PRODIG-5

EXPLORADOR UNIVERSAL DE TV

UNIVERSAL TV EXPLORER

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.

PROMAX

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1 GENERAL

1.1 Description

The television explorer **PRODIG-5** (**EXPLORER)** represents an evolution step with respect to the traditional field strength meters. The continuous **PROMAX** innovation process in the sector of field strength meter yields an equipment that changes the form to take and to understand the television signals measurements.

This equipment incorporates important advances in the **functional** aspects as in the **ergonomics** to allow the installers to make their work with the maximum **comfort** and **speed.** Simultaneously the instrument is **reliable** front any possible problem at he **input signal**, at the **distribution components** or the **receiver equipments**.

The **PRODIG-5** has been designed to satisfy all the necessities of measurement during the **transition from the analogue transmissions to the digital** in the **terrestrial**, **satellites** and **cable** systems. Allowing to take measurements of **analogue** signals as much **digital ones**. When pressing the **auto identification** key, it searches and identifies the **signal under test.** First it recognises whether the signal is an analogue channel or a digital one. If the channel is analogue, it determines the television standard of the signal. When the signal is digital (**DVB**), it analyses for each modulation type **QAM** / **QPSK** / **COFDM** all the associated parameters such as the modulation system: **carriers 2k-8k, symbol rate, code rate**, etc.,. and determines the value of the signals under test.

The **PRODIG-5** includes the main **TV standards**: **M**, **N**, **B**, **G**, **I**, **D**, **K** and **L**, adopting, apart from the characteristic parameters of the standard, the correcting automatic system to obtain in all the cases an accurate measuring of the input signal level. It admits any TV system (**PAL**, **SECAM** and **NTSC**) and allows the user to work directly with **digital TV** signals decoding them, so that the television image may be viewed, and directly measuring the power, carrier/noise ratio (**C/N**), the bit error rate (**BER**) and the modulation error ratio (**MER**), as well for **DVB-T (COFDM)** as **DVB-S (QPSK)** and **DVB-C (QAM)** signals. Being a multistandard instrument, it can be efficiently used in any country of the world.

[1] *Trade Mark of the DVB Digital Video Broadcasting.*

Includes a **symbol-based keyboard** that allows the direct access to the various functions that are displayed simultaneously on screen.

The **PRODIG-5** makes a **dynamic exploration** of the spectrum, detecting all the channels in the explored band, this applies for the **terrestrial** and the **satellite** television bands. The meter **locates** all the channels in the spectrum **with no need** of any **previous information** about the number of channels, the type of signals transmitted or their characteristics. With the data collected after each exploration, it creates a register that contains **tables of channels** that can be independent for each **system or installation**. At any time, the measurement sessions using only the pretuned channels can be repeated. In this way it is possible to optimise the measurement process.

On the frontal panel appears showed the **type of measurement** that is being carried (Terrestrial-Satellite/Analogue-Digital) and the data are visualised by means of a hi-res 5" graphic **TFT** display. The equipment incorporates a light sensor that activates the contrast and luminosity of the display according to the environmental conditions.

The **EXPLORER** has an **ideal size** to hold **with a hand**. The instrument can be held to the body with the carrying bag which at the same time protects it from the rain. Especially considering its outdoor use, includes an **anti-shock** protector that completely covers the instrument, and optionally can be supplied with a strong transport case. Besides the front panel does not have any keys nor gaps to avoid accidental water ingress.

The **PRODIG-5** is designed to integrate measurements that require different operating configurations. In this way it incorporates a specific function to facilitate the **alignement of antennas**. When activating it the instrument is set automatically to offer a **fast** spectrum **sweep** and a high **sensitivity** graphical bar allows the **fine adjust** of the maximums of signal. In addition it includes a module for the **feeding of LNBs**, and **DVB-T antennas** to 5V. As well as the commands for the **programming** of **DiSEqC 1.2 devices**.

The **EXPLORER** allows to be updated to new software versions that extend the available functions in the future. That means to incorporate new benefits without additional cost. For example the **test** of **satellite signals distribution networks**. The use in combination with an **IF** generator allows to carry out an easy verification of the installations before the operation beginning.

The **spectrum analyser** features with high accuracy, resolution, sensitivity and sweep speed can do the instrument very useful for applications as the **installation of antennas** or the detection of complex **impulsional noise** events. It presents an innovative control system based on four arrows, that makes the use of the spectrum analyser very intuitive. The arrows allow adjusting the **reference level** by steps of 10dB and the frequency margin **span** on screen.

Also, the meter incorporates a **DiSEqC**[2] command generator and permits to supply different voltages to the external unit (**5 V / 13 V / 15 V / 18 V / 24 V**) and includes an **EUROCONNECTOR**, or Scart connector, for audio/video input/output.

The **PRODIG-5** is powered by **rechargeable battery** or connected to the mains through the supplied **external DC power charger**.

It incorporates a **RS-232C** interface, which enables to carry out the checking, setup and calibration processes.

This instrument due to its extreme-compact design, technical specifications and low cost becomes the reference instrument for the installer.

[2] *DiSEqC™ is a trademark of EUTELSAT.*

1.2 Specifications ⚠

CONFIGURATION FOR MEASURING LEVEL AND POWER

TUNING	Digital frequency synthesis. Continuous tuning from 45 to 865 MHz and from 950 to 2150 MHz
Tuning modes	Chanel or frequency (If or forward at satellite band). Channel plan configurable on demand
Resolution	45-865 MHz: 50 kHz 950-2150 MHz: < 200 kHz (span FULL-500-200-100-50-32-16 MHz).
Automatic search (*Explorer*)	Threshold level selectable. DVB-T or DVB-C selection
Signal identification	Analogue and digital. Automatic.
RF INPUT	
Impedance	75 Ω
Connector	Universal, with BNC or F adapter.
Maximum signal	130 dBµV
Maximum input voltage	
DC to 100 Hz	50 Vrms (powered by the AL-103 power charger) 30 Vrms (not powered by the AL-103 power charger)
45 MHz to 2150 MHz	130 dBµV

DIGITAL SIGNALS MEASUREMENT

POWER RANGE	
COFDM:	45 dBµV to 100 dBµV.
QAM:	45 dBµV to 110 dBµV.
QPSK:	44 dBµV to 114 dBµV.

MEASUREMENTS

DVB-T (COFDM):	Power, CBER, VBER, MER, C/N
Presentation:	Numeric and level bar.
DVB-C (QAM):	Power, BER, MER, C/N
Presentation:	Numeric and level bar.
DVB-S (QPSK):	Power, CBER, VBER, MER, C/N
Presentation:	Numeric and level bar.

COFDM SIGNAL PARAMETERS

Carriers	2k / 8k (Selected by the user).
Guard Interval	1/4, 1/8, 1/16, 1/32 (Selected by the user).
Code Rate	1/2, 2/3, 3/4, 5/6, 7/8.
Modulation	QPSK, 16-QAM, 64-QAM.
Spectral inversion	Selectable: ON, OFF.
Hierarchy	Indicates hierarchy mode.

QAM SIGNAL PARAMETERS

Demodulation	16/32/64/128/256 QAM.
Symbol rate	1000 to 7000 kbauds.
Roll-off (α) factor of Nyquist filter	0.15.
Spectral inversion	Selectable: ON, OFF

QPSK SIGNAL PARAMETERS

Symbol rate	2 to 45 Mbauds.
Roll-off (α) factor of Nyquist filter	0.35.
Code Rate	1/2, 2/3, 3/4, 5/6, 7/8 and AUTO.
Spectral inversion	Selectable: ON, OFF

VIDEO

Format	MPEG-2 / DVB (MP@ML).
Services decoding	Service list and PIDs

ANALOGE SIGNALS MEASUREMENT

LEVEL MEASUREMENT

Measurement range

Terrestrial TV & FM bands	10 dBµV to 120 dBµV (3.16 µV to 1 V)
Satellite TV band	30 dBµV to 120 dBµV (31.6 µV to 1 V)
Reading	Auto-range, reading is displayed on an OSD window
Digital	Absolute value calibrated in dBµV, dBmV or dBm.
Analogue	Relative value through an analogue bar on the screen.
Measurement bandwidth	230 kHz (Terrestrial band) ■ 4 MHz (Satellite band) (maximum band ripple 1 dB).
Audible indicator	LV audio. A tone with pitch proportional to signal strength.

Accuracy	
Terrestrial bands	±1.5 dB (30-120 dBµV, 45-865 MHz) (22 °C±5 °C)
Satellite band	±2.5 dB (40-100 dBµV, 950-2050 MHz) (22 °C ± 5 °C)
Overrange indication	↑, ↓

MEASUREMENTS MODE

Terrestrial bands	
Analogue channels	Level, Video-Audio ratio and Carrier-Noise ratio..
Digital channels	Channel power, Carrier-Noise ratio and Channel identification.
Satellite band	
Analogue channels	Level and Carrier-Noise ratio.
Digital channels	Channel power and Carrier-Noise ratio.

SPECTRUM ANALYSER MODE

Satellite band	30 dBµV to 120 dBµV (31.6 µV to 1 V)
Terrestrial bands	10 dBµV to 120 dBµV (3.16 µV to 1 V)
Measurement bandwidth	
Terrestrial	230 kHz
Satellite	4 MHz
Span	
Terrestrial	*Full span* (full band) - 500 - 200 - 100 - 50 - 32 - 16 - 8 MHz selectable.
Satellite	*Full span* (full band) - 500 - 200 - 100 - 50 - 32 - 16 MHz selectable.
Markers	1 with Frequency and level indications..

Measurements	
Terrestrial bands	
Analogue channels	Level.
Digital channels	Channel power.
Satellite band	
Analogue channels	Level.
Digital channels	Channel power.

MONITOR DISPLAY	
Monitor	TFT colour 5 inches.
Colour system	PAL, SECAM and NTSC
TV standard	M, N, B, G, I, D, K and L
Spectrum mode	Variable span, dynamic range and reference level by means of arrow cursors.
Sensibility	40 dBµV for correct synchronism.
BASE BAND SIGNAL	
VIDEO	
External video input	Scart.
Sensibility	1 Vpp (75 Ω) positive video
Video output	Scart (75 Ω)
SOUND	
Input	Scart
Outputs	Built in speaker, Scart.
Demodulation	TV PAL, SECAM, NTSC system according to DVB-T, DVB-C, DVB-S and MPEG standards.
De-emphasis	50 µs
Subcarrier	Digital frequency synthesis according to the TV standard.
RS-232C INTERFACE	For service and calibration.
EXTERNAL UNITS POWER SUPPLY	Through the RF input connector.
Terrestrial and Satellite	External or 5/13/15/18/24 V
22 kHz signal	Selectable in satellite band.
Voltage	0.6 V ± 0.2 V
Frequency	22 kHz ± 4 kHz
Maximum power	5 W
DiSEqC[3] GENERATOR	According to DiSEqC 1.2 standard.
POWER SUPPLY	
Internal	
Batteries	7.2 V 11 Ah Li-Ion battery.
Autonomy	> 3.5 hours in continuous mode.
Recharging time	3 hours up to 80% (instrument off)
External	
Voltage	12 V
Consumption	35 W

[3] *DiSEqC™ is a trademark of EUTELSAT.*

Auto power off	Programmable. After the selected amount of minutes without operating on any control. Deactivable.

OPERATING ENVIRONMENTAL CONDITIONS

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

MECHANICAL FEATURES

Dimensions	230 (W) x 161 (H) x 76 (D) mm (Total size: 2.814 cm^3)
Weight	1.9 kg (without holster)

INCLUDED ACCESSORIES

1x CB-044	Rechargeable Li+ battery 7,2 V 11 Ah
1x AD-055	"F"/F-BNC/F adapter
1x AD-056	"F"/F-"DIN"/F adapter
1x AD-057	"F"/F-"F"/F adapter
1x AL-103	External DC charger
1x DC-261	Carrying bag.
1x AA-103	Car lighter charger.
1x CA-005	Mains cord.

OPTIONAL ACCESSORIES

DC-299	Transport suitcase.

2 SAFETY RULES

2.1 General safety rules

* Use this equipment connected **only to systems with their negative of measurement connected to ground potential**.

* The **AL-103** external DC charger is a **Class I** equipment, for safety reasons plug it to a supply line with the corresponding **ground terminal**.

* This equipment can be used in **Overvoltage Category I** installations and **Pollution Degree 2** environments.
  External DC charger can be used in **Overvoltage Category II**, installation and **Pollution Degree 1** environments**.**

* When using some of the following accessories **use only the specified ones** to ensure safety.

  Rechargeable battery
  External DC charger
  Car lighter charger cable
  Power cord

* Observe all **specified ratings** both of supply and measurement.

* Remember that voltages higher than **60 V DC** or **30 V AC rms** are dangerous.

* Use this instrument under the **specified environmental conditions**.

* When using the power adaptor, the **negative of measurement** is at ground potential.

* **Do not obstruct the ventilation system** of the instrument.

* Use for the signal inputs/outputs, specially when working with high levels, appropriate low radiation cables.

* Follow the **cleaning instructions** described in the Maintenance paragraph.

* Symbols related with safety:

DIRECT CURRENT


ALTERNATING CURRENT


DIRECT AND ALTERNATING


GROUND TERMINAL


PROTECTIVE CONDUCTOR


FRAME TERMINAL


EQUIPOTENTIALITY

ON (Supply)


OFF (Supply)


DOUBLE INSULATION
(Class II Protection)


CAUTION
(Risk of electric shock)


CAUTION REFER TO MANUAL

FUSE

2.2 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

3 INSTALLATION

3.1 Power Supply

The **PRODIG-5** (**EXPLORER**) is a portable instrument powered by one 7.2 V - 11 Ah Li-Ion battery. There is also an external DC charger provided for mains connection and battery charging.

3.1.1 Operation using the External DC Charger

Connect the external DC charger to **EXT. SUPPLY** [32] on the **PRODIG-5** (**EXPLORER**) side panel. Connect the DC charger to the mains. Then, press the rotary selector [1] for more than two seconds. The level meter is now in operation and the battery is slowly charged. When the instrument is connected to the mains, the **CHARGER** indicator [4] remains lit. This indicator changes of colour according to the battery charge status:

BATTERY CHARGE STATUS		
	OFF	**ON**
RED	< 50 %	< 90 %
YELLOW	> 50 %	> 90 %
GREEN	100 %	100 %

Table 1.- Indication of the battery charge status (**CHARGER**).

3.1.2 Operation using the Battery

For the device to operate on the battery, disconnect the power cable and press the rotary selector [1] for more than two seconds. The fully charged battery can power the equipment for more than 3.5 hours non-stop.

If battery is very weak, the battery cut-off circuit will prevent the device from functioning. In such a situation battery must be recharged immediately.

Before taking any measurements, you have to check the charge status of the battery by checking the battery charge level indicator that appears when activating the measurement mode pressing key 

[12]. These are the indicators on screen:

BATTERY CHARGE LEVEL INDICATORS		
COLOUR	**SYMBOL**	**CHARGE LEVEL**
GREEN		75 % ~ 100 %
YELLOW		30 % ~ 75 %
RED		10 % ~ 30 %
		< 10 %
		Charge in progress.

Table 2.- Indication of the battery charge level on screen.

3.1.2.1 Battery Charging

To fully charge the battery, connect the instrument to the external DC charger **without activating** the power on process. The length of time it takes to recharge it depends on the condition of the battery. If they are very low the recharging period is about 5 hours. The **CHARGER** [4] indicator should remain lit.

When the battery charging process is completed with the instrument off, the fan stops.

IMPORTANT

The instrument battery needs to be kept charged between 30% and 50% of its capacity when not in use. The battery needs to be fully charged for best results. A fully charged battery suffers temperature-related discharge. For example, at a room temperature of 20 ºC, it can lose up to 10% of its charge over 12 months.

3.2 Installation and Start-up

The **PRODIG-5** (**EXPLORER**) level meter is designed for use as a portable device. Therefore does not require installation

When the rotary selector [1] is pressed for more than two seconds, the instrument is started up in the *automatic power-off* mode; that is, the device is automatically disconnected after the selected minutes if no key has been pressed. When the device is operating, it is also possible to select the **auto power-off** mode by means of the ***Preferences*** menu [22] and to select the time out until the automatic power-off.

4 QUICK USER GUIDE

STEP 1.- Battery charging

1. Connect the DC external charger to the equipment through connector [32] located on the lateral panel.
2. Connect the DC charger to the mains.
3. When the equipment is connected to the mains, the **CHARGER** led [4] remains lighted.

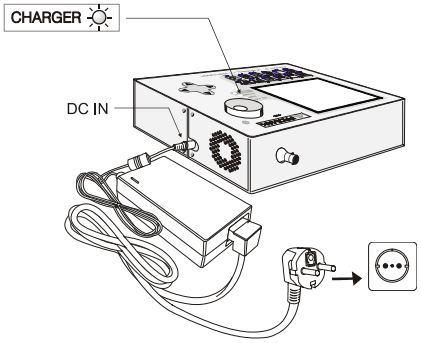

Figure 1.- Battery charging

STEP 2.- Power on and signal connection

1. Hold the rotary selector [1] pressed until the equipment is powered on.
2. Connect the RF signal source in the input connector [30].

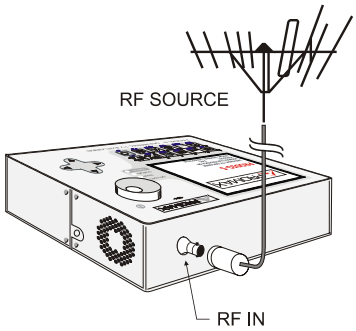

Figure 2.- Power on and signal connection.

STEP 3.- To carry out a complete channel band exploration

1. Select the frequency band to explore [14] (terrestrial or satellite).
2. Activate the exploration process by holding [25] key pressed.
3. Press [10] key to visualise the channels detected and [6] to change between channels from detected channels list.

STEP 4.- To carry out the tuned channel identification

1. Select the frequency band to explore [14] (terrestrial or satellite).
2. Activate the identification process pressing once on [25] key.
3. Press [10] key to visualise the signal detected from channel or frequency identified or [13] to monitor the corresponding spectrum.

NOTE: In the case that is desired to explore or identify **DVB-C** signals it is necessary to select previously **DVB-C** standard as digital signal identifier through [22] **PREFERENCES** menu.

STEP 5.- Taking measurements

1. Select the channel or frequency [24] to measure by means of the rotary selector [1].

2. Press 3 DEF [12] key to select the type of measurement until on screen appears the corresponding measurement.

STEP 6.- Frequency spectrum monitoring

1. Select the frequency band 5 JKL to graph [14] (terrestrial or satellite).
2. Press 4 GHI [13] key to activate the signals sweeping.
3. Press [6] to modify the reference level in the vertical axis.
4. Press [6] to modify span in the horizontal axis.

STEP 7.- Video signal monitoring

1. Select the terrestrial frequency band 5 JKL [14].
2. Tune the channel or frequency 0 +*# [24] that is desired to visualize on screen.
3. Verify that the equipment receives an appropriate signal level 3 DEF [12].
4. Press 1 [10] key to visualise the TV image, if the channel is digital press [6] and place the cursor on the Service Identifier field and press the rotary selector [1] to obtain the available list of services.

5 OPERATING INSTRUCTIONS

WARNING:

The following described functions could be modified based on software updates of the equipment, carried out after manufacturing and the publication of this manual.

5.1 Description of the Controls and Elements

Front panel

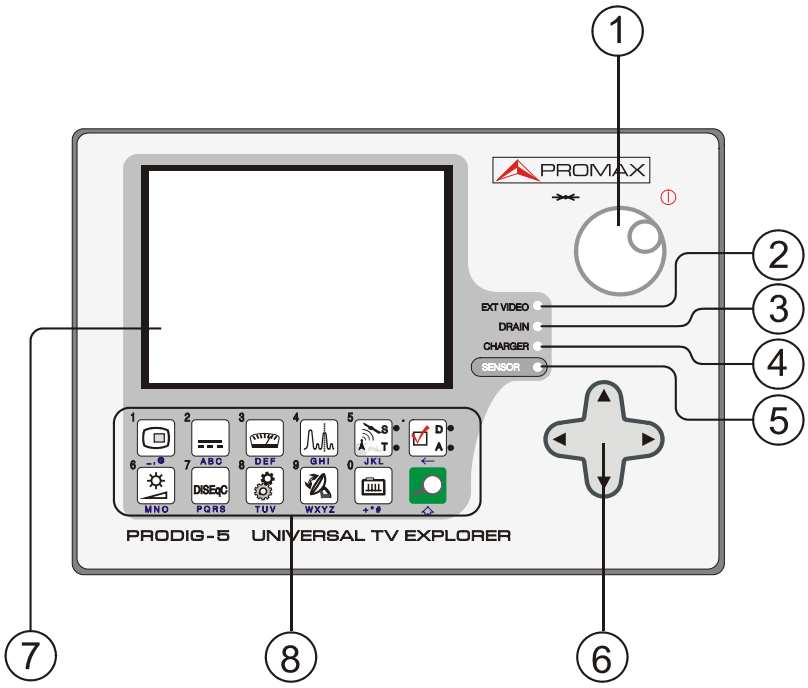

Figure 3.- Front panel.

[1] **Rotary selector-button**. This has many different functions: Equipment power on/off, tuning control, moving between the various on-screen menus and sub-menus, and validation of the different options.
In order to **power on** the equipment, hold the rotary selector pressed for more than two seconds until the presentation screen appears.

In order to **power off** the meter hold the rotary selector pressed.

Tuning purposes: turning it clockwise frequency increases while turning it anticlockwise frequency decreases.

To **move along the on-screen menus**: turning it clockwise active option moves downwards while turning it anticlockwise active option moves upwards.

[2] EXT VIDEO. Video signal presence light indicator
It lights up when video on screen is coming through the SCART connector [35].

[3] DRAIN
External units power supply indicator. Lights up when the **PRODIG-5** (**EXPLORER**) supplies a current to the external unit.

[4] CHARGER
External DC charger operation indicator. When batteries are installed the battery charger is automatically activated.

[5] SENSOR
Sensor of environmental luminosity, allows automatic adjusts of the display contrast and brightness contributing to the battery saving.

[6] CURSORS
Allow adjust in the Spectrum Analyser mode of the **reference level** and the margin of frequencies to represent (**span**). As well as the movement through the different menus and submenus that appear in the monitor.

[7] MONITOR

[8] MAIN KEYBOARD
12 keys to select functions and entering alphanumeric data.

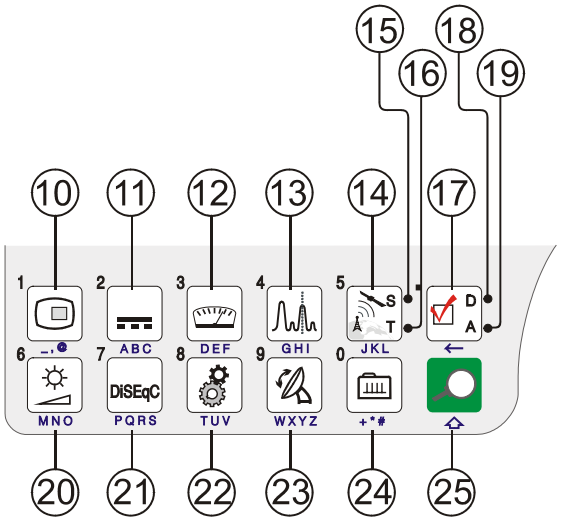

Figure 4.- Main keyboard

[10]  **TV KEY**

It allows visualising the image of TV corresponding to the input signal as well as data relative to the reception of the video signal.
Key number 1 to enter numeric data.

[11]  **EXTERNAL UNITS POWER SUPPLY**

Enables selecting the power supply to the external units. Available voltages are: **External**, **5 V**, **13 V**, **15 V**, **18 V** and **24 V** for the terrestrial band and **External**, **5 V**, **13 V**, **15 V, 18 V, 13 V + 22 kHz** and **18 V + 22 kHz** for the satellite band.
Key number 2 to enter numeric data.

[12]  **MEASUREMENTS**

Enables the type of measurement to be selected. The types of measurements available depend on the band, the standard and the operating mode.
Key number 3 to enter numeric data.

4 GHI

[13] SPECTRUM/TV

Allows switching between any previous operating mode and the Spectrum Analyser mode and viceversa.
Key number 4 to enter numeric data.

5 JKL

[14] SATELLITE/TERRESTRIAL BAND

Allows switching between the Satellite or Terrestrial TV frequency band.
Key number 5 to enter numeric data.

[15] S

This led remains lighted when the equipment works with the frequencies and the corresponding channels to the satellite band.

[16] T

This led remains lighted when the equipment works with the frequencies and the corresponding channels to the terrestrial band.

[17] MEASUREMENT CONFIGURATION

It allows the commutation between the measurement mode for Digital TV or Analogue TV.

[18] D

This led remains lighted when the equipment works with digital signals.

[19] A

This led remains lighted when the equipment works with analogue signals.

6 MNO

[20] IMAGE ADJUST

Activation of **VOLUME, CONTRAST, BRIGHT, SATURATION** and **HUE** (only for NTSC colour system) control menus.
Key number 6 to enter numeric data.

7 PQRS

[21] DISEQC

(Only in satellite band). It allows adjusting configuration parameters in satellite band.
Key number 7 to enter numeric data.

8 TUV

[22] UTILITIES / PREFERENCES

It activates the **Utilities** menu (short pulsation):

Equipment Info.	Displays information on the instrument: serial number, version of control software, included set-up, etc.
Modify Channel Plan	Deletes Channel Plan selected.
Exit	Exit from Utilities.

It activates the **Preferences** menu (long pulsation):

Language	Selects the language between DEUTSCH, ENGLISH, ESPAÑOL, FRANÇAIS, and ITALIANO.
Beep	Activates (ON) / deactivates (OFF) the beeper.
Skin	Sets the screen background colour.
Light Sensor	Activates the environmental luminosity sensor [5], to automatically adjust the resistance and brightness of the display.
Ter. Identify	Selects the type of terrestrial digital signal, DVB-C or DVB-T used by AUTO-ID and EXPLORER functions.
Min. Ter. Power	Minimum level of digital signal to display. (Between 0.0 dBμV and 130.0 dBμV)
Min. Ter. Level	Minimum level of analogue signal to display. (Between 0.0 dBμV and 130.0 dBμV).
Min. Sat. Power	Minimum level of digital signal to display
Auto Power Off	Activates the automatic power off mode.

Time Power Off	Select the power off timeout between 1 and 120 minutes.
Units	Select the measurements units: dBμV, dBmV or dBm.
Rotary Selector	Select the movement sense: CW (clockwise) or CCW (counterclockwise).
Exit	Exit from preferences menu

Key number 8 to enter numeric data.

9 
WXYZ

[23] ANTENNA ALIGNMENT

Tool for faster sweep antenna alignment at terrestrial and satellite bands. Displays the measurements by means of a graph level bar.
Key number 9 to enter numeric data.

0 
+*#

[24] TUNING BY CHANNEL OR FREQUENCY

Switches tuning mode between channel and frequency. In channel mode the tuning frequency is defined by the active channels table (CCIR, ...).
Key number 0 to enter numeric data.

[25] AUTO ID/ EXPLORER

Activates the **automatic identification** function (short pulsation):

The instrument will try to identify the signal under test.

First it recognises whether the signal is an analogue channel or a digital one.

If the channel is analogue, it determines the television standard of the signal detected.

When the signal is digital, it analyses the modulation type: **QAM** / **QPSK** / **COFDM** and all the associated parameters such as the **carriers 2k-8k**, the **symbol rate**, the **code rate**, etc and it tries to lock to the signal.

Activates the band **exploration** function (long pulsation):

The meter explores the entire frequency band to identify the analogue and digital channels present.

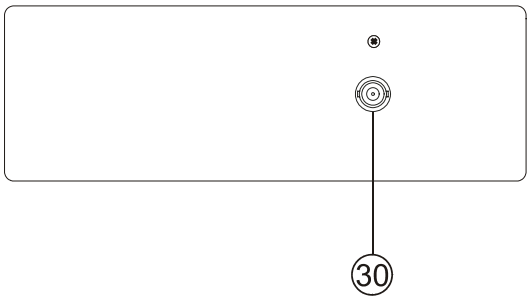

Figure 5.- Top panel view.

[30] RF RF signal input
Maximum level 130 dBµV. Universal connector for F/F or F/BNC adapter, with input impedance of 75 Ω.

ATTENTION

Note the importance to protect the RF [30] input signal with an accessory to block the AC voltages used in CATV cables (needed to feed the amplifiers) and remote mode.

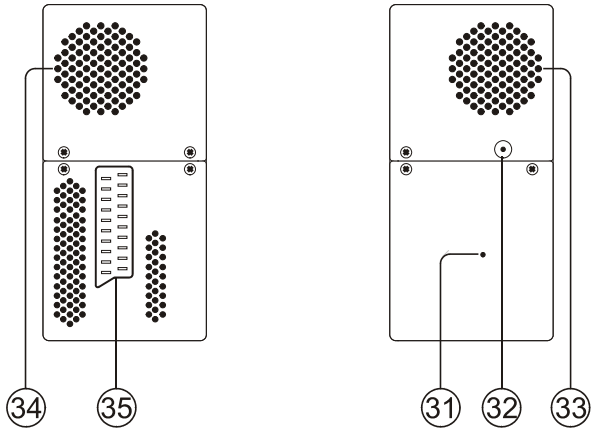

Figure 6.- Lateral panel connectors.

[31] RESET button
Enables the user to restart the instrument if there is any irregularity when operating.

[32] External 12 V power supply input

[33] Loudspeaker

[34] Fan

[35] SCART connector

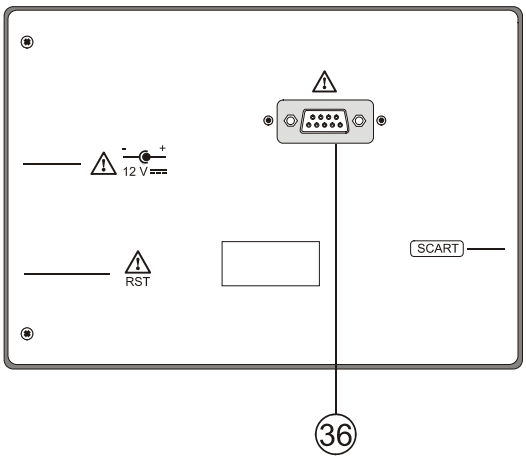

Figure 7.- Rear panel view.

[36] RS-232C Connector
For maintenance and calibration processes.

5.2 Adjustment of Volume and Monitor Parameters

Repeatedly pressing the 

[3] key sequentially activates the **VOLUME**, **CONTRAST**, **BRIGHTNESS**, **SATURATION** and **HUE** control menus (this last only for NTSC colour system). On activation of a menu for a specific parameter the screen displays a horizontal bar whose length is proportional to the parameter level, to modify this value simply turn the rotary selector [1]. To exit the menu and validate the new value press the rotary selector [1].

5.3 Selecting the Operation Mode: TV / Spectrum Analyser / Measurements

The **PRODIG-5** (**EXPLORER**) has three basic operation modes: **TV**, **Spectrum Analyser** and **Measurements**. To switch from TV operation mode to the Spectrum Analyser press 

[13] key. To switch to the Measurements mode press 

[12] key.

In the **TV operation** mode the demodulated television signal is shown on-screen; this is the default operation mode, various functions can be selected, as shown in the following paragraphs.

In the **Spectrum Analyser** operation mode the screen displays the spectrum of the active band (terrestrial or satellite). The *span* and the *reference level*.

In the **Measurement** mode the screen shows the available measurements according to the type of signal selected.

5.4 Channel Tuning / Frequency Tuning

Pressing 

[24] key the **EXPLORER** switches from frequency tuning to channel tuning and back again.

In **channel tuning mode** turning the rotary selector [1] sequentially tunes the channels defined in the active channels table. When turning it clockwise frequency increases while turning it anticlockwise frequency decreases.

In **frequency tuning mode** there are two ways of tuning:

1. **Turning the rotary selector** [1].
   Turning the rotary selector [1] selects the desired frequency (tuning is continuous from 45 to 865 MHz and from 950 to 2150 MHz). When turning it clockwise frequency increases while turning it anticlockwise frequency decreases.

2. **Using the keyboard**.
   Press the rotary selector [1] (the frequency listing will disappear and will appear on the upper left corner of screen the keyboard symbol of manual data entry 

), next enter the frequency value in MHz using the numeric keyboard. The **EXPLORER** will calculate the tuneable frequency closest to the entered value and then display it on-screen.

5.5 Automatic Transmission Search

Holding pressed the  [25] key search starts until it finds a transmission with a level higher than the search level. The threshold level is defined by means of the ***Min. Ter. Level*** for analogue channels and ***Min. Ter. Power***, ***Min. Sat. Power*** for digital channels from **PREFERENCES** menu.

5.6 Selecting the measurement configuration: Analogue/ Digital signal

Measuring the characteristics of a channel depends, in the first place, on the type of modulation: analogue or digital.

Use key  [20] to switch between analogue and digital channels. Press the  [20] key to show the **measurements CONFIGURATION** menu and select the **Signal** option by turning and pressing the rotary selector [1]. The **Signal** option allows setting the type of signal to measure. When switching to a new type, the **PRODIG-5** (**EXPLORER**) activates the last measurement configuration used for that type of signal.

5.7 External Units Power Supply

The **PRODIG-5** (**EXPLORER**) can supply the voltage needed to power the external units (antenna preamplifiers, in the case of terrestrial TV, LNB in the case of satellite TV, or IF simulators).

⚠ Maximum input levels

DC to 100 Hz	**50 Vrms (powered by the AL-103 power charger)**
	30 Vrms (not powered by the AL-103 power charger)
45 MHz to 2150 MHz	**130 dBµV**

In order to select the supply voltage of the external units, press  [11] key, and the screen will display a functions menu labelled **EXT. SUPPLY** listing the choice of voltages (which will depend on the band being used). Turn the rotary selector [1] to the desired voltage and press to activate it. The following table shows the choice of supply voltages:

Band	Powering voltages
SATELLITE	External 5 V 13 V 15 V 18 V 24 V 13 V + 22 kHz 18 V + 22 kHz
TERRESTRIAL MATV	External 5 V 13 V 15 V 18 V 24 V

Table 3.- External units powering voltages.

In the **External** power supply mode is the unit powering the amplifiers before the antenna (terrestrial television) or the satellite TV receiver (house-hold or community) also powers the external units.

The **DRAIN** [3] indicator lights when current is flowing to the external unit. If any kind of problem occurs (e.g., a short circuit), an error message appears on the monitor ('SUPPLY SHORT'), the acoustic indicator will be heard and the instrument will cease to supply power. The **PRODIG-5** (**EXPLORER**) does not return to its normal operating state until the problem has been solved, during this time it verifies every three seconds the persistence of the problem warning with an acoustic signal.

5.8 Automatic signal identification function (AUTO ID)

The **PRODIG-5** (**EXPLORER**) allows automatically identifying TV signals, according to the established configuration, which are presents in the channel or tuned frequency. In order to activate this function must once press  [25] key. Specially useful, is to combine this process with the spectrum monitoring  [13], so that after locating the marker on the levels susceptible to contain a transmission, and activating later the process of automatic identification in order to identify the present signal.

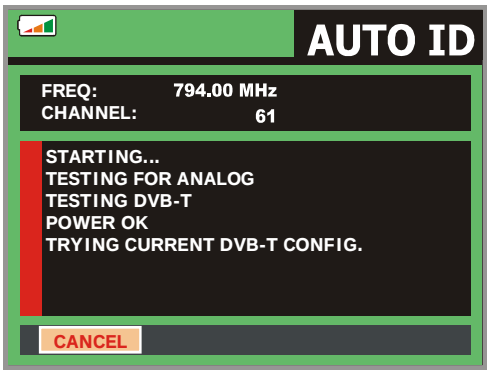

Figure 8.- Signal automatic identification screen. **AUTO ID**.

First it recognises whether the signal is an analogue channel or a digital one. If the channel is analogue, it determines the television standard of the signal. When the signal is digital (**DVB**), it analyses for each modulation type **QAM** / **QPSK** / **COFDM** all the associated parameters such as the modulation system: **carriers 2k-8k, symbol rate, code rate**, etc.,. and determines the value of the signals under test.

Whenever the process detects new parameters for a channel or frequency will create a new channel plan containing the detected information.

NOTE: In the case that is desired to explore or identify **DVB-C** signals will be necessary to select previously a **DVB-C** standard as digital signal identifier by means of [22] **PREFERENCES** menu.

5.9 Channel plans

As much the signal automatic identification process as the exploration of the frequency spectrum could yield the generation of new customised channel plans relative to the usual work locations of the meter equipment.

In this way the characterisation of the band will be more fast and simple when causing that the equipment only analyses a shorter set of channels.

Whenever a new process of exploration is activated, the **PRODIG-5** analyses all the present channels in the active channel plan, which acts as pattern channel plan specified by means of the option **CHANNEL SET** from configuration measurement menu: **CONFIGURATION** [17].

If during exploration or automatic identification process the **EXPLORER** detects new parameters for some channel or frequency a new list will be generated with the information updated and will be saved with the same name of the original channel plan followed by the extension: **_0x**. (See the following Figure).

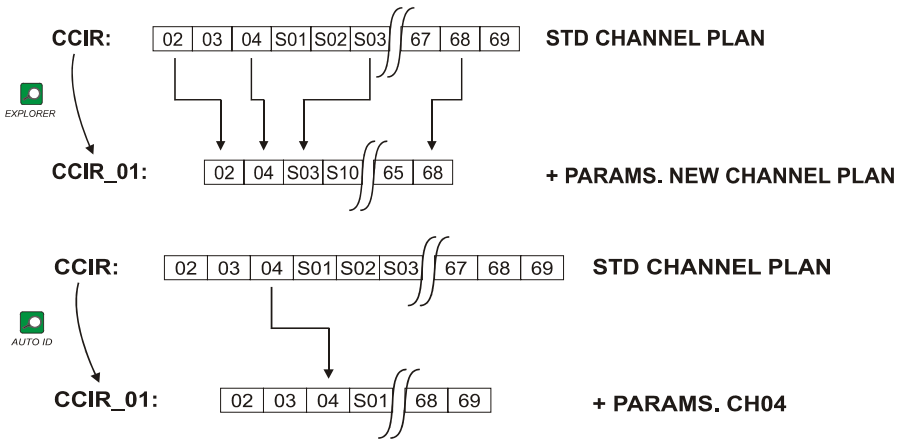

Figure 9.- New channel plan generation process.

The user can edit the channel plan name and select the channel plans to delete by means of **MODIFY CHANNEL PLAN** option from **UTILITIES** [22] menu.

The **EXPLORER** allows directly changing the tuned channel pertaining to the active channel plan by means of the horizontal cursors [6]. From this way, once selected the channel tuning field [24] and in the **TV** [10] and **MEASUREMENTS** [12] operation modes is possible to check cyclically the entire active channel list.

5.10 Spectrum exploration function (EXPLORER)

The **Exploration** function allows exploring the full frequency band in order to identify the analogue channels and digital presents, in agreement with the configuration set, in the tuning band. In order to activate the function hold pressed the [25] key until the **EXPLORER** screen appears.

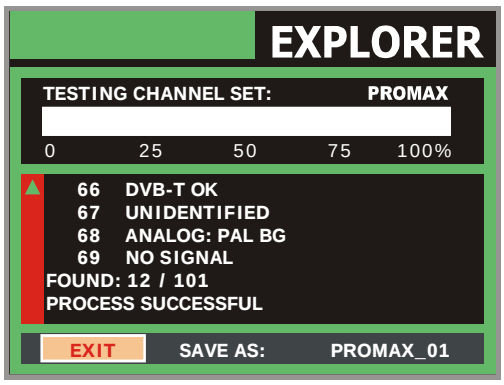

Figure 10.- Spectrum exploration screen. **EXPLORER**.

Whenever the process detects new parameters for some channel, it will create a new channel plan containing the detected information.

NOTE: In the case that is desired to explore or identify **DVB-C** signals will be necessary to select previously **DVB-C** standard as digital signal **identifier** by means of [22] **PREFERENCES** menu.

5.11 Measurements configuration

With the aim of taking the measurements of all types of signals some times could be necessary that user enters parameters relative to particular characteristics of these signals, whether an automatic detection has not been possible, or these parameters differ from the standard corresponding ones.

Press the **Measurements Configuration** [17] key to access to the **CONFIGURATION** menu and turn the rotary selector [1] to access to parameters whichare by the user.

5.11.1 DVB-C (QAM) Digital Channel Configuration

Press the **Measurements Configuration** [17] key to access to the **CONFIGURATION** menu and turn the rotary selector [1] to access the **QAM** signals parameters which can be defined by user and described below:

1) ***Modulation***
It defines the modulation type. When selecting this function and pressing the rotary selector [1] a multiple-choice menu will appear on the screen, this menu permits to choose one of the following modulations: **16**, **32**, **64**, **128** and **256**.

2) ***Symbol Rate***
When selecting this function and pressing the rotary selector [1] a multiple-choice menu will appear on the screen, this menu permits to choose the symbol rate.

3) ***Spectral inversion***
If necessary, activate the **Spectral inversion** (**On**). If the spectral inversion is not correctly selected, reception will not be correct.

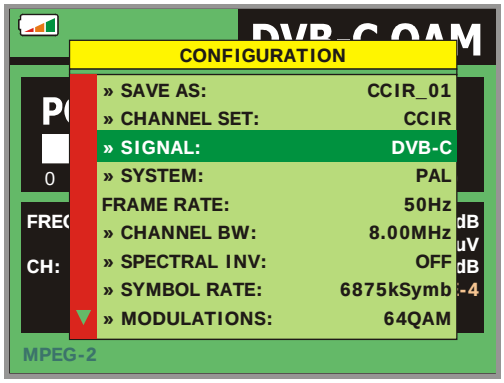

Figure 11.- Screen of mesurement configuration (**QAM** signals).

5.11.2 DVB-T (COFDM) Digital Channel Configuration

Press the **Measurements Configuration**  [17] key to access to the **CONFIGURATION** menu and turn the rotary selector [1] to access the **COFDM** signals parameters which can be defined by user and described below:

1) ***Carriers*** (Number of carriers)
It defines the number of modulation carriers between **2k** and **8k**. To modify its value, place the marker over the **Carriers** field by turning the rotary selector and then press it: a menu will appear on the screen. Turning the rotary selector [1] select the desired value for the Carriers parameter and finally press it again to validate.

2) ***Guard Interval***
The **Guard Interval** parameter corresponds to the dead time between symbols, its purpose is to permit a correct detection in multi-path situations. This parameter is defined according to the symbol length: **1/4**, **1/8**, **1/16**, **1/32**. To modify its value, by turning the rotary selector [1], place the marker over the **Guard Interval** field and then press it : a menu with the available values will appear. Turning the rotary selector [1] select the desired value and finally press it to validate.

3) ***Channel BW*** (channel bandwidth)
Enables the channel bandwidth to be selected between 8 MHz, 7 MHz and 6 MHz. The selection of this parameter is essential for the correct operation of the tuner, as it affects the frequency separation of the carriers.

4) ***Spectral Inv.*** (spectral inversion)
This option enables spectral inversion to be applied to the input signal, though in the majority of cases it should be in the OFF position (not inversion).

This configuration menu shows, besides the user definable **COFDM** signal parameters, the value of the rest of signal parameters detected automatically:

Code Rate Also known as Viterbi ratio, defines the ratio between the data bits number and the total number of bits transmitted (the difference corresponds to the number of control bits for the error detection and recovery).

Modulations Carriers modulation. It also defines the system noise immunity. (QPSK, 16-QAM and 64-QAM).

Hierarchy The **DVB-T** norm contemplates the possibility to make a **TDT** transmission with hierarchical levels, it is to say a simultaneous transmission of the same program with different image qualities and noise protection levels, in order the receiver can exchange to a signal of smaller quality when the reception conditions are not optimal.

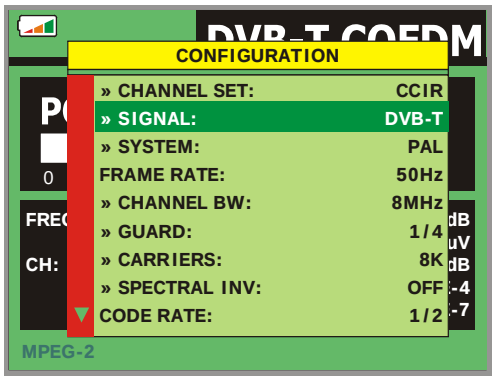

Figure 12.- Screen of mesurement configuration (**COFDM** signals).

5.11.3 DVB-S (QPSK) Digital Channel Configuration

Press the **Measurements Configuration** [17] key to access to the **CONFIGURATION** menu and turn the rotary selector [1] to access the **QPSK** signals parameters which can be defined by user and described below:

1) ***Symbol Rate***
It is possible to choose between the following values: from **2000** to **45000** kbauds. When selecting the option appears the current value, in order to modify it enter a new value through keyboard when appears the data enter symbol appears on the upper left corner screen.

2) ***Code Rate***
Also known as Viterbi ratio. It defines the ratio between the number of data bits and actual transmission bits (the difference corresponds to the control bits for error detection and correction).
It permits to choose between **1/2**, **2/3**, **3/4**, **5/6** and **7/8**.

3) ***Spectral Inv***
If necessary, activate the **Spectral inversion** (**On**). Reception will be bad if spectral inversion has been incorrectly selected.

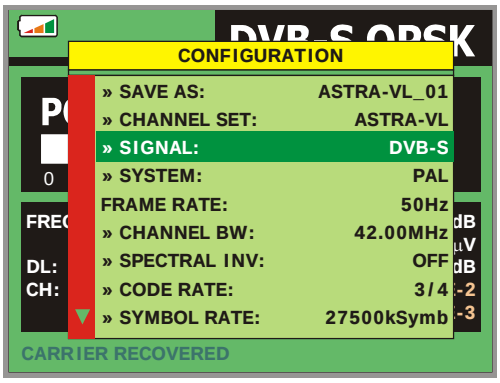

Figure 13.- Screen of mesurement configuration (**QPSK** signals).

IMPORTANT REMARK

DVB channels tuning may require an adjusting process. It is recommended to follow next procedure:

1. *From the **spectrum analyser** mode*  [13], *tune the channel at its central frequency.*

2. *Switch to **Measurements mode***  [12], *measurement selection.*

3. *If in the lower line of the screen does not appear **MPEG-2** message (and consequently BER is unacceptable), by turning the rotary selector deviate the tuning frequency until **MPEG-2** message appears. Finally tune channel again to minimize the **frequency deviation which optimizes the BER** and therefore minimize the BER.*

If it is not possible to detect any MPEG-2 channel, make sure that digital signal parameters are correctly defined.

5.12 Selecting the Measurements

The types of measurements available depend on the operating band (terrestrial or satellite) and the type of signals (analogue or digital).

Terrestrial band - Analogue channels:

Level Level measurement of the currently tuned carrier.

Video / Audio Video carrier to audio carrier ratio.

C/N Ratio between the modulated signal power and the equivalent noise power for a same bandwidth.

Terrestrial band - Digital channels (DVB-C and **DVB-T)**:

Channel power Channel power is measured assuming that power spectral density is uniform throughout channel bandwidth.
To measure it correctly it is indispensable to define the **Channel BW**.

C/N Out-channel measurement. Noise level is measured at f_{noise}= f_{tuning} ± ½*Channel BW*. To measure it correctly digital channel must be tuned at its central frequency.

MER Modulation error ratio.

CBER **BER** measurement (Bit error rate) for the digital signal before error correction (**BER before FEC**).

VBER **BER** measurement (Bit error rate) for the digital signal after error correction (**BER after Viterbi**).

Satellite band - Analogue channels

Level Level measurement of the currently tuned carrier.

C/N Ratio between the modulated signal power and the equivalent noise power for a same bandwidth.

Satellite band - Digital channels (DVB-S):

Channel Power *Automatic method.*

C/N Ratio between the modulated signal power and the equivalent noise power for a same bandwidth.

MER Modulation error ratio.

CBER **BER** measurement (Bit error rate) for the digital signal before error correction (**BER before FEC**).

VBER **BER** measurement (Bit error rate) for the digital signal after error correction (**BER after Viterbi**).

In order to change the measurement mode press 3 DEF [12] key. On the monitor will appear cyclically all the measures available for the tuned signal.

5.12.1 Analogue TV: Measuring the Video Carrier Level

In the measurement mode of analogue signals, the **PRODIG-5** (**EXPLORER**), monitor can work as an analogue indicator of level representing the signal present in the input.

In order to change the measurement mode press 3 DEF [12] key, it will appear a screen like the following one:

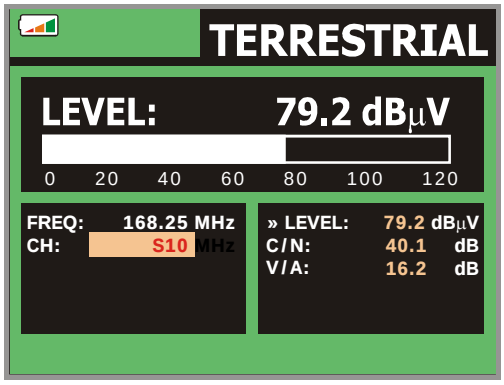

Figure 14.- Analogue signal level measurement in terrestrial band.

Turn the rotary selector [1] to change the tuning channel/frequency. Press the 3 DEF [12] key to select the type of measurement to visualise on the monitor.

The available types of measurements are:

LEVEL:	**Level indication** on the upper part of the screen (analogue bar).
C/N:	**Carrier/Noise** ratio measurement.
V/A:	**Video/Audio** ratio measurement.

WARNING

When at the RF input appear an important number of carriers with a high level the tuning circuit may become out of control, giving as a result wrong level measurements. To be able to determinate the equivalent level of a carrier group (with similar levels) at the RF input, it is possible to use the expression:

$$L_t = L + 10 \log N$$

L_t: equivalent total level
L: average level of the carriers group
N: number of carriers

So, if there are ten carriers with a level around 90 dBµV, their equivalent level will be:

$$90\ dB\mu V + 10 \log 10 = 100\ dB\mu V$$

Observe that in this case, loss of tuning by overload of the RF input may occur besides other effects such as tuner saturation and generation of intermodulation products that may mask the spectrum visualization.

5.12.2 Analogue TV: Measuring the Video / Audio ratio (V/A)

In the **Audio/Video** measurement mode, on the screen appears the following information:

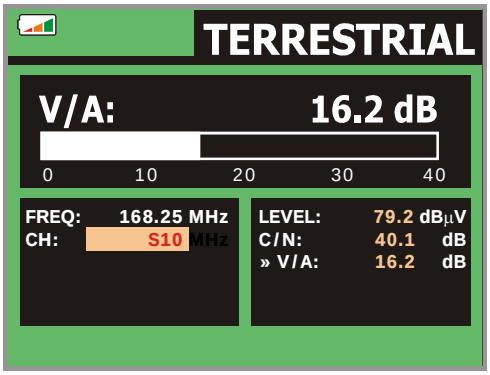

Figure 15.- Measurement of the video/audio rate

In addition to the video carrier / audio carrier level ratio (16.2 dB in previous figure) it also shows the frequency or channel, depending on the tuning mode selected, and the Carrier/Noise ratio.

5.12.3 Analogue/Digital TV: Measuring the Carrier / Noise ratio (C/N)

The **PRODIG-5** (**EXPLORER**) carries out **C/N** ratio measurement in four different ways, according to the carrier type and the used band:

A) **Terrestrial band, analogue carrier**
Carrier level is measured using a quasi-peak detector (230 kHz BW). Noise level is measured with an average detector and corrected to refer it to channel equivalent noise bandwidth (according to the definition of the selected standard).

B) **Terrestrial band, digital carrier**
Both measurements are done with an average detector (230 kHz) and the same corrections are introduced on them (bandwidth corrections).

C) **Satellite band, analogue carrier**
Carrier level is measured using a quasi-peak detector (4 MHz BW). Noise level is measured with an average detector (230 kHz) and corrected to refer it to channel bandwidth.

D) Satellite band, digital carrier

Equivalent to case B but now using the 4 MHz BW filter.

On selecting the **Carrier / Noise** measurement mode the screen displays the following information:

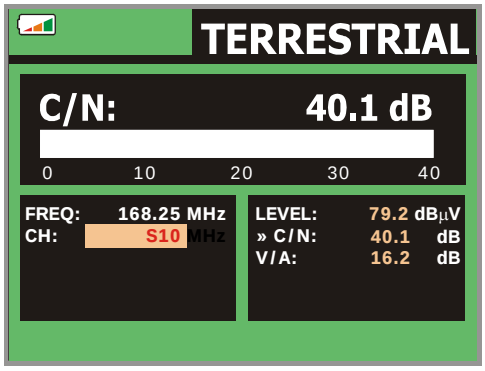

Figure 16.- Carrier-to-noise ratio measurement (**C/N**).

As well as the video carrier / noise level ratio (40.1 dB in previous figure), the frequency or channel (depending on the tuning mode selected) and the *level* of the *video carrier* and *video/audio ratio* are also shown.

When measuring channels in the satellite band or digital channels, to measure the C/N ratio correctly, the bandwidth of the channel must be defined previously, using the ***Channel BW*** option on the **Measurements Configuration** menu that appears when pressing [17] key.

IMPORTANT REMARK

To measure digital channels C/N ratio it is indispensable to tune channel at its central frequency.
In the case of the presence of adjacent digital channels, these could mask the noise level measurement.

5.12.4 Digital TV: Measuring the Power of Digital Channels

The **PRODIG-5** (**EXPLORER**) measures digital channel power in the measurement filter bandwidth and estimates total channel power assuming that spectral density is uniform throughout channel bandwidth.

On selecting the **CHANNEL POWER** measurement mode, the screen displays the following information:

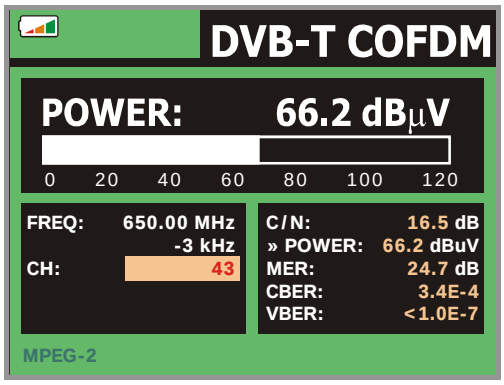

Figure 17.- Digital channel power measurement.

In addition to the power of the digital channel (66.2 dBµV in previous figure) this also shows the tuning frequency or channel, depending on the tuning mode selected, and the offset frequency to calculate the digital channel power.

For the power measurement of a digital channel to be correct it is essential to have previously defined the channel bandwidth using the **Channel BW** option, in the **Measurements Configuration** menu that appears when pressing [17] key.

5.12.5 Digital TV: Measuring BER

The **PRODIG-5** (**EXPLORER**) offers three ways to measure the error rate (**BER**) of digital signals depending on the type of used modulation.

To select the **BER** measurement mode:

1) Select digital signals **Measurements Configuration** pressing [17] key.

2) Select by means of **Signal** option from **CONFIGURATION** menu: **DVB-C** for the measurement of **QAM** modulated signals, **DVB-T** for the measurement of **COFDM** modulated signals or **DVB-S** for the measurement of **QPSK** modulated signals. Available frequency ranges are:

DVB-C (QAM) signals	45 MHz to 865 MHz
DVB-T (COFDM) signals	45 MHz to 865 MHz
DVB-S (QPSK) signals	950 MHz to 2150 MHz

3) Enter the parameters relative to the digital signal which appear in the measurement **CONFIGURATION** menu, as described previously (see section "*5.11 Measurements Configuration*").

4) Select the option to exit from measurements **CONFIGURATION** menu.

5.12.5.1 DVB-C signals

Once determined the parameters of **QAM** signal, it will be possible to measure **BER**, press the 3 DEF [12] key until the **BER** measurement display appears.

In the **BER** measurement mode, the monitor will show a display like the following one:

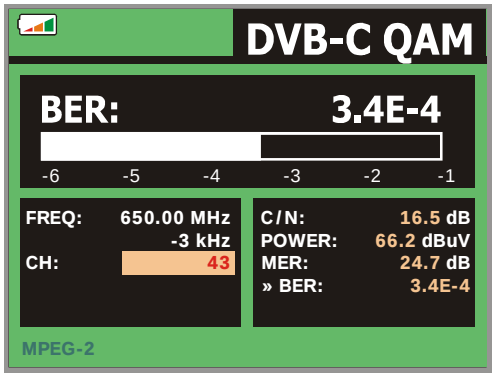

Figure 18.- Screen of **BER** measurement of **QAM** signals.

The **BER** measurement before error correction is shown: ***BER before FEC*** (Forward Error Correction).

In a digital reception system for cable signals, after the **QAM** demodulator an error correction method called **Reed-Solomon** is applied (see following Figure). Obviously, the error rate after the corrector is lower to the error rate at the **QAM** decoder output. This is the reason because this screen provides the **BER** measurement before FEC (Forward Error Correction).

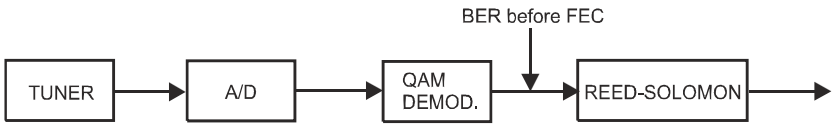

Figure 19.- Digital reception system via cable.

The **BER** measurement is provided in scientific notation (i.e. 1.0 E-5 means $1.0x10^{-5}$ that is to say one wrong bit of every 100,000) and through an analogue bar (as its length is smaller the signal quality will be better). The analogue representation is done on a logarithmic scale (not linear).

With the aim to have a reference about the signal quality, it is considered that a system has a good quality when it decodes less than one non-correctable error for every transmission hour. This border is known as **QEF** (**Quasi-Error-Free**) and it corresponds approximately to a BER before FEC of **2.0E-4 BER** ($2.0x10^{-4}$, that is to say two incorrect bits of every 10,000). This value is marked on the measurement bar of the **BER** and therefore, **BER** for acceptable signals must be at the **left** side of this mark.

Below the **BER** analogue bar it is shown the tuned frequency (or channel) and *the frequency deviation in kHz between the tuned frequency and the one which optimizes the BER* (i.e. *800.00 MHz + 1.2 kHz*). This deviation must be adjusted specially from the **C/N** measurement in satellite band, by tuning again the channel in frequency mode [24], to the lower reachable value.

5.12.5.2 DVB-T signals

Once determined the parameters of **COFDM** signal, it will be possible to measure **BER**.

Two types of measurements appear:

Following is shown the *BER measurement before the error corrections*: **BER before the FEC**: **CBER**.

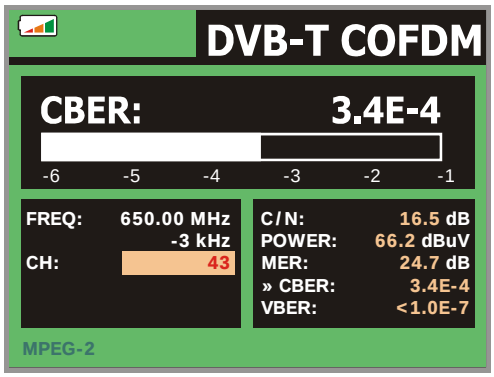

Figure 20.- Screen of **CBER** measurement (**COFDM** signals).

In a reception system of terrestrial digital signal, after the **COFDM** decoder two error correction methods are applied. Obviously, each time we apply an error corrector to the digital signal, the error rate changes, therefore if we measure the error rate at the output of the **COFDM** demodulator, at the output of the Viterbi decoder, and at the output of the Reed-Solomon decoder, we obtain nothing more than different error rates. The **PRODIG-5** (**EXPLORER**) provides the ***BER after Viterbi*** (**VBER**).

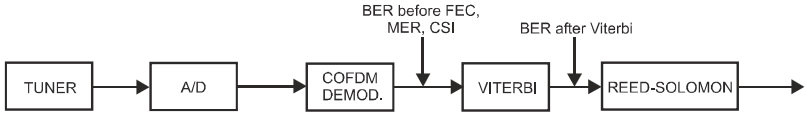

Figure 21.- COFDM reception system.

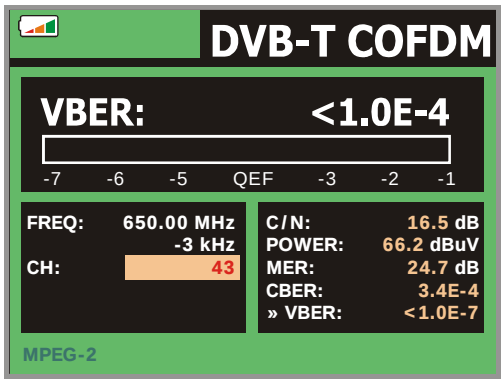

Figure 22.- Screen of **BER** measurement (**COFDM** signals). **VBER.**

The **BER** measurement is provided in scientific notation (i.e. 3.1 E-7 means $3.1x10^{-7}$, that is to say 3.1 average value of wrong bits of each 10000000) and through a graphic bar (as its length is smaller the signal quality will be better). The analogue representation is done on a logarithmic scale (not linear), that is to say, the bar divisions correspond to the exponent of the measurement.

With the aim to have a reference about the signal quality, it is considered that a system has a good quality when it decodes less than one non-correctable error for every transmission hour. This border is known as **QEF** (**Quasi-Error-Free**) and it corresponds approximately to a **BER** after Viterbi of **2.0E-4 BER** ($2.0x10^{-4}$, that is to say 2 wrong bits of each 10000). This value is marked on the measurement bar of the **BER** and therefore, **BER** for acceptable signals must be at the **left** side of this mark.

Finally it is shown a status line with information about the detected signal. The possible messages that can appear and its meaning are showing the following list. The messages are exposed from less to more fulfilment of the **MPEG-2** standard:

No signal received
No signal has been detected.

Timing recovered
Only it is possible to recuperate the symbol time.

AFC in lock
The system automatic frequency control can identify and lock a digital transmission (TDT) but its parameters can not be obtained. It can be due to a transitory situation previous to the TPS identification (*Transmission Parameter Signalling*) or well to a TDT transmission with an insufficient C/N ratio.

TPS in lock
The TPS (*Transmission Parameter Signalling*) are decoded. The TPS are carriers (17 in the 2k system and 68 in the 8k system) modulated in DBPSK, containing information related to the transmission, modulation and codification: Modulation type (QPSK, 16-QAM, 64-QAM), Hierarchy, Guard Interval, Viterbi Code Rate, Transmission mode (2k or 8k) and Number of the received frame.

MPEG-2
Correct detection of a MPEG-2 signal.

5.12.5.3 DVB-S signals

Once determined the parameters of **QPSK** signal, it will be possible to measure **BER**. Following is shown the *BER measurement before the error corrections*: **BER before the FEC**: **CBER**.

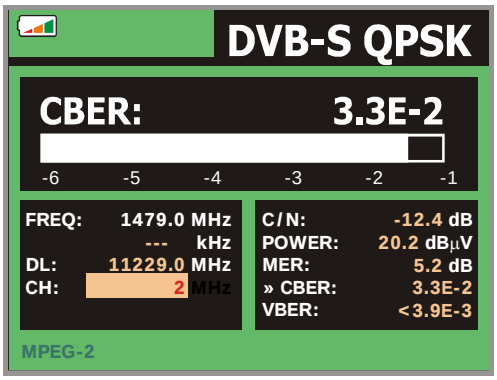

Figure 23.- Screen of **CBER** measurement (**QPSK** signals).

In a digital reception system for satellite signals, after the **QPSK** decoder two different correction methods are applied (see following Figure). Obviously, each time we apply an error corrector to a digital signal, the error rate changes, therefore if we measure in a digital satellite television system, for example, the error rate at the output of the **QPSK** demodulator, at the output of the Viterbi decoder, and at the output of the Reed-Solomon decoder, we obtain nothing more than different error rates. This is the reason because the **BER** measurement is provided before **FEC**, after **Viterbi (VBER**).

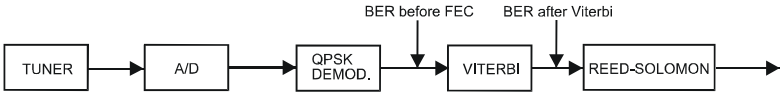

Figure 24.- Digital reception system via satellite.

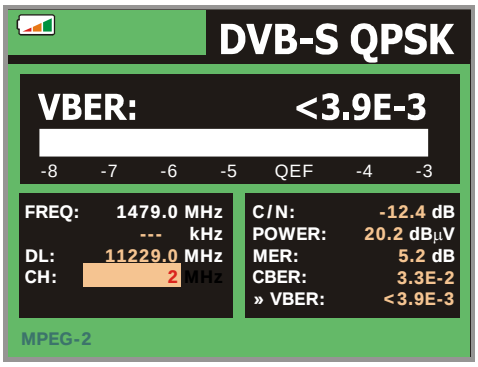

Figure 25.- Screen of **VBER** measurement (**QPSK** signals).

The **BER** measurement is provided in scientific notation (i.e. 2.0 E-3 means $2.0x10^{-3}$, that is to say two incorrect bits of every 1,000) and through an analogue bar (as its length is smaller the signal quality will be better). The analogue representation is done on a logarithmic scale (not linear).

With the aim to have a reference about the signal quality, it is considered that a system has a good quality when it decodes less than one non-correctable error for every transmission hour. This border is known as **QEF** (**Quasi-Error-Free**) and it corresponds approximately to a BER after Viterbi of **2.0E-4 BER** ($2.0x10^{-4}$). This value is marked on the measurement bar of the BER after Viterbi and therefore, BER for acceptable signals must be at the **left** side of this mark.

Next it is shown the tuning frequency and the *frequency deviation in MHz between the tuned frequency and the one which optimizes the BER* (i.e. *Freq: 1777.0 + 1.2 MHz*).

Finally it is shown a status line with information about the detected signal. The possible messages that can appear and its meaning are shown in the following list. The messages are exposed from less to more fulfilment of the **MPEG-2** standard:

No signal received
Any signal has been detected.

Signal received
A signal is detected but it can not be decoded.

Carrier recovered
A digital carrier has been detected but it can not be decoded.

Viterbi synchronized
A digital carrier has been detected and the Viterbi algorithm is synchronized, but too many frames arrive with non correctable errors. It is not possible to quantify the BER.

MPEG-2
Correct detection of a MPEG-2 signal.

5.12.6 Digital TV: Measuring MER

Once determined the suitable parameters for **COFDM**, **QAM** or **QPSK** signal reception, it will be possible to measure **MER**, press 3 DEF [12] key until it appears the **MER** measurement screen.

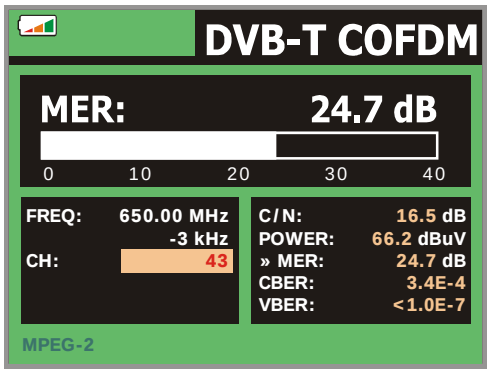

Figure 26.- Screen of **MER** measurement of **DVB-T (COFDM)** signals.

First of all, you will see the *modulation error ratio* measurement: ***MER***.

Analogue and digital carriers are very different in terms of signal contents and power distribution over the channel. They, therefore, need to be measured differently. The modulation error ratio (**MER**), used in digital systems is similar to the Signal/Noise (**S/N**) ratio in analogue systems.

MER represents the relation between the average power of **DVB** signal and the average power of noise present in the constellation of the signals.

By example, **QAM 64** demodulators require a **MER** greater than **23 dB** to work. Though it is preferable to have at least a **3** or **4 dB** margin to compensate for any possible degradation of the system. While **QAM 256** demodulators require an **MER** greater than **28 dB** with margins of al least **3 dB**. Normally, the maximum **MER** value seen in portable analysers is of approximately **34 dB**.

Finally it is shown a status line, which displays information about the detected signal. The possible messages that can appear and its meaning are shown in the following list. The messages are exposed from less to more fulfilment of the MPEG-2 standard:

No signal received
Any signal has been detected.

Signal received
A signal is detected but it can not be decoded.

Carrier recovered
A digital carrier has been detected but it can not be decoded.

MPEG-2
Correct detection of a MPEG-2 signal.

5.13 Spectrum Analyser

The **Spectrum Analyser** mode allows the user to discover the signals present in the frequency band in quickly and easily and to make measurements at the same time.

To select it press 4 GHI [13] key. The monitor will show a picture like the one described in the next figure.

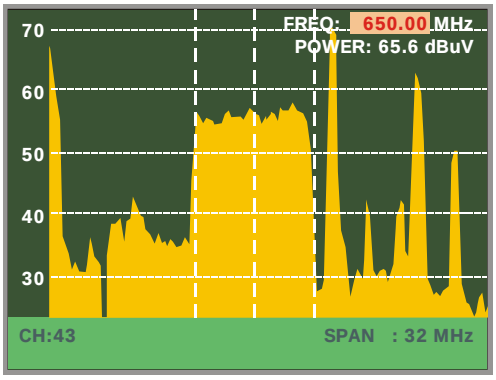

Figure 27.- Spectrum analyser mode.

The horizontal lines define the signal level, the broken lines being separated a distance equals to 10 dB. The level of the top line (70 dBµV in previous figure), named ***Reference Level***, can be altered using the vertical cursors [6] keys between a range of 60 dBµV to 130 dBµV by steps of 10 dB (from 70 dBµV to 130 dBµV in satellite band).

The signal level for each frequency is displayed vertically, the lower frequencies appear at the left of the screen and the higher ones at the right. The amplitude of the lobes is calibrated. In the example in previous figure the noise level is at around 25 dBµV and the lobe with the highest signal level (third from the right) is at 70 dBµV.

*The frequency range displayed (called **span** from hereon) can also be altered using the horizontal cursors [6] keys. Therefore enables selecting the displayed screen frequency range in Spectrum Analyser mode between* **Full** *(the entire band),* **500 MHz**, **200 MHz**, **100 MHz**, **50 MHz**, **32 MHz**, **16 MH** *and* **8 MHz** *(the latter one only in terrestrial bands).*

A vertical broken line, called **marker**, appears on the spectrum display to identify the tuned frequency.

One of the applications of the **PRODIG-5** operating as Spectrum Analyser is in the search for the best orientation and position of the receiving antenna. This is particularly important in UHF. Because such frequencies are involved, with wavelengths ranging from 35 cm to 65 cm, if the antenna is shifted only a few centimetres, the relationship between the picture, chrominance and sound carrier frequencies change, affecting the quality of the picture in the receiver.

If there is an excess of sound carrier, tearing or 'moiré' may appear on the screen due to the frequency beats between the sound, chrominance and the picture frequencies.

If there is a chrominance carrier defect, then the television colour amplifier must function at maximum gain, which could result in noise appearing all over the television screen with points of colour that disappear when the saturation control is reduced; in an extreme case, loss of colour may occur.

5.13.1 Markers

(*Only in Spectrum Analyser mode*). The marker in red colour indicates the central frequency or tuning frequency, which can be moved by means of turning the rotary selector [1] as well in channel as in frequency tuning mode  [24].

When monitoring a digital signal spectrum also appears two additional markers in white colour, which indicate the bandwidth of the digital channel (See previous Figure).

5.14 TV Operating Mode

When pressing the  [2] key from any mode of operation the **PRODIG-5** (**EXPLORER**) accedes to the **TV mode**, and tries to demodules on the monitor the currently tuned video signal.

In the monitor will appear the TV picture with a window on the lower part to show, for five seconds, in the case that the signal is analogue, the channel number, the frequency, the active canalization, the colour system and the TV standard.

If the signal is digital it shows, for about fifteen seconds, the following parameters: channel number, frequency, active channel plan, type of **DVB** signal, service, network, video program identifier (**VPID**) and audio program identifier (**APID**).

After few seconds only the TV image appears on screen. If the transmission is not codified on the lower right corner a (**FREE**) indication is showed or otherwise states (**COD**). Also the standard **MPEG-2** profile is indicated which determines the compression rate for the digital service decodified, the level of image resolution (**4:3**), the resolution (rows x columns) for received video and the picture refreshment frequency rate. The information window previously described will appear whenever the rotary selector is pressed again [1].

Figure 28.- Analogue channel monitoring.

When a digital channel is decodified, once the Table of Services **SDT** (***Service Description Table***) acquisition is completed, is possible to accede to the **list of services** contained in the Table.

For it place the field selector, by means of the vertical cursors [6], on the field of the active service (e.g. *Veo TV* in the following figure) and later press the rotary selector [1].

The **DVB SERVICES** menu will appear then with the services available in the digital **Multiplex**. Move the vertical cursors [6] or turn the rotary selector [1] and press it to select the service to visualise on screen.

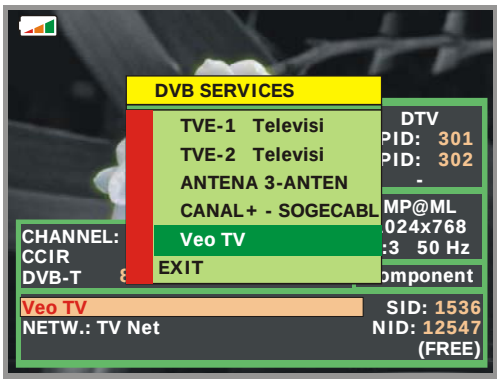

Figure 29.- Digital channel monitoring.

Also is possible to change the active service directly acting through the horizontal cursors [6] once has selected the field of the service from information window of the currently tuned channel.

5.15 Antenna Alignment Function

It allows executing the function **Antenna Alignment** to align antennas using a faster sweep without display of numerical measures. The display appears divided in two parts, the left one shows the spectrum of the signals detected in the band and on the right an analogue bar represents the level of signal corresponding to the tuned frequency or channel.

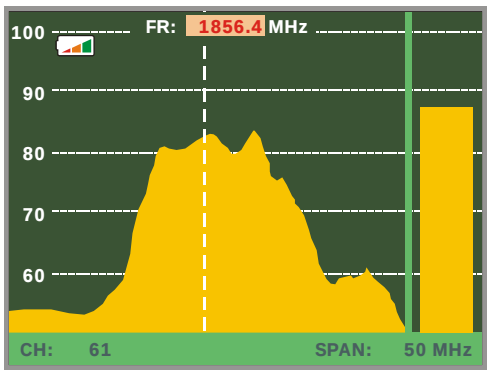

Figure 30.- Utility for antenna alignment

Simultaneously the instrument emits by means of the loudspeaker an acoustic tone which varies according to the level of received signal.

5.16 DiSEqC Command Generator

DiSEqC[4] (*'Digital Satellite Equipment Control'*) is a communication protocol between the satellite receiver and the accessories of the installation (switches, LNBs, etc.) proposed by Eutelsat, with the aim to standardize the diversity of switching protocols (13 - 18 V, 22 kHz) and to satisfy the demands of the digital TV installations.

In order to define and/or to send a sequence of DiSEqC commands, press the DiSEqC key [21] on frontal panel. It allows to define the satellite band configuration parameters and select through SEND function one of the eight predefined programs which execute basic functions to control an universal switch with two or four inputs, by means of the rotary selector [1].

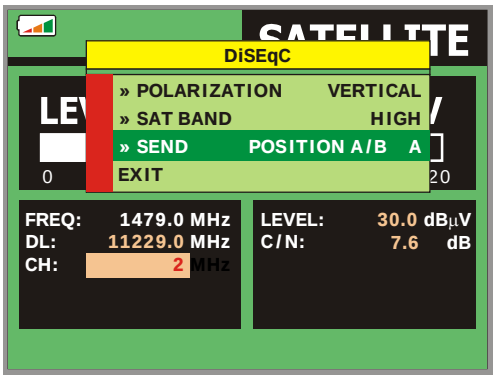

Figure 31.- DiSEqC command screen.

[4] *DiSEqC™ is a trademark of EUTELSAT.*

6 DESCRIPTION OF THE INPUTS AND OUTPUTS

6.1 RF input

The RF input is through the RF [37] connector on the side panel. The peak signal level should never exceed 130 dBμV.

6.2 RS-232C serial port

The **PRODIG-5** (**EXPLORER**) incorporates an RS-232C serial port for diagnosis, setup and calibration processes. The signals in this connector are described in Table 4.

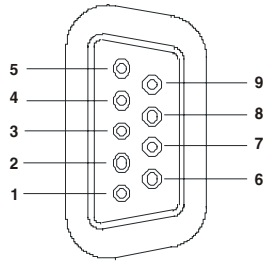

Figure 32.- RS-232C connector. External view.

PIN No.	SIGNAL	CHARACTERISTICS
1	Carrier detect	(not connected)
2	Data Receive (RxD)	
3	Data Transmit (TxD)	
4	Data Terminal Ready (DTR)	(not connected)
5	Ground (GND)	
6	Data Set Ready (DSR)	(not connected)
7	Request to Send (RTS)	
8	Clear to Send (CTS)	
9	Ring Indicator	(not connected)

Table 4.- Description of the RS-232C connector.

6.3 Scart (DIN EN 50049)

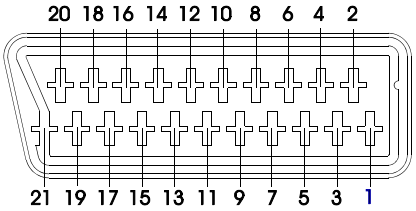

Figure 33.- Scart socket (external view).

Also known as PERITEL connector (in conformity with standard NF-C92250). The signals in this connector are the following:

PIN number	SIGNAL	CHARACTERISTICS
1	Right channel audio output	
2	Right channel audio input	
3	Left channel audio output	
4	Audio grounding	
5	Blue grounding (B)	
6	Left channel audio input	
7	Blue output (B)	
8	Switching voltage	
9	Green grounding (G)	
10	Digital bus interface	(not connected)
11	Green output (G)	
12	Digital bus interface	(not connected)
13	Red grounding (R)	
14	Digital bus reserved	(not connected)
15	Red output (R)	
16	Blanked signal	(not connected)
17	Composite video grounding	
18	Blanked return	(not connected)
19	Composite video output	
20	Video input	
21	Connector shield grounding	

Table 5.- Description of the Scart.

7 MAINTENANCE

7.1 Considerations about the Screen.

This paragraph offers key considerations regarding the use of the colour screen, taken from the specifications of the manufacturer.

In the TFT display, the user may find pixels that do not light up or pixels that are permanently lit. This should not be regarded as a defect in the TFT. In accordance with the manufacturer quality standard, 9 pixels with these characteristics are considered admissible.

Pixels which are not detected when the distance from the surface of the TFT screen to the human eye is greater than 35 cm, with a viewing angle of 90º between the eye and the screen should not be considered manufacturing defects either.

It is advisable a viewing angle of 15º in the 6.00 o'clock direction in orden to obtain the optimum visualization of the screen.

7.2 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 system again.

CAUTION

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