

INSTRUCTION MANUAL

6040 SELECTIVE LEVEL METER



RYCOM
instruments, inc.®

RYCOM INSTRUMENTS INC.
9351 East 59th Street
Raytown, Missouri 64133

INSTRUCTION MANUAL
6040
SELECTIVE LEVEL METER

Serial No. _____

Manual Part No. 030 00030 01

MODEL 6040

FREQUENCY SELECTIVE LEVEL METER

WARRANTY

This instrument is under warranty for one year from date of delivery against defects in material and workmanship (EXCEPTION-BATTERY). We will repair or replace products that prove to be defective during the warranty period.

This warranty is void if, after having received the instrument in good condition, it is subjected to abuse, unauthorized alteration or casual repair.

NO OTHER WARRANTY IS EXPRESS OR IMPLIED. THE WARRANTY DESCRIBED IN THIS PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. WE ARE NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

FACTORY SERVICE

The Rycom Model 6040 was designed for dependable operation with recommended annual inspection for correct operation. If, however, your 6040 is not working properly, return it to the factory for repair. We recommend that the unit be returned in the original containers in which it was received. Send the instrument PREPAID to:

Rycom Instruments, Inc.
9351 E. 59th Street
Raytown, Missouri 64133 U.S.A.
Telephone: 816-353-2100 or 800-851-7347
FAX: 816-353-5050

Normally, we will repair and ship back any instrument sent in within 10 days, unless the instrument is unrepairable. In this case, we will advise you.

If you need information, call the Rycom Factory Repair Department at 816-353-2100. If you return your 6040 for service or repair, return authorization is not required. Please include the following information:

1. Name and address of owner.
2. Brief description of symptoms or trouble.
3. Billing address and shipping address.
4. Purchase order number, if required.

CHAPTER 1 GENERAL INFORMATION

1.0 INTRODUCTION

This section of the Instruction Manual contains general information and technical specifications for the Rycom Model 6040 Selective Level Meter.

1.1 APPLICATION OF THE INSTRUMENT

The 6040 Selective Level Meter is a portable field or bench instrument designed to make precision measurements of both level and frequency on frequency division multiplex (FDM) equipment baseband signals. The level range of the instrument is -99.9 dBm to 20.9 dBm with 0.1 dB resolution. The frequency range is 300 Hz to 3.5 MHz with a signal counter accuracy of better than 4×10^{-7} in either the 10 Hz fast update mode or the 1 Hz 2 second update mode.

Although its primary application was intended to be on high density long haul microwave systems, the 6040 may be employed on any communications equipment requiring selective level or frequency measurements.

1.2 ELECTRICAL FEATURES

The key electrical features of the 6040 selective level meter are as follows:

- **Level Accuracy** — ± 0.2 dB at carrier frequencies provides the precision required to do end-to-end line-ups on high density, long haul microwave systems. Accurate measurement on the full range of customer test point configurations can be accommodated with the 6040 because this instrument compensates for bridging and impedance errors.

- **Auto Level Ranging** — is provided to allow the technician to make rapid signal search measurements since the instrument automatically selects the appropriate range for any signal level. The level range may also be manually selected.

- **AFC Tuning** — automatically takes the tuning errors out of your measurements. The 6040's AFC is locked to the high stability temperature compensated crystal oscillator module so that each measurement is made with the tuning at the same point on the bandpass filter, thus providing repeatable measurement accuracy. The AFC is also a great time-saver since no time consuming manual tuning is required to keep signals in tune. For measurements not suited to AFC tuning such as noise or FSK signals, manual tuning and a high resolution analog tuning indicator are provided.

- **Precision Frequency Counter** — is built into the 6040 level meter providing the capability of two instruments in one. The precision frequency counter derives its reference from a high stability temperature compensated crystal oscillator module which provides an accuracy of 0.4 ppm. This is excellent for testing the frequency drift on drop and insert carrier channel oscillator and pilots. A signal count with 1 Hz resolution is provided for the measurement of incoming signals. Other frequency display modes provided are signal count with 10 Hz resolution and a center passband frequency; the frequency to which the 6040 is tuned.

- **Analog Tuning Meter** — In addition to the digital LEVEL dBm display, an analog tuning meter is provided equipped with two ranges. One range provides a 21 dB window for sweeping a baseband for hot signals or observing noise spikes. The second range provides a 4 dB window with an adjustable zero dB set point to make it easy to manually tune and peak a signal with high manual resolution.

- **Level Out** — A front panel BNC connector provides a linear dBm scaled DC output to drive a recorder or oscilloscope for an analysis of fades, noise or level troubles.

- **LCD Digital Displays** — of both frequency and level are provided for high visibility. The LCD displays are designed for high ambient temperature operation and are equipped with self regulating heaters for low temperature operation below 5°C .

- **Field Operation** — the 6040 weighs 21 lbs and is AC or rechargeable battery powered. It has a unique battery discharge protection feature that helps prevent running out of battery capacity before tests are complete. At a threshold battery voltage, LO BAT alert will flash in the LEVEL dBm display. 25 minutes later, the 6040 shuts itself off to prevent permanent battery damage. By momentarily switching to POWER OFF, the protection circuit can be reset to complete remaining measurements.

- **Other Features** — Other standard selective level meter electrical features are identified in the Technical Specification Summary of this chapter.

1.3 MECHANICAL FEATURES

The key mechanical features of the 6040 selective level meter are as follows:

- **Field Portable** — due to compact size, rugged packaging and battery operation. A metal cover protects the front panel of the instrument during transportation. Before the metal cover is installed, the POWER switch must be in the OFF position thus preventing unintentional battery discharge.

- **Die Cast Aluminum Front Panel** — together with polycarbonate overlay provides great mechanical and electrical stability to the chassis and circuitry and withstands the rigors of shock and vibration experienced in the field.

- **Aluminum Chassis, Front Panel and Case** — are iridite coated to reduce the corrosion experienced in high humidity conditions. The case and cover are finished with a textured polyurethane enamel to provide an extremely scratch resistant external surface.

1.4 ELECTRICAL DESCRIPTION

The basic 6040 level meter is a selective, dual conversion superheterodyne circuit with auxiliary circuitry to provide the essential power level measurements scaled for signal level and impedance, frequency counting and demodulator functions.

The unit is designed for balanced or unbalanced inputs with 50 , 75 , 124 , 135 , 150 or 600 ohm line inputs, terminated or bridging. The front end attenuator circuit employs latching relays for reliable low power switching of level ranges. An AUTO RANGE position on the RANGE dBm (MAX LEVEL) switch permits automatic selection of the proper range for any selected input signal. The wide dynamic range circuitry employed in the 6040 allows accurate measurement of individual signal power levels in telecommunication systems where there are 600 or more channels between 4 kHz and 3.5 MHz; the noise power ratio for an equivalent 600 channel system is better than 55 dB for a 40 dB increase in sensitivity in any band-stopped slot.

The 1st local oscillator is phase locked to provide an AFC capability for ease of tuning. Two bandwidths are provided in the instrument: a narrow filter for measurement of signal carrier levels and a wide filter for signal search and channel level measurements. The standard nominally 3100 Hz wideband filter may be optionally replaced by a C-Message equivalent filter. Similarly, the standard nominally 50 Hz narrowband filter may be optionally replaced by a 100 Hz filter.

A high accuracy and stability frequency counter provides a 6 digit LCD readout of the incoming signal frequency or of the bandpass center frequency to which the level meter is tuned. A

fast updating frequency resolution of 10 Hz is provided which may be changed at will to a 1 Hz resolution with a 2 second update rate.

For locating carriers with no modulation, an audible output on the speaker or headphone is developed by means of a carrier re-insertion oscillator. Either upper or lower sidebands may be selected.

Signal power level is displayed with 0.1 dB resolution on a 3 digit LCD display. ADJUST RANGE lamps flash an alert for signal overload to prevent inaccurate measurements or to indicate the direction of manual level range change for more accurate measurements.

An internal crystal oscillator at a nominal frequency of 250 kHz with a stable level output of -30.0 dBm provides a reference level for calibration of the instrument.

1.5 TECHNICAL SPECIFICATION SUMMARY

1.5.1 Definition

Parameters shown in the following 6040 Selective Level Meter specification summary as being "typical", "nominal" or "approximate" are provided only as non-warranted supplemental information having possible value in the application of the instrument.

1.5.2 Specifications

MODEL

6040

FUNCTION

Selective Level Meter

FREQUENCY

Range:

50Ω, 75Ω:—

300 Hz to 3.5 MHz, 50 Hz bandwidth
400 Hz to 3.5 MHz, 100 Hz bandwidth
12.0 kHz to 3.5 MHz, 3.1 kHz, "C" Message bandwidth

124Ω, 135Ω, 150Ω:—

4.0 kHz to 2.0 MHz, 50 Hz, 100 Hz bandwidth
12.0 kHz to 2.0 MHz, 3.1 kHz, "C" Message bandwidth

600Ω:—

300 Hz to 100 kHz, 50 Hz bandwidth
400 Hz to 100 kHz, 100 Hz bandwidth
12.0 kHz to 100 kHz, 3.1 kHz, "C" Message bandwidth

Bands:

Band A — 0.3-650 kHz
Band B — 550-1650 kHz
Band C — 1300-2400 kHz
Band D — 2000-3500 kHz

Signal Counter Accuracy (Initial):

$\pm 4 \times 10^{-7}$ or \pm LSD whichever is greater at 23°C after 3 minute warm-up

Signal Counter Accuracy (Long Term):

$\pm 1 \times 10^{-6}$ per year aging rate with reset capability

Temperature Stability:

$\pm 2 \times 10^{-7}$ over the temperature range +20°C to +30°C
 $\pm 2 \times 10^{-6}$ over the temperature range -10°C to +55°C

Resolution:

Selectable: 10 Hz with fast update, signal count and center passband
1 Hz with 2 second update, signal count only

Display:

6 digit LCD in kHz units

Modes:

Signal Frequency Count with automatic mode switching or Passband Center Frequency Count

Automatic Frequency Control (AFC):

Selectable ON/OFF with either wide or narrow band filter operation

AFC Capture Range:

≥ 12 dB below RANGE MAX. LEVEL (Frequency range of capture depends on filter employed)

LEVEL

Range:	-99.9 dBm to 20.9 dBm
dBm Reference Impedance:	Selectable, 50Ω, 75Ω, 124Ω, 135Ω, 150Ω, 600Ω
Ranging:	Automatic or manual
Manual Ranges:	Eleven switched 10 dB steps
Display:	3 digit LCD with sign
Resolution:	0.1 dB
Level Measurement Accuracy (1):	

Range Dependence:—

1. Unbalanced, terminated internally or externally, 75Ω, referred to: 250 kHz, most sensitive manual range for specified level, AFC (ON), 23°C

LEVEL RANGE (dBm)		
-99.9 to -90	-89.9 to 0	0 to +20
±1.0 dB	±0.2 dB	±0.3 dB

2. Unbalanced, terminated internally or externally, 50Ω, 124Ω, 135Ω, 150Ω, referred to: 250 kHz, most sensitive manual range for specified level, AFC (ON), 23°C

Typically, same as 1. above

3. Unbalanced, terminated internally or externally, 600Ω, referred to: 50 kHz, most sensitive manual range for specified level, AFC (ON), 23°C

Typically, add ±0.15 dB to 1. above

4. Balanced, terminated internally or externally, 124Ω, referred to: 250 kHz most sensitive manual range for specified level, AFC (ON), 23°C

LEVEL RANGE (dBm)		
-99.9 to -90	-89.9 to 0	0 to +20
±1.0 dB	±0.3 dB	±0.4 dB

5. Balanced, terminated internally or externally, 50Ω, 75Ω, 135Ω, 150Ω, referred to: 250 kHz, most sensitive manual range for specified level, AFC (ON), 23°C

Typically, same as 4. above

6. Balanced, terminated internally or externally, 600Ω, referred to: 50 kHz, most sensitive manual range for specified level, AFC (ON), 23°C

Typically, add ±0.15 dB to 4. above

Frequency Dependence:—

1. Unbalanced, terminated internally or externally, 75Ω, referred to: -30 dBm measured on -30 dBm max. level range, AFC (ON), 23°C

FREQUENCY RANGE (kHz)		
0.3 to 12	12 to 3250	3250 to 3500
±0.2 dB	±0.2 dB	+0, -0.5 dB

2. Unbalanced, terminated internally or externally, 50Ω, 124Ω, 135Ω, 150Ω, 600Ω, referred to: -30 dBm measured on -30 dBm MAX. LEVEL range, AFC (ON), 23°C

Typically, same as 1. above for frequency limits of specified impedance

Temperature Dependence:—

Time Dependence:—

Analog Peaking Indicator:

Type:—

Range:—

Resolution:—

Input Over-Range Indicator:

Input Under-Range Indicator:

Maximum Input:

Unbalanced port:—

Balanced ports:—

3. Balanced, terminated internally or externally, 50Ω, 75Ω, 124Ω, 135Ω, 150Ω, 600Ω, referred to: -30 dBm measured on -30 dBm MAX. LEVEL range, AFC (ON), 23°C

Typically, add ±0.1 dB to 1. above for frequency limits of specified impedance higher than 1.0 kHz. Typically, add ±0.2 dB to 1. above for lower frequency limits of specified impedance 0.3 kHz to 1.0 kHz.

1. Without recalibration: ±0.1 dB/°C referred to: 250 kHz, -30 dBm level measured on -30 dBm MAX. LEVEL range at any ambient temperature between -10°C and +55°C, with initial calibration at 23°C

2. With recalibration: See "LEVEL CALIBRATION REFERENCE, Level Stability"

See "WARM-UP CHARACTERISTICS"

Vertically mounted edgewise meter indicates relative level

Switchable, typically 20 dB without set point and 4 dB FSD with manual set-point adjustment

Nominally, 1 dB in 20 dB range and 0.2 dB in 4 dB range

Red flashing LED indicator reports over-range signal inputs. Level display is simultaneously blanked

Amber flashing LED indicator reports under-range signal inputs which may cause measurement errors

d.c. coupled, +30 dBm bridging or terminated

a.c. coupled, +30 dBm bridging or terminated, ±200 V (d.c. and peak a.c.)

WARM-UP CHARACTERISTICS

(Ambient Temperature +23°C, Test Frequency 250 kHz, Filter Wide Band)

Recommended Warm-up Period:

3 minutes

Time Dependent Level Drift

(Initial calibration, no recalibration, input tuning maintained):

3 to 60 minutes ±0.5 dB max.

3 minutes to 4 hours ±0.7 dB max.

Time Dependent Tuning Drift

(Initial tuning, no retuning):

Without AFC:—

3 to 60 minutes ±400 Hz max.

3 minutes to 4 hours ±700 Hz max.

With AFC:—

3 to 60 minutes ±2 Hz max.

3 minutes to 4 hours ±4 Hz max.

LEVEL CALIBRATION REFERENCE

Calibration Level:

-30.0 dBm ±0.25 dB at 23°C

Level Stability:

Better than ±0.2 dB over operating temperature range (typically ±0.006 dB/°C)

Frequency:

250 kHz ±30 Hz

SELECTIVITY

Wideband Filter:

3100 Hz nominal

Passband: 2 kHz min. at -0.5 dB points

3100Hz ±10% at -3 dB points

Stopband: 9200 Hz max. at -70 dB points

Narrowband Filter:

50 Hz nominal

Passband: 20 Hz min. at -0.5 dB points

50 Hz $\pm 10\%$ at -3 dB points

Stopband: 365 Hz max. at -70 dB points

INPUT

Impedance (Balanced):

Terminated — 75 Ω , 124 Ω , 135 Ω , 150 Ω , 600 Ω (10 μ F D.C. blocking)

Bridging — 50 Ω , 75 Ω , 124 Ω , 135 Ω , 150 Ω , 600 Ω

Typically 5 k Ω shunted by 55 pF

Automatic level correction with impedance selected

Automatic compensation of bridging errors

Impedance (Unbalanced):

Terminated — 75 Ω , 124 Ω , 135 Ω , 150 Ω , 600 Ω (10 μ F D.C. blocking)

Bridging — 50 Ω , 75 Ω , 124 Ω , 135 Ω , 150 Ω , 600 Ω

Typically 5 k Ω shunted by 55 pF

Automatic level correction with impedance selected

Automatic compensation of bridging errors

Common Mode Rejection:

≥ 30 dB at 250 kHz

≥ 20 dB at 1.0 MHz

Return Loss (75 Ω Unbalanced):

≥ 30 dB

Connectors:

Unbalanced:-

BNC female nom. 75 Ω

Balanced:-

Banana jack nom. 600 Ω

INTRINSIC DISTORTION

Noise Power Ratio (NPR)

(Equivalent 600 channel system, 75 Ω Unbalanced):

≥ 55 dB for 40 dB increase in sensitivity measured in any band-stopped slot in band

2nd and 3rd Order Harmonics:

≥ 70 dB below fundamental, single tone 2.5 kHz to 3.5 MHz for 60 dB increase in sensitivity

I.F. and Image Rejection:

≥ 70 dB

INTERMEDIATE FREQUENCIES

5 MHz and 455 kHz

DEMODULATOR

AM, USB, LSB

OUTPUTS

Loudspeaker (Internal):

Output greater than 50 milliwatts, adjustable level

External Audio Output:

$\geq +10$ dBm into 600 Ω load 5% THD, adjustable level

Harmonic Distortion (1 kHz Tone):

$\leq 5\%$ for 50 milliwatt loudspeaker output

Recorder Output:

Linear dBm scaled output, +4.0 V DC output at RANGE
MAX. LEVEL 0.0 V DC at 20 dB below RANGE MAX.
LEVEL. Source impedance 2 k ohms

Probe Power Output:

Nominally 12.6 V d.c. 100 ma. max. available at 0.080 in. front panel tip jack

POWER REQUIREMENTS

AC Supply:

115 V AC $\pm 10\%$, 50-60 Hz for operation and/or battery charging

Battery Operation:

Internal rechargeable lead acid starved electrolyte battery (See NOTE 2. page 1-6)

Battery Capacity:

Approximately 8 hour normal operation. 6 hour low battery protection cut-off typical. 3 hour operation below 5°C. A discharged battery will recharge overnight

AC Watts:

19 watts with fully charged battery

40 watts with unit operating and battery discharged (operation above 5°C)

Battery Discharge Protection:

25 minutes low voltage advance warning on LCD display. Low voltage battery shut-off, after time-out with manual reset

Powering From External Battery:

12.6 V DC minimum, 2.5 amp maximum to 0.080 in. front panel tip jack

Fuses:

Battery — Type AGA 2 amp
A.C. line — Type MDL ½ amp

MISCELLANEOUS

AC Supply Option:

230 V AC $\pm 10\%$ 50-60 Hz

Standard Filter Options:

Wideband:—

“C” Message Noise Equivalent
Passband: 1,400 Hz min. at -0.5 dB points
2,000 Hz $\pm 10\%$ at -3 dB points
Stopband: 6,200 Hz max. at -70 dB points

Psophometric Noise Equivalent
Passband: 1,740 Hz $\pm 10\%$ at -3 dB points

Narrowband:—

100 Hz nominal
Passband: 40 Hz min. at -0.5 dB points
100 Hz $\pm 20\%$ at -3 dB points
Stopband: 580 Hz max. at -70 dB points

TEMPERATURE RANGE

Operate:

-10°C to $+55^{\circ}\text{C}$

Storage:

-40°C to $+75^{\circ}\text{C}$

MECHANICAL

Dimensions:

8" x 12" x 9"
(203.2mm x 304.8mm x 228.6 mm)

Weight:

21 lbs (9.5 kg)

NOTE 1.

Measured after a warm-up period of 30 minutes and after level calibration, unless otherwise noted.

NOTE 2.

The lead acid starved electrolyte battery employed in this unit is sealed and classified as “dry” under International Air Transport Association Restricted Articles Regulation #210. The battery is not subject to Federal hazardous material regulations and is not considered to be a restricted article by the Civil Aviation Authority and the U.S. Department of Transportation. Local governments, however, may have created regional ordinances relating to the disposal of batteries. It is therefore, suggested that a check be made with local authorities before disposal of batteries is made by normal means. In the event that difficulty is experienced, defective batteries may be returned to Rycorn for disposal.

CHAPTER 2 OPERATING INSTRUCTIONS

2.0 INTRODUCTION

The various controls, displays, indicators and connectors of the 6040 are shown in Figure 2-1. Identifying numbers correspond to the paragraph suffixes describing these items.

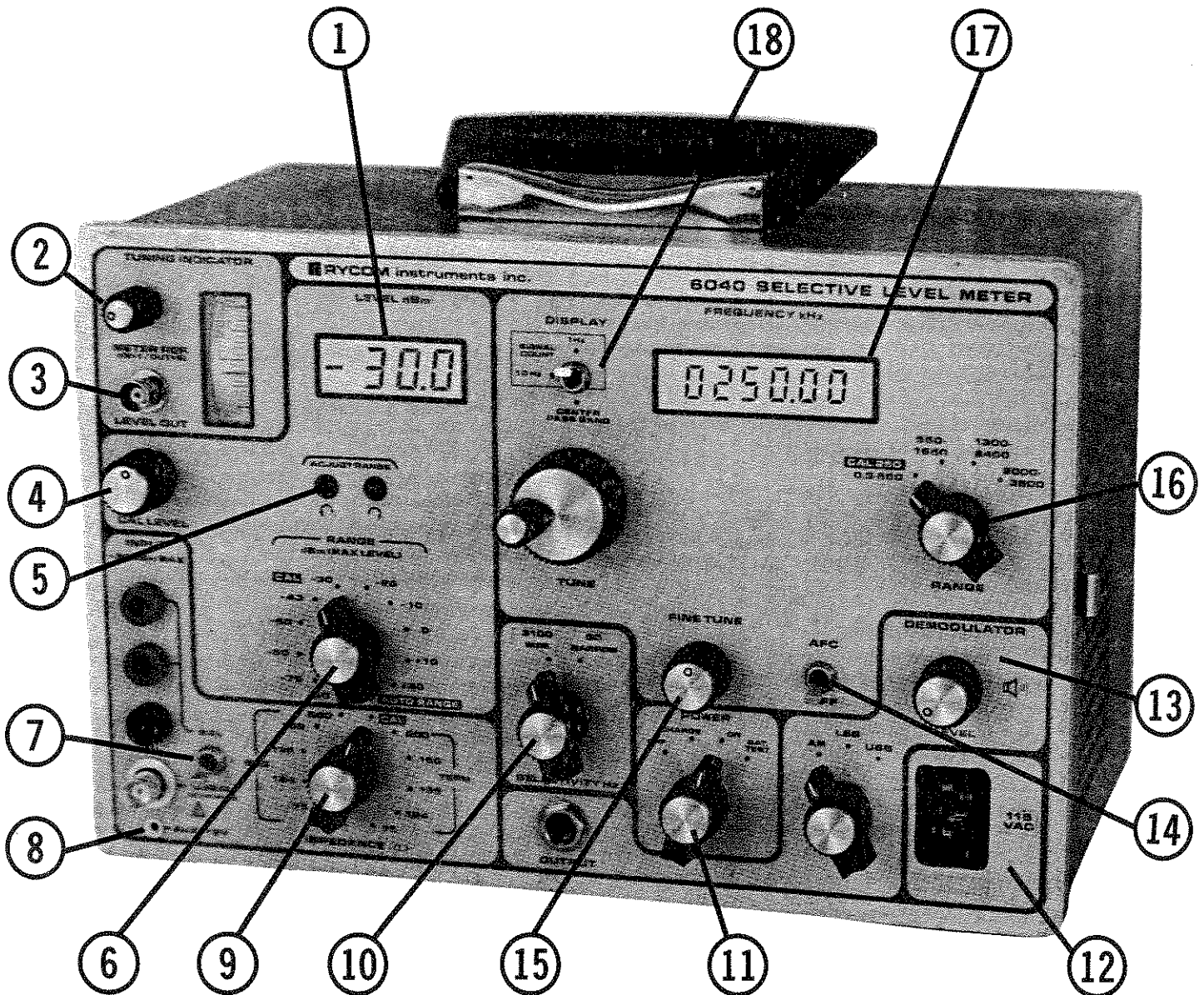


FIGURE 2-1
FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

2.0.1 "LEVEL dBm" Display

The LEVEL display indicates input signal levels with 0.1 dB resolution. The digital LCD display employed is thermostatically controlled, has a rapid display response in the cold and resists damage from heat extremes.

This display also provides a LO BAT alert when the low battery protection circuit is activated. This feature will be described later in Chapter 7.4 POWER.

The level display will blank when the input signal level exceeds the maximum level input shown on the RANGE dBm switch position by greater than +0.9 dB.

2.0.2 "TUNING INDICATOR" Display and Control

The tuning indicator features a two range (4 dB or 21 dB) full scale deflection with an operator adjustable reference level in the lower range provided. Its operation is simultaneous with the digital level display.

With the METER REF control in the (OUTx5) position, the analog TUNING INDICATOR has a full scale range of approximately 4 dB. In this position the reference 0 dB point of the analog TUNING INDICATOR may be adjusted to provide a high analog resolution and sensitivity for the purpose of making gain/level adjustments on users equipment. The resolution is nominally 0.2 dB.

With the METER REF control in the (INx1) position, the analog TUNING INDICATOR has a full scale range of approximately 21 dB. The resolution, in this case, is nominally 1 dB.

2.0.3 "LEVEL OUT" BNC Connector

A DC level output of 5 dB per volt for each attenuator setting is available at the LEVEL OUT BNC connector port. It can be used with an oscilloscope or strip chart recorder for long term analysis of signal level fades or noise conditions. This is a linear dB scaled output with +4 V DC at range reference level and 0.0 V DC at 20 dB below range reference level.

2.0.4 "CAL LEVEL" Control

This potentiometer control allows you to calibrate the level reading of the instrument by adjusting the I.F. gain precisely. The actual calibration procedure is detailed in section 2.1 at the end of this chapter.

2.0.5 "ADJUST RANGE" Indicators

These lamps flash to indicate the direction in which you must manually change level ranges for measurement accuracy. The appropriate direction in which the range switch must be turned is indicated beneath each light. In the AUTO RANGE condition, the lamps indicate the direction in which the range adjustment is being automatically made.

When the 6040 is connected to a signal having a level above the selected level range the red lamp will flash and in addition, the LEVEL dBm display will blank. A signal level above +30 dBm may cause a front end overload and damage the instrument.

2.0.6 "RANGE dBm (MAX LEVEL)" Control

For optimum measurement accuracy when manually setting range levels, the instrument should be operated in the range where the ADJUST RANGE lamps are not flashing. The maximum signal level of each range selection is appropriately marked beside each switch position.

When the AUTO RANGE mode has been selected, the instrument will automatically switch to the proper level range required by the signal across the input terminals.

2.0.7 "BAL UNBAL" Switch

This switch selects the blue banana jacks, or the BNC connector as the operator defined signal input port.

In the UNBAL position, the BNC connector provides an un-

balanced input to the unit. The banana jacks are disconnected in this mode and the BNC shield will be connected to case ground. Note that the case will be connected to earth ground when the unit is grounded through a three terminal AC power line cord or by some other earth ground connection.

With the switch in the BAL position, the two blue banana jacks provide a balanced input to the unit. The BNC center conductor in this case will be disconnected.

The black banana jack provides a low impedance point for the connection of the case to a ground of the operators choice.

It is important to note that whenever the banana jacks are employed to make an unbalanced measurement, the BAL UNBAL switch must be placed in the BAL position. The signal should be connected to the upper blue jack for optimum accuracy. The lower blue jack should be connected to signal ground. See figure 2-2 below for a simplified schematic of the configuration of the 6040 input circuitry.

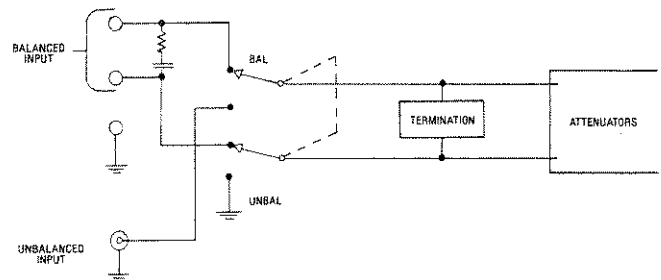


FIGURE 2-2
INPUT CIRCUITRY

2.0.8 "AUX +12V" Connector

This 0.080 inch tip jack connector, in conjunction with the black banana plug socket ground, provides for the possible operation of the selective level meter from an auxiliary 12 V DC battery power source such as an auto battery. Positive connection is made to the tip jack connector. This connector also makes possible the powering of an external probe or other equipment drawing less than 100 mA of current.

2.0.9 "IMPEDANCE (Ω)" Switch

When the switch is set to select a bridging impedance, the input terminals present a high impedance to the line and the LEVEL dBm display is appropriately scaled to reflect the correct power level for the input reference impedance selected. With the switch selecting a terminating impedance, the input terminals are terminated by the line impedance selected and the correct terminated power is shown on the LEVEL dBm display.

For either balanced or unbalanced measurements it is important that the impedance chosen be correctly matched to that of the line on which the measurement is being made.

2.0.10 "SELECTIVITY Hz" Switch

This switch allows you to select the WIDE or NARROW band pass filter suitable for your particular measurements.

2.0.11 "POWER" Switch

A four position "POWER" switch is provided which performs the following functions:

OFF — The instrument should be shut OFF for storage or transportation. A bracket on the face plate cover will prevent the face plate cover from being attached to the instrument unless the instrument is turned "OFF". This prevents the instrument from being left on during transport which will run down the battery.

CHARGE — The internal battery will normally recharge overnight with the switch in this position and be ready for another 8 hours of normal operation.

ON — This position switches the instrument ON for operation for either AC or battery power. When AC is connected to the instrument, the battery will be trickle charged.

BAT. TEST — The battery charge status is shown by a TUNING INDICATOR reading in the section marked BAT OK whenever the switch is in the BAT. TEST position.

A protection circuit will help prevent you from running out of battery capacity before you have completed your measurements and prevent battery damage resulting from over-discharging the battery. When the battery voltage reaches a threshold level, a "LO BAT" alert flashes in the LEVEL dBm display. Exactly 25 minutes after this alert signal, the instrument will shut itself off. The battery protection feature can be reset to allow additional operation of the instrument by momentarily switching the POWER switch to the CHARGE position. Note that, over-use of the reset feature will eventually lead to the deep discharge of the battery and the possible reduction of its life that the protection feature is intended to avoid. It is good practice to restrict use of the reset mechanism to emergency extended operation of the selective level meter.

2.0.12 "115 VAC or 230 VAC" Connector and Line Fuses

This connector mates with the standard line power cable supplied for AC operation of the instrument.

The AC line is protected with a fuse type MDL 3/8 amp.

The battery is also protected with a fuse type AGA 2 amp.

See paragraph 8.2.1 for fuse replacement instructions.

2.0.13 "DEMODULATOR LEVEL" Control and Switch

The DEMODULATOR LEVEL control adjusts the audio level of the speaker and the 600 ohm headset OUTPUT.

The DEMODULATOR switch selects AM or upper (USB) or lower (LSB) single sideband demodulation.

2.0.14 "AFC (Automatic Frequency Control)" Switch

When this switch is in the AFC position, the instrument automatically tunes a signal to the same point on the filter with each measurement. This ensures amplitude accuracy by reducing tuning errors. In order to rapidly tune in the signal, place the SELECTIVITY switch in the WIDE filter position and tune in the signal. Next, switch on the AFC and change to a NARROW filter selection.

Operation of the AFC circuit will provide an AFC indication displayed in the right hand side of the FREQUENCY kHz display window.

Rapidly changing frequency signals such as noise and FSK are not suited to AFC tuning. The AFC should be switched off when making measurements on these signals.

2.0.15 "TUNE/FINE TUNE" Controls

The "TUNE" control provides for coarse/rapid tuning of the frequency band selected. In conjunction with the WIDE filter this control allows for easy location of the desired signal.

The "FINE TUNE" control provides for fine/slow tuning of the frequency band selected. In conjunction with the NARROW filter the FINE TUNE control allows accurate placement of the signal at the desired point in the passband of the filter.

2.0.16 "RANGE" Switch

The RANGE switch sets the frequency range of the instrument to the signal being measured.

Four ranges are provided to cover input frequencies of 0.3 to 3500 kHz.

2.0.17 "FREQUENCY kHz" Display

The 6 digit LCD display shows the frequency of the incoming signal or the frequency to which the instrument is tuned in kHz. The display is thermostatically controlled, resistant to damage from heat and has a rapid response in cold environments.

When the instrument is operating as a frequency counter, a "SIGNAL COUNT" display will appear in the left hand side of the FREQUENCY kHz display.

When the AFC is activated, an "AFC" display will appear in the right hand side of the FREQUENCY kHz display.

2.0.18 "DISPLAY" Switch

This 3 position switch performs the following functions:

CENTER PASS BAND — In this position, the FREQUENCY kHz display will show the frequency to which the instrument is tuned with 10 Hz resolution.

SIGNAL COUNT 10 Hz — In this position, the FREQUENCY kHz display will show the frequency of the incoming signal with 10 Hz resolution. The display will revert back to showing the CENTER PASS BAND frequency when no signal of sufficient strength falls within the filter passband.

SIGNAL COUNT 1 Hz — When the switch is in this position, the FREQUENCY kHz display shows the frequency of the incoming signals to a resolution of 1 Hz. The 1 Hz switch position is spring-loaded and must be momentarily moved into the 1 Hz position when a 1 Hz resolution frequency count display is required. The 1 Hz count will appear after a brief delay following the switch position change. In the SIGNAL COUNT 1 Hz mode, the MHz digit rolls off the display.

2.1 CALIBRATION PROCEDURE

Set the instrument switches and controls as follows:

Switch/Control	Position
RANGE dBm	CAL -30
IMPEDANCE	CAL
SELECTIVITY Hz	Band Pass Filter which you intend to use to make your measurement.
AFC	ON
RANGE kHz	CAL 250, 0.3-650 kHz
FREQUENCY (TUNE)	250.00 kHz

Note that the CAL positions on the various controls are clearly marked in negative image letters.

To calibrate, adjust the CAL LEVEL to -30.0 dBm on the LEVEL dBm display.

For maximum level accuracy, always calibrate the instrument with the band pass filter that you intend to use to make your measurements.

Usually, only a three minute warmup period is required before you may accurately calibrate and operate the 6040. When turning on the instrument in extreme cold or hot conditions, a slightly longer warmup may be required. For the most accurate measurements, recalibration every 15 to 20 minutes within the first 60 minutes of operation is recommended, particularly when the instrument has been moved from one environmental extreme to another.

