- 5 Next, a screen will display the instrument's name, company and user names (editable by software) and the current version of firmware (Figure 3.).



Figure 3. Name of the instrument (TVHUNTER+), user's name, company, firmware's version (v1.04.02), year and serial number.

- 6 Finally, it will appear the Detect screen (1 > DETECT).

2.3 Main Screen Description

The top line of this screen is the same one for all functions of the equipment. Next it will be explained the icons and messages that can appear depending on the situation. At the top left corner it is shown the active function. There are three different states or functions: 1) **DETECT**, 2) **IDENTIFY** and 3) **ADJUST**.

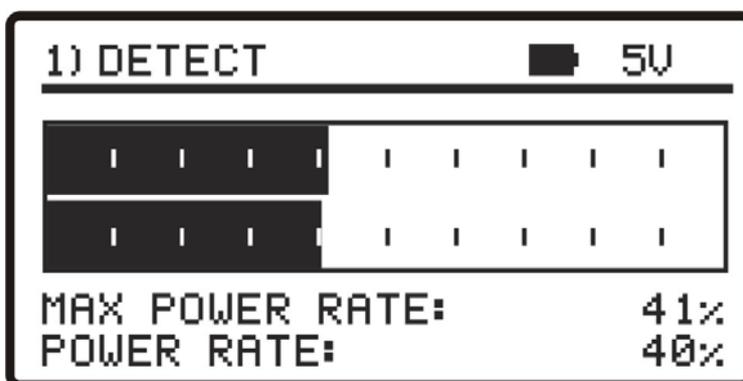


Figure 4. Main Screen (on Detect Screen).

When using the TVHUNTER+ it may appear on the display some messages and icons, depending on the status or event is taking place. These messages and icons are detailed below:

Message	Description
"LOW BATTERY"	Low power level battery. Plug it to the charger.
"VERY LOW BATTERY"	The equipment will be switched off immediately.
"SUPPLY SHORT CIRCUIT"	The external supply can be shortcut.
"SUPPLY OVER CURRENT"	The external supply has a high current consumption.
"MANUAL POWER OFF"	The instrument has to be switched off by hand.
"AUTO POWER OFF"	The instrument will switch off after five minutes of inactivity.
"SERVICE MODE"	Normal operation mode.
"BATTERY MODE"	When the battery is being charged.
"UPDATE MODE"	When the instrument is being updated.
"NETWORK NOT FOUND"	The instrument cannot find a TV network.
"SERVICES NOT FOUND"	The instrument cannot detect the services of a network.
"SIGNAL NOT DETECTED"	When no signal is detected.
"FULL BATTERY"	Battery fully charged.
"MPEG-2 NOT DETECTED"	It is not detecting the Transport Stream MPEG-2 signal.
"LOADING NETWORK"	After finding a signal, needs a time to load the network.
"LOADING SERVICES"	After finding a network, needs a time to load services.
"HIGH TEMPERATURE"	The running temperature is too high. The instrument must be switched off for a while. If the problem persists, contact with the technical support.

At right top corner, next to the messages, the following icons may appear:

	Power supply connected.		ISDB-T/T _B signal locked.
	Battery power level.		Manual switch off.
	ISDB-T/T _B signal not locked.		Connected to PC through a USB port
		External voltage supplied through the RF connector (5V/12V/15V/24V/OFF)	

3 OPERATING INSTRUCTIONS

3.1 Description of Controls and Elements

- Front panel

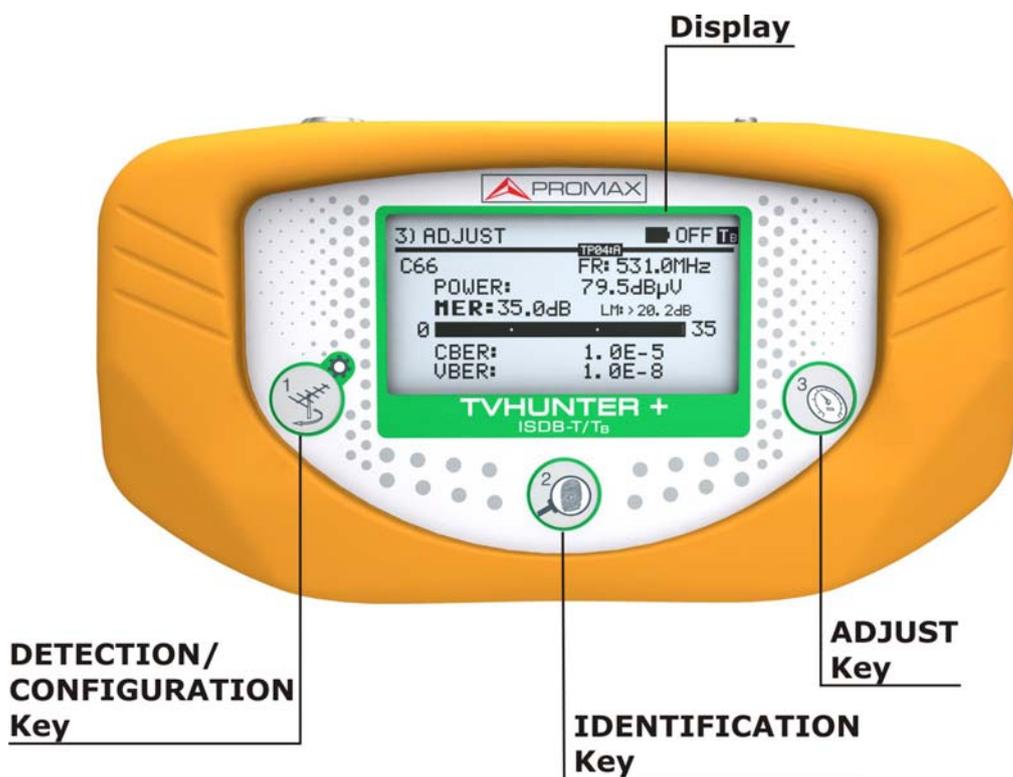


Figure 5. Front panel.



DETECT/CONFIGURATION key

This key activates the function for **Detecting** the **TDT** signal. Press and hold this key to turn on the instrument. At the **DETECT** screen, press and hold this key to access the **Setup** menu. At the **DETECT** screen, pressing this key you can switch between 0V and the external power supply selected at the **Setup** menu. Press and hold this key on the **Identify** or **Adjust** screen to move to the **Test Point 1 (TP01)**.



IDENTIFY key

This key activates the **Identification** function in order to check if the detected test point is one of the memorised in the instrument. It shows the frequency, network name and the list of services (first 48 services). Press and hold this key to turn **ON** or **OFF** the instrument. At the **IDENTIFICATION** screen, pressing this key you go to the next **Test Point**. With a short press on the **Identify** screen you go to the next **Test Point**. With a long press (1s) you go to the previous **Test Point**.



ADJUST key

This key activates the fine-tune **Adjustment** function in order to adjust accurately the antenna for optimum signal reception. This function measures **POWER, MER, CBER** and **VBER/LBER**. Press and hold this key to switch ON or OFF the instrument. At the **ADJUST** screen, pressing this key it goes to the next test point or to the next layer of the same test point. With a long press (1s) you go to the previous **Test Point**.

■ **Side panels**

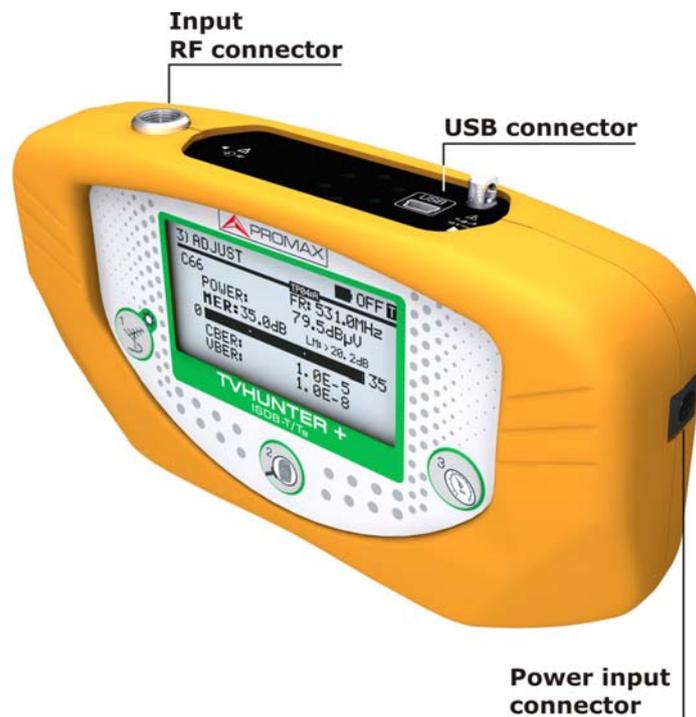


Figure 6. Side panels.



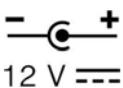
RF signal input

Maximum level 120 dB μ V. Universal connector for F/F, F/DIN and F/BNC adapter, with an input impedance of 75 Ω . External power supply for external amplifiers (OFF, 5V, 12V, 15V, 24V).



USB input

USB connector for data transfer, calibrating and configuring the instrument using a PC.



Power input

External 12 V power input for charging the battery or plug to the electricity network.

3.1.1 Navigation keys

The same key has different functions depending on the time user is pressing the key and the screen:

KEYSTROKE	TIME	
Short	< 0,5 s	
Long	0,5 < > 1 s	
Hold	> 1 s	

► With the equipment OFF

		It turns ON the equipment with auto power-off enabled (4 s)
		It turns ON the equipment with auto power-off disabled (manual power-off) (8 s)

► From the **DETECT** screen

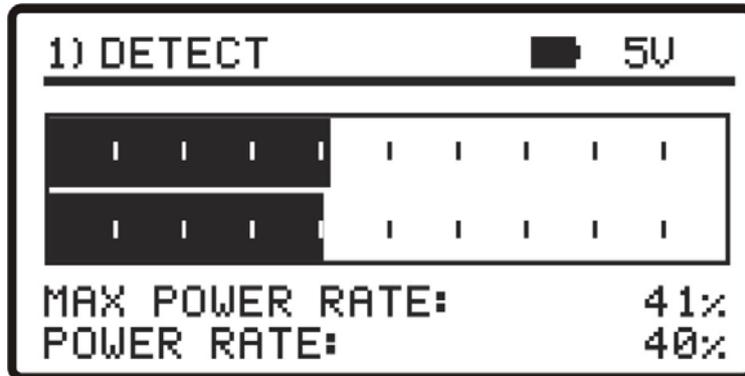
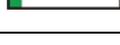


Figure 7. DETECT screen.

		It switches external power supply
		It accesses the CONFIGURATION menu
		It goes to the IDENTIFICATION screen
		It turns off the equipment
		It goes to the ADJUST screen
		It turns off the equipment

► From the **IDENTIFICATION** screen



Figure 8. IDENTIFICATION screen.

	<input type="checkbox"/>	It goes to the DETECT screen
	<input checked="" type="checkbox"/>	It goes to the first test point
	<input type="checkbox"/>	It goes to the next layer (A,B,C) of the test point or to the next test point
	<input checked="" type="checkbox"/>	It goes to the previous test point
	<input checked="" type="checkbox"/>	It turns off the equipment
	<input type="checkbox"/>	It goes to the ADJUST screen
	<input checked="" type="checkbox"/>	It turns off the equipment

► From the **ADJUST** screen

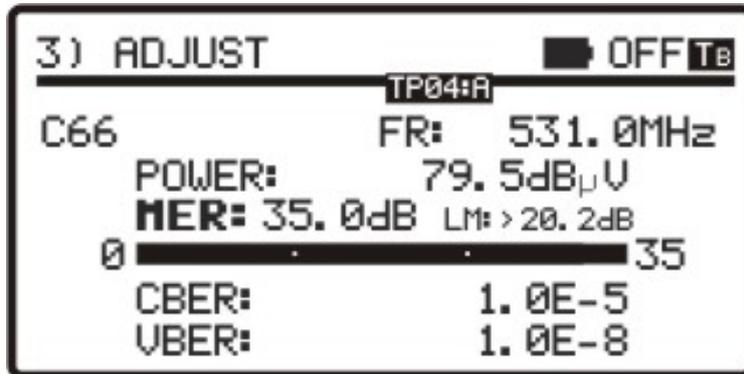


Figure 9. ADJUST screen.

		It goes to the DETECT screen
		It goes to the first test point
		It goes to the IDENTIFICATION screen
		It turns off the equipment
		It goes to the next layer (A,B,C) of the test point o to the next test point
		It goes to the previous test point
		It turns off the equipment

3.2 Setup menu

To access the setup menu, from the **DETECT** screen, press and hold the key



[1] for 2 s approximately until appears the setup screen (Fig. 10).



Figure 10. Setup Menu.

Once inside, to move along the setup menu, press:



To exit the setup menu.



To move along the setup options.



To move among the available values of a menu option or to accept when there are not available values.

Available setup options are:

▶ **START AUTO-SCAN**

It starts the auto-scan function (refer to section 4.2.1).

▶ **EXTERNAL SUPPLY**

This is the voltage that the instrument can provide to the antenna through the RF connector. Available values are: **OFF, 5V, 12V, 15V, 24V**.

▶ **SOUND CONTROL**

There are three different options: **ON, OFF** and **BEEP**. The option **ON** emits a sound that varies in tone depending on the input power and also sounds a beep when pressing a key. The option **OFF** does not emit any sound. The option **BEEP**, emits a beep every time you press a key but does not sound the power detector.

► **BACKLIGHT MODE**

Activates (**ON**) or disables (**OFF**) the back-light of the screen. The **AUTO** option activates the back-light when the user is pressing keys. After one minute without using the instrument, the back-light turns off.

► **CONTRAST LCD**

Allow to chose between four contrast levels.

► **CONFIRM & EXIT**

After making changes in the setup menu, you should use this option to confirm and apply the values and exit the setup menu.

ATTENTION: From the **DETECTION** screen, pressing the key  [1] you can change between 0V (**OFF**) and the voltage selected in the option "**EXTERNAL SUPPLY**". This voltage is displayed at the top right corner of the screen. This voltage will be applied on the **IDENTIFY** and **ADJUST** stage.

3.2.1 **Auto-Scan**

The **Auto-Scan** function scans the frequency band of the DTT (ISDB-T/T_B) along the frequency range set by the user.

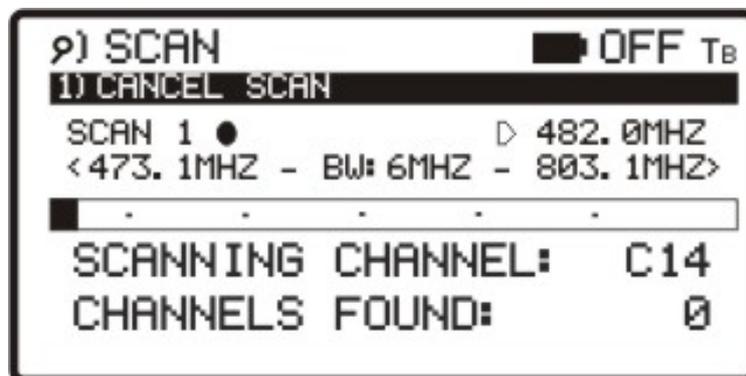


Figure 11. Scanning process.

The auto-scan is configurable by the user through an application software (see **TVHUNTER+** software section). The user can set up **to four different scans**, defining the frequency range and the scan of the step among other features. They can also be enabled or disabled by the user. For more information about how to configure the auto-scan, see section "General Configuration of the Instrument".

On screen, the progress bar placed at the middle of the screen shows the progress of the current scan.

On the line above there is some information about the scan: on the left there is the number of scan (next to it a symbol, if the background is black, indicates this scan is active) and on the right the frequency being scanned at the time (next to it a "play" symbol, if the background is black, indicates the channel detection is working). On the line below there is the range of frequency scanning and in between the scan step per channel. Both the frequency scanning and the scan step can be set by the user using the software application.

At the bottom of the screen, the line "**Scanning Channel**" shows the channel being scanned and the line "**Channels Found**" the number of channels detected so far. The name given to each channel is according to some parameters set by the user through the software application.

When it detects a channel with programs, it beeps and increases in one unit the counter "**Channels Found**". When one scan is finished, it goes to the next one, until the fourth and last, after which the process ends. The auto-scan goes through the four scans, even if one of these scans is disabled. In that case it shows a message ("scan disabled") on screen and goes to the next scan. By default, scan 1 must be always enabled.

At the top of the screen appears the available options. These options change depending on the status of the Auto-Scan. They are:

► **Cancel Scan** (during the scan)

This option works pressing the key  [1] during the scan. This option appears during the scan. After canceling the fourth and last scan the user can start a new scan (starting from scan 1) or discard the results obtained.

► **Discard** (after finish or cancel)

This option works pressing the key  [1] after canceling or finishing the last scan. It discards all the scans done, then all found channels are deleted and goes back to the Detection screen.

► **Rescan** (after finish or cancel)

This option works pressing the key  [2] after cancelling or finishing the last scan. It starts the whole auto-scan, starting from Scan 1.

► **Save** (after finish the scan)

This option works pressing the key  [3] after finishing the last scan and only if some channel has been detected. It saves all data obtained during the four scans.

If you save the channels after scanning, they will be used as a test points. It also assigns the name of the channel as an identification name for the test point.



Figure 12. Scan finished.

After saving the channels found during scanning, the instrument goes to the function "**Adjust**" (refer to section "Antenna Adjustment for Optimum Signal Quality").

3.3 **Antenna Orientation for Optimum Reception**

The TVHUNTER+ has been designed to adjust the orientation of a digital terrestrial receiver antenna. By this way, you can achieve an optimal signal reception from the transmitting source. You should previously enter the measurement points of the area where you are going to work, via the control software.

The adjustment process consists of three stages:

- 1 Transmitter source detection and location: **1 > DETECT.**
- 2 Identification of the multiplex channel: **2 > IDENTIFY.**
- 3 Antenna adjustment for optimum signal quality: **3 > ADJUST.**

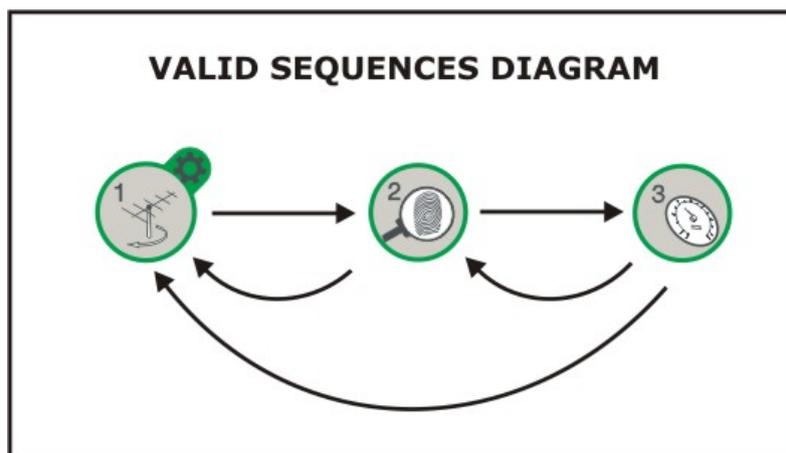


Figure 13. Valid sequences diagram.

3.3.1 Transmitter Focus Detection and Location (1 > DETECT)

When starting up, the instrument firstly access this function (Figure 14.). If it is not the active function then press the key  [1] to select it.

The purpose of this function is to find the best orientation for the antenna. For that, you should place the antenna where you receive the most powerful signal from the transmitter source.

- 1 Connect the instrument to the antenna socket.
- 2 On the screen you will see two horizontal bars that can vary depending on the power signal. The upper horizontal bar keeps the maximum value measured during tracking. The lower horizontal bar shows the signal power in real time. On the lowest part of the screen is displayed the power in percentage equivalent to the figures shown in the charts. In addition to these bars, there is an audible signal (configurable through the setup menu) that varies depending on the power signal, from low tone (low power) to high tone (high power).
- 3 If no signal is detected, the display will show horizontal bars at minimum level and the percentage of power rate at 0 %. There will not be either audible signal and it will appear the message "**SIGNAL NOT DETECTED**".

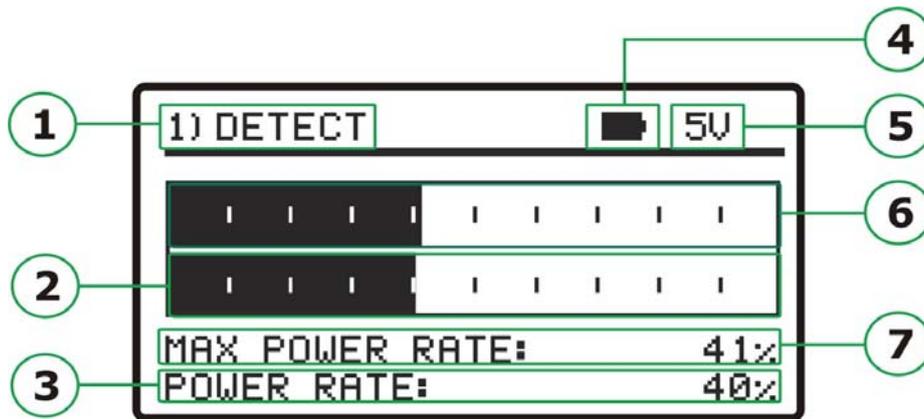


Figure 14. DETECT function.

- ① Active function indicator.
- ② Real time power bar.
- ③ Percentage of the real time power.
- ④ Battery status.
- ⑤ External power supplied.
- ⑥ Maximum measured power bar.
- ⑦ Percentage of maximum measured power.

3.3.2 Identifying multiplex channels (2 > IDENTIFY)

Once the transmitting source has been detected (by localising a power maximum), you should check if the received signal corresponds to any of the test points memorised.

- ① Select the identification function **2> IDENTIFY** by pressing the key  [2].
- ② The key  [2] enables you to change the selected test point or the layer in a sequential way (see next figure). After a while at the test point, if it locks the signal, first it shows the layer A of the test point, and pressing again shows the layer B and C (if there are). If does not lock the signal or the user does not wait long enough for the locking, pressing this key moves to the next test point. To select a specific test point, press repeatedly this key until the display shows the name assigned to the desired point. Each time you press shortly this key it advances to the next Test Point or layer. If you press longer (1s) this key it goes back to the previous test point or layer. If you want to go to the first Test Point (TP1) you should press the key  [1] for 1s.

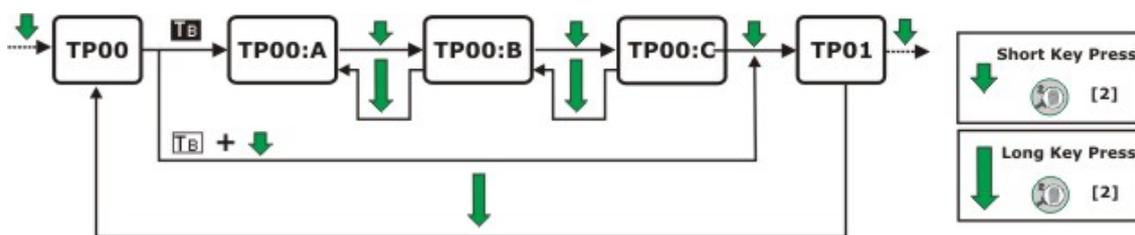


Figure 15. Rotation of active test points.

- 3 When you select a specific test point, the name and frequency assigned to that point is displayed on the screen. On the top line of the screen it appears the number of the detection point you are identifying, from TP01 to TP50 maximum.
- 4 After selecting a test point, if it is detected a signal with a valid transport stream, the instrument shows the symbol **T_B** at the top right corner (white letter on a black background) which means the signal has been locked and next to the test point appears the corresponding layer (A, B or C). Then, try to obtain the network name and its services.
- 5 When this information is detected, it will be shown on the display. Sometimes this could cause a reduction in the amount of identifying text characters, in order to adjust them to the screen size.

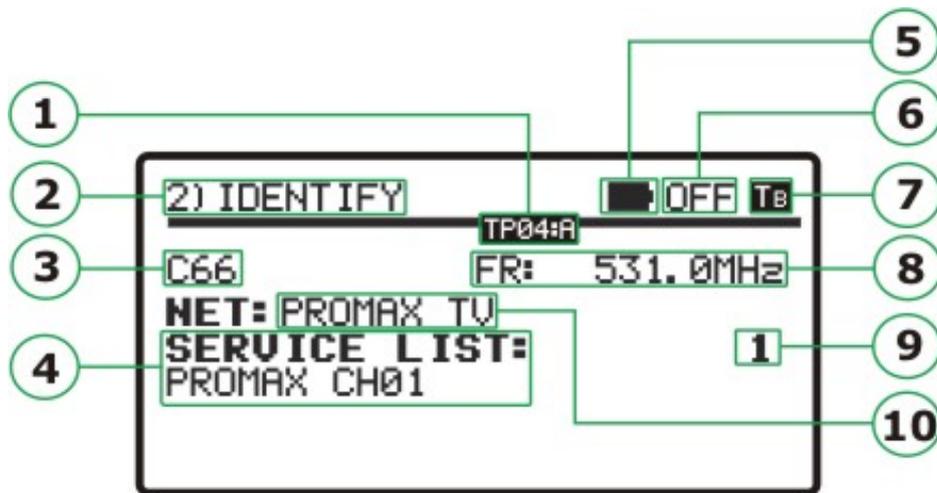


Figure 16. IDENTIFY function.

- ① USB conect.
- ② Manual Power off.
- ③ Function 2: Identification.
- ④ Test Point Name.
- ⑤ Channel Services.
- ⑥ Remaining battery power.
- ⑦ External power supplied.
- ⑧ Locked signal (black background).
- ⑨ Frequency.
- ⑩ Number service/Total services.
- ⑪ Frequency Network.

- ⑥ Maybe it could not get any **ISDB-T/T_B** signal, or with a valid Transport Stream, or even not a **RF** signal. Then it will appear the **T_B** symbol (white letter on a black background) at the top right corner and the name of the test point memorised. If later on, it achieves to lock the signal, it will update the services list of the layer and the colour of the symbol shown will change (white letter on a black background).

The identification system is based on a database of test points. Each test point corresponds to a frequency and a multiplex channel of a broadcasting company. Test points can be defined and updated to the instrument by the user via software (refer to the software manual section) or they can be detected and memorised in the instrument by mains of the Auto-Scan function (refer to auto-scan section).

The instrument can store up to fifty points of detection. Each test point is defined with a name up to 8 letters, which appears on the display when is selected. The number of active test points can be also selected.

3.3.3 Antenna Adjustment for Optimum Signal Quality (3> ADJUST)

Once the antenna has been positioned in order to receive the maximum power and you have identified the multiplex, it should be adjusted to achieve the maximum **MER** level, and therefore the best quality at reception.

Through the function **ADJUST** you should check every access point of the telecommunication facility, according to the characteristics and rules of your area. Check what rules or decrees are applied on your country or area:

- 1 To select the function **3> ADJUST** you must press the key  [3]. When a signal with a valid transport stream is detected, the **TVHUNTER+** shows the network at the top line and the sign **T_B** at the right corner. Next to the test point appears the layer.
- 2 This function measures the ratio between the **ISDB-T/T_B** average power and the noise average in a constellation (**MER**). Next to it, it shows the measure of the Link Margin. It also measures the error rate, before the Viterbi correction process (**CBER**) and after it (**VBER/LBER**).
- 3 Measurements are shown on the screen in a graphical and alphanumerical way (see next figure). The unit of measure of the power average is configurable by software. It can be selected among dB μ V, dBmV or dBm.

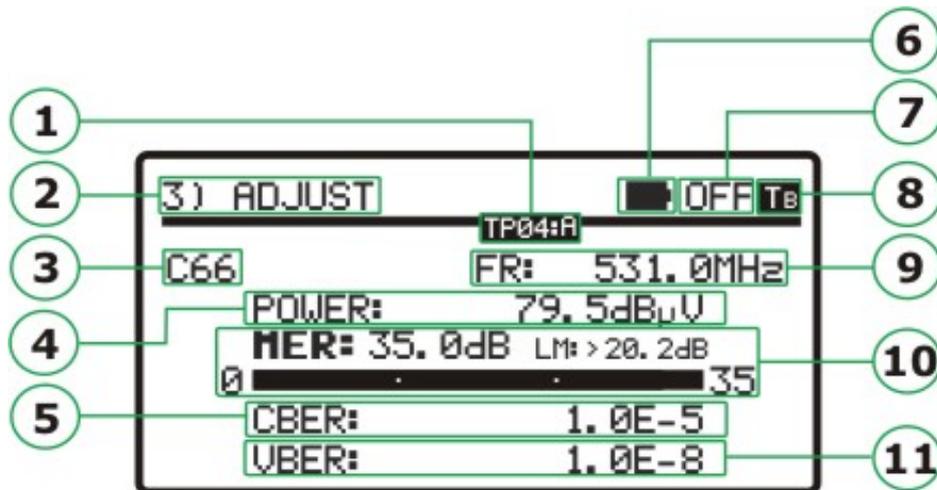


Figure 17. ADJUST function.

- 1 Sequential number of the test point and layer.
- 2 Active function (3.- Adjust).
- 3 Test point Name (terrestrial multiplex name stored).
- 4 Transmitter power measurement.
- 5 CBER measurement.
- 6 Remaining battery power.
- 7 External power supplied.
- 8 Signal locked.
- 9 Frequency.
- 10 MER measurement and Link Margin.
- 11 VBER/LBER measurement.

4 Once the antenna is properly oriented the user can measure another test point of the equipment. A short press on  [3] advances to the next test point. If it is a long press (1 s) goes to the previous test point or layer. To return to the first test point (TP01), press holding on  [1].

5 When moving the antenna, the signal / noise ratio (**MER**) exceeds the quality reference value, the instrument will emit a high-pitched audible signal and the word MER will become bold (**MER**). If the MER value is below the quality reference then the instrument will emit a low-pitched audible signal and the word "MER" will not change. To configure the quality reference value use the remote control software (see section 3.).

- 6 To turn off the instrument, simply press the key ( [1],  [2] or  [3]) for more than two seconds.

As time goes by, the demodulator circuit tends to measure better, due to it includes an input signal tracking and an adaptation algorithm. Therefore, to ensure a good quality at reading signal, you should wait for some additional measurements.

NOTE: For the final step of precise adjustment and the optimisation of the signal quality, it is important to select the most critical test point. This will guarantee the quality for other points with better conditions.

3.4 Equipment Configuration

Along with the computer software it is provided the control software named "TVHUNTER+" that allows several operations on your instrument.

The most important function of this software is that allows you to create a table with different points of measurement. Later on, it is loaded into the instrument through a USB cable. Each of these measurement points has associated a name and a frequency that corresponds to a multiple channel.

The user can load the configuration with the measurement points corresponding to the area where the instrument will work, because the multiplex channels can change depending on the geographic area. The equipment can store up to 50 measurement points, which is enough to cover any geographical area.

In addition, the user can also configure the auto-scan parameters, such as the frequency range and the step.

The software also allows you to set various parameters of the instrument and edit some text messages on the screen, such as the user's name and the user's company.

Once you have configured your instrument, in order the new settings take effect, it must be restarted.

All the necessary information for the computer's configuration and the use of the "TVHUNTER+" software can be found in the next section.

CONTROL PROGRAM (PC)

NOTE:

To update the software version and the user's manual access the download area at the **PROMAX** web page:

www.promaxelectronics.com

4 SOFTWARE APPLICATION

4.1 General

4.1.1 Description

The **TVHUNTER+** software configuration is the complementary software application for the measuring equipment **TVHUNTER+**. The **TVHUNTER+** design is based on a microprocessor, which allows data to be exchanged between the instrument and a remote controller (usually a personal computer) via an USB 2.0 cable. So, the **TVHUNTER+** can transmit, receive, store and modify different settings and parameters, which gives it a great versatility.

This program works with file texts in "**PRO**" format. A "**PRO**" file is a text file that can be edited, using the program interface, to define the **TVHUNTER+** detection points and configuration parameters. Once this is done, it can be saved and sent to the instrument. These files can be also transmitted from the instrument and received by the computer, where is installed the software, in order to be read by the interface, and if necessary, reconfigured and sent back.

From the program the user can set the detection points parameters, like the channel name, frequency channel and other measurement data (guard interval, spectral inversion, etc ...) adapting them to the channels the user wants to measure. Once created the file containing the table with the detection points, it is loaded into the **TVHUNTER+**. Then, the installer will use these detection points to track, measure and check these channels.

In digital terrestrial television, due to the large number of channels, at national, regional and local levels, it is advisable to have several configurations, one for each area. In this way, the installer can load on the instrument the file with the points of detection for the area where it is going to work.

If the installer could not configure the test points or they are unknown, he has the option to start an auto-scan to detect which channels are received in the area.

4.1.2 Hardware and Software Requirements

The minimum requirements for the installation and proper operation of the application are the next:

► **Hardware requirements**

- Computer IBM compatible Pentium Computer or higher.
- 7 MB of available space on the hard disk.
- Internet connection.

► **Software requirements**

- To run this software is necessary a computer with one of these Operative System: Windows XP Vista 32bits, Vista 64bits, XP 32bits, XP 64bits, Win7 32bits, Win7 64bits and Windows 8.

4.1.3 Software Installation

The installation file is in the **TVHUNTER+** product page, in the download area on the PROMAX webpage at:

www.promaxelectronics.com

Before proceeding the installation, read the following instructions. If you have any doubt, please contact the technical support.

- 1 Download the installation file on your PC and unzip it.
- 2 Double click on the file **TVHUNTER+.exe**.
- 3 It will start the installation wizard that will guide you during the process.
- 4 The installation program creates, by default, a directory in the path **C:\Program Files\PROMAX\TVHUNTER+**, where the application files are copied.
- 5 To run the program, go to: **Start \Programs\PROMAX\TVHUNTER+** or click on the desktop shortcut.
- 6 In the section "Software Description" it is explained in detail how works the program.

NOTE: If your PC does not recognize the **TVHUNTER+** when connecting, install the corresponding driver, available at the **TVHUNTER+** product page.

4.1.4 Legal conditions

Read the contract carefully in its entirety before you install the program. Installing the program means that you have accepted the following terms and conditions:

- ▶ **SUBJECT.** The subject matter of this Contract is the grant to the end user by **PROMAX ELECTRONICA, S.L.** a non-exclusive and non-transferrable personal license to use this version of the "TVHUNTER+" program for an indefinite period of time.
- ▶ **LICENCE.** The Licence of Use granted hereby refers exclusively to the end user, who shall be considered legitimised to use the program only.
- ▶ **OWNERSHIP OF THE SOFTWARE.** The end user acknowledges that the program referred to in this Contract is the exclusive property of **PROMAX ELECTRONICA, S.L.** The end user may only acquire the personal and non-transferrable right to use the software that is the subject matter of this Contract for the purposes herein expressed.

Since the program granted is protected by industrial and intellectual copyright, infringements by the user of these aforementioned obligations will give rise to the corresponding liabilities in accordance with the legislation in force.

- ▶ **RESOLUTION.** The licence or authorisation of use is granted for an indefinite period of time. However, in the event of non-compliance by the end user with any of the clauses hereof, the Contract may as of right be terminated without any legal formality.
- ▶ **EXPLANATORY PROVISION.** Notwithstanding the accuracy of the software granted, **PROMAX ELECTRONICA, S.L.** is fully exempt of liability for consequences arising from any possible omission existing in the program or from improper use by the end user of any of the information it contains and generates. Nor can **PROMAX ELECTRONICA, S.L.** be held liable for the suitability or accuracy of the data obtained for particular purposes or functions, since the only obligation of the latter, under this Contract, is the provision of means and not of results.
- ▶ **FINAL CLAUSE.** The use of this software referred to herein signifies the tacit and unconditional acceptance of its conditions.
- ▶ **JURISDICTION.** Both parties, explicitly waiving any rights that may correspond to them, agree to submit all controversies that may arise from this Contract to the jurisdiction and competence of the Judges ad Courts of Barcelona.

4.2 Software Description

4.2.1 Main Window Description

When running the **TVHUNTER+** software, it appears the main window (see next figure). From top to bottom, this window is divided in:

- **Title Bar:**
It shows the program name and the usual options to maximize, minimize and close.
- **Menu Bar:**
Through these menus you can access to all available options.
- **Toolbar:**
These icons are shortcuts to access the most common functions.
- **Log Window:**
On this window is displayed all actions the program performs. You can view but not edit.
- **Status bar:**
At the bottom left side it is displayed the path to the file that is loaded in memory. At the middle it is displayed the name of the equipment which is connected (**TVHUNTER+**). At the bottom right side it is displayed the port used to communicate (USB virtual serial port).

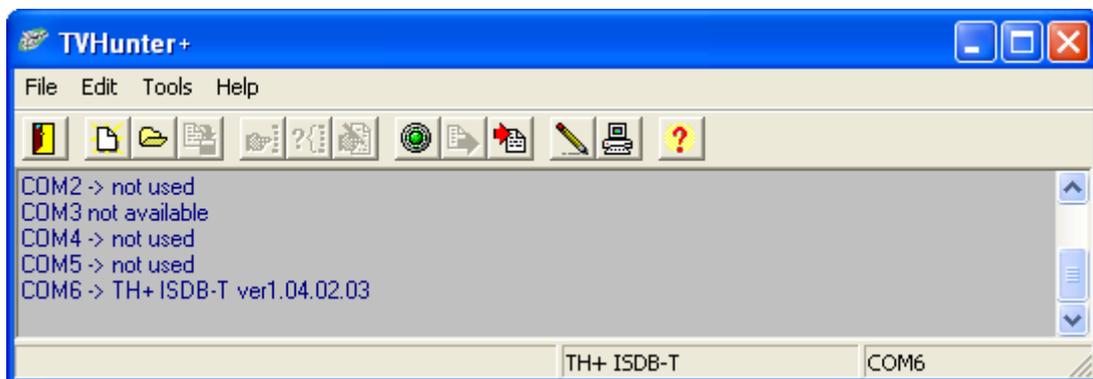


Figure 18. Main window of the **TVHUNTER+** software.

Next we are going to explain in detail every menu option and the shortcut icon associated with each one.

4.2.2 File Menu

It is the first menu in the menu bar. Files generated and read by the program are identified with the "PRO" extension. The program is not able to keep more than one configuration file in its memory.

The **File** menu includes following submenus in order to manage files:

- ▶ **New** : It creates a new configuration file. If you select this option and there is an existing configuration file in the program memory, you will be asked to save the file before creating a new one.
- ▶ **Open** : It opens a configuration file. If you select this option and there is a configuration file in the program memory, you will be asked to save the file before opening a new one.
- ▶ **Save** : It saves the current configuration file with the same name.
- ▶ **Save As:** It saves the current configuration file with the name the user wishes.
- ▶ **Exit** : It closes the program. If you select this option and there is a configuration file in the program memory, you will be asked to save the file before exiting.

4.2.3 Menu Edit

The "**Edit**" menu allows you to set parameters and edit **TVHUNTER+** messages.

- ▶ **Point** : It enables you to define every detection point and related parameters. These are frequency, name, guard interval, etc... See section "Configuring detection points" for details.
- ▶ **Config** : It enables you to edit general parameters of the program, such as detection points to send, threshold of quality signal, noise ratio, auto-scan parameters, etc... See section "General Configuration of the Equipment" for details.
- ▶ **Message** : It allows you to edit some messages that appear on the **TVHUNTER+**. See section "Configuring text messages" for details.

4.2.4 Test Points Configuration

The test points are the points of measurement that the **TVHUNTER+** uses for analysis and measurement of digital terrestrial channels. The table with the points of test must have been previously created, configured and loaded on the instrument. Subsequently, when a specific detection point is selected and the **TVHUNTER+** detects a channel that matches with the parameters of that test point, the instrument identifies the signal, extracts the name of the transport stream received and displays it on the screen. After identification, the instrument can perform the measurement of the signal power and the **MER**, **CBER** and **VBER/LBER**.

In the case of digital terrestrial television, due to the large number of existing channels, adding national, regional and local ones, it is advisable to have several configurations grouped by area. In this way, the installer can load on the instrument the file with the points of detection for the area where is going to work.

Parameters that appear in the editing window are selectable by the user. There are two other parameters that do not appear in the editing window, because the **TVHUNTER+** can detect and configure them automatically. They are the Code Rate, Constellation, Spectral inversion, FFT Mode and Guard Interval.

In order to set the parameters of the detection points, select the **"Point"** option in the **"Edit"** menu or click on the icon .

The **"Detection Points Editor"** window allows you to define each point of detection (see next figure).

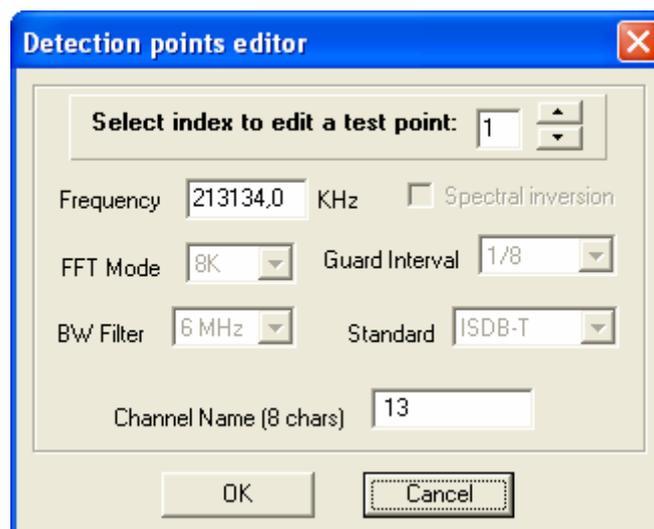


Figure 19. Configuring **Detection Points**.

In this window there are next fields:

- **Select index to edit a test point:**
This field identifies every detection point with a number. There is a total of 50 detection points, numbered from 1 to 50. To edit a specific detection point, you should enter the corresponding number using the arrows to increase or decrease the counter.
- **Frequency:**
In this field is entered the frequency for the multiple channel you want to tune. This frequency should be between 170 MHz and 858 MHz. Out of these range is not valid.
- **Spectral inversion:**
The TVHUNTER+ performs the spectral inversion automatically when the tuner is not locking.
- **FFT Mode:**
Signal transmission mode.
- **Guard Interval:**
The purpose of the guard interval is to introduce immunity to propagation delays, echoes and reflections.
- **BW Filter:**
Define the bandwidth of the signal. Select among the available values (5, 6, 7 or 8 MHz).
- **Standard:**
Selection of the digital terrestrial standard between ISDB-T or ISDB-T_B.
- **Channel Name:**
You may assign a name up to eight letters to each detection point. These names will appear on the TVHUNTER+ screen identifying every detection point.

See a practical example of how to configure and load test points in the section "How to create a file with new detection points".

4.2.5 General Configuration of the Instrument

In order to modify the general configuration of the instrument, you should select the **"Config"** option from the **"Edit"** menu or click on the icon .

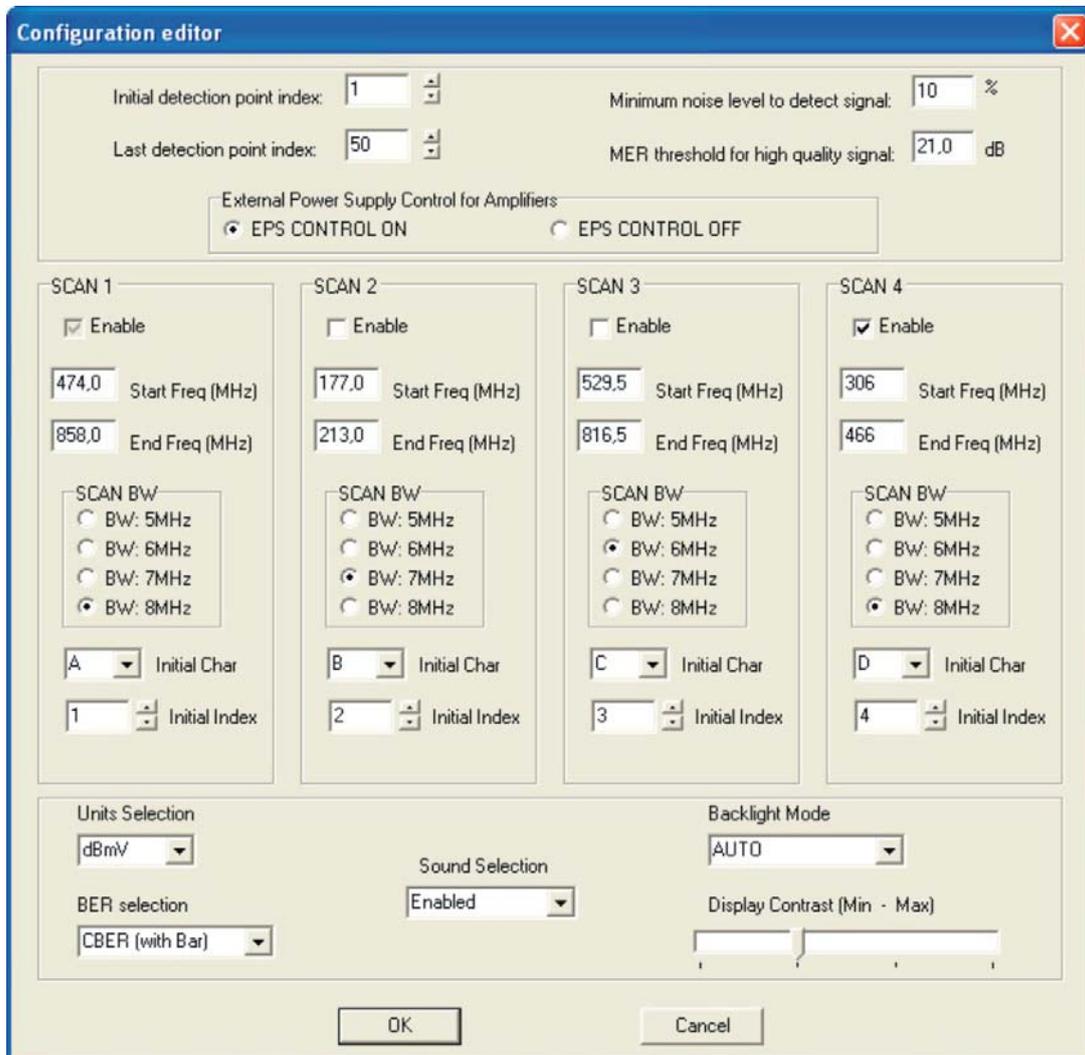


Figure 20. General Configuration of the instrument.

At the General Configuration window (see figure above) there are displayed next fields:

- **Initial detection point index:**

It allows you to define the margin of detection points that will be sent to the **TVHUNTER+**. This field indicates what point will be the first one to be sent of those selected. To increase or decrease the index number, you should click on arrows, which are next to the box.

- ***Last detection point index:***
 It allows you to define the margin of detection points that will be sent to the **TVHUNTER+**. This field indicates what point will be the last one to be sent of those selected. To increase or decrease the index number, you should click on arrows, which are next to the box.
- ***Minimum noise level to detect signal:***
 In this field you should enter the percentage of noise signal from which it is considered that the equipment has detected the signal. It is recommended a value around 10 %. Over this value, the equipment will beep, varying pitch depending on the power signal. Below this value it will not beep.
- ***MER threshold for high quality signal:***
 This field allows you to define the MER threshold from which it is considered that a signal is a good quality one.
- ***External Power Supply Control for Amplifiers:***
 It allows you to active (**ON**) or to disable (**OFF**) the external voltage for Amplifiers. This value will be applied on starting the **DETECT** function of the **TVHUNTER+**. If the user disables this option and later selects a voltage on the configuration menu of the **TVHUNTER+**, the voltage will not be applied. This option avoids than a user may accidentally apply voltage to an antenna.
- ***SCAN:***
 There are four boxes for the configuration parameters of the scan from 1 to 4. Each box contains the same parameters. The following describes in detail:
 - ▶ **Enable:** Checking this box it enables scanning. When performing the auto-scan only works with the enabled scans. The default scan 1 must be always enabled.
 - ▶ **Start Freq (MHz)** Start frequency of the scan.
 - ▶ **End Freq (MHz):** End frequency of the scan.
 - ▶ **SCAN BW:** The step in MHz used by the system to find channels from the start to the end frequency.
 - ▶ **Initial Char:** First character assigned to all channels during scanning.

- ▶ **Initial Index:** First number of the sequence to be assigned to the first channel during scanning.

See a practical example of how to configure the auto-scan in the section "**How to change the Auto-Scan parameters**".

- **Units Selection:**
It allows you to choose what kind of units you want to use in the TVHUNTER+: dB μ V, dBmV or dBm.
- **Sound Selection:**
There are three different options: Enabled, Disabled and Only Warnings. The option **Enabled** emits a sound that varies in tone depending on the input power, also sounds a beep when pressing a key and for warnings. The option **Disabled** does not emit any sound. The option **Only Warnings** emits a beep only if there is a warning.
- **BER selection:**
It allows you to select the measurements you want to watch on the **ADJUST** screen. They can be **CBER** (with bar chart), **VBER/LBER** (with bar chart) or **CBER + VBER/LBER** (both at the same time in numeric format but with no charts).
- **Display Contrast (Min – Max):**
Allow you to select among 4 levels of contrast.
- **Backlight Mode:**
Allows selecting among three possible options of backlighting: AUTO, ON and OFF. The option **ON** activates the backlight and the option **OFF** disables the backlight. The option **AUTO** activates the backlighting when the user is working with the instrument. After one minute without using the instrument, the backlight turns automatically off.

4.2.6 Messages Configuration



Figure 21. Text messages editor window.

The TVHUNTER+ uses 57 text messages. There are two messages that user can edit. The message number one (user) and the message number two (Company). The rest of messages are blocked and protected by password. They are accessible only by qualified staff. You can difference between editable and non-editable messages because in editable ones letters are in black and in non-editable ones they are in grey.

To modify a text message, first you should click on the "Select the message to edit" box, and put the message number to edit. You may also use the arrows next to the box to increase or decrease the counter. At the "edited" box it will be shown messages.

When displaying at the box "**Edited**" the message to edit, click on it and edit the text. If during editing you want to restore the previous text, which appears in the box "**current**", click on the icon .

Digits and letters above the box "**edited**" mean the amount of characters that accepts each message.

Once edited, click on "**OK**" to exit saving changes or "**Cancel**" to exit without saving.

4.2.7 Tools Menu

Tools menu includes next options:

- ▶ **Detect** : This option scans all existing computer ports searching the port that is using the **TVHUNTER+**. As the program checks ports, these are displayed in the log window, showing their status (available/used/not used). When it finds the port where the **TVHUNTER+** is connected, it will be shown on the log window and the icon will light up. This port will be the one used by the program to send or receive files. If your PC does not detect the **TVHUNTER+**, install the USB driver available on the **PROMAX** website or contact the technical service.

- ▶ **Send** : This option allows you to transmit the configuration loaded into the program memory to the **TVHUNTER+**. The program sends the configuration through the port where is connected the **TVHUNTER+**. If it does not know what port is, it will check all existing ports. If at the end it cannot find the port, it will show an error message at the log window.

- ▶ **Receive** : This option is the same as the previous one but in the opposite direction. The configuration is transmitted from the **TVHUNTER+** to the program memory. Take in account that if you select this option and there was a configuration in the program memory, it will ask you for save the configuration before the transmission. After that, the **TVHUNTER+** sends the configuration through the port to which it is connected. If it does not know the port, it will check all existing ports. If at the end cannot find the port, it will appear an error message at the log window. If it finds it, it will start transmission.

- ▶ **Editor** : This is an option only for using by qualified staff. It opens a text editor that enables you to edit, create, save and print ASCII files. This application has the same basic functions than other text editors: Find, Copy, Cut, Paste, etc... Usually, there is no need to use this option, because the program automatically generates configuration files. Even so, in specific instances may be interested do small changes on these files. If you are going to do some changes on a configuration file in text format, be cautious because you can damage the whole file.

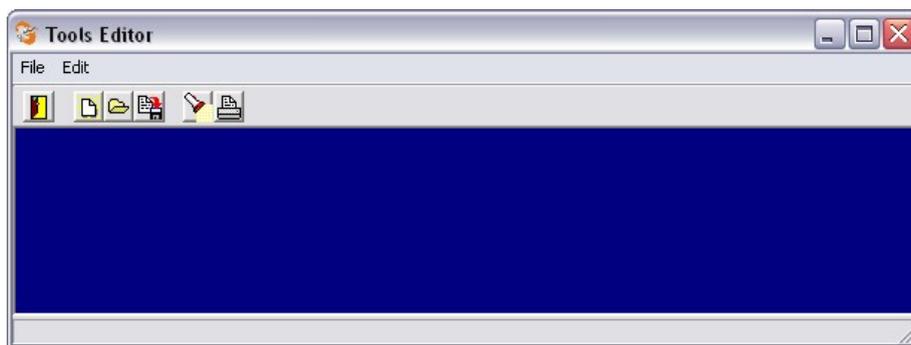


Figure 22. Tools Editor Window.

- ▶ **Terminal** : This is an option for advanced users. It opens a remote control console that enables you to communicate with the equipment using some specific commands. For details, see section "**5.4.1 Remote Control**"

4.2.8 Remote Control of the Instrument

Terminal is a console based in PkTerm program, for MSDOS. This console allows you to communicate with the **TVHUNTER+** using a set of commands.

Terminal works with the same set of commands used by the program to transmit and receive data and you do not have to use them in normal conditions.

TVHUNTER+, when is working in service mode, can recognise and execute remote control commands. That is to say, it is necessary to set instrument to SERVICE Mode before sending any remote command to the instrument.

Terminal mode cannot detect whether an instrument is connected or not. At first it checks if the detect utility has been executed from the main window. If that is the case, Terminal uses the same port already detected, otherwise looks for the value saved in the Windows Registry. If there is no value, it uses the default value of 'COM2'. If after that Terminal chooses a wrong port, you will have to select manually the correct one using the following keys:

If "**Terminal**" choose a wrong port, you must select the appropriate port manually, using the following keystrokes.

For **COM1**: Alt + 1

For **COM2**: Alt + 2

For **COM3**: Alt + 3

For **COM4**: Alt + 4

In normal circumstance, **TVHUNTER+** transmits a XON code (code 11h) every two seconds. The aim is to indicate that the instrument is ready to receive data from a remote device. When it receives a "*" (this character means the start of a remote control) the XON transmission stops and the echo of all characters received is returned until it receives a CR (carriage return, code 0Dh). At that time, **TVHUNTER+** understands that it has received a complete remote command, and then it identifies and executes it. To indicate to the control instrument that it is in busy status, it sends a XOFF (code 13h).

If the command is received as valid, an ACK (acknowledge, code 06h) is transmitted and if is not valid, a NAK (not acknowledged, code 15h) followed by a CR (carriage return, code 0Dh) and an LF (line feed, code 0Ah).

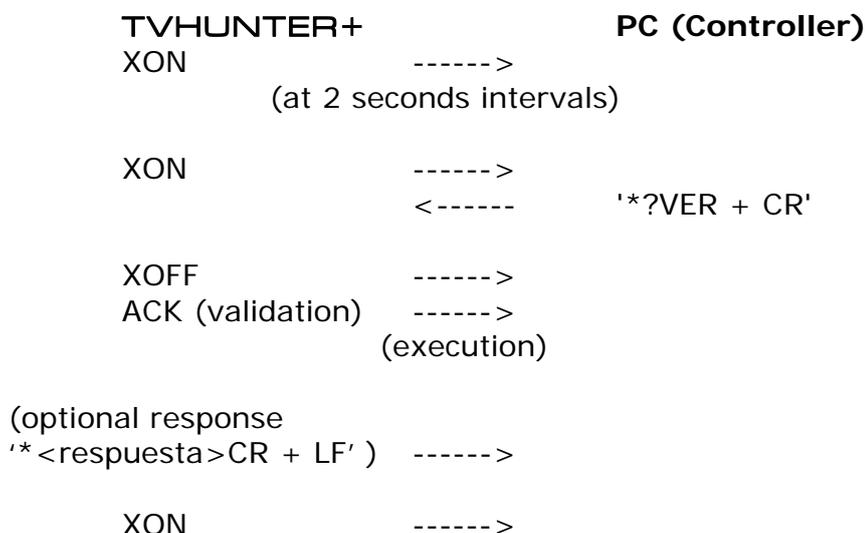
If the command has been recognised as valid, it is executed and the required response is returned (if the command so requires) followed by a new CR+LF.

After receiving an erroneous command, the **TVHUNTER+** answers with a NAK code instead of an ACK, and there is no response. After that it will be in XON state waiting for new data.

Commands should always be sent in capital letters and cannot be edited on-line, i.e., once a character is received, it is stored in the **TVHUNTER+** buffer and cannot be removed by sending an erase code..

Commands in remote control are divided into two groups, orders and interrogations. Orders modify a variable or the instrument status. Interrogations respond with information concerning instrument status or the value of a variable. For interrogative command, it is necessary to add the character '?' after the '*' character.

A typical communication chronogram would be as follows:



From the point of view of the programmer, the control sequence follows the next steps:

- 1** Wait to receive a XON.
- 2** Send a complete command string.
- 3** Send a CR.
- 4** Receive a XOFF as confirmation that a complete command has been received and is being processed.
- 5_a** Receive ACK as confirmation that a remote command has been recognised.
- 5_b** Receive a NAK if the command has not been recognised (skip to status 7).
- 6** If the command is interrogative, the response is a string followed by CR+LF.
- 7** Once the command is completed, XON is sent. This is then repeated at 2 seconds intervals.

Some keys have special meaning inside “**Terminal**”:

- ▶ **Alt + T:** “**Terminal**” enters in Test mode, so nothing is written or read on the serial port. This is useful to check the syntax of PRO files.
- ▶ **Alt + X :** In 'Hex' mode, you can view the characters sent by the instrument in their hexadecimal value; in 'Text' mode, the hexadecimal value is converted to ASCII characters.
- ▶ **Alt + L:** When Echo is 'Local' mode everything you write to the port is written to the console, and all characters received in serial port are written to the console, too. If Echo is 'None' you will not see what is really read or written to the serial port.
- ▶ **Alt + C:** When CR is 'CR+LF', a linefeed is appended to the end of the answer. Otherwise answers will be overwritten.

For retails about remote commands see the remote commands manual.

4.2.9 **Menu Help**

In order to know what program version are you using, click on “About” option on the “Help” menu and or click on the icon .

4.3 Practical examples

4.3.1 How to create a file with new detection points

In order to create a file with detection points, follow these steps:

- 1 Double click on the icon **TVHUNTER+** which is on the desktop, to open the program.
- 2 Click on the icon  "Create file".
- 3 Click on the icon  "Edit Detection Points". This action opens the window for editing detection points.
- 4 In the box "Select Index to edit a test point", use the arrows to select the detection point you want to edit (from 1 to 50).
- 5 Change the frequency, channel name, etc... and enter the data corresponding to the channel you want to measure. Some parameters are not editables.
- 6 After finishing with one detection point, go to the next you want to edit or press OK if you have already finished and you want to save the changes made. If you do not want to save the changes made, press Cancel.
- 7 If you want to change some parameters of the general configuration, such as the external voltage, the sound or the scan parameters, press  "Edit equipment configuration" and change it.
- 8 After changements, press  "Save file" to save the file with the table of detection points you have just create.
- 9 It appears a window from the OS Windows, where you should select the place where you want to save the file, write a name and press "**Save**". You have your first file.

To load the new file created, follow the steps explained on the next section.

4.3.2 How upload the TVHUNTER+ with a file of detection points

In order to upload the TVHUNTER+ with a file of detection points you already have, follow these steps:

- 1 Double click on the icon TVHUNTER+ , which is on the desktop, to open the program.
- 2 Click on the icon  "Open file".
- 3 It appears a window of the OS Windows. Find the place where the file is, select it and press Open.
- 4 The file is loaded into the program. Now you can send it to the TVHUNTER+.
- 5 To send the file to the TVHUNTER+ , connect the **USB 2.0** cable, which is supplied with the instrument, from the **USB** of your computer to the mini-USB input of the TVHUNTER+.
- 6 Click on the icon  "Detect COM port". The program starts to scan the computer ports to find the one connected to the TVHUNTER+.
- 7 Once the com port has been detected, the icon lights up and the program shows a confirmation message on the log window to indicate that the communication is successful.
- 8 Click on the icon  "Send data to the equipment". The program sends the file to the TVHUNTER+ . Now, it has a new table with new detection points. If there was already a table in the TVHUNTER+ , when you transfer the new file overwrites on the old one.

4.3.3 How to change the Auto-Scan parameters

- 1 Turn on the **TVHUNTER+** in Manual Power Off mode to avoid shutdown when editing parameters. To enable the Manual Power Off, when turning on, hold the key ,  or  for eight seconds. You should see the **MANUAL POWER OFF** icon  screen.
- 2 Connect the **TVHUNTER+** to a USB port of your PC using the supplied USB 2.0 cable. Check that the **USB** icon appears on the equipment screen.
- 3 Double click on the icon **TVHUNTER+** placed on the desktop of your PC. The program will open.
- 4 Click on the "Detect COM port" . It starts the process to detect which port of the PC is connected to the **TVHUNTER+**.
- 5 Once the communication port is detected, the  lights and the log window shows the port connected, showing that it has successfully established communication with the equipment.
- 6 Click on the "Receive data from the equipment"  icon to transmit the configuration file from the PC to the program.
- 7 Click on the "Edit equipment configuration"  icon. A window opens that allows editing the SCAN parameters (auto scan) among others.
- 8 Edit SCAN values according to your needs.

Selectable parameters are:

- **Enable:**
If you want to activate a SCAN check this box. By default, the SCAN 1 must be enabled.
- **Start Freq:**
Start frequency of the scan.
- **End Freq:**
End frequency of the scan.
- **SCAN BW:**
Step of the scan to look for channels between the start and the end frequency.
- **Initial Char:**
Letter assigned to all the channels.
- **Initial Index:**
First number of the sequential index assigned to each channel.

During the auto-scan, the channels are given a name consisting of the letter defined in "Initial Char" and a sequence number.

- 9 Click on the "Send data to the equipment"  icon to send the file to your equipment. The equipment shuts down and restarts again. Now the **TVHUNTER+** has loaded the new data for the auto-scan. When you transfer, the new data overwrites on the previous one.
- 10 If you want to save the program file with the new data to your PC, click on the "Save file"  icon and choose the name and location to save the file.
- 11 You can now close the program, disconnect the **TVHUNTER+** from the PC and start the auto-scan with the new configuration.

5 SPECIFICATIONS

TUNING

Frequency range	170 MHz to 858 MHz (UHF).
Measurement points	50 maximum.

RF INPUT

Impedance	75 Ω
Connector	Universal, including BNC, DIN and F interchangeable adapter.
Level range	40 dB μ V to 100 dB μ V.
Maximum signal level	DC to 100 Hz 30 Vrms 170 MHz to 858 MHz 120 dB μ V

MEASUREMENTS

ISDB-T/T_B	Power, CBER, VBER, MER and Link margin.
Data display	Numeric and level bar.

MARGIN OF POWER MEASUREMENT

ISDB-T/T_B	From 45 dB μ V to 100 dB μ V.
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ISDB-T/T_B SIGNAL PARAMETERS

Code Rate	2/3, 1/2, 3/4, 5/6, 7/8.
Spectral inversion	ON, OFF.
Demodulation	QPSK, 16QAM and 64QAM.
Layer	A, B, C.
Mode	1 (2k), 2 (4k), 3 (8k).
Guard	1/4, 1/8, 1/16, 1/32.
Test point setting	Through USB 2.0 to PC (cable included and free download software).

EXTERNAL UNITS POWER SUPPLY

SUPPLY	Through the RF input connector.
Output voltage	+5V, +12V, +15V, +24V \pm 1 V.
Maximum external output power	5 W (2,5 W for +5 V).

BACK-LIGHT DISPLAY	Automatic.
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POWER SUPPLY

Battery	7,4 V 2,2 Ah Li-Ion Battery.
Low battery indication	Acoustic indication and message on the display.
Charger	Built-in. It disconnects power supply when charging process ends.
Autonomy	5 hours typically, without powering any amplifier through the external power supply.
Charging time	90 min. approx. starting from a complete discharge (instrument off), within the margin of tolerated temperatures.
Temperature of start charging	Between 5 °C and 45 °C. Outside this range of temperatures, the charger will not initiate the charging process. At high ambient temperatures, the charging process will not be carried out in continuous mode because the charger circuit has a heat-protection device that disconnects this circuit when it is over 45 °C, returning to connect itself when it is above 40 °C.
Mains Adapter External	100 - 240 V/50-60 Hz (included).
Voltage	12 V DC.
Consumption	20 W.

OPERATING ENVIRONMENTAL CONDITIONS

Altitude	Up to 2000 m.
Temperature range	From 5 °C to 40 °C.
Max. relative humidity	80 % (up to 31 °C), decreasing lineally up to 50 % at 40 °C.

MECHANICAL FEATURES

Dimensions	180 mm (A) x 95 mm (Al) x 50 mm (Pr).
Weight	480 gr.

INCLUDED ACCESSORIES

1x AL-0122	Mains power adapter 100-240 V AC.
1x AA-012	Car lighter adapter.
1x AD-055	"F"/H- BNC / H adapter.
1x AD-056	"F"/H- DIN / H adapter.
1x AD-057	"F"/H-"F"/H adapter.
1x DC-270	TVHUNTER+ Transport Case.
1x 0 PG4378	TVHUNTER+ Wrist Strap.
1x 0 MF0180	USB 2.0 connector cable.
1x 0 DG0103	Quick Reference Guide.
1x 0 DG0112	Auto-Scan Quick Reference Guide

OPTIONAL ACCESSORIES**DC-269**

TVHUNTER+ carrying bag.

RECOMMENDATIONS ABOUT THE PACKING

It is recommended to keep all the packing material in order to return the equipment, if necessary, to the Technical Service.

6 MAINTENANCE

6.1 Cleaning Recommendations

CAUTION

To clean the cover, take care the instrument is disconnected.

CAUTION

Do not use scented hydrocarbons or chlorized solvents. Such products may attack the plastics used in the construction of the cover.

The cover should be cleaned by means of a light solution of detergent and water applied with a soft cloth.

Dry thoroughly before using the equipment again.

CAUTION

Do not use alcohol or its derivatives for the cleaning of the front panel and particularly the viewfinders. These products can attack the mechanical properties of the materials and diminish their useful time of life.

6.2 Fuses

Fuses not replaceable by the user.

F001: FUS SMD 2,5 A T 125 V.

