



HEWLETT
PACKARD

OPERATING AND SERVICE MANUAL

3730B

DOWN CONVERTER

3736B, 3737B, 3738B and 3739B

RF MODULES

(including option 010)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2012U. For additional information about instruments with other serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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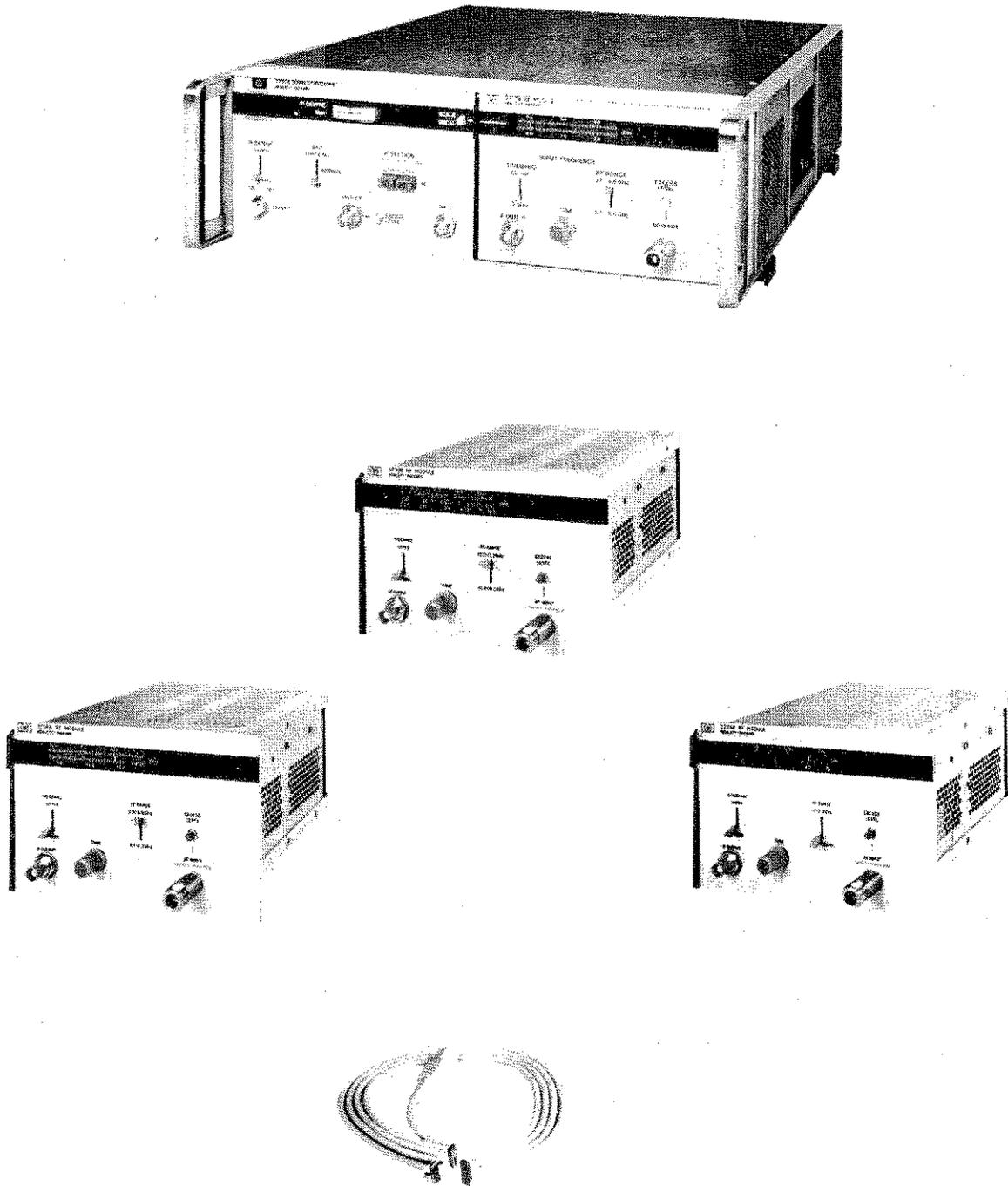


Figure 1-1 3730B Down Converter with 3736B, 3737B, 3738B and 3739B RF Module plug-ins.

SECTION 1

GENERAL INFORMATION

1-1 INTRODUCTION

1-2 This operating and service manual contains information required to install, operate, test, adjust and service the Hewlett-Packard Model 3730B DOWN CONVERTER and Models 3736B, 3737B, 3738B and 3739B RF MODULE plug-ins. The instrument, with a full range of plug-in modules and the accessories supplied, is shown in Figure 1-1.

1-3 SPECIFICATIONS

1-4 The specifications of the 3730B DOWN CONVERTER mainframe and the 3736B, 3737B, 3738B and 3739B RF MODULE plug-ins are given in Table 1-2. These specifications are the performance standards or limits against which the instrument is tested.

1-5 SAFETY CONSIDERATIONS

1-6 The Model 3730B DOWN CONVERTER, individually, complete with an RF MODULE plug-in, or with an RF MODULE plug-in connected to the mainframe via the 15906A umbilical cable accessory, is a safety class 1 instrument (provided with a protective earth terminal). The instrument and manual should be reviewed for safety markings and instructions before operation or service.

1-7 INSTRUMENTS COVERED BY MANUAL

1-8 Attached to the rear panel of the instrument is a serial number plate. The serial number is in the form: 0000U-00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-9 An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial number prefix indicates that the instrument may be different from those described in this manual. A Manual Changes supplement may be supplied with this manual to provide information on how to adapt the manual for such instruments.

1-10 In addition to change information, the supplement may contain information for correcting errors in the man-

ual. To keep the manual as accurate as possible, Hewlett-Packard recommend that periodic requests for the latest Manual Change supplement are made to one of the Sales and Service offices listed at the rear of this manual.

1-11 DESCRIPTION

1-12 The RF input is mixed with the local oscillator in the RF module to produce an IF output. When the AFC is switched OFF, local oscillator tuning is controlled directly with the front panel switches and controls. When the AFC switch is in the NORMAL position compensation is applied to the local oscillator for frequency drifts in either the down converter or the source, of up to ± 40 MHz with a 140MHz IF or ± 20 MHz with a 70MHz IF. The TRACKING mode allows the local oscillator to be swept by an internally recovered sweep, in addition to the normal AFC, to track the RF source by up to 250MHz.

1-13 OPTIONS

1-14 The Model 3730B OPTION 010 is fitted with an independent IF amplifier and attenuator. The amplifier has a fixed 25dB gain and the attenuator is variable in 10dB steps from 0 to 30dB.

1-15 ACCESSORIES SUPPLIED

1-16 The Model 3730B is supplied complete with a power cable and an extender board. The extender board is mounted in a socket next to assembly A5. Option 010 instruments are supplied with a link to connect the plug-in IF OUTPUT to the 3730B IF INPUT.

1-17 EQUIPMENT REQUIRED

1-18 A complete down converter system comprises the Model 3730B DOWN CONVERTER mainframe and one of the four available RF MODULE plug-ins, Models 3736B, 3737B, 3738B or 3739B.

1-19 ACCESSORIES AVAILABLE

1-20 The accessories available include cables with alternative connectors, isolators, and an umbilical cable which allows the RF MODULE to be mounted near to the RF source with the DOWN CONVERTER mainframe at a more convenient location.

1-21 Cables with Alternative Connectors

1-22 The following accessories comprise cables, length approximately 48 inches (120cm), which mate with the instrument BNC connectors and provide an alternative output connectors.

Accessory Cable	Output Connector
15525A OPT 006	WECO LARGE, commercial equivalent of WECO 477B
15525A OPT 007	WECO SMALL, commercial equivalent of WECO 560A
15525A OPT 008	SIEMENS 2.5/6mm
15525A OPT 009	SIEMENS 1.6/5.6mm

Isolator Accessory

15600A
15601A
15602A
15603A

Frequency Range

3.7 to 4.2GHz
5.9 to 6.5GHz
7.1 to 8.5GHz
10.7 to 11.7GHz

1-25 Umbilical Cable

1-26 The 15609A umbilical cable, length approximately 3 metres, has connectors which mate with the rear plug on the RF Module and the socket in the down converter plug-in compartment.

1-23 RF Input Isolators

1-24 The following accessories comprise an RF input isolator complete with input cable which replaces the input attenuator and cable in the RF MODULE.

1-27 RECOMMENDED TEST EQUIPMENT

1-28 Table 1-1 lists the recommended test equipment together with its critical specification and information on the section of the manual in which it is used.

Table 1-1 Recommended Test Equipment

Instrument Type	Critical Specification	Suggested Model	Use*
Sweep Oscillator	Mainframe — to accept suitable plug-ins	8620C	P, A
RF Plug-in	1.7 to 4.2GHz	86235A OPT 008 †	3736B P, A
RF Plug-in	3.7 to 8.5GHz	86240C	3737B P, A
RF Plug-in	5.9 to 11.7GHz	86245A OPT 008 †	3738B P, A
RF Plug-in	10.7 to 14.5GHz	86260A OPT H82 †	3739B P, A
Electronic Counter	Up to 150MHz	5345A	P, A
Microwave Frequency Counter	65MHz to 14.5GHz	5340A	P, A
Digital Voltmeter	No special requirements	3476A/B	A
IF/BB Transmitter	Unique	3711A/3791B**	P, A, T
IF/BB Receiver	Unique	3712A/3791B**	P, A
Accessory Kit		15550C	P
Power Meter with Power Sensor	-20 to +10dBm, up to 14.5GHz	435A with 8481A	P, A
Spectrum Analyzer System	10MHz to 20GHz	141T/8555A/8552B	P, T
10dB Attenuator Pad	Up to 15GHz	8491B OPT 010	A
20dB Attenuator Pad (2 off)	Up to 15GHz	8491B OPT 020	P
Oscilloscope	Bandwidth dc — 100MHz, Timebase speed 100ns to 2 secs	1740A	T

* P = Performance Tests, A = Adjustments, T = Troubleshooting

** A limited range of Test and Adjustments can be achieved using 3710 MLA System

† Option 008 only required when using BB tones above 2MHz.
Otherwise standard plug-ins can be used throughout.

Table 1-2 Specifications

SPECIFICATIONS

Except where otherwise indicated, the following parameters are warranted performance specifications. Parameters described as "typical" or "nominal" are supplemental characteristics which

provide a useful indication of typical, but non-warranted, performance characteristics

<p>DOWN CONVERTER SYSTEM 3730B + 3736/7/8/9B</p> <p>FREQUENCY RANGE: 3730B + 3736B : 1.7 to 4.2 GHz;* 3730B + 3737B : 3.7 to 8.5 GHz; 3730B + 3738B : 5.9 to 11.7 GHz; 3730B + 3739B : 10.7 to 14.5 GHz. *Restricted to 1.77 to 4.13 GHz for 140 MHz operation.</p> <p>RESIDUAL PERFORMANCE †</p> <table border="1"> <thead> <tr> <th></th> <th>50 MHz Sweep Width at 70 MHz centre frequency</th> <th>100 MHz Sweep Width at 140 MHz centre frequency</th> </tr> </thead> <tbody> <tr> <td>Amplitude Response</td> <td>0.2 dB</td> <td>0.3 dB</td> </tr> <tr> <td>Group Delay</td> <td>0.2 ns</td> <td>0.3 ns</td> </tr> <tr> <td>Diff Gain (5.6 MHz test tone)</td> <td>0.3%</td> <td>0.5%</td> </tr> <tr> <td>Diff Phase (5.6 MHz test tone)</td> <td>0.3°</td> <td>0.5°</td> </tr> </tbody> </table> <p>† The residual specifications quoted are measured using the FM Sweep input to reduce the residual contributions of the RF test source, and using storage normalizer techniques to remove Microwave Link Analyzer receiver contributions.</p> <p>MIN RF INPUT LEVEL: For correct operation of MLA: -15 dBm, typically; -40 dBm when Opt 010 is fitted; however, min input level dependent on input sensitivity of MLA and RF-IF gain conversion of Down Converter (3710A/3702B MLA - min input sensitivity -10 dBm; 3711A/3712A MLA - min input sensitivity -19 dBm).</p> <p>General</p> <p>DIMENSIONS: 141 mm (5.5 in) high; 425 mm (16.75 in) wide; 467 mm (18.375 in) deep.</p> <p>POWER SUPPLY: 100, 120, 220, or 240V ac, +5 -10%; 48 to 66 Hz; consumption 100 VA max, including plug-in.</p> <p>WEIGHT**: 11.9 kg (26 lb), net 17.7 kg (39 lb), shipping. ** including plug-in.</p> <p>TEMPERATURE RANGE: 0 to +55°C, operating; -40 to +75°C, storage.</p> <p>Options</p> <p>010: 25 dB fixed gain amplifier, with 30 dB (10 dB step) attenuator.</p> <p>Various connector types can be fitted on a special basis. Only BNC connectors are offered on the standard product; to interface with equipment fitted with other types of connector, the following adapter cables are recommended:</p> <p>15525A Opt 008: BNC to large Siemens cable; 15525A Opt 009: BNC to small Siemens cable; 15525A Opt 006: BNC to WECO 477B cable; 15525A Opt 007: BNC to WECO 560A cable.</p>				50 MHz Sweep Width at 70 MHz centre frequency	100 MHz Sweep Width at 140 MHz centre frequency	Amplitude Response	0.2 dB	0.3 dB	Group Delay	0.2 ns	0.3 ns	Diff Gain (5.6 MHz test tone)	0.3%	0.5%	Diff Phase (5.6 MHz test tone)	0.3°	0.5°	<p>RF MODULE (PLUG-IN) 3736/7/8/9B</p> <p>RF Input</p> <p>MIN INPUT LEVEL: For correct operation of AFC circuit: -40 dBm.</p> <p>RECOMMENDED MAX INPUT LEVEL: For operation to specification: > 0 dBm, EXCESS LEVEL lamp indicates at +3 dBm RF input level, typically. Absolute max level: +10 dBm.</p> <p>LOCAL OSCILLATOR LEAKAGE:</p> <table border="1"> <thead> <tr> <th></th> <th>3736B</th> <th>3737B</th> <th>3738B</th> <th>3739B</th> </tr> </thead> <tbody> <tr> <td>Max</td> <td>23 dBm</td> <td>27 dBm</td> <td>20 dBm</td> <td>15 dBm</td> </tr> <tr> <td>Typical</td> <td>-35 dBm</td> <td>35 dBm</td> <td>30 dBm</td> <td>30 dBm</td> </tr> </tbody> </table> <p>Note: incorporating an Isolator Accessory will reduce the local oscillator leakage by 15 dB.</p> <p>IMPEDANCE: 50Ω.</p> <p>RETURN LOSS:</p> <table border="1"> <thead> <tr> <th></th> <th>3736B</th> <th>3737B</th> <th>3738B</th> <th>3739B</th> </tr> </thead> <tbody> <tr> <td>Typical</td> <td>> 16 dB</td> <td>> 15 dB</td> <td>> 14 dB</td> <td>> 13 dB</td> </tr> </tbody> </table> <p>Note: incorporating an Isolator Accessory will improve the RF INPUT return loss figure - see Isolator Accessory Specifications.</p> <p>CONNECTOR: N-type female (mates with MIL-C-71, and MIL-C-39012).</p> <p>Local Oscillator</p> <p>FREQUENCY RANGE: suitable to provide RF coverage as specified in Down Converter System Specifications.</p> <p>SCALE ACCURACY (MHz):</p> <table border="1"> <thead> <tr> <th></th> <th>3736B</th> <th>3737B</th> <th>3738B</th> <th>3739B</th> </tr> </thead> <tbody> <tr> <td>At 25°C</td> <td>± 20</td> <td>± 20</td> <td>± 40</td> <td>± 50</td> </tr> </tbody> </table> <p>FREQUENCY STABILITY (MHz/°C):</p> <table border="1"> <thead> <tr> <th></th> <th>3736B</th> <th>3737B</th> <th>3738B</th> <th>3739B</th> </tr> </thead> <tbody> <tr> <td>Unlocked</td> <td>± 0.5</td> <td>± 0.5</td> <td>± 1.2</td> <td>± 4</td> </tr> </tbody> </table> <p>For stability with AFC, see Down Converter (mainframe) Specifications.</p> <p>IF Output</p> <p>FREQUENCY RANGE: 45 to 190 MHz. RF-IF GAIN CONVERSION (dB):</p> <table border="1"> <thead> <tr> <th></th> <th>3736B</th> <th>3737B</th> <th>3738B</th> <th>3739B</th> </tr> </thead> <tbody> <tr> <td>Typical: Standard</td> <td>+4</td> <td>+5</td> <td>+5</td> <td>+3</td> </tr> <tr> <td>Opt 010</td> <td>+24</td> <td>+30</td> <td>+30</td> <td>+28</td> </tr> </tbody> </table> <p>OUTPUT LEVEL: dependent on RF-IF conversion gain. HARMONICS: > 30 dB below fundamental. IMPEDANCE: 75Ω. RETURN LOSS: > 30 dB. CONNECTOR: BNC.</p>					3736B	3737B	3738B	3739B	Max	23 dBm	27 dBm	20 dBm	15 dBm	Typical	-35 dBm	35 dBm	30 dBm	30 dBm		3736B	3737B	3738B	3739B	Typical	> 16 dB	> 15 dB	> 14 dB	> 13 dB		3736B	3737B	3738B	3739B	At 25°C	± 20	± 20	± 40	± 50		3736B	3737B	3738B	3739B	Unlocked	± 0.5	± 0.5	± 1.2	± 4		3736B	3737B	3738B	3739B	Typical: Standard	+4	+5	+5	+3	Opt 010	+24	+30	+30	+28
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Table 1-2 Specifications (continued)

<p>DOWN CONVERTER (MAINFRAME) 3730B</p> <p>IF Centre Frequency Meter</p> <hr/> <p>RANGE: 45 to 95 MHz, or 90 to 190 MHz. ACCURACY: ± 0.5 MHz at 70 MHz centre frequency; ± 2 MHz over rest of 45 to 95 MHz scale; ± 1.0 MHz at 140 MHz centre frequency; ± 4 MHz over rest of 90 to 190 MHz scale.</p> <p>Automatic Frequency Control</p> <hr/> <p>RF input may be CW or swept sinusoidally at rate of 18 to 100 Hz. SWEEP WIDTH: 0 to 50 MHz at 70 MHz IF centre frequency. 0 to 100 MHz at 140 MHz IF centre frequency. MODES: OFF, NORMAL, TRACKING. NORMAL: will track any drift of the unmodulated RF carrier frequency. TRACKING: in addition to tracking drift of RF carrier, compresses sweep width to approx 3%. LOCAL OSCILLATOR CAPTURE RANGE: ± 20 MHz at 70 MHz centre frequency. ± 40 MHz at 140 MHz centre frequency. IF OUTPUT: 70 ± 0.5 MHz, or 140 ± 1.0 MHz.</p> <p>Recovered Sweep Output(AFC TRACKING mode)</p> <hr/> <p>SENSITIVITY: 100 mV/MHz, typical, at 70 MHz centre frequency; 50 mV/MHz, typical, at 140 MHz centre frequency.</p> <p>Local Oscillator Sweep Input</p> <hr/> <p>SENSITIVITY: 20 MHz/V, typical. SWEEP RATE: 18 to 100 Hz.</p>	<p>Option 010</p> <hr/> <p>Option 010 provides an additional IF section comprising a 30 dB step attenuator and 25 dB fixed gain amplifier.</p> <p>IF Input</p> <hr/> <p>FREQUENCY: 45 to 190 MHz. MAX INPUT LEVEL: +10 dBm. IMPEDANCE: 75Ω, nominal. RETURN LOSS: > 30 dB.</p> <p>Attenuator</p> <hr/> <p>RANGE: 0 to 30 dB, in 10 dB steps. ACCURACY: ± 0.5 dB.</p> <p>Amplifier</p> <hr/> <p>GAIN: 25 ± 1.0 dB. NOISE FIGURE: 8 dB, nominal. HARMONICS: > 30 dB below carrier at +5 dBm output level. OUTPUT LEVEL FOR 1 dB GAIN COMPRESSION: > +12 dBm.</p> <p>IF Output</p> <hr/> <p>MAX OUTPUT LEVEL: +5 dBm. IMPEDANCE: 75Ω, nominal. RETURN LOSS: > 30 dB. RESIDUAL RESPONSE: no degradation on quoted system specifications.</p>																																						
<p>ISOLATOR ACCESSORIES 15600A/1A/ 2A/ 3A</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">15600A</th> <th style="text-align: center;">15601A</th> <th style="text-align: center;">15602A</th> <th style="text-align: center;">15603A</th> </tr> </thead> <tbody> <tr> <td>Frequency Range</td> <td style="text-align: center;">3.7 to 4.2 GHz</td> <td style="text-align: center;">5.9 to 6.5 GHz</td> <td style="text-align: center;">7.1 to 8.5 GHz</td> <td style="text-align: center;">10.7 to 11.7 GHz</td> </tr> <tr> <td>Return Loss (typical)</td> <td style="text-align: center;">> 25 dB</td> <td style="text-align: center;">> 19 dB</td> <td style="text-align: center;">> 17 dB</td> <td style="text-align: center;">> 15 dB</td> </tr> <tr> <td>L.O. Leakage max typical</td> <td style="text-align: center;">-40 dBm -50 dBm</td> <td style="text-align: center;">-42 dBm -50 dBm</td> <td style="text-align: center;">-35 dBm -45 dBm</td> <td style="text-align: center;">-36 dBm -45 dBm</td> </tr> <tr> <td>Min Input Level</td> <td style="text-align: center;">-50 dBm</td> <td style="text-align: center;">-50 dBm</td> <td style="text-align: center;">-50 dBm</td> <td style="text-align: center;">-50 dBm</td> </tr> <tr> <td>Max Input Level</td> <td style="text-align: center;">-10 dBm</td> <td style="text-align: center;">-10 dBm</td> <td style="text-align: center;">-10 dBm</td> <td style="text-align: center;">-10 dBm</td> </tr> <tr> <td>RF-IF Gain (typical)</td> <td style="text-align: center;">14 dB</td> <td style="text-align: center;">15 dB</td> <td style="text-align: center;">15 dB</td> <td style="text-align: center;">13 dB</td> </tr> </tbody> </table> <p>RACK MOUNTING: A rack mounting kit stock number 5060-8740, is available for the model 3730B.</p>						15600A	15601A	15602A	15603A	Frequency Range	3.7 to 4.2 GHz	5.9 to 6.5 GHz	7.1 to 8.5 GHz	10.7 to 11.7 GHz	Return Loss (typical)	> 25 dB	> 19 dB	> 17 dB	> 15 dB	L.O. Leakage max typical	-40 dBm -50 dBm	-42 dBm -50 dBm	-35 dBm -45 dBm	-36 dBm -45 dBm	Min Input Level	-50 dBm	-50 dBm	-50 dBm	-50 dBm	Max Input Level	-10 dBm	-10 dBm	-10 dBm	-10 dBm	RF-IF Gain (typical)	14 dB	15 dB	15 dB	13 dB
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RF-IF Gain (typical)	14 dB	15 dB	15 dB	13 dB																																			

SECTION II

INSTALLATION

2-1 INTRODUCTION

2-2 This section provides installation instructions for the Model 3730B DOWN CONVERTER and Models 3736B, 3737B, 3738B and 3739B RF MODULES. This section also contains information about initial inspection and damage claims, preparations for use, packaging, storage and shipment.

2-3 INITIAL INSPECTION

WARNING

To avoid hazardous electrical shocks, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, meters).

2-4 Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment of a Model 3770B DOWN CONVERTER (mainframe) are shown in Figure 1-1 together with the four compatible RF MODULE plug-ins. The RF MODULES are not normally part of the same shipment. Procedures for checking the electrical performance of the Model 3730B mainframe and its associated RF MODULE plug-ins, are given in Section IV of this manual. If the contents of the shipment is incomplete, if there is mechanical damage or defect, or

if the instrument does not pass the performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carriers inspection. The HP office will arrange for repair or replacement at HP's Option without waiting for claims settlement.

2-5 PREPARATION FOR USE

2-6 Power Requirements

2-7 The Model 3730B requires a power source of 100, 120, 220 or 240V ac +5% -10%, 48 to 66Hz, single phase. The power requirements of the RF module plug-ins are provided from the 3730B mainframe via the plug-in connector. The power consumption of the 3730B, complete with RF module is less than 100VA.

2-8 Line Voltage and Fuse Selection

2-9 Figure 2-1 provides instructions for line voltage selection and fuse changing. The appropriate fuses are listed in Table 2-1.

CAUTION

Before connecting the instrument to the power source, ensure that the correct line voltage has been selected and that the correct fuse is fitted.

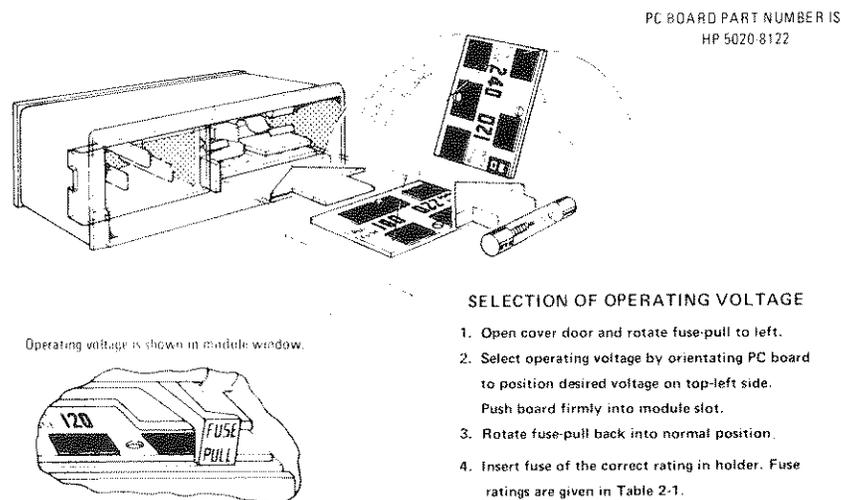


Figure 2-1 Line Selector

Table 2-1 Fuse Selection

Line Voltage	Fuse Rating	HP Stock No
100/120	1.5A (250V)	2110-0304
220/240	0.75A (250V)	2110-0360

2-10 Power Cable

2-11 The model 3730B is equipped with a three wire power cable. When connected to an appropriate ac power receptacle this cable grounds the instrument cabinet. The type of plug fitted to the power cable depends on the country of destination. Figure 2-2 gives the part numbers of power cables fitted with the various plugs available. The colour codes used in the power cable are as follows:

- Line - Brown
- Neutral - Blue
- Ground - Green/Yellow

2-12 Mating Connectors

2-13 The mating connectors used with the Model 3730B and its associated RF Module plug-ins are given in Table 2-2. Provision is made for alternative mating connectors using accessory cables, see Paragraph 1-21.

2-14 Operating Environment

2-15 The instrument may be operated in temperatures from 0°C to 55°C and at altitudes up to 7,630 metres (25,000 feet).

2-16 STORAGE AND SHIPMENT

2-17 Environment

2-18 The instrument may be stored or shipped in environments within the following limits:

- Temperature -40°C to +75°C
- Altitude up to 7,630 metres (25,000 feet)

2-19 Packaging

2-20 **Tagging for Service.** If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags located inside the front cover of this manual, and attach it to the instrument.

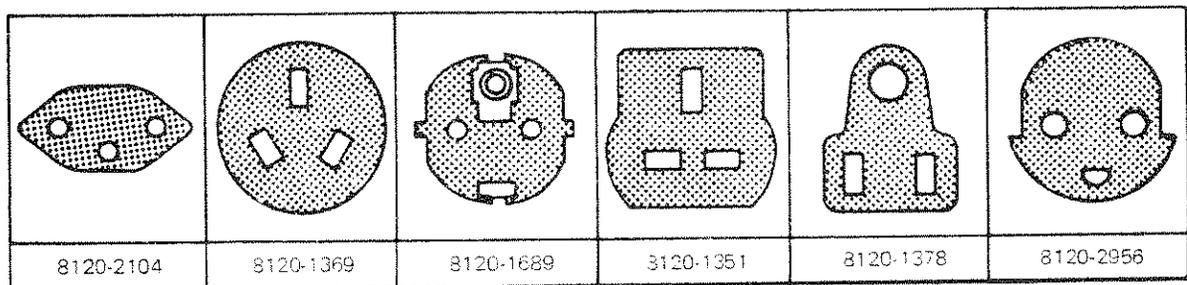


Figure 2-2 Power Cable Part Numbers/Power Receptacles

Table 2-2 Mating Connectors

Connector	Mating Connector Type	HP Part Number
RF INPUT	N type male MIL-C-71 MIL-C-39012	1250-0882
IF OUTPUT	BNC male } BNC male } BNC male } BNC male } BNC male }	1250-1448 1250-0629
IF INPUT OPT 010		
IF OUTPUT OPT 010		
SWEEP INPUT		
SWEEP OUTPUT		

2-21 Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-22 Other Packaging. The following general instructions should be used for re-packing with commercially available materials.

- (a) Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service center, attach tag indicating type of service required, return address, model number, and full serial number.)

- (b) Use strong shipping container. A double-wall carton made of 350-pound test material is adequate.
- (c) Use a layer of shock-absorbing material 70 to 100mm (3 to 4 inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside container. Protect control panel with cardboard.
- (d) Seal shipping container securely.
- (e) Mark shipping container FRAGILE to ensure careful handling.
- (f) In any correspondence, refer to instrument by model number and full serial number.

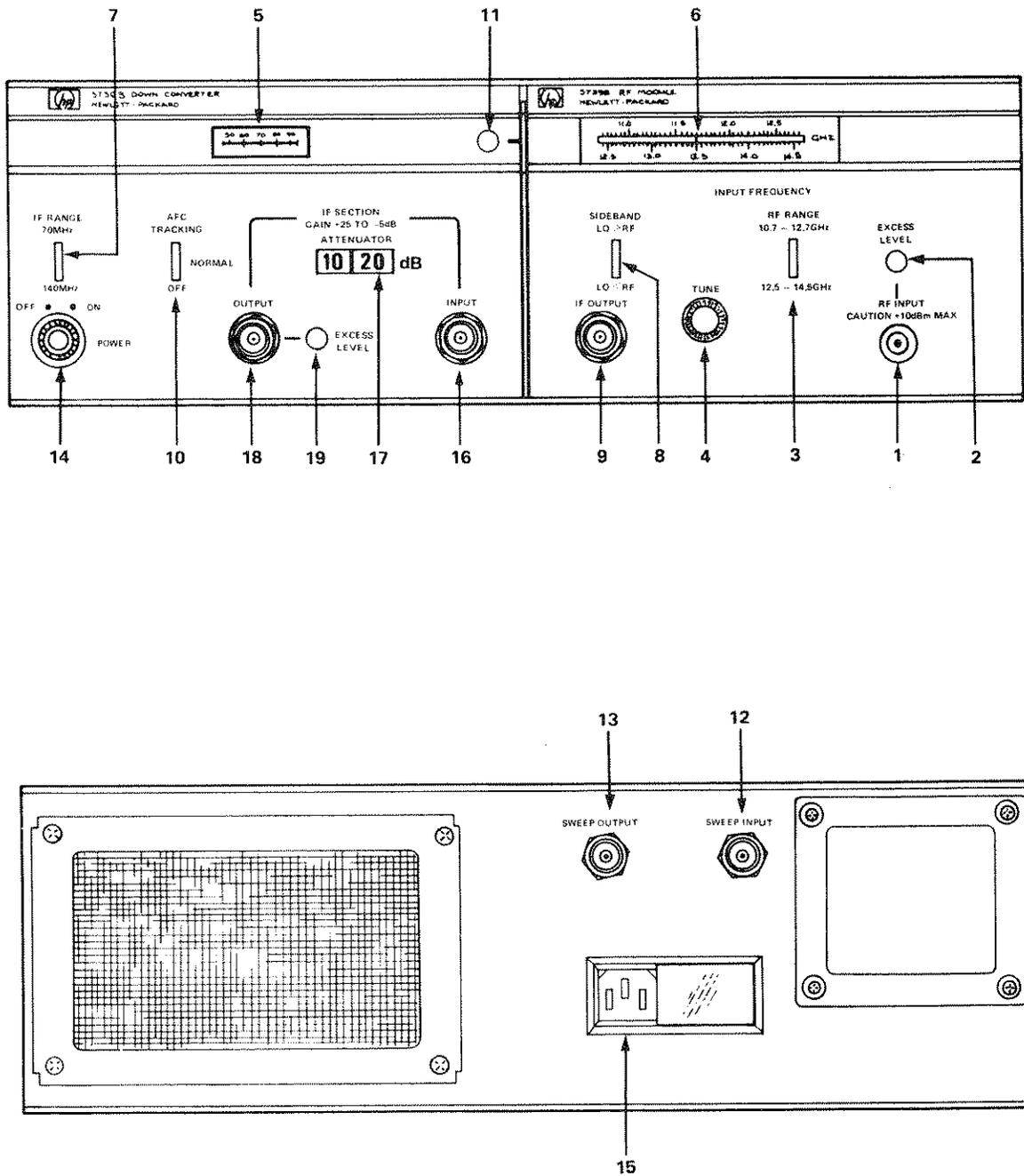


Figure 3-1 Panel Features

SECTION III OPERATION

3-1 INTRODUCTION

3-2 This section covers the operation of the model 3730B DOWN CONVERTER mainframe complete with one of the RF MODULE plug-ins 3736B, 3737B, 3738B or 3739B. Plug-in selection information is given and the front and rear panel controls, connectors and indicators are described. General operating procedures, including an example of tracking operation are given at the end of the section.

3-3 PLUG-IN SELECTION

3-4 The frequency ranges provided by the RF MODULE plug-ins are given in Table 2-1.

Table 3-1 Plug-in Selection

Plug-in	Frequency Ranges	
3736B	1.7 to 3GHz	2.9 to 4.2GHz
3737B	3.7 to 6.5GHz	5.7 to 8.5GHz
3738B	5.9 to 8.9GHz	8.7 to 11.7GHz
3739B	10.7 to 12.7GHz	12.5 to 14.5GHz

3-5 PANEL FEATURES

3-6 Figure 3-1 shows the front and rear panel controls, connectors and indicators with reference numbers. These reference numbers are used to identify the panel features in the following description.

1. RF INPUT connector. Accepts RF in the frequency ranges shown on the RF RANGE switch 3.
2. RF INPUT EXCESS LEVEL indicator. Comes on when the RF input level exceeds approximately +3dBm. Input levels of greater than +10dBm can cause damage to the instrument.
3. RF RANGE switch. Selects one of two frequency ranges of the local oscillator. The corresponding RF frequency ranges are given on the front panel.
4. TUNE control. Provides a variable control for the local oscillator frequency. The local oscillator frequency also depends on the setting of the RF RANGE switch 3, SIDEBAND switch 8 and IF RANGE switch 7. The local oscillator frequency can also be controlled by the incoming RF, using the AFC switch, or with an external sweep signal.
5. IF CENTRE MHz meter. Indicates the IF centre frequency output.
6. RF FREQUENCY scale. Indicates the setting of the TUNE control 4 for the corresponding RF input.
7. IF RANGE switch. Selects either 70MHz or 140 MHz as the IF centre frequency.
8. SIDEBAND switch. LO > RF sets the local oscillator above the RF by the frequency selected with the IF RANGE switch 7. LO < RF sets the local oscillator below the RF by the frequency selected with the IF RANGE switch 7.
9. IF OUTPUT connector. Provides a 75Ω IF output at 70MHz or 140MHz depending on the setting of the IF RANGE switch 7.
10. AFC switch. Provides three modes of operation OFF, NORMAL and TRACKING.

OFF: This is the mode which is normally used for tuning as the AFC is disconnected.

NORMAL: In this mode the local oscillator frequency is under the control of both the TUNE control 4 and the AFC signal, see Paragraph 3-12.

TRACKING: In addition to the normal AFC the local oscillator tracks the RF source by up to 250 MHz, see Paragraph 3-14.
11. SCALE UNCAL indicator. Indicates when the local oscillator is controlled by the AFC i.e. when the AFC switch 10 is in the TRACKING or NORMAL position.
12. SWEEP INPUT. Allows the local oscillator to be swept by an external sweep signal in the range 18 to 100Hz. This input is normally used as a test input to check the residual response of the DOWN CONVERTER.
13. SWEEP OUTPUT connector (rear panel). Provides an output of the sweep recovered from the incoming RF signal. The output sensitivity is typically 100mV/MHz with a 70MHz IF centre frequency and a 50mV/MHz with a 140MHz IF centre frequency.
14. POWER ON/OFF switch. Controls the ac power input to the instrument.

15. **POWER INPUT** module. Comprises a supply voltage selection plug-in card, the supply fuse and a socket for the power supply cable. Details of setting the supply voltage and fuse selection are given in Section II, Paragraph 2-8.

THE FOLLOWING PANEL FEATURES APPLY TO THE INDEPENDENT IF AMPLIFIER/ATTENUATOR SECTION FITTED TO INSTRUMENTS WITH OPTION 010.

16. **IF INPUT** connector. The 75Ω input of the independent IF amplifier/attenuator. The amplifier has a fixed 25dB gain and the attenuator is variable in 10dB steps from 0 to 30dB. The maximum input level is that which produces a +5dBm output i.e. -20dBm with the attenuator set to 0dB. +10dBm with the attenuator set to 30dB.
17. **ATTENUATOR** controls. The 10dB and 20dB switches provide four levels of attenuation between 0 and 30dB in 10dB steps.
18. **IF OUTPUT** connector. The 75Ω output of the independent IF amplifier/attenuator. The maximum output level is +5dBm.
19. **IF OUTPUT EXCESS LEVEL** indicator. Comes on when the IF output exceeds approximately +5dBm.

3-7 GENERAL OPERATING PROCEDURES

3-8 The recommended procedure for setting up and tuning the DOWN CONVERTER and RF MODULE is as follows:

WARNING

Before connecting the instrument to the ac power supply, check that the exterior panels are not damaged, that the voltage selector is correctly set and that the correct fuse is fitted.

3-9 Initial Procedures

1. Connect the instrument to the ac power supply.
2. Set the POWER ON/OFF switch 14 to ON.
3. Allow at least 15 minutes warm up time.
4. Connect the RF source to the RF INPUT connector 1.

Note: The maximum input level is +10dBm. The EXCESS LEVEL indicator 2 comes on if the level exceeds approximately +3dBm.

5. Set the RF RANGE 3, IF RANGE 7, and SIDE-BAND 8 switches as required.

3-10 Tuning

6. Set the AFC switch 10 to OFF.
7. Tune the RF MODULE with the TUNE control 4, using the RF FREQUENCY scale 6 as a coarse indication and a 70/140MHz reading on the IF CENTRE frequency meter 5 as a fine indication.
8. Check the tuning by observing the IF CENTRE frequency meter 5 and setting the AFC switch 10 to NORMAL.
Correct tuning is indicated by a rapid return to the previous reading on the IF CENTRE frequency meter (70/140MHz).
Incorrect tuning is indicated by an off scale reading of the IF CENTRE frequency meter.
If the tuning is incorrect, reset the AFC switch 10 to OFF and, using the TUNE control 4, search for a different tuning point. Recheck the tuning by repeating Step 8.
9. With the RF MODULE correctly tuned set the AFC switch 10 to the NORMAL or TRACKING position as required.

3-11 NORMAL MODE

3-12 In this mode AFC is applied to the local oscillator to compensate for frequency drifts in either the local oscillator or the RF source, of up to ± 40 MHz with a 140MHz IF or ± 20 MHz with a 70MHz IF. The local oscillator frequency is still adjustable with the front panel TUNE control.

3-13 TRACKING MODE

3-14 The TRACKING mode has two main features:

- Sweep Range Extension
- Reduction in Residual Response.

3-15 In the TRACKING mode, the local oscillator of the DOWN CONVERTER follows the RF input, and the IF output is swept by the tracking difference. This effectively reduces the sweep width by a factor of approximately 30.

3-16 **EXAMPLE:** Where in the NORMAL mode, an input RF signal swept by ± 50 MHz produces an IF output swept by ± 50 MHz; in the TRACKING mode, the same RF input produces an IF output swept by approximately ± 1.5 MHz.

3-17 Sweep Range Extension

3-18 The NORMAL mode operates with sweep widths of up to $\pm 50\text{MHz}$. Where operation is required with sweep widths of between $\pm 50\text{MHz}$ and $\pm 125\text{MHz}$, or when sweep compression is required, the TRACKING mode must be used.

3-19 Figure 3-2A shows a typical test system when using the DOWN CONVERTER in the NORMAL mode. Figure 3-2B shows the same measurement modified for TRACKING mode operation. The following points should be noted when using the system in the tracking mode.

1. The sweep recovery of some MLA receivers may not be adequate with the very small sweep widths obtained in the tracking mode and it is therefore necessary to use the recovered sweep from the down converter as an external sweep input to the MLA.

Note: The phasing of the MLA trace should be performed with the bandwidth of the MLA receiver plug-in set at 10kHz.

2. Frequency markers generated in the MLA receiver are invalid as a result of the sweep compression. For sweep widths within the bandwidth of the MLA receiver (ie up to $\pm 25\text{MHz}$ with 70MHz IF or $\pm 50\text{MHz}$ with 140MHz IF) the sweep width can

be accurately measured in the NORMAL mode before switching to the TRACKING mode. For wider sweep widths it is necessary to generate frequency markers externally using a directional coupler to couple some of the RF signal into a tuned cavity frequency meter. Markers are produced by a fall in level from the crystal detector as the RF signal is swept through the tuned frequency meter. The detector output is applied to the MLA EXT input so that with external input selected a frequency marker "blip" occurs on the display.

3-20 Reduction of Residual Response

3-21 The residual response of the test equipment is reduced when using the TRACKING mode as a result of the reduced sweep width. Any residual error produced in the DOWN CONVERTER or MLA RECEIVER is virtually eliminated.

3-22 EXTERNAL SWEEP OPERATION

3-23 The local oscillator can be swept with an external sweep signal in the range 18 to 100Hz. This mode of operation can be used for one method of checking the DOWN CONVERTER residual response, this method is used in the Performance Test, see Paragraph 4-6.

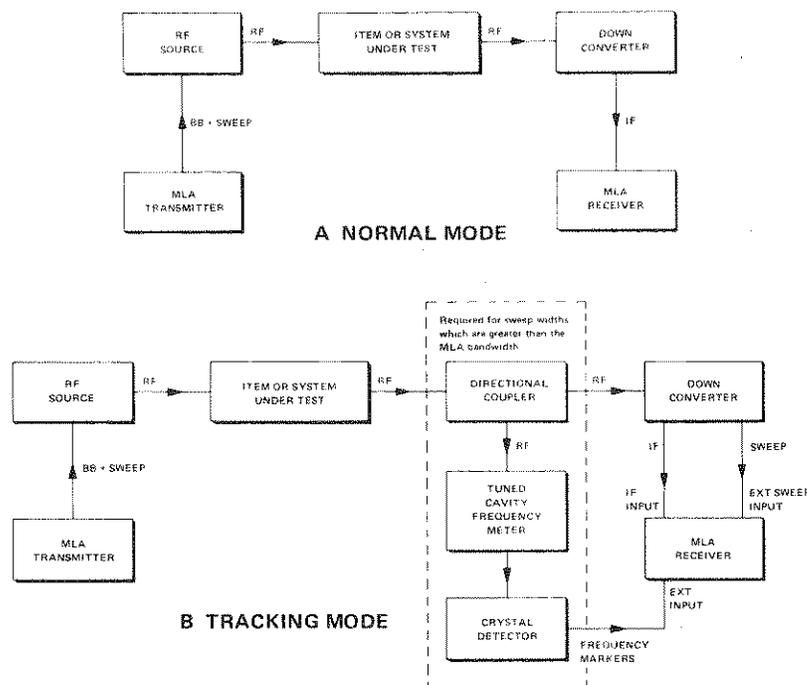


Figure 3-2 Typical Test Systems

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