TV & FM LEVEL METER
PROLINK-1B

1 GENERAL

1.1 Description

The **PROLINK-1B** is a professional, true portable, TV and FM Level Meter which allows the measure of **analogue and digital signals** with a high degree of accuracy and it is provided with advanced functions such as Video/Audio ratio measure, tunable audio carrier, remote control and automatic start-up configuration. On the other hand, its simple but powerful control procedure makes of it a really easy to use instrument.

It incorporates three different modes for the measure of analog signals: video, audio and video to audio carrier rate. The measure is shown in a LCD alphanumeric display and its presentation can be selected between numeric or analog, in the last case it is shown by a bar graph.

The **PROLINK-1B** is equipped with a 30 dB RF attenuator, which enables the user to measure signals of up to 120 dBµV with no need for additional external attenuators. The frequency indication is carried out by a digital frequency meter and shown in an alphanumeric display. The meter tuning bandwidth is from 47.25 up to 870 MHz. The tuning can be continuous (frequency mode) with selectable 62.5 kHz or 1 MHz steps, or by channel.

It is possible to select three different audio demodulators: FM, AM and Level Sound. In the last mode the acoustical indicator emits a tone whose frequency varies with the received power, this allows the user to find the peak signal without the need for continuous observation on the display. Also it is possible to select two detection modes: peak and average detection which allows the correct measure of digital or AM modulated sound carriers.

It is also equipped with an RS-232C serial connector which permits the connection to a personal computer for remote control and calibration purposes or the connection to a serial printer for data dumping.

The device is powered by a rechargeable battery, which provides an autonomy for about 3 hours (at 30% On/Off). To recharge the battery the meter is equipped with a built-in charger that may be connected using an external AC/DC power adapter or a car lighter plug. A LED in the front panel shows the battery charger operation .

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1.2 Specifications

TUNING	Digital frequency synthesis
Frequency mode	Selectable 62.5 kHz or 1 MHz steps
Channel mode	Up to 7 channel plans, each one with 126 channels max. Channel plan configurable on demand (OPT-101-61).
Frequency range	From 48.25 to 870 MHz
Indication	Frequency or channel by a 16 digits alphanumeric display readout.
Resolution	62.5 kHz
Tuning accuracy	± 32 kHz
Memory	One memory to store power-on configuration.
RF INPUT	
Impedance	75 Ω
Connector	BNC
Maximum signal	130 dBµV (3.16 V)
Maximum input voltage	60 V AC rms / 50-60 Hz
MEASUREMENT	
Sensitivity	
Low range (0 dB RF atten.)	30 dBµV to 90 dBµV
High range (30 dB RF atten.)	60 dBµV to 120 dBµV
Readout	
Numeric	Displayed in the alphanumeric display with 0.1 dB resolution, with over-range and under-range indication.
Analog	Bar Graph Display
Acoustical Indicator	A tone whose frequency varies with the signal level
RF Attenuators	
10 dB RF	Automatic attenuator, for low range measuring scale.
30 dB RF	Manual attenuator, for high range measuring scale.
Direct measurements accuracy	±2dB (0 dB attenuator, 20ºC ± 5ºC, 40 to 70% RH)
Attenuator accuracy	±1 dB (20 ºC ± 5 ºC, 40 to 70% RH)
SOUND	
Demodulation	FM, AM and Level Sound
Volume control	
Built-in speaker	

POWER SUPPLY

Internal	6 V - 1.2 Ah Lead Acid Battery
External	
Measure	9 to 15 V DC
Bat. recharge	12 to 15 V DC
Autonomy	3 hours (at 30% on/off)
Recharging time	About 10 hours (starting from a total discharge) using an appropriate external power adapter.
Safety devices	Low battery indication under 5.5 V
Consumption	7.2 W

OPERATING ENVIRONMENT CONDITIONS

Max. altitude	2000 m
Temperature range	From 5 ºC to 40 ºC
Max. relative humidity	80% (up to 31 ºC) decreasing lineally up to 50% at 40 ºC

MECHANICAL FEATURES

Dimensions	W. 199.5 x H. 60.5 x D. 131.5 mm (without case)
Weight	1200 g (battery included)

ACCESSORIES INCLUDED

AD-050	BNC/m-ANT/f IEC adapter
AD-051	BNC/m -"F"/f adapter
AL-013	Europe and other countries 230 V / 50-60 Hz mains adapter
CB-039	6V 1.2 Ah lead acid rechargeable battery
0 PG4034	Carrier belt
DC-244	Carrying bag

OPTIONAL ACCESSORIES

RM-101	Control software
AL-023	USA and Canada 120 V / 50-60 Hz mains adapter
AA-012	Car supply adapter cable
AD-052	BNC/m-ANT/f (NF) Adapter
MC-75/300	75 Ω (BNC) / 300 Ω (TV) Impedance adapter
CV-550	5-50 MHz Sub-band converter
AT-20	20 dB Attenuator
LN-370B	20 dB Amplifier
NG-282	Noise Generator
CI-023	Portable serial printer
0 CA2040	RS-232 cable DB25/f-DB9/f
AMC/1	Reference antenna

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OPTIONS

OPT-101-01	Replace mains adapter with U.S. AL-023
OPT-101-16	MMDS voltage supply
OPT-101-61	Programming of channel plan, measuring units, etc.
OPT-101-67	Extension of frequency range to cover the subband (5 to 45 MHz)

2 SAFETY RULES

* Use this equipment connected **only to devices or systems with their common at ground potential**.

* This equipment can be used in **Category I Installations** and **Pollution Degree 2 Environments.**

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

  Rechargeable battery
  Mains adapter
  Car supply adapter cable

* 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**.

* **The user is only authorized to** carry out the following maintenance operations:

  Replace the battery

  On the Maintenance paragraph the proper instructions are given.

  Any other change on the equipment should be carried out by qualified personnel.

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

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* Symbols related with safety:

DIRECT CURRENT

ALTERNATING CURRENT

DIRECT AND ALTERNATING

GROUND TERMINAL

PROTECTIVE CONDUCTOR

FRAME TERMINAL

EQUIPOTENTIALITY

ON (Supply)

OFF (Supply)

DOUBLE INSULATION PROTECTED
(Class II Protection)

CAUTION
(Risk of electric shock)

CAUTION (Refer to manual)

FUSE

3 INSTALLATION ⚠

The **PROLINK-1B** level meter is designed for use as a portable device powered by a rechargeable battery. Before taking any measurement, the user should make sure that the battery is charged.

3.1 Charging the battery

The **PROLINK-1B** is powered by a lead acid 6 V 1.2 Ah internal battery. If battery charge is below 5.5 V, **LOW BAT.** message and current battery voltage will appear on the LCD display, showing that it is necessary to recharge the battery. Also, a beep will be heard.

The instrument is equipped with a 230 V / 50-60 Hz mains adapter (AL-013) for Europe and other countries to power the battery charger. To request different adapters, see 'Optional Accessories' in the specifications paragraph.

To fully recharge the battery, connect the device to the AC/DC mains adapter through the **[11] DC input** (see figure 3). Connect then the adapter to the mains. Under these circumstances the **[6] BAT** LED indicator on the front panel will be on. The length of time it takes to recharge depends on the condition of the battery. If battery is very low the recharging period will be about 10 hours with the unit turned off.

CAUTION

1) ***BEFORE USING THE CHARGER, MAKE SURE THAT THE ADAPTER IS SUITABLE FOR THE MAINS VOLTAGE.***
2) ***THE MAINS ADAPTER IS DESIGNED FOR INDOOR USE.***
3) ***IF THE EQUIPMENT IS IN STORAGE OR IS USED ONLY OCCASIONALLY FOR A LONG PERIOD OF TIME, IT IS ABSOLUTELY NECESSARY TO CARRY OUT FULL-CHARGE OPERATIONS PERIODICALLY (EVERY SIX MONTHS, FOR EXAMPLE) TO COMPENSATE THE SELF-DISCHARGING EFFECT OF THE BATTERY.***

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4 OPERATING INSTRUCTIONS

4.1 Controls and Elements Description

Front Panel

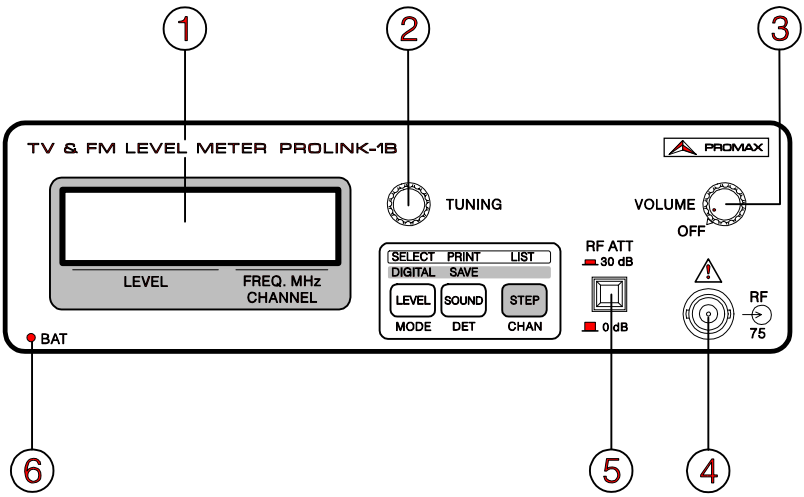

Figure 1.- Front Panel.

[1] **DISPLAY**: 16 characters alphanumeric display. Indicates the level, the tuned frequency or channel, the measurement mode, the sound demodulation and the sound detection mode.

[2] **TUNING**: Rotary knob for tuning control.

[3] **VOLUME, OFF**: On/Off and Volume control.

[4] **RF** : RF signal input. BNC connector with an input impedance of 75 Ω.

⚠ **Maximum input voltage level 130 dBµV or 60 V AC rms / 50-60 Hz**

[5] **RF ATT**: 30 dB RF manual attenuator selector.

[6] **BAT**: LED indicator, it lights on when the battery charger is connected.

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Keyboard

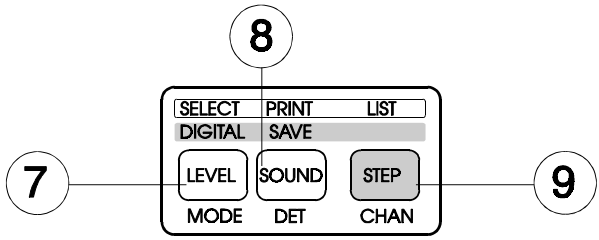

Figure 2.- Keyboard

[7] **LEVEL**: By successive pushing this key, the different measuring modes for analog channels are allowed: **Video Level**, **Audio Level** and **Video/Audio Level**.
When pushing this key for more than one second the level readout mode changes between **Numeric Level** and **Bar Graph Level**.
Pushed together with the **[9] STEP** key it selects the **digital** or **analog** channels measuring mode.
Pushed together with the **[8] SOUND** it selects the *print mode*.

[8] **SOUND**: By pushing over it, the different sound functions are selected: **FM**, **AM** and **Level Sound**.
Also, keeping this key pushed for more than one second, it changes the sound detection mode between **Peak Detector** and **Average Detector**.
When it is pushed together with the **[9] STEP** key, the equipment stores the current configuration as start-up configuration.
In the print mode, when this key is pushed, the unit dumps to the printer the information relative to the tuned channel.

[9] **STEP**: In the **Channel Tuning** Mode when this key is pushed the instrument switches to **Frequency Tuning** Mode. Once in this mode (**Frequency Tuning** mode) this key enables faster tuning by shifting the minimum frequency step between **62.5 kHz** and **1 MHz**.
In the **Frequency Tuning Mode** it allows to return to **Channel Tuning Mode** by keeping this key pushed for more than one second.
In the **Channel Tuning** mode, it permits to change to the next channel plan stored in the unit (if available) by keeping it pushed for more than one second.
In the print mode, when this key is pushed, the unit dumps to the printer the information relative to the selected channels.

Side panel

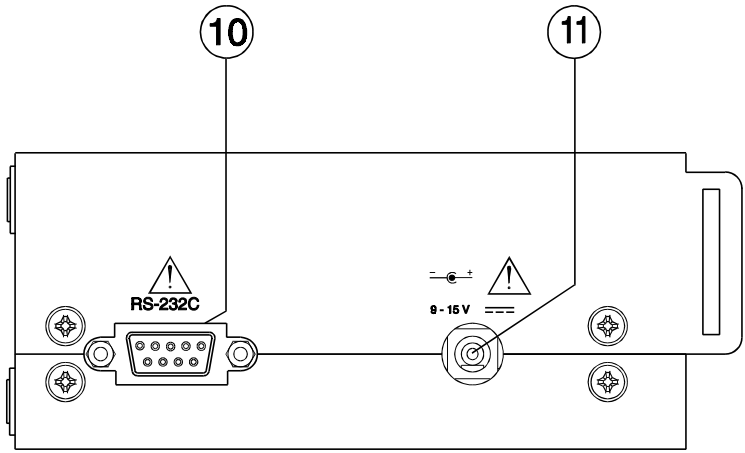

Figure 3.- Side Panel

[10] **RS-232C connector**: Enables the remote control of the **PROLINK-1B** from a personal computer with an optional software pack and the data dumping to a printer.

[11] **DC input for the mains adapter**

4.2 Operating Instructions

4.2.1 Quick operation guide

1.- Power on the equipment by turning clockwise the **[3] VOLUME/OFF** control.

Figure 4.- Start-up

The display will show the **PROLINK-1B** version and the recorded initial configuration in the following order:

Measure:	**Video**, Audio or Video/Audio rate
Sound:	**FM**, AM, or Level Sound
Level readout:	**Numeric** or Bar Graph Level
Audio detection:	**Peak** or Average
Tuning method:	**Frequency** or Channel

Factory start-up configuration is marked with bold letters. These operation modes can be modified and stored in order to replace the start-up configuration as it is described in the following paragraphs.

When the **PROLINK-1B** is battery powered and except if battery is near to full charge, the device automatically disconnects the display back-lighting one minute after last control has been modified; when pressing any key it will light again automatically. If battery voltage is low, the display back-lighting is deactivated in order to increase the operation time in extreme conditions.

2.- Tune the desired frequency by means of the **[2] TUNING** control. To change to Channel Tuning Mode see paragraph '*4.2.2 Tuning*'.

3.- The tuned frequency is shown on the right side of the display and the video carrier level on the left side.

Figure 5 shows, as an example, the information that will appear as a result of tuning a video carrier at 471.25 MHz with a level of 54.2 dBµV.

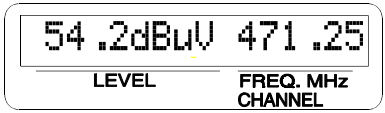

Figure 5.-

To select the bar graph level readout mode, see paragraph '*4.2.3 Readout presentation mode*'. If the level is higher than **90 dBµV** the 30 dB attenuator must be selected by means of the **[5] RF ATT** key as described in paragraph '*4.2.5 Setting the attenuators*'.

4.- To change the sound demodulation mode to AM or Level Sound proceed as it is described in paragraph '*4.2.6 Audio demodulation and detection mode*'. The **[3] VOLUME/OFF** control allows to select the volume level.

5.- To select a different measuring mode: sound carrier level or Video/audio rate proceed as described in paragraph '*4.2.4.1 Measure of analog signals*'.

6.- For measuring digital channels proceed as described in paragraph 4.2.4.2.

Following paragraphs describe the different operation modes of the **PROLINK-1B**. To explain it several figures are used, arrows point to the key/s which must be pushed. The indication 2 SEC means that the key must be pushed for more than one second. Below the keyboard it is shown the message that will appear on the display when selecting the new operation mode.

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4.2.2 Tuning

The **PROLINK-1B** has two tuning modes:

1) **Frequency Tuning**, with selectable frequency step: 62.5 kHz or 1 MHz.

2) **Channel Tuning**.

In the **Channel Tuning Mode** by pushing the **[9] STEP** the unit switches to the **Frequency Tuning Mode** as showed in figure 6.

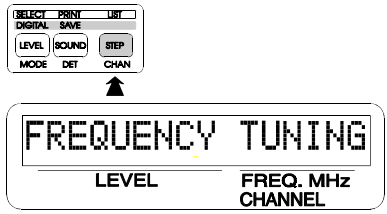


Figure 6.- Frequency tuning mode

With the **[2] TUNING** rotary knob it is possible to tune the desired frequency.

In the **Frequency Tuning Mode** the **[9] STEP** key enables faster tuning by shifting the minimum step between 62.5 kHz and 1 MHz in order to carry out substantial changes in frequency. When the 1 MHz step is selected in the display appears the symbol **^** at the left side of the tuned frequency as shown in figure 7.

Figure 7.- Frequency tuning, 1 MHz step indication.

In the **Frequency Tuning Mode** it is possible to change to **Channel Tuning Mode** keeping pushed the **[9] STEP** key for more than one second.

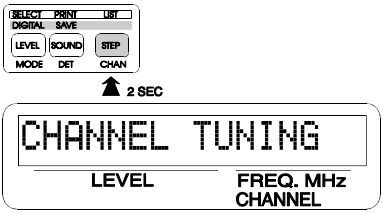


Figure 8.- Channel Tuning Mode.

In the **Channel Tuning** mode it is possible to change to the next **channel plan** stored in the unit by keeping pushed for more than one second the **STEP [9]** key. Active channel plan is kept when switching between the channel and frequency tuning modes. If present channnel plan and tuned channel are desired to be defined as power-on tuning, present configuration must be stored in the power-on memory (to do this press **SOUND** [8] and **STEP** [9] keys together).

4.2.3 Readout presentation mode

It is possible to select the level readout mode between **Numeric Level** or **Bar Graph Level** by pushing the **[7] LEVEL** key for more than one second as show next figures.

Figure 9.- Setting Numeric Level readout mode.

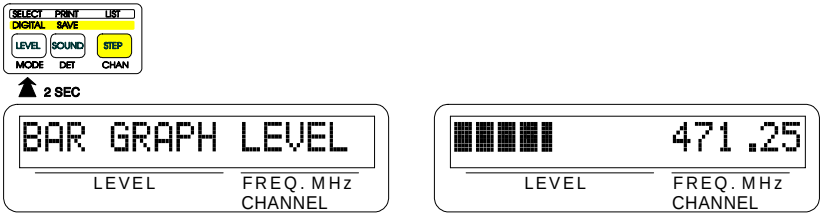


Figure 10.- Setting the Bar Graph Level readout mode.

In the Bar Graph Level readout mode, the reference value (the left side of the display) is **20 dBµV**, and each display character corresponds to **10 dB**.

4.2.4 Analog and digital channels measure

The **PROLINK-1B** enables the measure of analog and digital channels. To select the measuring mode it is necessary to push the **[7] LEVEL** and **[9] STEP** keys together as it is shown in figures 11 and 12.

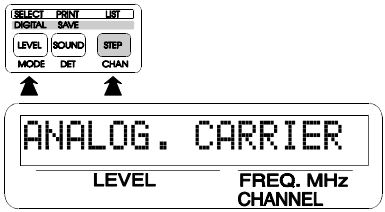


Figure 11.- Analog signals measure.

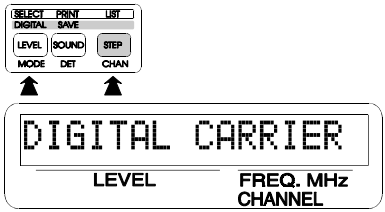


Figure 12.- Digital signals measure.

4.2.4.1 Analog signals measure

In the measure of analog signals three different measuring modes can be selected: Video, Audio and Video/Audio rate, to do this push the **[7] LEVEL** key. The measuring mode selection is sequential as described in the following figure:

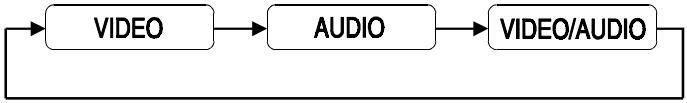


Figure 13.- Measuring modes.

Next it is explained the selection of the different measuring modes.

1) **Video Carrier Measure**, selects the level measure of the currently tuned video carrier frequency.

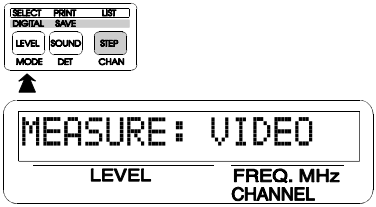


Figure 14.- Video Carrier Measure Display.

2) **Audio Carrier Measure**, selects the level measure of the audio carrier related to the tuned video carrier .

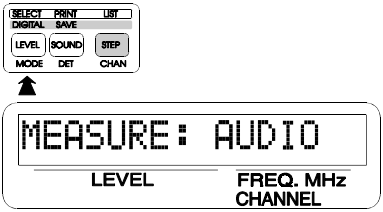


Figure 15.- Audio Carrier Measure Display.

3) **Video/Audio Measure**, selects the VIDEO/AUDIO rate measure.

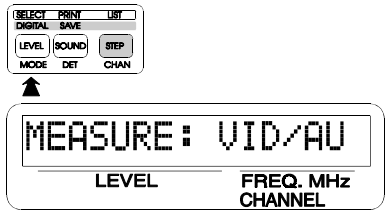


Figure 16.- Video/Audio Rate Measure Display.

The Video to Audio rate is a signal quality test that relate to the picture being delivered to the customer. The following specifications ensure that there is no interference in the same or in the adjacent channel. Its physical meaning is shown in next figure.

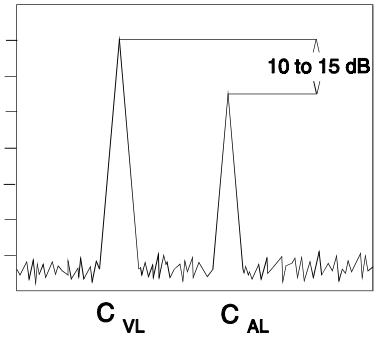


Figure 17.- Video to Audio rate.

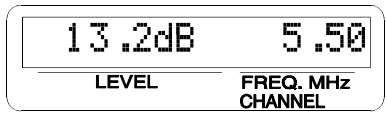


Figure 18.- Measurement of the relative video to audio rate.

Although this process depends on the standard used, it is usual to consider that a properly transmitted PAL channel should have a sound subcarrier **13 dB** below the video carrier.

In this mode, the audio carrier position can be modified with the **TUNING** [2] knob from 0 to 10 MHz, in order to adapt the measure to any TV standard. This has two important applications as described in the following paragraphs:

4.2.4.1.1 Measurement of the adjacent channel level

The user can obtain the rate of the video carrier amplitudes of two consecutive channels as shown in the figure:

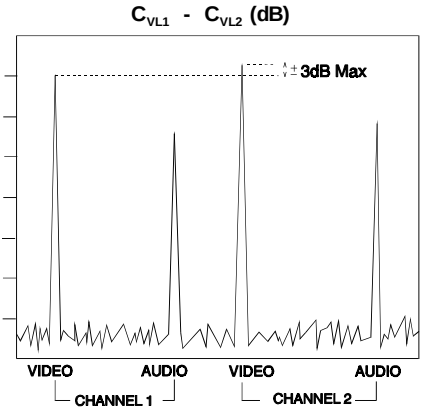
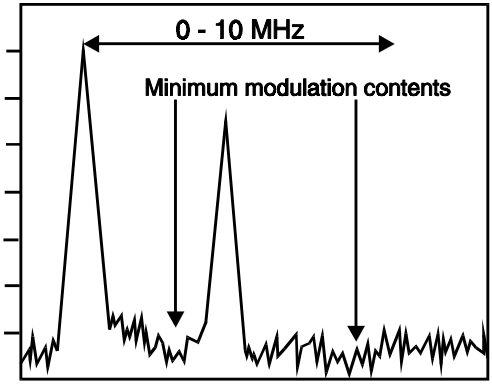


Figure 19. Measurement of the adjacent channel level

Differences of more than **3 dB** between carriers of adjacent channels may cause problems of interference in reception.

4.2.4.1.2 Qualitative C/N evaluation

The measurement of the carrier-to-noise ratio is a very important parameter to define the quality of the received signal. With the **PROLINK-1B** it is possible to obtain a qualitative evaluation of this parameter. To do this just select the average value sound detection system and make a video/audio measurement, tuning the audio subcarrier at a frequency where the readout will be maximum (this will correspond to the minimum modulation content). If there is not an adjacent channel, the measurement will be done out-of-channel; on the contrary, if there is an adjacent channel the most suitable point is around 3.5 MHz from the video carrier. This measurement can be taken as a reference value and by modifying the situation it is possible to deduce if the noise increases or not.



4.2.4.2 Measure of digital channels power

The **PROLINK-1B** allows to measure the power associated to a **8 MHz** digital channel directly. To do this follow next procedure:

Select the Digital Channels Measuring Mode:

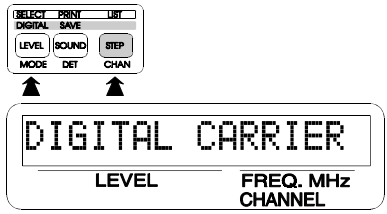


Figure 20.- Measuring Digital Channels Power

Then check that the bandwidth associated to the digital Channel is **8 MHz** (in this margin the signal level is maintained high). The instrument readout inside this margin will correspond to the digital channel power (in dBµV).

Example

Imagine a digital channel with a central frequency of 400 MHz as it is shown in figure 21. Its frequency bandwidth is of 8 MHz (from 396 MHz to 404 MHz signal level is maintained high).

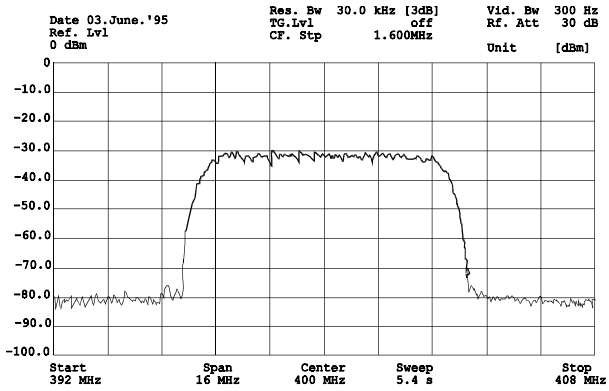


Figure 21.- Digital channel.

The readout provided by the unit is directly the power of the digital channel: 77.2 dBµV.

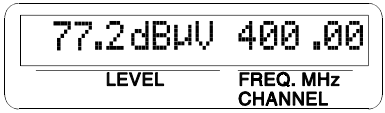


Figure 22.- Digital channel.

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4.2.4.2.1 Considerations about the measure of digital channels

When measuring channels with a bandwidth different to 8 MHz it will be necessary to apply a numeric correction on the readout provided by the unit.

The numeric correction is the following:

POWER [dBµV] = READOUT [dBµV] + CF

Where:

POWER: Digital channel power in dBµV
READOUT: Readout provided by the **PROLINK-1B** in dBµV
CF: Correction Factor according to the following table :

Channel Bandwidth	CF
6 MHz	- 1.2 dB
7 MHz	- 0.6 dB
9 MHz	+ 0.5 dB

Previous correction must be done because the **PROLINK-1B** measurement bandwidth is 230 kHz and the unit is programmed to perform the corrections necessary for 8 MHz channels (most habitual situation). Previous formula can be deduced using the next figure:

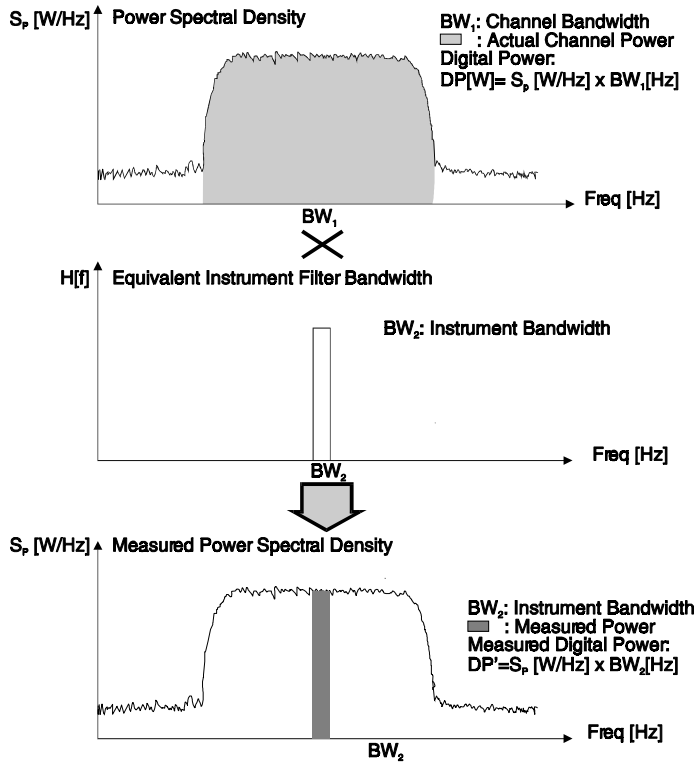

Figure 23.- PROLINK-1B measurement.

First of all figure 23 shows the Digital Channel Power Spectral Density. The figure just below displays the **PROLINK-1B** equivalent input filter. Finally the figure at the bottom shows how measurement is made by the **PROLINK-1B**. The unit is programmed at factory to show on the display the equivalent power for a 8 MHz channel bandwidth.

If channel spectral density is constant within the bandwidth, the ratio between the measurement and the actual power will be:

$$\textbf{POWER [W] = MEASUREMENT [W] X } BW_1 / BW_2$$

where:

BW_1: DIGITAL CHANNEL BANDWIDTH
BW_2: 230 kHz, PROLINK-1B MEASUREMENT BANDWIDTH

and in logarithmic units it corresponds to:

$$\textbf{POWER [dBµV] = MEASUREMENT [dBµV] + 10 log } [BW_1/BW_2]$$

4.2.5 Setting the attenuators

When the **[5] RF ATT** key is resting the equipment detects automatically the attenuator state and includes its active value in the displayed level.

In the measure of signals with a level higher than 90 dBµV it is necessary to select the 30 dB manual attenuator to prevent the measuring circuits saturation. To do this, it is necessary to push the **[5] RF ATT** key. Also in this mode the equipment automatically detects the attenuator state and includes its active value in the displayed level.

4.2.6 Audio demodulation and detection mode

The **[8] SOUND** key permits to select the different sound demodulators of the equipment (FM, AM and Level Sound) and the detection mode (Peak or Average).

To select the sound demodulator push the **[8] SOUND** key until the desired mode will be showed in the display, the selection mode is cyclical as shown in the following figure, so at most it will be necessary to push it twice.

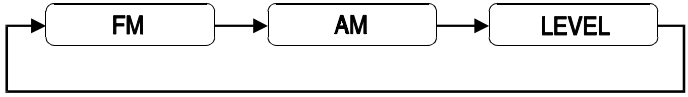

Figure 24.- Audio demodulator selection.

Next, the different sound demodulation circuits that can be selected are explained by showing the message which will appear in each case. In all of them it is possible to select the volume with the **[3] VOLUME/OFF** control.

1) **Sound FM**: Selects the FM sound demodulator for the tuned frequency, giving its output to the internal speaker.

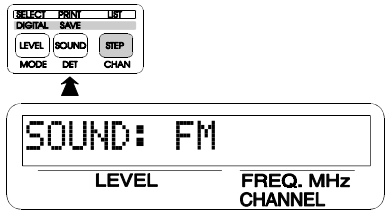

Figure 25.- FM Sound Demodulator.

2) **Sound AM**: Selects the AM demodulator output.

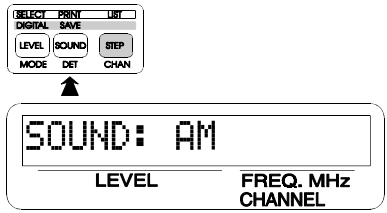

Figure 26.- AM Sound Demodulator.

3) **Level Sound**: A single tone of frequency related to the current measured input level is passed to the speaker.

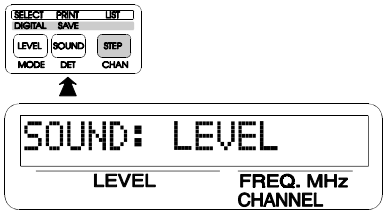

Figure 27.- Level Sound Demodulator.

This feature facilitates the peak signal search by eliminating the need of continuous observation of the instrument.

Also, keeping the **[8] SOUND** key pushed for more than two seconds, the instrument switches between **Peak Detector** and **Average Detector**. The Average Detector is the suitable detector to measure correctly digital sound and AM (standard L) modulations, while the Peak Detector is the appropriate one for the measurements of FM modulations. Next figures show the text that appears when selecting these options.

At all times, the display shows information concerning the detection system used for measurement in accordance with the following:

a) Peak detector: normal decimal point. ■

b) Average value detector: hollow decimal point. ▪

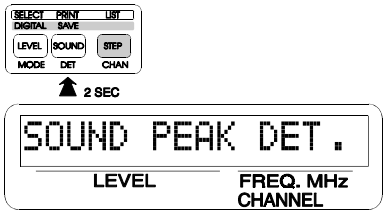

Figure 28.- Peak Detector Measure.

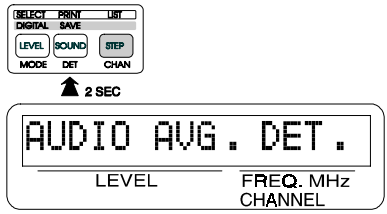

Figure 29.- Average Detector Measure.

4.2.7 Start-up configuration

To store the current configuration as a start-up configuration push the **[8] SOUND** key together with the **[9] STEP** key.

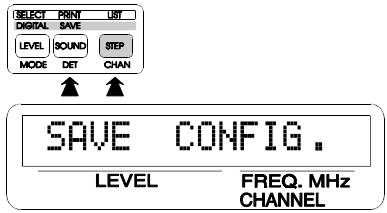

Figure 30.- Storing the current Configuration.

4.2.8 Print mode

Connecting the **PROLINK-1B** to a serial printer it is possible to print the information concerning to the tuned channel or to several channels previously selected. Proceed as follows:

1.- Connect the unit to a serial printer through the RS-232C connector placed at the side panel. PROMAX can supply the **CI-23** portable serial printer.

In a case where the user opts for the connection to another serial printer, the handshake used by the **PROLINK-1B** must be present. See point *4.2.8.1 Handshake and control lines.*

2.- Power on the **PROLINK-1B** by turning clockwise the **[3] VOLUME/OFF** control. Turn on the printer.

3.- Tune the desired frequency by means of the **[2] TUNING** rotary knob.

4.- Select the *print mode*. To do this push the **[7] LEVEL** (SELECT) and **[8] SOUND** (PRINT) keys together as shown in figure 31. The upper row of the display (SELECT, PRINT and LIST) refers to the available operations in this mode.

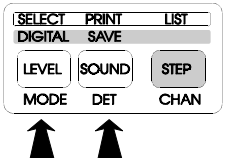

Figure 31.- Print mode selection.

In the display will appear the message **PRINT MODE ON** in order to confirm the new operation mode.

5.- To print the information relative to the tuned channel, push the **[8] SOUND** (PRINT) key, as shown in figure 32.

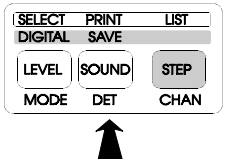

Figure 32.- Printing the tuned channel.

In measurement printing, fields appear to be filled in by the user in order to identify the measurements. These fields are as follows:

LOCATION:
TEST P:
DATE:
TIME:
SIGNATURE:

If the unit is in the **numeric level presentation mode**, it will print the channel number, the video carrier level (in dBµV) and the ratio Video/Audio.

On the other hand, if the unit is in **bar graph presentation mode** it will print a representation on the power spectrum as shown in figure 33.

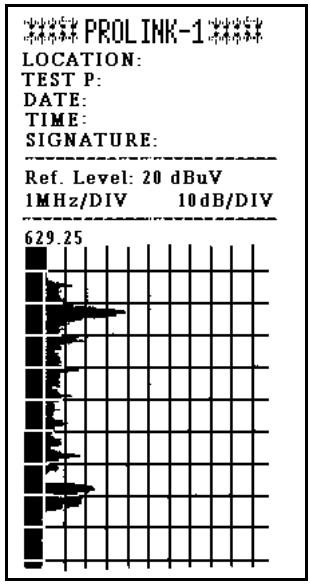

Figure 33.- Channel printing in bar graph presentation mode: spectrum function

The total sprectum bandwidth printed is of 10 MHz. The initial frequency printed is 2 MHz before the nominal frequency for analogue channels and 5 MHz for digital channels. Divisions are of 1 MHz in frequency and 10 dB/div in level. The reference level is 20 dBµV.

6.- Also it is possible to print the information concerning to several channels automatically.

Previously it is necessary to select the channels we want to print. Tune the channel using the rotary control **[2] TUNING** and next push the **[7] LEVEL** (SELECT) key. When tuning a channel previously selected, letter **p** will appear on the right side of the display as shown in figure 34.

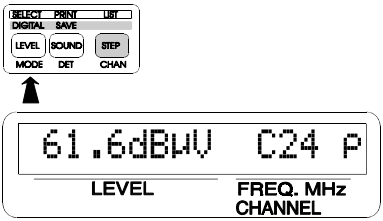

Figure 34.- Selecting a channel and display indication.

To print the information concerning to the selected channels, push the **[9] STEP** (LIST) key.

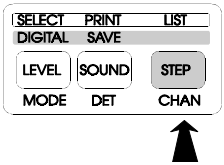

Figure 35.- Printing the selected channels.

If the unit is in **numeric level presentation mode** it will print, for each selected channel, its number, video carrier level (in dBµV) and Video to Audio rate.

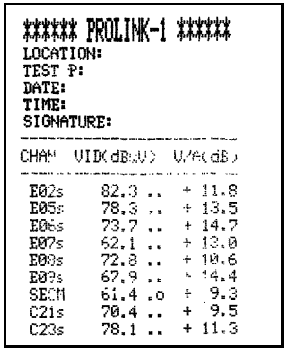

Figure 36.- Printing selected channels in numeric presentation mode.

On the other hand, if the unit is in **bar graph presentation mode**, it will print two bars for each channel, one relative to the video carrier level and the other relative to the audio carrier level as shown in figure 37.

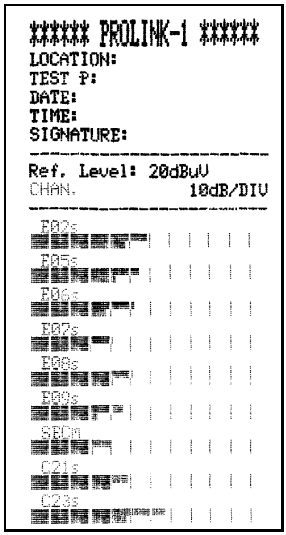

Figure 37.- Printing selected channels in bar graph presentation mode.

7.- To exit the *print mode* repeat step 4. In the display will appear the message **PRINT MODE OFF**.

4.2.8.1 Handshake and control lines

Next is described the handshake and control lines used by the **PROLINK-1B**:

- The following parameters are used for printing through the serial port:

Data bits:	8 bits
Parity:	None
Baud-Rate:	19,200 bauds
Stop bits:	1

  To modify the printer parameters see *4.2.8.2 CI-23 set-up.*

- The control lines used are:

  - DATA TRANSMIT (PROLINK-1B pin 3):
    To send data to the printer.

  - CLEAR TO SEND (PROLINK-1B pin 8) :
    Data transfer control. Data are sent only when this line is active.

  - DATA TERMINAL READY (PROLINK-1B pin 4)
    This line is permanently active in order to indicate the establishment of the communication.

Connections

The cable between the **PROLINK-1B** and the printer must have the following connections:

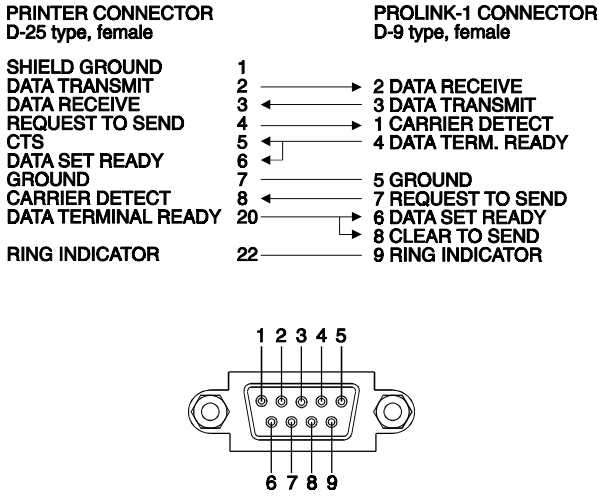

Figure 38.- PROLINK-1B RS-232C connector. Pins numbering.

4.2.8.2 CI-23 Set-up

This point explains how to modify the CI-23 printer set-up. Figure 39 shows the printer keyboard:

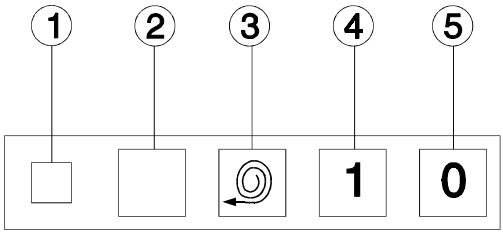

Figure 39.- CI-23 keyboard.

[1] POWER LED

[2] SET-UP

[3] FEED

[4] ON

[5] OFF

To initiate the set-up mode push the **[2] SET-UP** and the **[4] ON** keys. The **[1] POWER ON** LED will flash until set-up mode is turned off. The current parameter status will be printed. The status of the DATA BITS parameter will be printed in order to modify it if necessary.

To select the status of the resting parameters (PARITY, BAUD-RATE, COUNTRY, PRINT MODE, AUTO-OFF, EMULATION and DTR) push the **[3] FEED** key. The parameters are selected in a sequential way. To modify the status of any parameter push sequentially the **[2] SET-UP** key. Example:

SERIAL BAUD RATE: 300, 600, 1200, 2400, 4800, 9600, 19200, 300...

When all the necessary changes have been made, push the **[2] SET-UP** and **[3] FEED** keys to update the configuration of the printer.

If no key is pressed for 15 seconds the set-up mode will be terminated without changing the original parameters.

5 REMOTE CONTROL VIA A PC

5.1 Introduction

The design of **PROLINK-1B**, based on a microprocessor, allows data to be exchanged between the equipment and a remote controller (personal computer) via an RS-232C connector. It is thus possible to obtain data as well as remote control of the **PROLINK-1B** (tuning, measurement, detection mode, etc) for maintenance purposes and monitoring of installations.

5.2 Protocol for communication

This protocol is controlled by software and uses a RS-232C connector. Data and information are exchanged using messages consisting of ASCII alphanumerical characters. This method ensures easy carrying between different types of personal computers.

To ensure error-free communication between the two devices, the communication parameters of the series port must be selected on the Remote Controller (personal computer) as described in section '*4.2.8.1 Handshake and control lines*'.

PROLINK-1B accepts remote commands at any time at which the instrument is on, except when in print mode. That is, it is not necessary to put the instrument in a special remote control mode; rather, this mode is selected immediately when it detects a complete command during the time necessary for its execution.

In normal circumstance, **PROLINK-1B** transmits a XON code (code 11h) every second. The aim is to indicate to any possible remote device that the equipment is ready to receive data. The moment it receives a '*****' character indicating the start of a remote command, the XON transmission stops and the echo of all the characters received is returned until it receives a CR (carriage return, code 0Dh). At that moment, **PROLINK-1B** understands that it has received a complete remote command, identifies it and executes it. To indicate to the control equipment that it is in busy status, it sends a XOFF (code 13h).

If the command received is identified as valid, an ACK (acknowledge, code 06h) is transmitted and if 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.

A typical communication chronogram would be as follows:

PROLINK-1B		**PC (Controller)**
XON	------>	
•	(at 1 second intervals)	
•		
•		
XON	------>	
	<------	'*L0 + CR'
'*L0'	------>	(character echo until CR)
XOFF	------>	
CR + LF	------>	
ACK (validation)		
•		
• (execution)		
•		
• (optional response)		
•		
XON	------>	

From the programmer's point of view, the control sequence passes through the following status:

1) Wait to receive a XON
2) Send a complete command string, at the same time receiving the echo or confirmation of each characters.
3) Send a CR.
4) Receive a XOFF as confirmation that a complete command has been received and is being processed.
5a) Receive ACK as confirmation that a remote command has been recognised.
5b) Receive a NAK if the command has not been received (skip to status 8)
6) Receive CR+LF to allow the separation of the response line in terminal mode.
7) If the command is interrogative, the response is a string followed by CR+LF.
8) Once the command is completed, XON is sent. This is then repeated at 1 second intervals.

The special '*' character always starts the receipt of a command. **PROLINK-1B** interprets the character CR as the end of the command. Any character received between these two codes is returned as an echo. The information received between these two codes is interpreted as the command received.

In print mode, as the same port is used as for the data dump to the printer, all data received is rejected and no XON character is transmitted until leaving this mode.

In the event an erroneous command is received, it is answered with a NAK code instead of ACK and no execution or response phase is produced; instead it goes into XON phase to wait for new data.

Commands should always be sent in capital letter and cannot be edited on-line, i.e., once a character is received it is stored in the **PROLINK-1B** buffer and cannot be rectified by sending an erase code.

Commands in remote control are divided into two groups, orders and interrogations. Order modify a variable or the equipment status. Interrogations respond with information concerning equipment status or the value of a variable.

For interrogative command, it is necessary to add the character '?' after the '*****' character.

5.3 Remote orders

NOTE 1: The (') character should not be sent; it is only included in the description in order to define the string that makes up the remote command.

NOTE 2: The values given in small letter are parameters that change in value depending on the function to be executed. These values are always decimal or hexadecimal ASCII characters. For example, to transmit the value "1", we must send the hexadecimal code 31 the corresponds to this character. Consult the text for acceptable value margins. The transmission of erroneous parameters or contradictory information may cause **PROLINK-1B** to stop operating correctly. In this case it is necessary to reset the equipment by momentarily switching it off.

'***Bm**': Blocks the automatic control of the 10 dB attenuator. The 'm' parameter must be 0 for automatic operation (usual value) and 1 to set the attenuator position in the current status.

'***CF**' Tunes the nearest channel to the tuned frequency

'***Cnnnn**' Selects one channel of the active channel table. 'nnnn' is the hexadecimal representation of the channel number (from 0 to 125 in decimal notation).

'***FC**' Changes from channel tuning mode to frequency tuning mode, tuning the frequency of the last tuned channel.

'***Fxxxx**': Modifies the tuning frequency reprogramming a new value for the PLL. The value of the PLL 'xxxx' must be sent in hexadecimal format, according to the next expression:

xxxx = hexa value of [16(f_{in} + 33,375)]

f_{in} = input frequency in MHz

For example, calculating the divider for an input frequency of 655.25 MHz, would be:

f_{in} + 33,375 = 688,625
16 (f_{in} + 33,375) = 11018
xxxx = hexadecimal value of (11018) = 2B0A
command = '*F2B0A'

Four figures, including non-significant zeros must always be sent in the PLL value.

'***Jsnn**' Increases or decreases the tuned channel or frequency (it is equivalent to turn the **TUNING** [2] rotary knob). Parameters follow the next rules:

's'	+ Increment	
	- Decrease	
'nn'	01 < nn < 05	Moves one step
	nn ≥ 5	Moves 10 steps in channel mode, one step in frequency mode.

'***Lm**': Modifies the active measurement mode. The 'm' parameter corresponds to the election value for the 'LEVEL' function of the keyboard, in accordance with the following:

0: measurement LEVEL VIDEO
1: measurement LEVEL AUDIO
2: measurement LEVEL VIDEO/AUDIO

'***Mn**' : Selects the measurement mode between analogue or digital. The valid values for the 'n' parameter are: 0: Analogue channels
1: Digital channels

'***Pm**': Selects the detector used in the audio level measurement. Valid values for the 'm' parameter are: 0: Selects the peak detector
1: Selects the average detector

'***Qm**': Selects the active channel plan between one of channel plans stored in the unit (7 maximum). Valid values for the 'm' (channel plan) parameter are: 0, 2, 3, 4, 5, 6, and 7.

'*R': Recuperates the power-up configuration established by 'SAVE'. Has no parameters.

'*S': Establishes the current configuration as the power-up configuration. Has no parameters.

'*Txxxx': Shifts the sound carrier with respect to the video carrier. This shift is that applied in the LEVEL AUDIO and LEVEL VID/AU measurements. The 'xxxx' value corresponded to the positive increment over the current PLL divider which must shift the tuning to include the sound carrier.

For example, for a sound carrier shifted 5.50 MHz with respect to the video carrier (G standard), the value is calculated by dividing this frequency by the minimum synthesis step (62.5 kHz):

5.50 MHz / 62.5 kHz = 88
xxxx = hexadecimal value of [88] = 0058

It is always necessary to send four figures included the non-significative zeros.

'*Um': Establishes the active sound mode associated with the 'SOUND' function. Valid values of the 'm' parameter are:

0: selection of SOUND FM
1: selection of SOUND AM
2: selection of SOUND LEVEL

'*Xm': Allows switching of the 10 dB attenuator status in accordance with the value of the 'm' parameter. The 0 value turns the attenuator OFF (0 dB) while the 1 value turns it ON (10 dB).

Command	Action
B0	Automatic operation of 10 dB attenuator
B1	Blocks position of 10 dB attenuator
CF	Tunes the nearest channel to the tuned frequency
Cnnnn	Selection of one channel of the active channel table
FC	Changes from channel tunning mode to frequency mode
Fxxxx	Modifies the tuning frequency
Jsnn	Increases / decreases the channel / the frequency
L0	Moves to VIDEO measurement
L1	Moves to AUDIO measurement
L2	Moves to VIDEO/AUDIO measurement
M0	Analogue measuring mode selection
M1	Digital measuring mode selection
P0	Selects the peak detection system for the sound measurement
P1	Selects the average detection system for the sound measurement
Qm	Selects the channel plan (m: 0, 2, 3, 4, 5, 6, 7)
R	Recalls power-up configuration
S	Establishes power-up configuration
Txxxx	Shifts sound carrier
U0	Selects FM sound demodulator
U1	Selects AM sound demodulator
U2	Selects sound LEVEL demodulator
X0	Disables 10 dB attenuator
X1	Enables 10 dB attenuator

Table II.- Remote commands

5.4 Remote interrogations

'*?&xx': Returns the value contained in certain internal variables of **PROLINK-1B**. These variables are addressed with a byte and return a byte. The address value and the returned value are always hexadecimal. Not all equipment variables make sense for the programmer. The main purpose is for reading the buffer that appears on the display. This buffer contains the corrected level reading and the frequency or channel tuned to. As this information is expressed in ASCII characters, it is easily interpreted by an external programmer.

Some useful addresses are (hexadecimal values):

18: high byte of PLL divider
19: low byte of PLL value
20 to 2F: 16 characters of the LCD display (from left to right)

For example we can determine if there is overflow or underflow by reading the first characters of the displayed buffer: '*?&20'+CR+ LF'.

The response is: '*yy'

If the 'yy' code is the ASCII character for the '<' or '>' characters (3Ch and 3Eh, respectively), this indicates that we are outside the equipments measurement margins.

'*?Am': Returns the level at the A/D converter input or at the display. The 'm' parameter can have the following values:

1: average detector measurement
6: peak detector measurement
8: display content (corrected level, measuring units and channel or frequency).

The average detector is used in the measurement of AM modulated sound carriers (L standard) or digital carriers as is the case with NICAM sound or QPSK or QAM modulations.

The values read are not corrected not compensated by temperature. There they can only be used as a qualitative measurement of the input signal. For example, for channel search.

The code returned corresponds to a voltage between 0 and 4.095V. Codification is hexadecimal.

ENGLISH

For example: '*?A6' + CR

with a response: '*A60237'

The '0237' value corresponds to 567 in decimal, which is the value in millivolts of the input voltage (0.567 V). The approximate value corresponding to the input level in dBs can be determined by multiplying this voltage by a factor of 23 and adding an offset value of some 15 dB. Thus we have:

approx. dB = 0.567*23 + 15 = 28 dB.

'*?B': The response to this command is to block the 10 dB attenuator

'*B0': indicates the attenuator is in automatic mode.
'*B1': indicates that the attenuator is blocked.

'*?C' Returns the tuned channel in hexadecimal notation

'*?F' Returns the PLL divider value in hexadecimal notation

'*?M' Returns the measurement mode. The answer is '0' for analogue mode and 1 for digital mode.

'*?P' Returns detection system used in the sound measurement. '0': peak detector. '1': average detector.

'*?Q' Returns active chanel plan (possible responses are : 0, 2, 3, 4, 5, 6 and 7).

'*?X': This command returns the status of the 10 dB and 30 dB attenuators. Possible responses are:

'*X00': 30 dB and 10 dB attenuators disabled (attenuation is 0 dB).
'*X01': 30 dB attenuator disabled and 10 dB attenuator enabled (attenuation is 10 dB).
'*X30': 30 dB attenuator enabled and 10 dB attenuator disabled (attenuation is 30 dB).
'*X31': 30 dB and 10 dB attenuators enabled (attenuation is 40 dB).

'*?V': Responds with a string identical to that shown on powering up the equipment. In this set of characters you can read the model and the version of the control program. Its mains use is to detect the presence of **PROLINK-1B** and determine the software version.

Command	Action
?&xx	Returns the value contained in certain internal variables of **PROLINK-1B**
?A1	Returns the input level of the A/D converter (average detector)
?A6	Returns the input level of the A/D converter (peak detector)
?A8	Returns the display content
?B	Returns the blocked status of the 10 dB attenuator
?C	Returns the tuned channel
?F	Returns the value of the PLL divider
?M	Returns the measurement mode: analogue or digital
?P	Returns the detection system used in the sound measurement
?Q	Returns the number of the actual channel plan
?V	Returns the model and version of the control program
?X	Returns the status of the 10 dB and 30 dB attenuators

Table III.- Remote interrogations

6 MAINTENANCE

6.1 Replacing the battery

The battery must be replaced when the capacity of the fully-charged battery is appreciably reduced.

To install the battery, follow these steps:

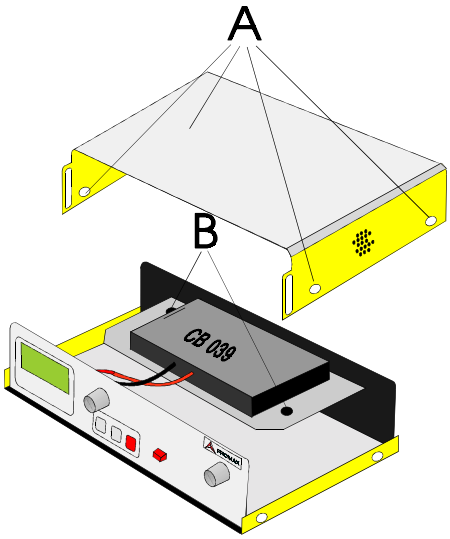

Figure 40.- Installing the battery

1 - Turn off the instrument.
2 - Remove the 4 attachment screws **(A)** which are positioned in the laterals of the device.
3 - Remove the instrument top lid.
4 - Remove the two screws **(B)** which close the battery compartment.
5 - Disconnect the battery terminals and replace it with a new one. (CB-039 reference). **Take care with the polarity (red positive, black negative) of the terminals**.
6 - Close the battery compartment and replace the two screws **(B)**. Replace the instrument top lid and attach it with the corresponding screws **(A)**.

WARNING ⚠

Avoid any type of short circuit among the cables connected to the battery, since the resulting high current may cause serious damage to the instrument.

6.2 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.

TABLE OF CONTENTS

ENGLISH