TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL FOR

FREQUENCY SELECTIVE LEVEL METER

AN/USM-490

(NSN 6625-01-138-3351) (EIC: N/A)

HEADQUARTERS, DEPARTMENT OF THE ARMY
1 JANUARY 1987

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

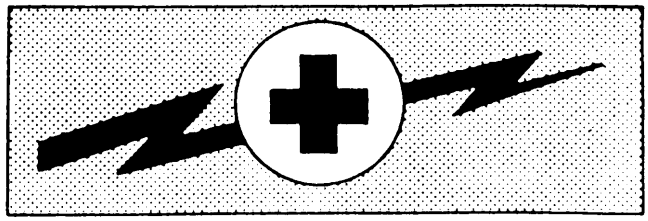
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING



HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Be careful not to contact high-voltage connections of 115-volt ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term “LOW VOLTAGE” Potentials as low as 50 volts may cause death under adverse conditions.

CHANGE)
)
No. 1)

Headquarters
Department of the Army
Washington, D.C., 25 August 2005

TECHNICAL MANUAL
OPERATOR'S AND ORGANIZATIONAL
MAINTENANCE MANUAL
FOR

FREQUENCY SELECTIVE LEVEL METER
AN/USM-490

(NSN 6625-01-138-3351) (EIC: N/A)

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TECHNICAL MANUAL }
NO. 11-6625-3087-12 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 January 1987

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL FOR

FREQUENCY SELECTIVE LEVEL METER AN/USM-490

(NSN 6625-01-138-3351) (EIC: N/A)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U. S. Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via email, fax or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our email address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hardcopy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

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CONTENTS—Continued

HOW TO USE THIS MANUAL

This manual tells you about your Frequency Selective Level Meter AN/USM-490 and contains instructions about how to use it during maintenance on other electronic equipment.

The technical manual for the electronic equipment you are maintaining will tell you where to make certain connections and when to use various accessories which are part of the AN/USM-490.

When you first receive your AN/USM-490, start at the front of the manual and go all the way through to the back. Become familiar with every part of the manual and the AN/USM-490.

This manual has an edge index which will help you find specific information in a hurry. Simply spread the pages on the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the page lines up with your selected topic printed on the front cover block.

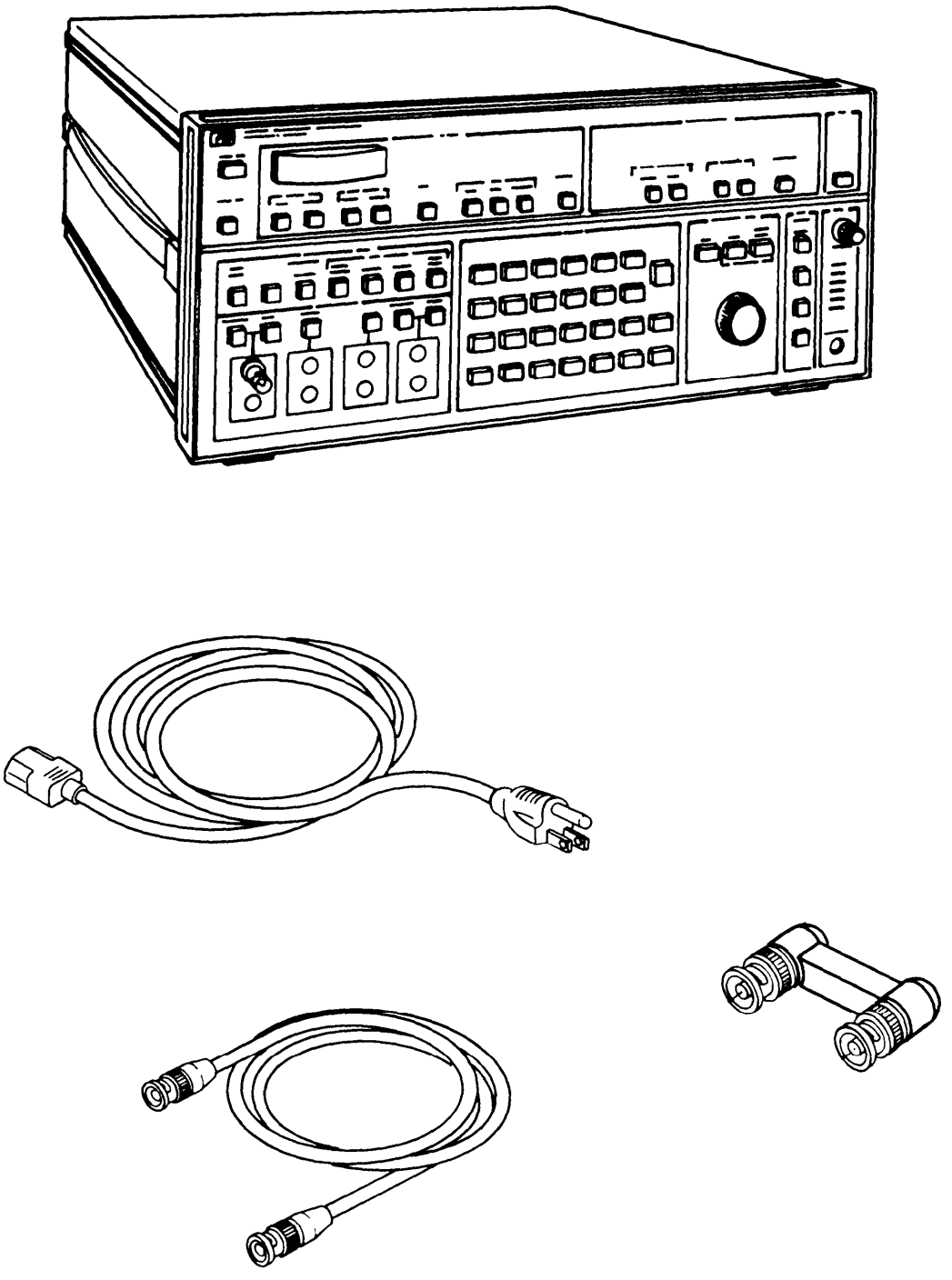


Figure 1-1. Frequency Selective Level Meter AN/USM-490.

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

a. Type of Manual: Operator's and Organizational Maintenance Manual.

b. Equipment Name and Model Number: Frequency Selective Level Meter AN/USM-490.

c. Purpose of Equipment: The Level Meter is designed for use in installation and maintenance of Frequency Domain Multiplexing (FDM) Systems, wave analysis, frequency synthesis, carrier frequency, and voice channel measurements.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

a Report of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750 as contained in Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy) as prescribed in AR 735-1102/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (SF 361) as prescribed in AR 55-38/ NAVSUPINST 4610.33C/ AFR 75-18/ MCO P4610.19D/DLAR 4500.15.

1-4. ADMINISTRATIVE STORAGE.

Refer to TM 740-90-1 for administrative storage procedures.

1-5. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

1-7. WARRANTY INFORMATION.

The AN/USM-490 is warranted by Hewlett-Packard Company for one year. Warranty starts on the date of shipment to the original buyer. Report all defects in material or workmanship to your supervisor who will take appropriate action.

1-8. NOMENCLATURE CROSS-REFERENCE LIST.

Common names will be used when major components of the Frequency Selective Level Meter are mentioned in this manual.

NOTE

Official nomenclature must be used when filling out report forms or looking up Technical Manuals.

Common Name	Official Nomenclature
Level Meter	Frequency Selective Level Meter AN/USM-490
AIWUSM-490	Frequency Selective Level Meter AN/USM-490

1-9. LIST OF ABBREVIATIONS.

This list identifies abbreviations and descriptions that are used in this manual.

AUTO	Automatic
AVE	Average
CAL	Calibration
CARR	Carrier
CNTR	Counter
CONT	Continue
DEMOD	Demodulation
DIST	Distortion
FDM	Frequency Domain Multiplexing
LSB	Lower side band
MEAS	Measure
MIN	Minutes
MIP	Maximum input power
OVLD	Overload
para	Paragraph
pW	Picawatt
STBY	Standby
SSB	Single side band
T	Time
THSHLD	Threshold
USB	Upper side band
	Weighted

Section II. EQUIPMENT DESCRIPTION

1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a CHARACTERISTICS.

•Provides means for maintenance of Frequency Division Multiplex (FDM) systems.

• Allows for:

Testing message channels (voice and carrier).

Troubleshooting voice channel malfunctions.

Message channel voice traffic simulation.

RMS wideband power measurements.

Harmonic level and distortion analysis.

Testing of high frequency radio systems.

• Meets North American (Bell) Standards.

• Designed for bench top use.

b. CAPABILITIES AND FEATURES.

•Push button control allows for easy operation of equipment.

•Annunciator lights on front panel for constant equipment status.

•Nine digit LED for frequency display.

• Four digit LED for amplitude display.

•Self-test function for operational verification.

•Programmed interface for remote operation.

1-11. EQUIPMENT DATA.

WEIGHTS AND DIMENSIONS

Frequency selective level meter:

Weight	50LB (23Kg)
Length	18.38 IN. (466.7 MM)
Width	16.75 IN. (425.5 MM)
Height	7 IN. (177 MM)

BNC to BNC adapter:

Contact centers	1.750 IN. (44.5 MM)

POWER REQUIREMENTS

Voltage	100 to 240Vac (+5, -10%)
Frequency	48 to 66Hz
Power	150V/A
Fuse	2.0 Amp 115Vac operation
Fuse	1.0 Amp 240Vac operation

ENVIRONMENTAL

Operating temperature range	0 to +55° C
Storage temperature range	-40 to +75° c
Storage temperature range	40 to +75° c
Relative humidity	95% maximum
Operating altitude	15,000 feet
Storage altitude	50,000 feet

PERFORMANCE

Frequency range:

75Ω and unbalanced	50Hz to 32.5 MHz
124Ω balanced	4KHz to 10 MHz
135Ω balanced	4KHz to 1MHz
600Ω bridged	100Hz to 108 KHz

Frequency resolution	0.1HZ
Tuned frequency accuracy	±2 times 10^{-7}
Counter accuracy	±1.0Hz

Input connector type:

75 Ω	BNC female
124 Ω	WECO 372
135 Ω	WECO 241A
600 Ω	WECO 310

Return loss:

75Ω, , 50Hz to 32.5 MHz	30dB
124 Ω, 10 KHz to 10MHz	30dB
135 Ω, 10 KHz to 1MHz	30dB
600 Ω, 50Hz to 108 KHz	25dB

Balance:

124 Ω, 10KHz to 10MHz	30dB
135 Ω, 10 KHz to 1MHz	30dB
600 Ω, 50Hz to 108 KHz	25dB

Bandwidth selectivity . . . . . 20Hz, 400Hz, and 3100HZ

Carrier rejection:

20Hz . . . . . 30dB, ±45Hz, 60dB, ±90Hz
400Hz . . . . . 60dB,±1100Hz
3100HZ . . . . . 60dB, ±1850Hz

Adjacent charnel rejection, ±2850Hz, 3100Hz BW . . . . . 75dB minimum

Passband flatness:

20Hz . . . . . ±0.3dB at ±3Hz
400Hz . . . . . ±0.3dB at ±50Hz
3100HZ . . . . . ±0.3dB at 11000Hz

Amplitude measurement range . . . . . +25dBm to–120dBm

Amplitude resolution . . . . . ±0.1dB

Amplitude accuracy (–100dBm to +20dBm):

75Ω . . . . . ±0.95dB
124 Ω . . . . . ±1dB
135Ω . . . . . ±1dB
600 Ω . . . . . ±0.75dB

Spurious responses:

Image rejection (100 to 132MHz) . . . . . -80dBc
IF rejection (15625Hz) . . . . . -80dBc
Non–harmonic spurious signals (> 1600Hz offset) . . . . . -80dBc
Residual (>349Hz) . . . . . -115dBc

Distortion:

Harmonic (>4KHz) . . . . . 70dB below full scale
Intermodulation (>10MHz) . . . . . 70dB below full scale

Wideband power accuracy . . . . . ±2dB

Noise floor:

75 Ω, 100KHz to 32.5MHz, 3100HZ . . . . . -116dBm
75Ω, , 100KHz to 32.5MHz, 20Hz and 400Hz . . . . . -120dBm
75Ω and Ω, 600 2 KHz to 100KHz . . . . . -105dBm
124Ω, , 100KHz to 10MHz, 3100HZ 116dBm
124Ω, , 100KHz to 10MHz,20Hzand 400Hz . . . . . -120dBm
135Ω, , 100KHz to 1MHz, 3100HZ 116dBm
135Ω, , 100KHz to 1MHz,20Hz and 400Hz . . . . . -120dBm
All input impedance, 10KHz to 100 KHz . . . . . -105dBm

Demodulated audio output amplitude . . . . . 0dBm into 600 Ω

Tracking output:

Amplitude . . . . . 0dBm into 75 Ω at 10KHz, ±0.5dB
Flatness (200Hz to 32.5MHz) . . . . . ±0.5dB

Phase jitter:

Demodulated tone frequency . . . . . 960Hz to 1060Hz
Accuracy . . . . . ±(10% +0.5° p-p)
Input signal level . . . . . <30dB below full scale, –65dBm minimum
Residual phase jitter (50KHz to 32.5MHz) . . . . . <0.5° p-p
Frequency response . . . . . 20Hz to 300Hz

Weighted noise filter:

C-message 1004Hz
Accuracy ..... ±.5dB

Impulse noise counting rate ..... 143 ins/count ±5%

Threshold accuracy ..... ±1dB at 1700Hz

Notch filter rejection (995 to 1025Hz) ..... 50dB minimum

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-12. GENERAL FUNCTIONAL DESCRIPTION.

(Fig. 1-2). Frequency Selective Level Meter AN/USM-490 accepts signals from 50Hz to 32.5MHz and, dependent on the measurement mode selected, displays the desired results on the front panel. Signals are applied using one of the five impedance ranges and can be balanced, unbalanced or bridged.

The desired value is displayed as amplitude in the MEASUREMENT/ENTRY display/analog meter and frequency in the FREQUENCY/ENTRY display. Demodulated audio can be listened to using the front panel speaker or headphone jack.

(1) The input signal connected to the front panel is measured, then amplified or attenuated to a usable level. This 50Hz to 32.5MHz signal is then mixed with the first local oscillator frequency of from 50MHz to 82.5MHz. This mixing produces the first intermediate frequency of 50MHz.

A low pass filter keeps input frequencies greater than 32.5 MHz from being processed. This 50MHz intermediate frequency is amplified and passed to the IF/audio section.

When CAL is on and a calibration cycle occurs, the input signal is disconnected and a precise calibration signal from the calibration tracking section is mixed with the first local oscillator. This is then used to automatically check and adjust the Level Meter for operation within specified limits. Once the calibration cycle is completed, the input signal is reconnected and normal operation is resumed.

(2) The 50MHz intermediate frequency from the input section is passed to the IF/audio section where it goes through a 50MHz filter to bandpass to 10KHz. This 50MHz signal with 10 KHz wide bandpass is mixed with the second local oscillator frequency of 49.984375MHz to produce a second intermediate frequency of 15.625KHz. This 15.625 KHz signal with a 10KHz wide bandpass is amplified and split into two separate signals. One signal goes through a 400Hz filter. The result is one 15.625KHz, 400Hz wide bandpass signal and one 15.625KHz, 10KHz wide bandpass signal,

Depending on the front panel bandwidth selection, one of the 15.625KHz signals is passed or filtered, and then amplified. The desired selected bandwidth of 20Hz, 400Hz, or 3100Hz is then obtained.

The 15.625KHz signal with the desired 20Hz,400Hz or 3100Hz bandwidth is amplified and split three ways.

- The first path is to the digital section where the frequency of the input signal is determined.
- The second path is computed to an RMS voltage and passed to the digital section where the amplitude of the input signal is determined.
- The third path is to the impairments section for demodulating single sideband audio.

A voltage is developed for the front panel analog meter and to the rear panel METER output connector.

Audio from the impairments section is amplified and passed to the speaker. Detected audio also goes to the rear panel AUDIO connector.

(3) The digital section monitors most functions in the Level Meter. This includes processing data, front panel display changes, monitors circuit card operation, handles all front panel operator entries, performs calibration, and diagnostic tests. It also contains all the front panel displays, annunciators and switches necessary for operation.

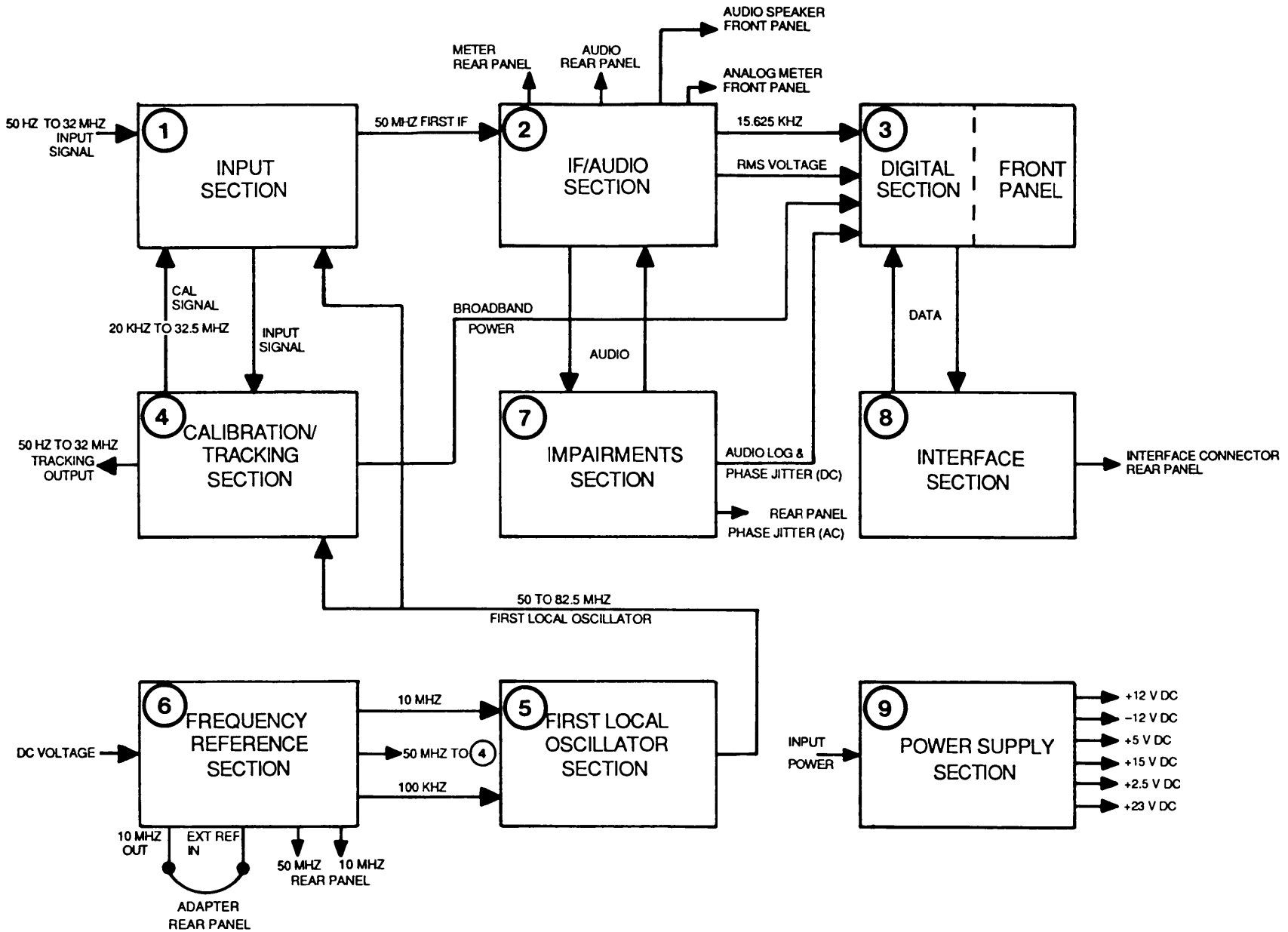


Figure 1-2. Frequency Selective Level Meter AN/USM-490 Simplified Block Diagram

One of the outputs from the IF/audio section is compared to the first local oscillator frequency and the input frequency is calculated. The other is a RMS voltage that is processed and the amplitude of the input signal is calculated. These values are then sent to the front panel and shown as frequency and amplitude in the appropriate display.

The front panel keyboard and frequency fine tune knob entries are processed in the digital section and passed to the appropriate assembly for processing. The status of the assemblies is returned to the digital section for corrective action or operator notification. This notification is in the form of error codes and annunciator lights on the front panel.

The digital section contains the stored software necessary to execute the diagnostic tests and calibration cycle. A memory is also available for store/recall of nine different front panel configurations.

4 The first local oscillator frequency of from 50 to 8.25 MHz is mixed with 50MHz from the frequency reference section to produce a 0 to 32.5 MHz signal. This signal matches the tuned frequency on the front panel display. The 0 to 32.5MHz signal is amplified and split two ways.

- The first path is to the rear panel BNC connector marked Fo.
- The second path is used to generate the calibration output signal of from 20KHz to 32.5MHz. When calibration is activated, this signal goes to the input section.

When wideband mode is selected, the average broadband power present on the input signal is measured, and goes to the digital section for display on the front panel.

The input signal is monitored for correct amplitude and if incorrect, sends an overload or underload message to the digital section.

5 The first local oscillator generates a frequency of from 50MHz to 82.5MHz. This frequency is exactly 50MHz higher than the tuned frequency displayed on the front panel. The input to the first local oscillator is a precise 10MHz and 100KHz signal from the frequency reference section.

6 The first part of the frequency reference section uses DC voltage to generate a stable, accurate 10MHz signal. This signal is either:

- Coupled to internal circuits using a rear panel adapter.
- Not used. If not used, a stable external source of 5MHz, 3.333333MHz, 2.5MHz, 2MHz or 1MHz must be used.

The second part of the frequency reference section generates a 5MHz signal. This 50 MHz is divided and amplified to generate the required operating frequencies of 50MHz, 10MHZ, 2MHz, 1MHz and 100KHz. These signals are then used in various internal operations of the Level Meter.

7 The impairments uses the single sideband demodulated output from the IF/audio section. A DC phase jitter output is generated and passed to the digital section for display on the front panel. An AC phase jitter output is provided on the rear panel.

When C-message 3100Hz is selected, the single sideband demodulated audio is applied to a weighted filter to measure noise.

When NOISE/TONE is selected, the single sideband demodulated audio is applied to a notch filter to remove the 1004Hz tone.

When all other modes, except impulse, are selected, the single sideband demodulated audio bypasses the filters.

When IMPULSE is selected, the single sideband demodulated audio is passed to the weighted filter, if selected and then to the notch filter. The noise is then compared to the threshold level set by the operator. Any impulse noise spike that exceeds the threshold level is counted and passed to the digital section for display on the front panel.

The interface section accepts data or instructions from the rear panel connector and sends it to the digital section for processing. It also accepts data from the digital section and sends it to the rear panel connector for use by other instruments.

The power supply uses the 100 to 240VAC input power, and supplies all operating voltages to the internal circuitry of the Level Meter. These include + 12VDC, –12VDC, +5VDC, +15VDC, +2.5VDC, and +23VDC.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS

2-1. INTRODUCTION.

This section describes all of the operator controls and indicators for the Level Meter. Due to the large number of controls and indicators on the front panel, it is necessary to separate the panel into five different portions. Figure 2-1 (views A thru E) shows each portion of the front panel. The rear panel is shown in figure 2-2.

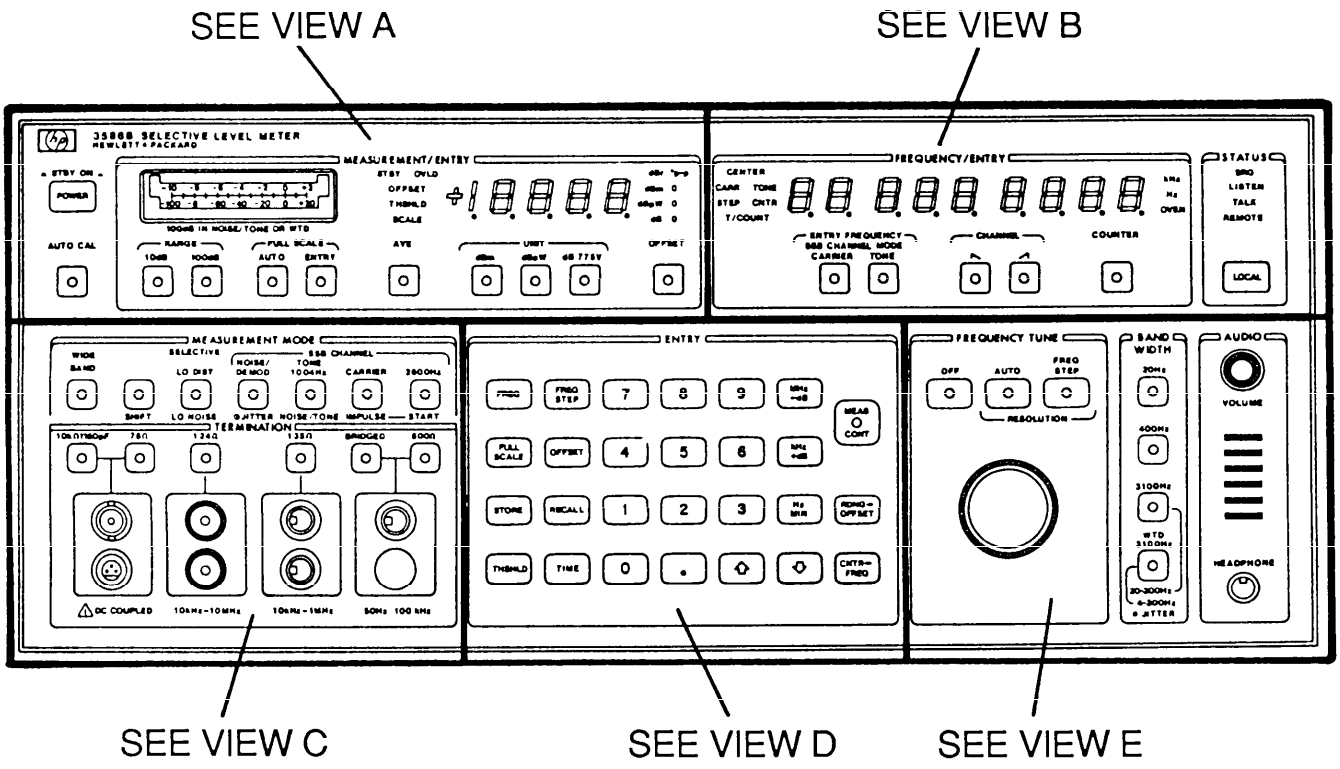
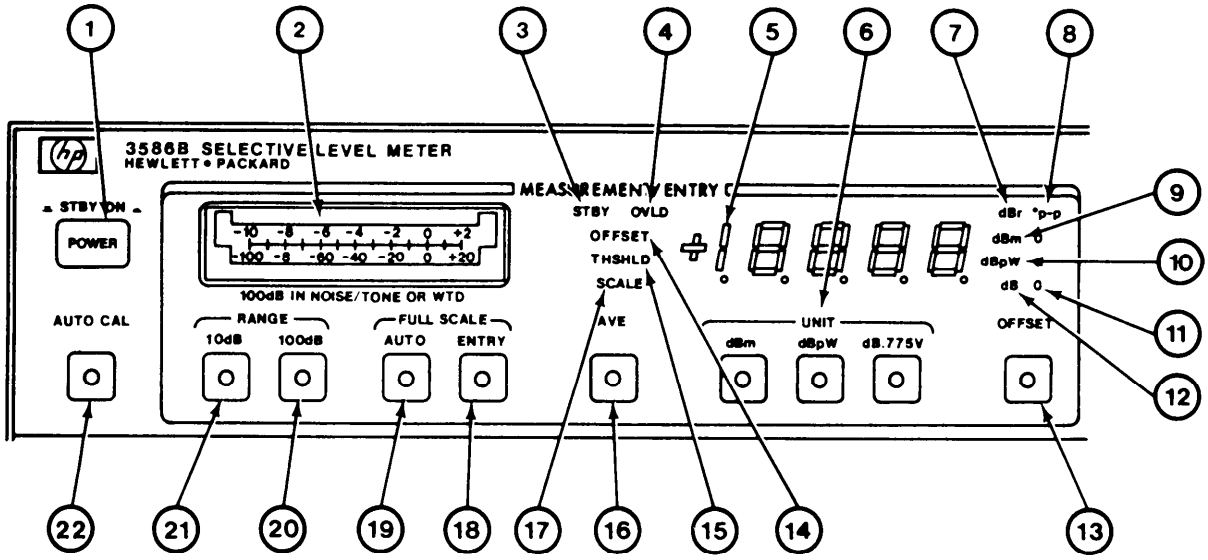


Figure 2-1. Operator's Controls, Indicators, and Connectors, front view.

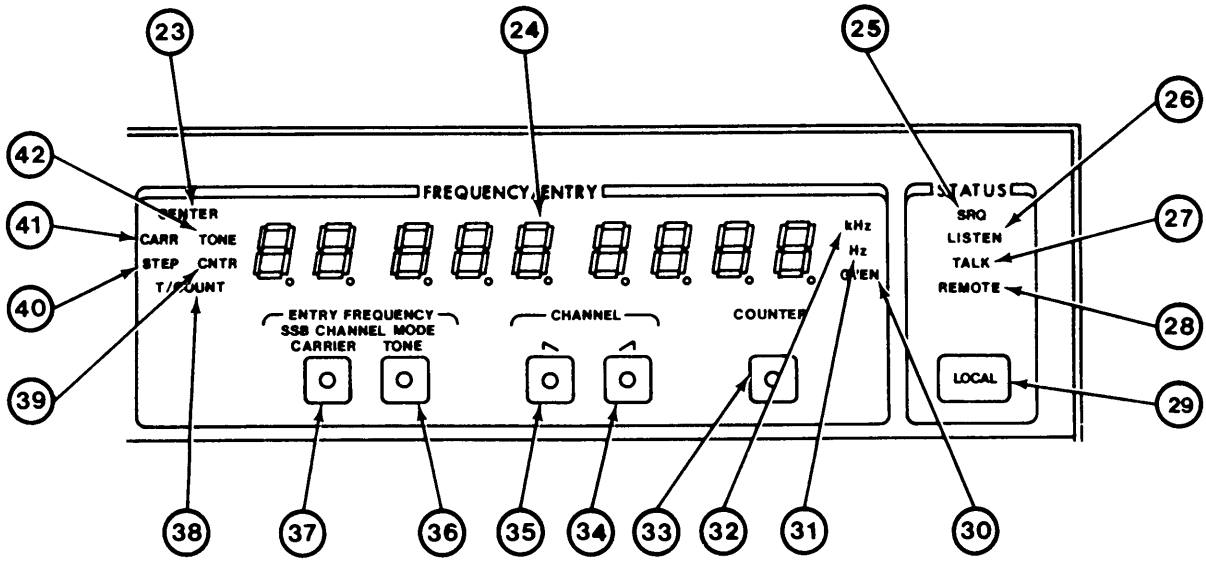


VIEW A

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	POWER switch	Changes Level Meter from standby to on. Push in for on and push in again for standby.
2	Analog meter	Indicates strength of signal being measured. Sensitivity is controlled by full scale setting. Meter scale is determined by range selection. Top scale is 10dB and bottom scale is –100dB.
3	STBY indicator	Indicates Level Meter is in standby mode when on.
4	OVLD indicator	Flashes if input signal power level is too high. When flashing, Level Meter is overloaded and will not measure input signal. In entry full scale, full scale level must be increased. In auto, full scale is automatically adjusted and indicator will flash briefly during autoranging.
5	MEASUREMENT/ENTRY	Displays power level of input signal being measured. Also displays entry levels for offset, full scale, and threshold along with error messages; calibration messages; and underload or overload conditions.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
6	UNIT push buttons	Selects unit of measurement for input signal. Selections are limited to dBm, dBpw, and dB.775V. OdBm reference level is one miliwatt dissipated at the input impedance selected. OdBpw reference level is one picowatt dissipated at the input impedance selected. OdB.775V reference level is 0.775 volts. Lights in push buttons indicate selection in use.
7	dBr indicator	Unit of measurement for offset. When on, indicates MEASUREMENT/ENTRY is displaying offset.
8	°p-p indicator	Unit of measurement for phase jitter. When on, indicates MEASUREMENT/ENTRY is displaying phase jitter in degrees peak to peak. For use with phase jitter measurements only.
9	dBm indicator	Unit of measurement for all modes. When on, indicates MEASUREMENT/ENTRY is displaying in dBm. Works with dBm push button.
10	dBpW indicator	Unit of measurement for all modes. When on, indicates MEASUREMENT/ENTRY is displaying in dBpW. Works with dBpW push button.
11	O indicator	Indicates value in MEASUREMENT/ENTRY display is offset. Works with OFFSET push button.
12	dB indicator	Unit of measurement for all modes. When on, indicates MEASUREMENT/ENTRY is displaying in dB. Works with dB.775V push button.
13	OFFSET push button	Subtracts stored offset from input signal power level. Zero is subtracted if no value is stored in offset. MEASUREMENT/ENTRY displays result. When in use, O indicator opposite unit of measure indicator lights and push button lights. Push for on and push again for off.
14	OFFSET indicator	Indicates Level Meter is ready to store an offset value. MEASUREMENT/ENTRY displays value. Lights when offset is used.
15	THSHLD indicator	Indicates Level Meter is ready to store a threshold value. MEASUREMENT/ENTRY displays value. Lights when threshold is used.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
16	AVE push button	Five level measurements of the input signal power level are taken and then averaged. Analog meter or MEASUREMENT/ENTRY then displays new value. Used when readings in the measurement display and analog meter are erratic. When in use, push button lights. Push for on and push again for off.
17	SCALE indicator	Indicates Level Meter is ready to store a full scale value. MEASUREMENT/ENTRY displays value. Lights when full scale is used.
18	ENTRY push button	Used to manually enter full scale value. Value entered must be higher than the input signal level or an overload will exist. When in use, push button lights, Push for on.
19	AUTO push button	Tells Level Meter to automatically select full scale value for best signal to noise ratio without overloading. When required, Level Meter will autorange to find new full scale value. When in use, push button lights. Push for on.
20	100dB push button	Selects entire Level Meter operating range (80dB) for use in input signal detection. Any signal level between full scale and 80dB below full scale can be measured. Use 100dB scale on analog meter when selected. MEASUREMENT/ENTRY resolution is 0.1dB. When in use, push button lights. Push for on.
21	10dB push button	Selects most linear 10dB region of Level Meter operating range (80dB) for use in detection of input signals. Any signal level between full scale and 10dB below full scale can be measured. Use 10dB scale on analog meter when selected. MEASUREMENT/ENTRY resolution is 0.01dB. This selection cannot be used in wideband and impulse measurement modes. When in use, push button lights. Push for on.
22	AUTO CAL push button	Tells Level Meter to automatically calibrate all ranges and bandwidths of the internal circuitry. When off, the data stored during the last calibration is used to correct the signal being measured. Inoperable in phase jitter and impulse measurement modes. When in use, push button lights. Push for on and push - again for off.

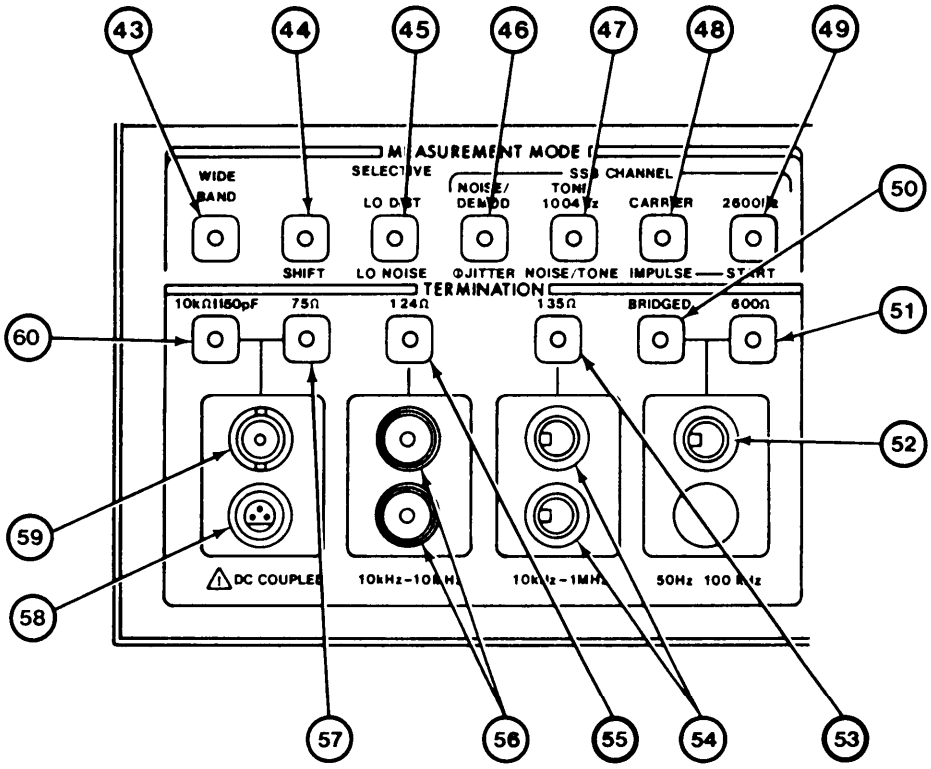


VIEW B

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
23	CENTER indicator	Indicates Level Meter is in selective measurement mode. FREQUENCY/ENTRY display shows center frequency of Level Meter bandwidth. Works with LO DIST or LO NOISE push buttons.
24	FREQUENCY/ENTRY	Displays frequency of input signal being measured. Also displays frequency, frequency steps, time and counts along with operator messages.
25	SRQ indicator	Used only when external device is connected to Level Meter. When on, one or more external devices connected to Level Meter are requesting attention.
26	LISTEN indicator	Used only when external device is connected to Level Meter. When on, the Level Meter can receive data.
27	TALK indicator	Used only when external device is connected to Level Meter. When on, Level Meter can send data.
28	REMOTE indicator	Used only when external device is connected to Level Meter. When on, Level Meter can be controlled from a remote location.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
29	LOCAL push button	Used only when external device is connected to Level Meter. When used, Level Meter is switched to remote operation and REMOTE indicator will come on. All front panel controls except volume, power and local are disabled. Push for on and push again for off. If local is pressed and Level Meter not set up for remote operation, FREQUENCY/ENTRY will display digital address "addr=XX".
30	OVEN indicator	Indicates frequency reference oven is cold and its output is disabled. Comes on when oven is cold and goes out when oven reaches operating temperature.
31	Hz indicator	Unit of measurement for all modes. When on, FREQUENCY/ENTRY is displaying in hertz.
32	kHz indicator	Unit of measurement for all modes. When on, FREQUENCY/ENTRY is displaying in kilohertz.
33	COUNTER push button	Used to display strongest single frequency signal within Level Meter bandpass. Appropriate Hz or KHz indicator lights. Display fills with dashes if input signal level is too low to count. When in use, push button lights. Push for on and push again for off.
34	⟋ push button	Used only when measuring telecommunication signals. Allows Level Meter to receive upper sideband signals. When in use, push button lights. Push for on.
35	⟍ push button	Used only when measuring telecommunication signals. Allows Level Meter to receive lower sideband signals. When in use, push button lights. Push for on.
36	TONE push button	Used to fine tune Level Meter to telecommunication signals. RF frequency of a 1004Hz test tone is entered and shown. When in use, push button lights. Push for on.
37	CARRIER push button	Used to fine tune Level Meter to telecommunication signals. RF frequency of carrier is entered and shown. When in use, push button lights, Push for on.
38	T/COUNT indicator	Indicates Level Meter will accept a time in minutes and seconds for impulse duration. Works with TIME push button.
39	CNTR indicator	Indicates FREQUENCY/ENTRY is displaying measured input signal frequency.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
40	STEP indicator	Indicates Level Meter is readyto store frequency step interval value. Works with FREQ STEP push button.
41	CARR indicator	Indicates Level Meter single sideband channel mode entry frequency is set to carrier. Works with CARRIER push button.
42	TONE indicator	Indicates Level Meter single sideband channel mode entry frequency is set to tone. Works with TONE push button.

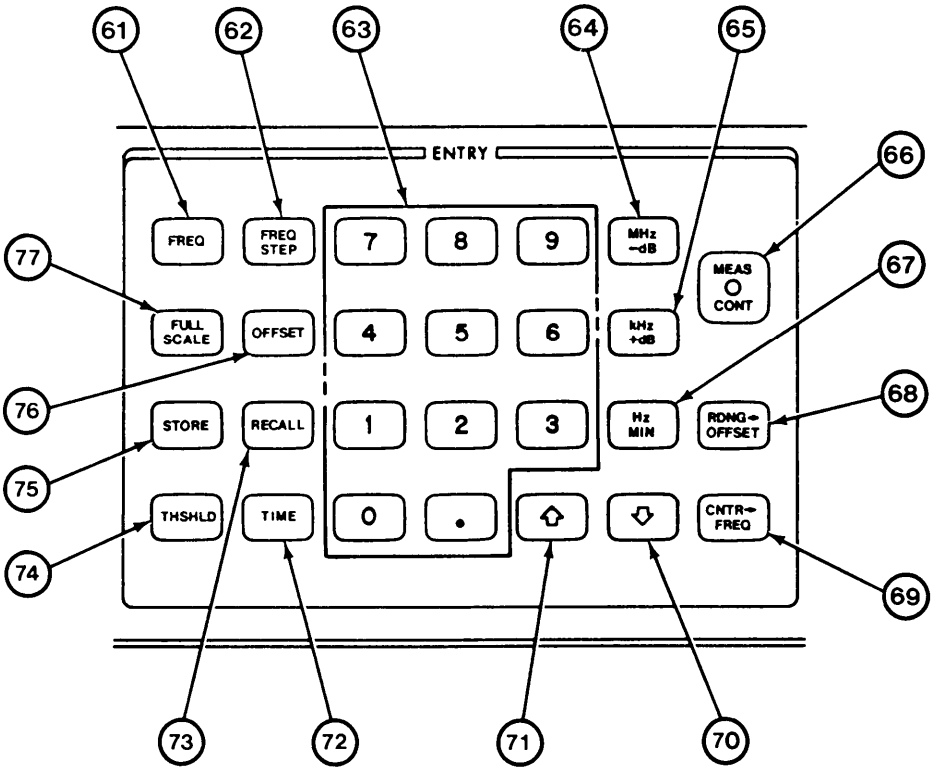


VIEW C

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
43	WIDEBAND push button	Used to measure total input signal power level. When selected, all frequency related controls are inoperative. When in use, push button lights. Push for on. See paragraph 2-12 for additional information.
44	SHIFT push button	Selects MEASUREMENT MODE group push button functions. When in use, push button lights and LO NOISE, Ø JITTER, NOISE/TONE, IMPULSE, and START push buttons can be used. Push for on and push again for off.
45A	LO DIST push button	Used for selective level measurement of non-telecommunication signals. When in use, push button lights. Push for on. See paragraph 2-10 for additional information.
45B	LO NOISE push button	Used for selective level measurement of signals spread across bandwidth. When in use, SHIFT push button is on and LO NOISE push button lights. Push for cm. See paragraph 2-11 for additional information.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
46A	NOISE/DEMOD push button	Used for monitoring telecommunication signals or measuring noise levels on telecommunication signal message channels. When in use, push button lights. Push for on. See paragraph 2-13 for additional information.
46B	Ø JITTER push button	Used to measure phase jitter of 1004HZ test tone on telecommunication signal message channels. When in use, SHIFT push button is on and Ø JITTER push button lights. Push for on. See paragraph 2-14 for additional information.
47A	TONE 1004Hz push button	Used to measure test tone level of telecommunication signals. When in use, push button lights. Push for on. See paragraph 2-15 for additional information.
47B	NOISE/TONE push button	Used to measure noise levels in presence of 1004Hz test tone on telecommunication signal message channels. When in use, SHIFT push button is on and NOISE/TONE push button lights. Push for on. See paragraph 2-16 for additional information.
48A	CARRIER push button	Used to measure telecommunication carrier leak signals. When in use, push button lights. Push for on. See paragraph 2-17 for additional information.
48B	IMPULSE push button	Used to count telecommunication signal message channel noise spikes. When in use, SHIFT push button is on and IMPULSE push button lights. Push for on. See paragraph 2-18 for additional information.
49A	2600Hz push button	Used to measure telecommunication signaling tones. When in use, push button lights. Push for on. See paragraph 2-15 for additional information.
49B	START push button	Used with impulse to start counting noise spikes. When in use, SHIFT and IMPULSE push buttons are on but START push button does not light when pushed. Push for on.
50	BRIDGED push button	Used to select balanced 600 Ω input for 600 Ω connector. Termination impedance is 10KΩ shunted by 50pF. When in use, push button lights. Push for on.
51	600Ω push button	Used to select balanced floating input for 600Ω connector. Termination impedance is 600Ω. . When in use, push button lights. Push for on.
52	600Ω connectors	Used to connect bridged or 600Ω source to Level Meter when 600 Ω termination impedance is required. Connector mates with WECO type 310 plug.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
53	135Ω push button	Used to select balanced input for both 135Ω connectors. Termination impedance is 135Ω. When in use, push button lights. Push for on.
54	135Ω connectors	Used to connect source to Level Meter when 135Ω termination impedance is required. Connector mates with WECO type 241 A plug.
55	124Ω push button	Used to select balanced input for both 124Ω connectors. Termination impedance is 124Ω. When in use, push button lights. Push for on.
56	124 Ω connectors	Used to connect source to Level Meter when 124Ω termination impedance is required. Connector mates with WECO type 372A plug.
57	75Ω push button	Used to select unbalanced input for 75Ω connector. Termination impedance is 75Ω. When in use, push button lights. Push for on.
58	Probe Power connector	Used to supply power for active probes. Mates with probe plug.
59	75Ω connector	Used to connect source to Level Meter when 75Ω termination impedance is required. Mates with BNC plug. Frequency from 50Hz to 32.5MHz.
60	10k‖50pF push button	Used to select unbalanced input for 75Ω connector. Termination impedance is 10KΩ shunted by 50pF. When in use, push button lights. Push for on.

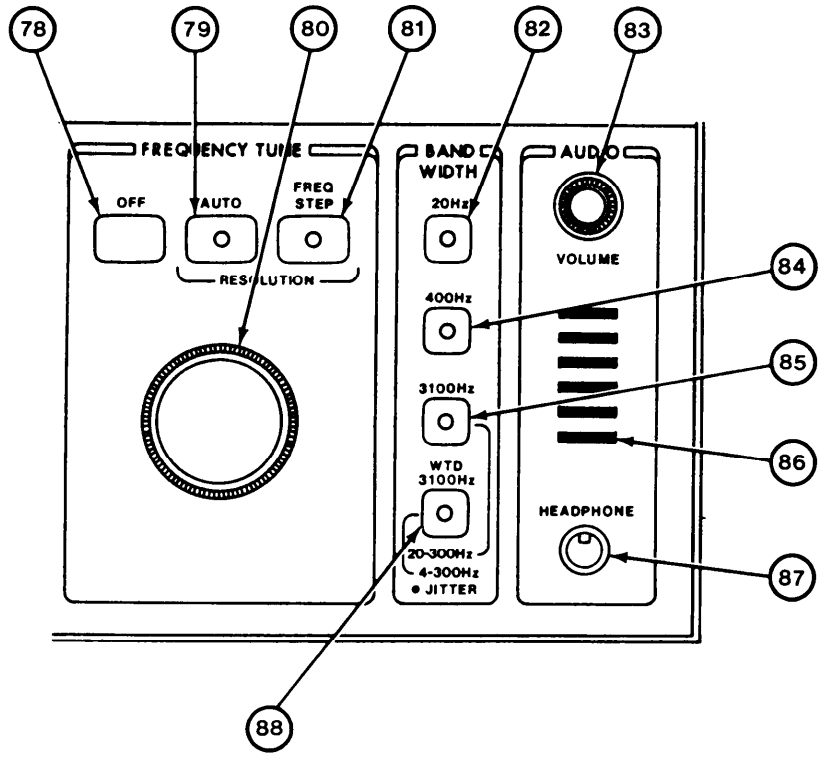


VIEW D

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
61	FREQ push button	Used to store, raise, lower, or display Level Meter tuned frequency. Push to display present value, and if desired, enter new value from 50Hz to 32.5MHz using numeric keys and appropriate Hz, KHz or MHz key.
62	FREQ STEP push button	Used to store, raise, lower, or display Level Meter step value. Push to display present value, and if desired, enter new value from 50Hz to 32.5 MHz using numeric keys and appropriate Hz, KHz or MHz key.
63	Numeric keys	Used to enter numeric value with decimal point for frequency, frequency step, full scale, offset, threshold and time. Push desired key.
64	MHz -dB push button	Used to terminate entries from numeric keys. Frequency and frequency step are assigned MHz. Full scale, offset, and threshold are assigned -dB. Push for on.
65	KHz +dB push button	Used to terminate entries from numeric keys. Frequency and frequency step are assigned KHz. Full scale, offset, and threshold are assigned +dB. Push for on.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
66	MEAS CONT push button	Used to control measurement sequence. After value has been entered and displayed, push button flashes until pushed.
67	Hz MIN push button	Used to terminate entries from numeric keys. Frequency and frequency step are assigned Hz. Time is assigned minutes. Push for on.
68	RDNG-> OFFSET push	Used to store value shown in MEASUREMENT/ENTRY display as new offset in Level Meter. Push for on,
69	CNTR-> FREQ push button	Used to fine tune Level Meter to value shown in FREQUENCY/ENTRY display. Used only when counter is on. Push for on.
70	⇩ push button	Used to lower values each time push button is pushed. Frequency step, threshold, and time are lowered by one; full scale is lowered by five; frequency step is lowered by power of two; and frequency is lowered by frequency step value stored in Level Meter. Push for on.
71	⇧push button	Used to raise values each time push button is pushed. Frequency step, threshold, and time are raised by one; full scale is raised by five; frequency step is raised by power of two; and frequency is raised by frequency step value stored in Level Meter. Push for on.
72	TIME push button	Used to enter, raise, lower, or display duration of an impulse noise measurement. Press to display present value, and if desired, enter a new value from O to 99 minutes 59 seconds using the numeric keys and MIN. Format is minutes, decimal point seconds.
73	RECALL push button	Used to recall Level Meter front panel measurement setup. Push for on.
74	THSHLD push button	Used to enter, raise, lower, or display the minimum level of noise spikes used for impulse noise measurement. Spikes present below this level will not be counted, Press to display present value, and if desired, enter a new value from –116dBm to +28dBm using the numeric keys and -dB or +dB.
75	STORE push button	Used to store Level Meter front panel measurement setup. Push for on.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
76	OFFSET push button	Used to enter, raise, lower, or display offset value stored in Level Meter. Press to display present value, and if desired, enter anew value from -199.99dB to + 199.99dB using the numeric keys and -dB or +dB. New value can be stored with offset on or off.
77	FULL SCALE push button	Used to enter, raise, lower, or display full scale value stored in Level Meter. Press to display present value, and if desired, enter a new value using the numeric keys and -dB or +dB. New value can be from -45dB to +25dB in 5dB steps for 100dB range and from –120dB to +25dB in 5dB steps for 10dB range.



VIEW E

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
78	OFF push button	Used to disable frequency tune knob. Push for off.
79	AUTO push button	Used to vary frequency tune resolution based on bandwidth selection. Frequency steps are 100Hz for 3100Hz bandwidth, 20Hz for 400Hz bandwidth, and 1Hz for 20Hz bandwidth for 100dB range. Frequency steps are 20Hz for 3 100Hz bandwidth, 4Hz for 400Hz bandwidth, and .2Hz for 20Hz bandwidth for 10dB range. When in use, push button lights. Push for on.
80	FREQUENCY TUNE knob	Used to vary frequency shown in FREQUENCY/ENTRY display. Clockwise rotation raises frequent y and counterclockwise rotation lowers frequency. Step size determined by value stored in FREQ STEP or bandwidth selected in AUTO.
81	FREQ STEP push button	Used to vary frequency tune resolution based on frequency step value stored in Level Meter. When in use, push button lights. Push for on.
82	20Hz push button	Used to measure 20Hz section of input signal. When in use, push button lights. Push for on.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
83	VOLUME knob	Used to vary audio level to speaker and headphone jack. Clockwise rotation raises volume and counterclockwise rotation lowers volume.
84	400Hz push button	Used to measure 400Hz section of input signal. When in use, push button lights. Push for on.
85	3100Hz push button	Used to measure 3100Hz section of input signal. When Ø Jitter on, measures 20Hz to 300Hz. When in use, push button lights. Push for on.
86	Loudspeaker	Used for audio monitoring of input signals or impairment measurements.
87	Headphone connector	Used to audio monitoring of input signals or impairment measurements through headphones. Output impedance is 600Ω and output power is 0dBm. Connector mates with 1/4" phone plug.
88	WTD 3100Hz push button	Used to measure noise in 3100Hz section of input signal on telephone message channels. When making phase jitter measurements, bandwidth is 4Hz to 300Hz. When in use, push button lights. Push for on.

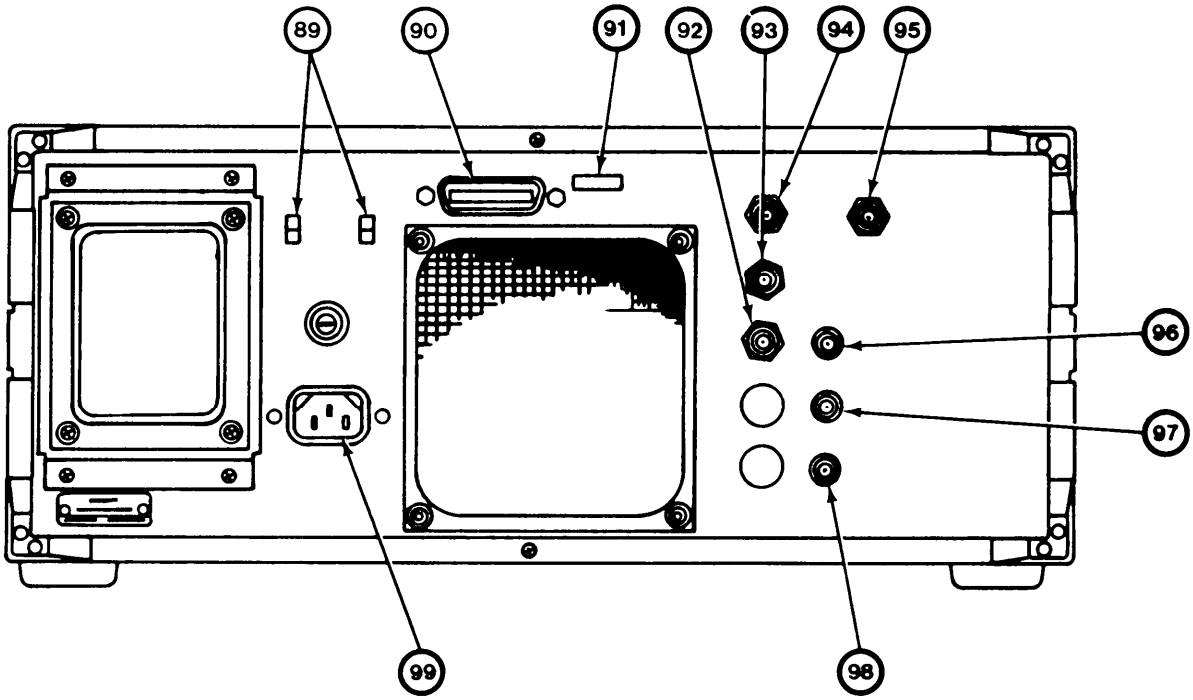


Figure 2-2. Operator's Controls, Indicators, and Connectors, rear view.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
89	Line voltage switch	Used to select 100, 120, 220, or 240 volt operation. Two two-position switches. Up-up for 100Vac operation, up-down for 120Vac operation, down-up for 220Vac operation, and down-down for 240Vac operation.
90	Interface connector	Input and output connector for all external devices. Connector has 24 pins with metric posts.
91	Interface control switch	Used to select tracking generator operating mode and address of AN/USM-490. Seven-position DIP switch. Position one is interface troubleshooting test. Position two sets tracking generator operating mode. Positions three thru seven are for address settings.
92	Fo (0-32MHz) connector	Used for network analysis. Output frequency is 0 to 32.5 MHz and tracks the front panel displayed frequency. Output power is 0dBm and impedance is 75Ω. Leave open for normal use. Connector mates with BNC plug.
93	10MHZ connector	[1] Used for a signal reference to synchronize external devices to Level Meter frequency reference. Output power is +8dBm at 50Ω. Leave open for normal operation. Connector mates with BNC plug.

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
94	10 MHz oven connector	Provides a long-term, high stability frequency reference for Level Meter. Connect to EXT REF 10MHz+N connector with BNC to BNC adapter (supplied) for normal operation. Connector makes with BNC plug.
95	EXT REF 10MHz+N connector	Used to connect 10MHz external reference to Level Meter. Input power can be no less than - 10dBm. Connect to 10MHz oven connector with BNC to BNC adapter (supplied) for normal operation. Connector mates with BNC plug.
96	Meter connector	Connection providing MEASUREMENT/ENTRY display reading in DC voltage. Sensitivity is 100mv/dB on the 10dB range and 10mv/dB on the 100dB range. Leave open for normal use. Connector mates with BNC plug.
97	Audio connector	Used for impairment measurements. Output level is nominally 750mV p-p. Output impedance is 1,000Ω.. Leave open for normal operation. Connector mates with BNC plug.
98	Phase jitter connector	Used for additional analysis of phase jitter signal. Sensitivity is 166mv per degree of phase jitter. Output impedance is 10,000Ω. Leave open for normal operation. Connector mates with BNC plug.
99	Power input connector	Connector for line voltage power cable (supplied). Connector mates with CEE 22 plug.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2-2. GENERAL.

To be sure that your equipment is always ready for your mission, you must do scheduled preventive maintenance checks and services (PMCS). When you are doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS about electrical shock and bodily harm.

2-3. PMCS PROCEDURES.

a. Tools, Materials, and Equipment Required for Preventive Maintenance. No tools or equipment are required for operator preventive maintenance. Cleaning materials required are listed in Appendix E, items 1 and 2.

b. PMCS for Level Meter is limited to routine checks such as shown below.

- cleaning,
- dusting,
- wiping,
- checking for frayed cables,
- storing items not in use,
- covering unused receptacles,
- checking for loose nuts, bolts, and screws.

c. Perform these routine checks anytime you see they must be done.

Section III. OPERATION UNDER USUAL CONDITIONS

2-4. GENERAL.

Operation is broken down into ten individual operating procedures. Before measurement of a specific signal can be made, the operator must determine which of the ten operation modes will perform the desired measurement. Table 2-3 is a cross-reference of the Level Meter measurement mode to the type of signal to be measured. Error messages encountered during operation will be displayed in the measurement/entry area. Table 2-2 lists all operator errors and the probable cause.

2-5. PREPARATION FOR USE.

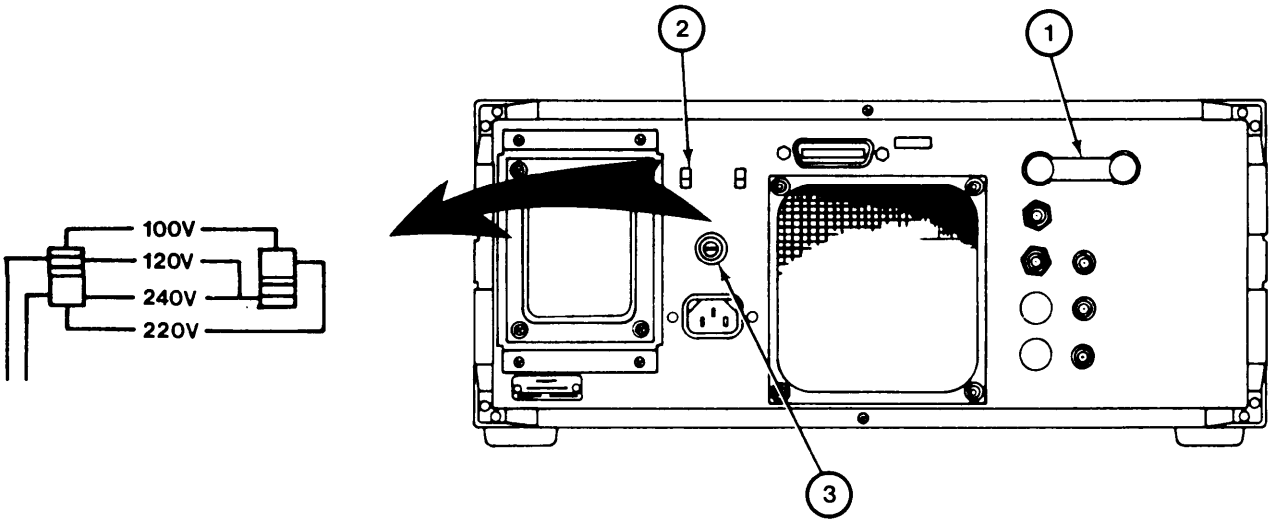
a. Connect the BNC adapter (1) to the 10MHz OVEN output and EXT REF 10MHZ input connectors on the rear panel.

b. Locate line voltage switch (2) on rear panel of Level Meter. Verify line voltage switch and fuse size are correct for your power source (table 2-1).

Table 2-1. Line Voltage Switch Settings and Fuse Size.

Input Voltage	Switch Position	Fuse
90 to 105	UP UP	2 amp
108 to 126	UP DOWN	2 amp
198 to 231	DOWN UP	1 amp
216t0252	DOWN DOWN	1 amp

c. Check fuse (3) to see if it is missing, broken, or appears to be blown. If fuse is missing, broken, or appears to be blown, contact organizational maintenance.

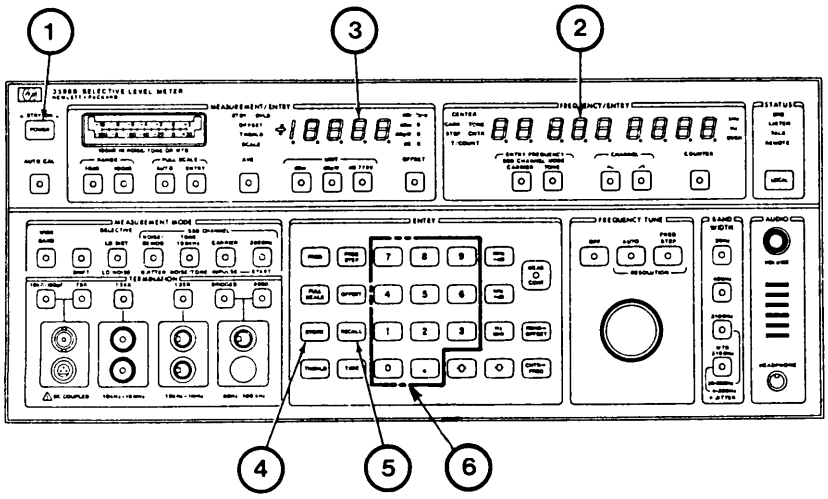


2-6. TURN-ON PROCEDURES.

a. With the power cable connected to the rear panel power input connector, verify that the STBY light is illuminated.

b. Push the POWER BUTTON (1) in and release. Verify that the button remains in and that all front panel controls and indicators illuminate for approximately two seconds and then go blank. Verify that the fan on the rear panel is operating.

c. Verify that the FREQUENCY/ENTRY (2) displays “3586 b OP”. The MEASUREMENT ENTRY (3) display will cycle an AUTO CALIBRATION. It will display “CAL”. Verify that after the calibration cycle completes, no errors are present in the MEASUREMENT/ENTRY display, If an error is displayed, “CE”, “E” or “Err” followed by a number, see table 2-2 for probable cause.



d. Verify the following condition exists on the Level Meter front panel:

MEASUREMENT/ENTRY display	*ON*
FREQUENCY/ENTRY display	*ON*
CENTER indicator	*ON*
KHz indicator	*ON*
AUTO CAL push button	*ON*
10dB push button	*ON*
AUTO push button	*ON*
dBm push button	*ON*
CARRIER push button	*ON*
HIGHER push button	*ON*
LO DIST push button	*ON*
10k Ω shunted by 50pF push button	*ON*
3100Hz push button	*ON*
All other controls and indicators	*OFF*

e. If the above condition is obtained and no errors are displayed, the Level Meter is ready for use in one of the ten measurement modes (table 2-3).

NOTE

If the power cable has been disconnected for a period of time, the OVEN indicator will be illuminated for approximately 20 minutes. Do NOT operate the Level Meter with the OVEN indicator on. The measurements obtained will not be within specification.

2-7. STORE/RECALL PROCEDURES.

Up to nine front panel control settings and entry parameters can be stored for recall at a later date as follows:

1. To store a set-up:
   - Press the STORE (4) push button and the desired number from 1 to 9 using the numeric key board (6). The number selected will flash in the MEASUREMENT/ENTRY display. If a set-up was previously stored at the location selected (1-9), it will be erased and the new set-up will be stored.
2. To recall a set-up:
   - Press the RECALL (5) push button and the desired number from 1 to 9 using the numeric key board (6). The set-up previously stored at that location will display.
3. To reset the Level Meter to the turn-on condition:
   - Press RECALL (5), and then O (6).

2-8. ERROR MESSAGES.

Some operator actions and Level Meter failures cause error messages to appear in the MEASUREMENT/ENTRY display. See table 2-2 for a list of error messages and probable cause.

NOTE

If an error appears that is not listed in table 2-2, notify next higher level of maintenance.

Table 2-2. Error Messages.

ERROR	PROBABLE CAUSE	CORRECTIVE ACTION
Err 1	The FULL SCALE level cannot be changed by the operator while the Level Meter is in AUTOMATIC FULL SCALE.	Press MEAS CONT, then ENTRY push buttons.
E 1.2	The 10dB range cannot be used when the Level Meter is set up in the WIDEBAND or IMPULSE measurement modes.	Press MEAS CONT push button.
E 2.2	Ø Jitter cannot be measured because the signal level is 40dB or more below full scale in entry.	Select AUTO then 10dB RANGE.
E 2.3	Ø Jitter cannot be measured because the 1 KHz test tone is not present due to improper test setup.	Correct test setup.
E 2.9	0 Jitter is out of range.	Verify test setup. If correct, notify next higher level of maintenance.
Err 3	Level Meter failure.	Notify next higher level of maintenance.
E4.1	Level Meter failure.	Notify next higher level of maintenance.
E 4.2	Level Meter failure.	Notify next higher level of maintenance.
Err 5	The Level Meter is in REMOTE operation and will not respond to front panel controls.	Verify test setup. If correct, notify next higher level of maintenance.
E 6.1	Accurate impulse measurements are unlikely because the THSHLD level is 56dB or more below full scale.	Press MEAS CONT push button. Increase THSHLD level or decrease Full Scale.
E 6.2	The THSHLD level is more than 3dB above full scale.	Press MEAS CONT push button. Decrease THSHLD level or increase Full Scale.
Err 7	Level Meter failure.	Notify next higher level of maintenance.
CE-1 to 9	Level Meter failure.	Notify next higher level of maintenance.

2-9. OPERATING PROCEDURES.

The operating procedures for the Level Meter are broken down into ten individual measurement modes. See table 2-3 for the measurement mode required to perform the desired signal measurement.

NOTE

If a signal has been measured in any one operational mode listed, the Level Meter can be switched to another measurement mode without having to coarse or fine tune to the input signal.

Table 2-3. Level Meter Measurement Mode Index.

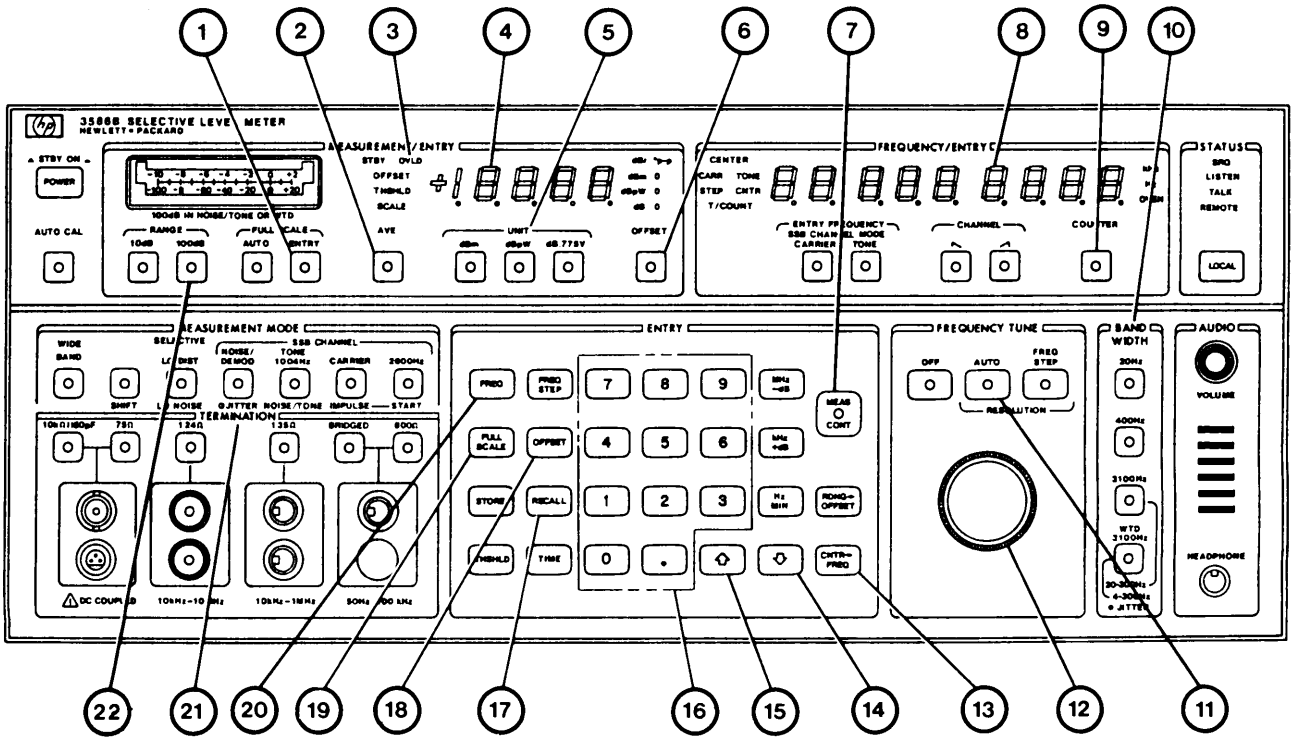
TYPE OF SIGNAL MEASUREMENT	LEVEL METER MEASUREMENT MODE
Non-telecommunication signals. Provides the best overall performance for measuring signals other than telecommunication.	LO DISTORTION (para 2-10).
Non-telecommunication signals. Provides best performance for measuring low level components of high level signals.	LO NOISE (para 2-11).
Any input signal from 50Hz to 32.5MHz. Measures only total power of an input signal.	WIDEBAND (para 2-12).
Telecommunication signals. Measures idle message channel noise or translates message channel signals to voice frequencies for monitoring or for audio output.	NOISE/DEMODULATION (para 2-13).
Telecommunication signals. Measures incidental phase modulation of 1lKHz tones on message channels.	PHASE JITTER (para 2-14).
Telecommunication signals. Measures the 1004Hz signal on a message channel. Can be used with NOISE/TONE for signal to noise ratio on a message channel.	TONE 1004Hz (para 2-15).
Telecommunication signals. Measures noise on a message channel. Removes 1004Hz signal component from message channel. Can be used with TONE 1004Hz for signal to noise ratio on a message channel.	NOISE/TONE (para 2-16).
Telecommunication signals. Measures carrier leak signals or pilot tones.	CARRIER (para 2-17).
Telecommunication signals. Measures noise spikes on message channels.	IMPULSE (para 2-18).
Telecommunication signals. Measures the 2600Hz signal on a message channel. The 2600Hz tone indicates an idle message channel.	2600Hz (para 2-15).
Measures the insertion loss of cables and other connection devices used in any given testing hook-up.	NETWORK ANALYSIS (para 2-19).

2-10. LOW DISTORTION MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (17) then number 0 (16) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMINATION (21).

CAUTION

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124Ω or 135 Ω input may be used at one time.

3. On Level Meter, select desired UNIT of measurement (5).

4. If an OFFSET is required,
   - Press OFFSET (18).
   - Enter offset value (16).
   - Press MEAS CONT (7).

NOTE

Do not change the units after offset has been entered.

5. On Level Meter,
   - Press FREQ (20) and enter approximate frequency of input signal.
   - Press AUTO (11) and adjust FREQ TUNE KNOB (12) for stable indication in MEASUREMENT/ENTRY display (3).
   - Press COUNTER (9).
   - Press CNTR->FREQ (13).
   - Verify FREQUENCY/ENTRY and MEASUREMENT/ENTRY indications are stable.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

   - If indications are unstable, proceed with step 8.

6. If an offset was entered in step 4, press OFFSET (6).
7. MEASUREMENT/ENTRY display (3) indicates input signal power level. FREQUENCY/ENTRY display (8) indicates input signal frequency.
8. If MEASUREMENT/ENTRY display is unstable,

   Press AVE (2). If display still unstable, turn AVE off.

   Press ENTRY (1),

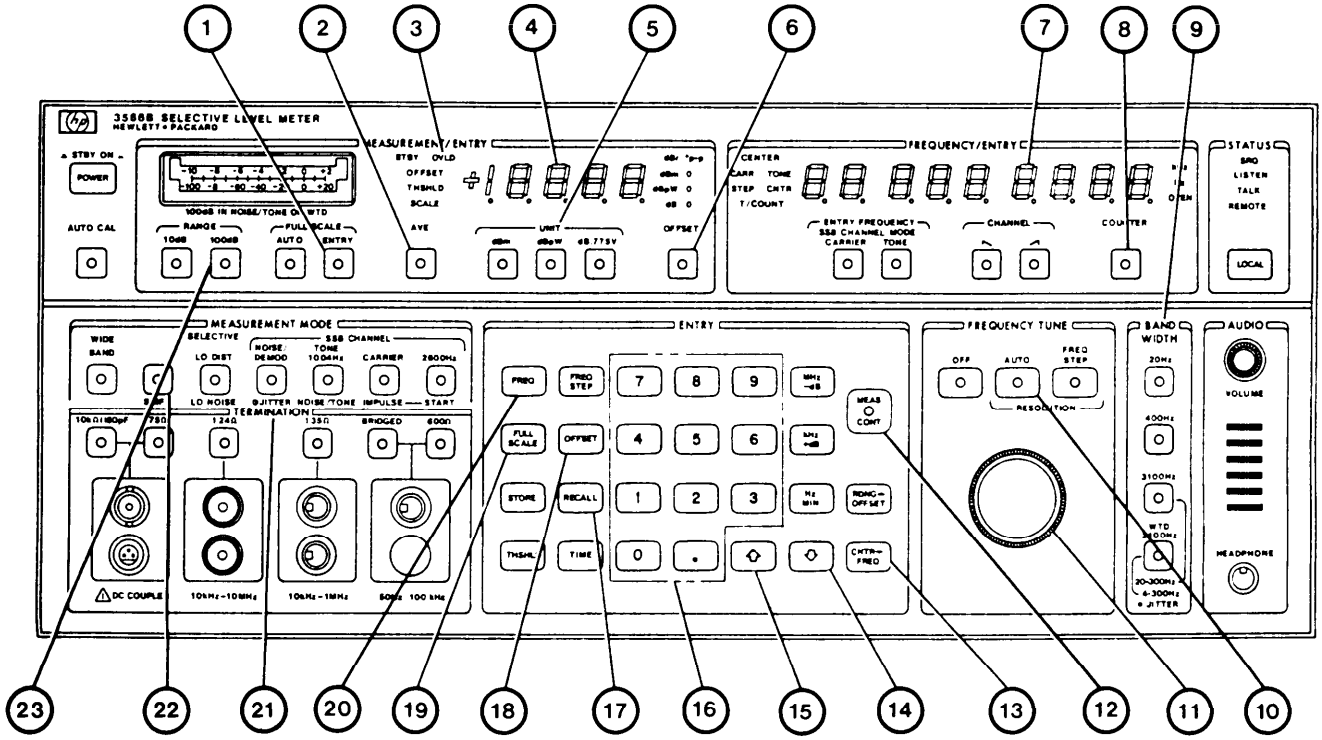
   - Press FULL SCALE (19), UP ARROW (15) or DOWN ARROW (14) then MEAS CONT (7) push buttons until display is stable. Verify OVLD indicator (3) remains off.
   - Select 100dB RANGE (22).
   - Select 400Hz BW (10).
   - Select 20Hz BW (10).

2-11. LOW NOISE MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (17), number 0 (16), then SHIFT (22) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMINATION (21).

CAUTION

When using BNC input, use only 75 Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124 Ω or 135 Ω input may be used at one time.

3. On Level Meter, select desired UNIT of measurement (5).

4. If an OFFSET is required,

- Press OFFSET (18).
- Enter offset value (16).
- Press MEAS CONT (12).

NOTE

Do not change the units after offset has been entered.

5. On Level Meter,

Press FREQ (20) and enter approximate frequency of input signal.

Press AUTO (10) and adjust FREQ TUNE KNOB (11) for stable indication in MEASUREMENT/ENTRY display (4).

Press COUNTER (8).

Press CNTR->FREQ (13).

Verify FREQUENCYLENTRY and MEASUREMENT/ENTRY indications are stable.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

If indications are unstable, proceed with step 9.

6. If an offset was entered in step 4, press OFFSET (6).

7. MEASUREMENT/ENTRY display (4) indicates input signal power level. FREQUENCY/ENTRY display (7) indicates input signal frequency.

8. On Level Meter, record MEASUREMENT/ENTRY indication. Press SHIFT (22) push button. Compare recorded value to present indication. The desired mode is the one with lowest MEASUREMENT/ENTRY indication.

9. If MEASUREMENT/ENTRY display is unstable,

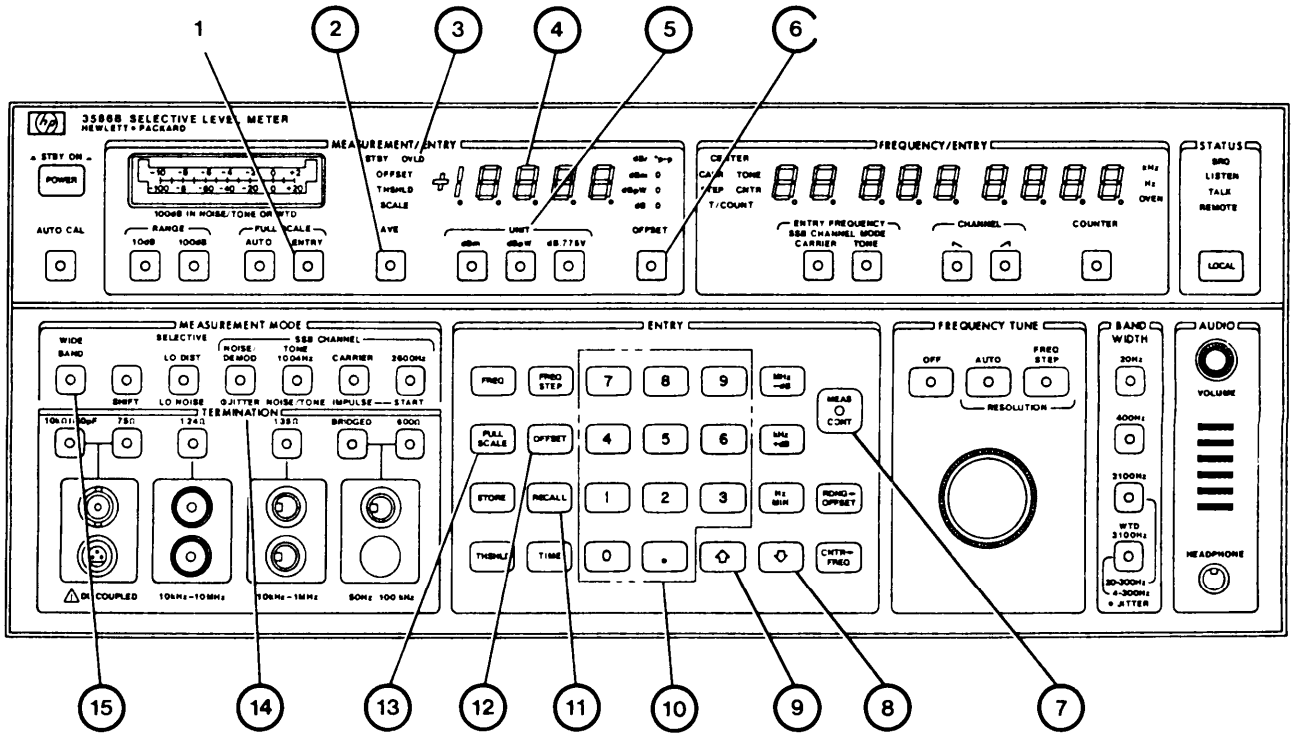
- Press AVE (2). If display still unstable, turn AVE off.
- Press ENTRY (1).
- Press FULL SCALE (19), UP ARROW (15) or DOWN ARROW (14) then MEAS CONT (12) push buttons until display is stable. Verify OVLD indicator (3) remains off.
- Select 100dB RANGE (23).
- Select 400Hz BW (9).
- Select 20Hz BW (9).

2-12. WIDEBAND MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (11), number 0 (10), then WIDEBAND (15) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMNATION (14).

CAUTION

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124Ω or 135Ω input may be used at one time.

3. On Level Meter, select desired UNIT of measurement (5).

4. If an OFFSET is required,
   - Press OFFSET (12).
   - Enter offset value (10).
   - Press MEAS CONT (7).
   - Press OFFSET (6).

NOTE

Do not change the units after offset has been entered.

5. MEASUREMENT/ENTRY display (4) indicates input signal power level.

NOTE

Input signal modulation (AM or FM) may cause instability in MEASUREMENT/ENTRY display.

6. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,
   - Press AVE (2). If display still unstable, turn AVE off.
   - Press ENTRY (1).
   - Press FULL SCALE (13), UP ARROW (9) or DOWN ARROW (8) then MEAS CONT (7) push buttons until display is stable. Verify OVLD indicator (3) remains off.

NOTE

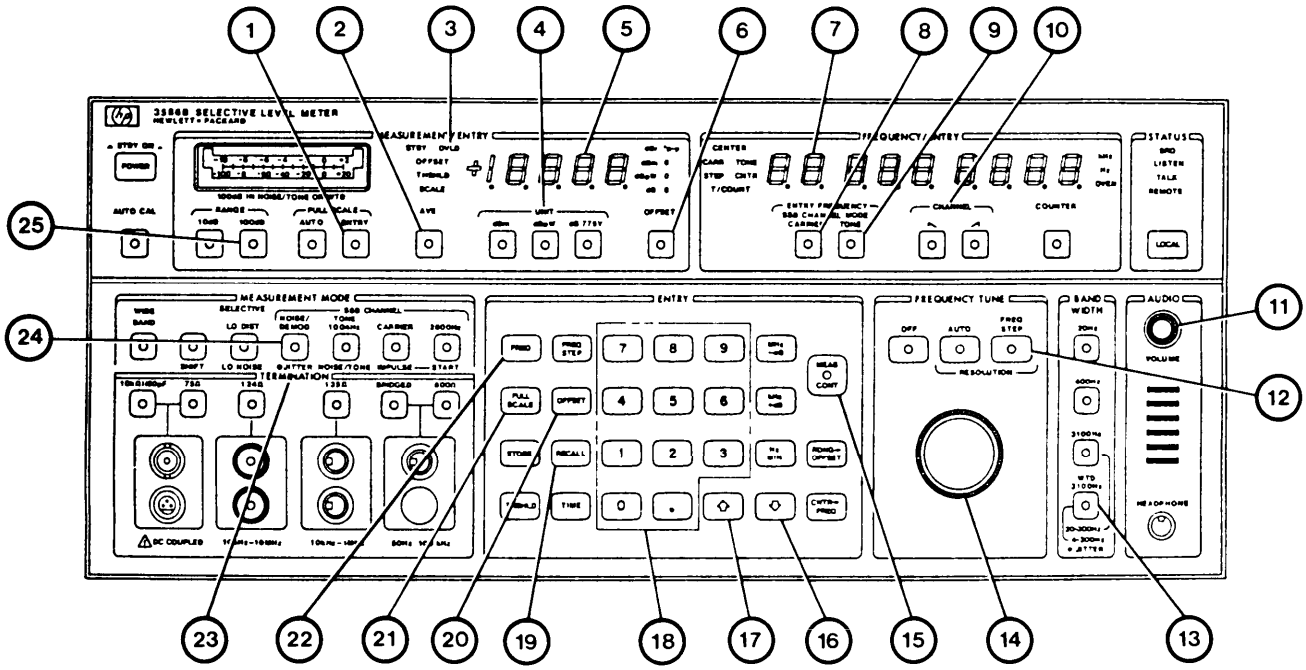
If OVLD indicator is on or “OL” appears in MEASUREMENT/ENTRY display, increase full scale level. If “UL” appears in MEASUREMENT/ENTRY display, decrease full scale level.

2-13. NOISE/DEMODULAT10N MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (19), number O (18), NOISE DEMOD (24), then WTD 3100HZ (13) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMINATION (23),

CAUTION

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may darnage Level Meter.

NOTE

Only 124Ω or 135Ω input may be used at one time.

3. On Level Meter, select desired UNIT of measurement (4).

4. If an OFFSET is required,
   - Press OFFSET (20).
   - Enter offset value (18).
   - Press MEAS CONT (15),

NOTE

Do not change the units after offset has been entered.

5. On Level Meter, select desired sideband CHANNEL (10).
6. Tune the Level Meter to the input signal frequency as follows:
   - If the carrier frequency is to be used to tune the Level Meter to a message channel, press CARRIER (8), FREQ (22), and enter the carrier frequency.
   - If the tone frequency is to be used to tune the Level Meter to a message channel, press TONE (9), FREQ (22), and enter the tone frequency.
7. If an offset was entered in step 4, press OFFSET (6).
8. Verify FREQUENCY/ENTRY and MEASUREMENT/ENTRY indications are stable.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

- If indications are unstable, proceed with step 11.

9. MEASUREMENT/ENTRY display (5) indicates input signal power level. FREQUENCY/ENTRY display (7) indicates tuned carrier or tone frequency.
10. Tune the Level Meter to voice signals as follows:
    - Enter FREQ STEP of 1Hz.
    - Press MEAS CONT (15).
    - Increase AUDIO VOLUME (11).
    - Press FREQ STEP (12).

    Using the FREQUENCY TUNE knob (14), slowly adjust for natural sound.
11. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,
    - Press AVE (2). If display still unstable, turn AVE off.
    - Press ENTRY (1).
    - Press FULL SCALE (21), UP ARROW (17) or DOWN ARROW (16) then MEAS CONT (15) push buttons until display is stable. Verify OVLD indicator (3) remains off.

NOTE

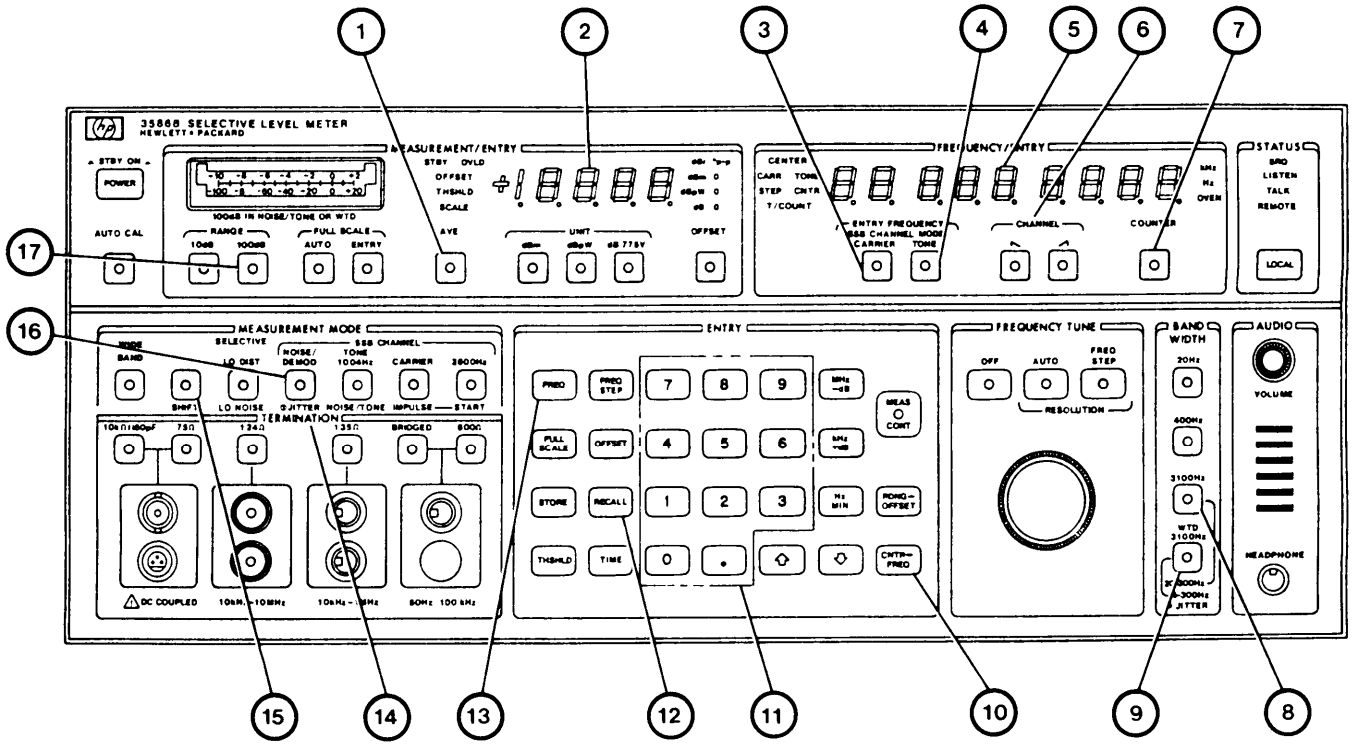
If OVLD indicator is on or “OL” appears in MEASUREMENT/ENTRY display, increase full scale level. If “UL” appears in MEASUREMENT/ENTRY display, decrease full scale level and/or select 100dB RANGE (25).

2-14. PHASE JITTER MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (12), number 0 (11), SHIFT (15), then Ø JITTER (16) push buttons.
2. On Level Meter,
   - If 20-300Hz band is desired, press 3100Hz (8) push button.
   - If 4-300Hz band is desired pressWTD3100Hz (9) push button.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

3. On Level Meter, select desired TERMINATION (14).

CAUTION

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124 Ω or 135 Ω input may be used at one time.

4. On Level Meter, select desired sideband CHANNEL (6).
5. Tune the Level Meter to the input signal frequency as follows:

   l If the carrier frequency is to be used to tune the Level Meter to a message channel, press CARRIER (3), FREQ (13), and enter the carrier frequency.

   If the tone frequency is to be used to tune the Level Meter to a message channel, press TONE (4), FREQ (13), and enter the tone frequency.

6. Fine tune the Level Meter to the input signal frequency as follows:

   • Press COUNTER (7).

   • Press CNTR->FREQ (10).

7. MEASUREMENT/ENTRY display (2) indicates input signal phase jitter. FREQUENCY/ENTRY display (5) indicates input signal frequency.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

8. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,

   • Press AVE (1). If display still unstable, turn AVE off.

NOTE

Use AVE only when necessary because it will decrease the accuracy of this measurement.

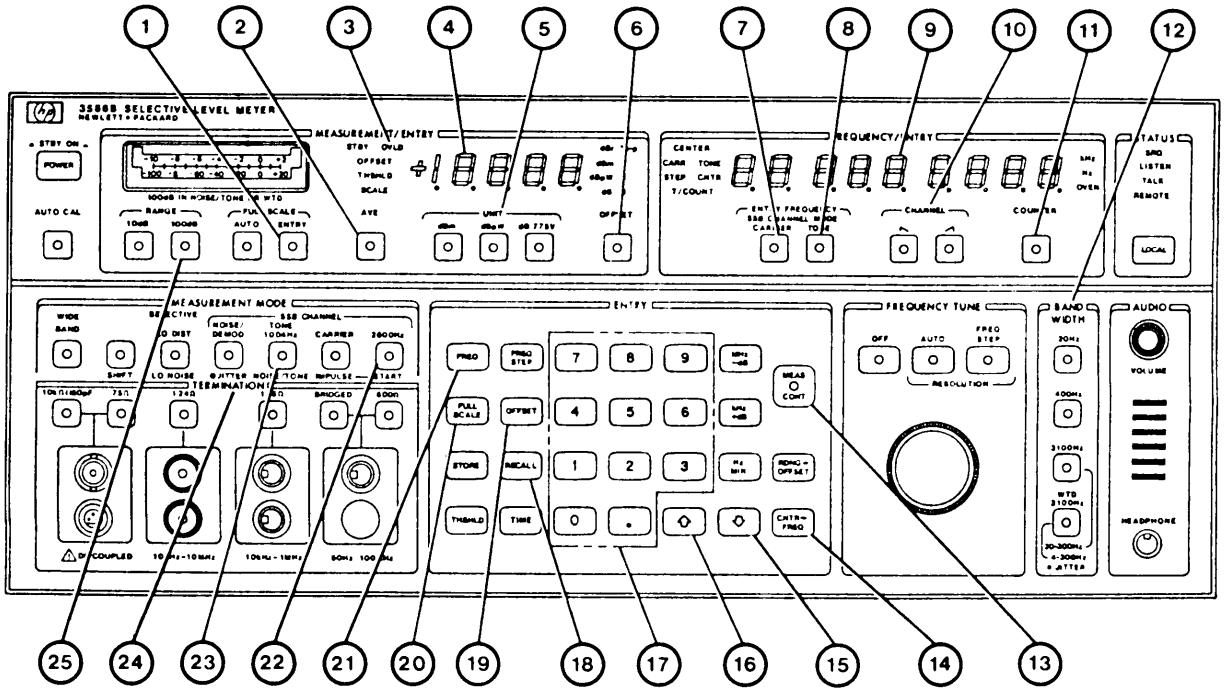
• Select 100dB RANGE (17).

2-15. TONE 1004Hz AND 2600Hz MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (18) then number 0 (17) push buttons.
2. On Level Meter,
   - •If 1004Hz measurement is desired press 1004Hz (23).
   - •If 2600Hz measurement is desired press 2600Hz (22).



The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

3. On Level Meter, select desired TERMINATION (24).

CAUTION

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124 Ωor 135 Ω input may be used at one time.

4. On Level Meter, select desired UNIT of measurement (5).

5. If an OFFSET is required,
   - Press OFFSET (19).
   - Enter offset value (17).
   - Press MEAS CONT (13).

NOTE

Do not change the units after offset has been entered.

6. On Level Meter, select desired sideband CHANNEL (10).
7. Tune the Level Meter to the input signal frequency as follows:
   - If the carrier frequency is to be used to tune the Level Meter to a message channel, press CARRIER (7), FREQ (21), and enter the carrier frequency.
   - If the tone frequency is to be used to tune the Level Meter to a message channel, press TONE (8), FREQ (21), and enter the tone frequency.
8. Fine tune the Level Meter to the input signal frequency as follows:
   - Press 3100HZ (12).
   - Press COUNTER (11).
   - Press CNTR->FREQ (14).
   - Press 400Hz (12).
9. If an offset was entered in step 5, press OFFSET (6).
10. MEASUREMENT/ENTRY display (4) indicates input signal power level. FREQUENCY/ENTRY display (9) indicates input signal frequency.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

11. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,
    - Press AVE (2), If display still unstable, turn AVE off.

NOTE

Use AVE only when necessary because it will decrease the accuracy of this measurement.

- Press ENTRY (1).
- Press FULL SCALE (20), UP ARROW (16) or DOWN ARROW (15) then MEAS CONT (13) push buttons until display is stable. Verify OVLD indicator (3) remains off.

NOTE

If OVLD indicator is on or “OL” appears in MEASUREMENT/ENTRY display, increase full scale level. If “UL” appears in MEASUREMENT/ENTRY display, decrease full scale level and./or select 100dB RANGE (25).

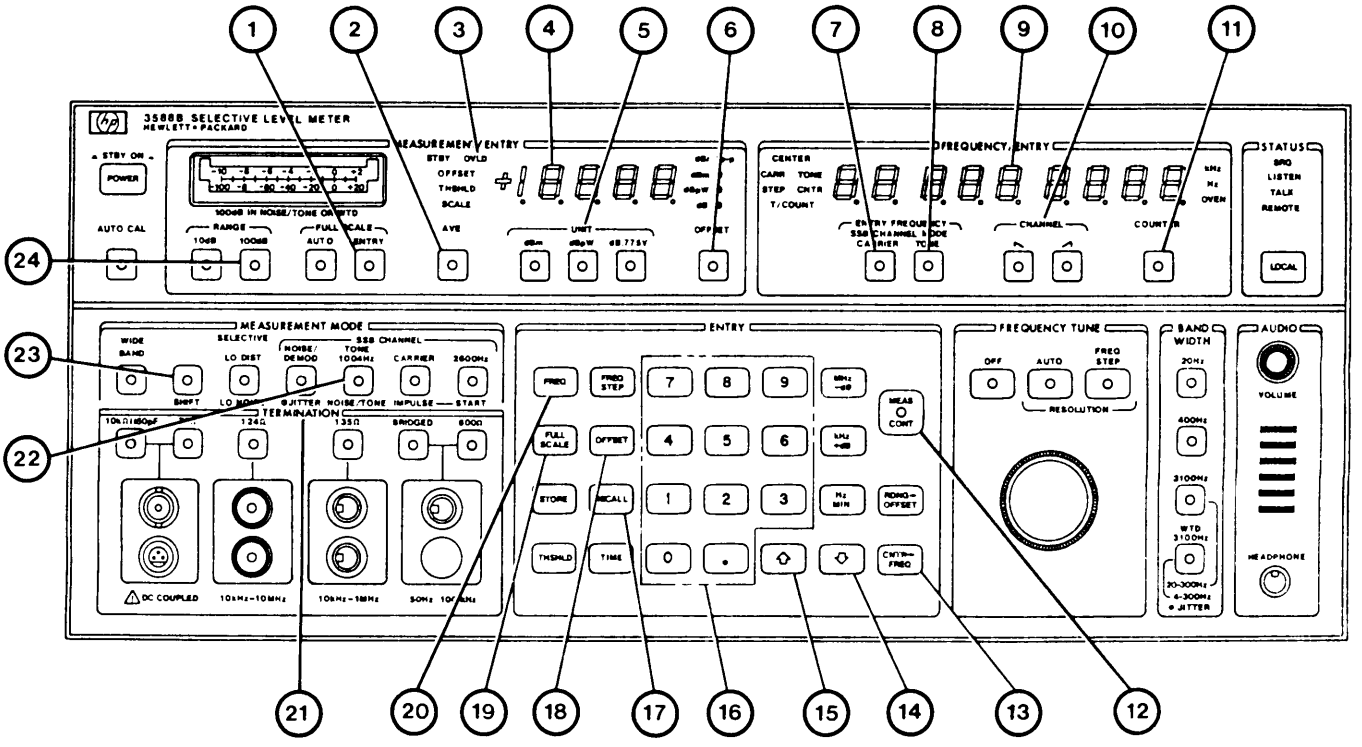
- Repeat step 8.

2-16. NOISE/TONE MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (17), number 0 (16), SHIFT (23), then NOISE/TONE (22) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMINATION (21).

CAUTION

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124Ω or 135Ω input may be used at one time.

3. On Level Meter, select desired UNIT of measurement (5).

4. If an OFFSET is required

- Press OFFSET (18).
- Enter offset value (16).
- Press MEAS CONT (12).

NOTE

Do not change the units after offset has been entered.

5. On Level Meter, select desired sideband CHANNEL (10).

6.Tune the Level Meter to the input signal frequency as follows:

If the carrier frequency is to be used to tune the Level Meter to a message channel, press CARRIER (7), FREQ (20), and enter the carrier frequency.

- If the tone frequency is to be used to tune the Level Meter to a message channel, press TONE (8), FREQ (20), and enter the tone frequency.

7. Fine tune the Level Meter to the input signal frequency as follows:

- Press SHIFT (23).
- Press COUNTER (11).
- Press CNTR->FREQ (13).
- Press SHIFT (23).

8. f an offset was entered in step 4, press OFFSET (6).

9. MEASUREMENT/ENTRY display (4) indicates input signal power level. FREQUENCY/ENTRY display (9) indicates input signal frequency.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

10. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,

- Press AVE (2). If display still unstable, turn AVE off.

NOTE

Use AVE only when necessary because it will decrease the accuracy of this measurement.

- Press ENTRY (1).
- Press FULL SCALE (19), UP ARROW (15) or DOWN ARROW (14) then MEAS CONT (12) push buttons until display is stable. Verify OVLD indicator (3) remains off.

NOTE

If OVLD indicator is on or “OL” appears in MEASUREMENT/ENTRY display, increase full scale level. If “UL” appears in MEASUREMENT/ENTRY display, decrease full scale level and/or select 100dB RANGE (24).

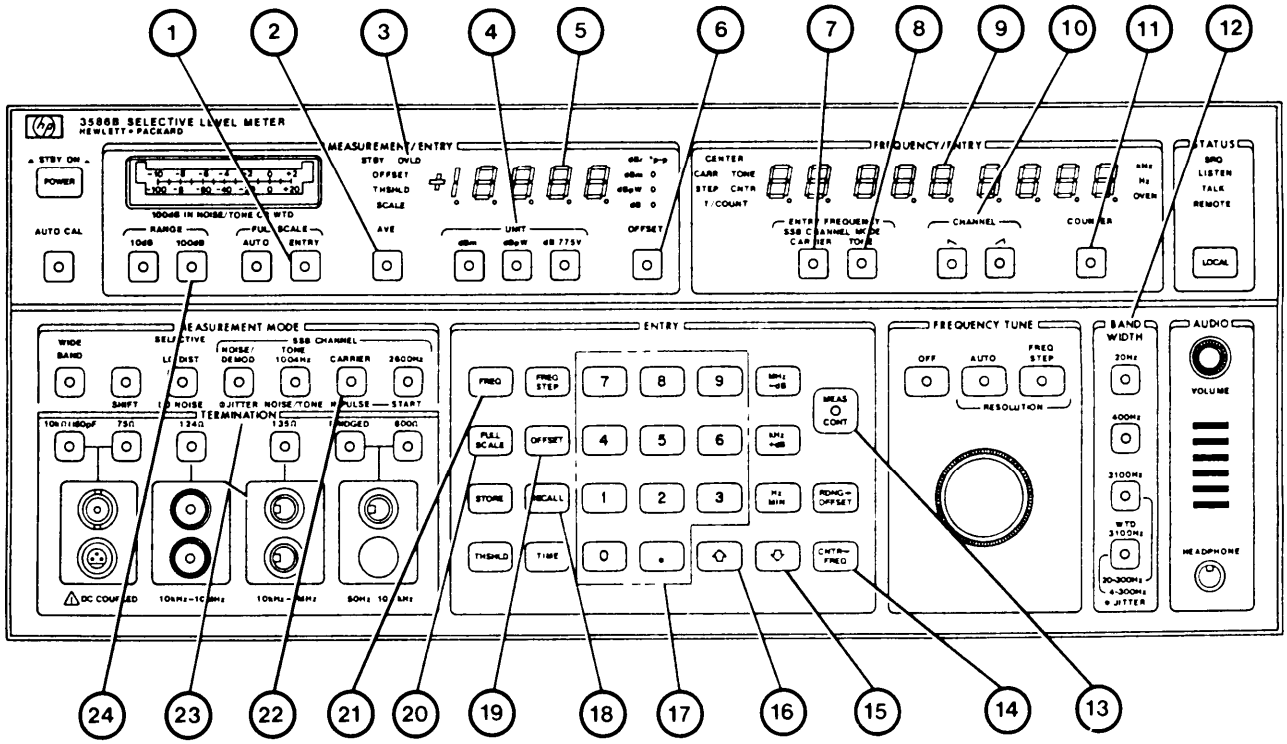
- Repeat step 7.

2-17. CARRIER MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test.

1. On Level Meter, press RECALL (18), number 0 (17), then CARRIER (22) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMINATION (23).

When using BNC input, use only 75Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124 Ω or 135Ω i nput may be used at one time.

3. On Level Meter, select desired UNIT of measurement (4).

4. If an OFFSET is required,

- Press OFFSET (19).
- Enter offset value (17).
- Press MEAS CONT (13).

NOTE

Do not change the units after offset has been entered.

5. On Level Meter, select desired sideband CHANNEL (10).

6. Tune the Level Meter to the input signal frequency as follows:

- If the carrier frequency is to be used to tune the Level Meter to a message channel, press CARRIER (7), FREQ (21), and enter the carrier frequency.
- If the tone frequency is to be used to tune the Level Meter to a message channel, press TONE (8), FREQ (21), and enter the tone frequency.

7. Fine tune the Level Meter to the input signal frequency as follows:

- Press 3100HZ (12).
- Press COUNTER (1 1).
- Press CNTR->FREQ (14).
- Press 20Hz (12).

8. If an offset was entered in step 4, press OFFSET (6).

9. MEASUREMENTLENTRY display (5) indicates input signal power level. FREQUENCY/ENTRY display (9) indicates input signal frequency.

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

10. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,

- Press AVE (2). If display still unstable, turn AVE off.

NOTE

Use AVE only when necessary because it will decrease the accuracy of this measurement.

- Press ENTRY (1).
- Press FULL SCALE (20), UP ARROW (16) or DOWN ARROW (15) then MEAS CONT (13) push buttons until display is stable. Verify OVLD indicator (3) remains off.

NOTE

If OVLD indicator is on or “OL” appears in MEASUREMENT/ENTRY display, increase full scale level. If “UL” appears in MEASUREMENT/ENTRY display, decrease full scale level and/or select 100dB RANGE (24).

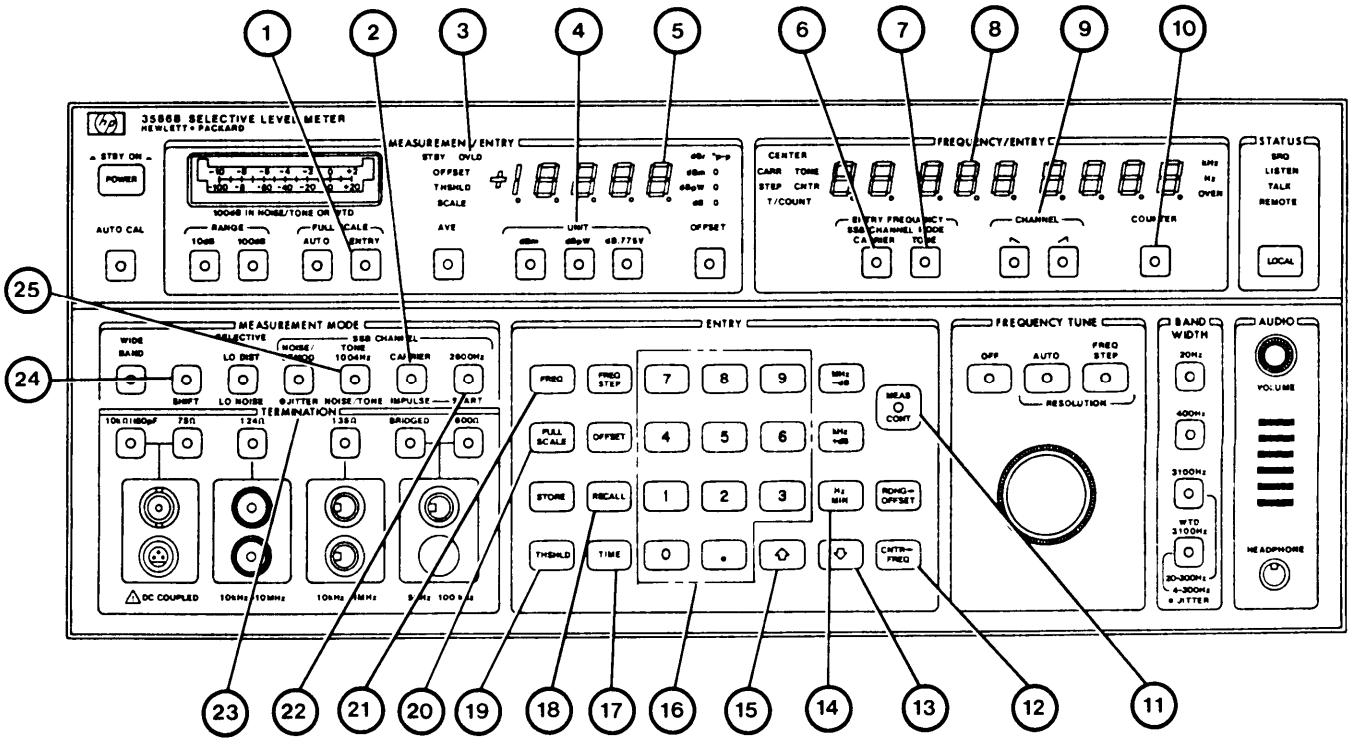
- Repeat step 7.

2-18. IMPULSE MEASUREMENT.

NOTE

To insure optimum performance, keep cable lengths as short as possible. Try to use the same power source for the Level Meter and the unit under test

1. On Level Meter, press RECALL (18), number 0 (16), SHIFT (24), then IMPULSE (2) push buttons.



CAUTION

The maximum input power must not exceed +27dBm or damage to internal circuitry may result.

2. On Level Meter, select desired TERMINATION (23).

CAUTION

When using BNC input, use only 75 Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

NOTE

Only 124 Ω or 135 Ω input may be used at one time.

3. On Level Meter, select desired UNIT of measurement (4).

4. On Level Meter, enter minimum number of noise spikes to be counted as follows:
   - Press THSHLD (19).
   - Enter threshold level (16).
   - Press MEAS CONT(11).

NOTE

Do not change the units after threshold has been entered.

5. On Level Meter, select desired sideband CHANNEL (9).
6. Tune the Level Meter to the input signal frequency as follows:
   - If the carrier frequency is to be used to tune the Level Meter to a message channel, press CARRIER (6), FREQ (21), and enter the carrier frequency.
   - If the tone frequency is to be used to tune the Level Meter to a message channel, press TONE (7), FREQ (21), and enter the tone frequency.
7. If 1004Hz test tone is on message channel, fine tune Level Meter as follows:
   - Press NOISE/TONE (25).
   - Press COUNTER (10).
   - Press CNTR->FREQ (12).
   - Press IMPULSE (2).
8. On Level Meter, enter duration as follows:
   - If counting for a specific time limit, press TIME (17) and enter time in minutes, decimal point, and seconds. Press MEAS CONT (11).
   - If counting is to be continuous, press TIME (17) and enter 1000000. Press MIN (14). Verify “CON” appears in FREQUENCY/ENTRY display (8). Press MEAS CONT (11).
9. Press START (22).
10. MEASUREMENT/ENTRY display (5) indicates input signal power level. FREQUENCY/ENTRY display (8) indicates time duration (left side) and number of impulse spikes (right side).

NOTE

Input signal modulation (AM or FM) may cause instability in either display.

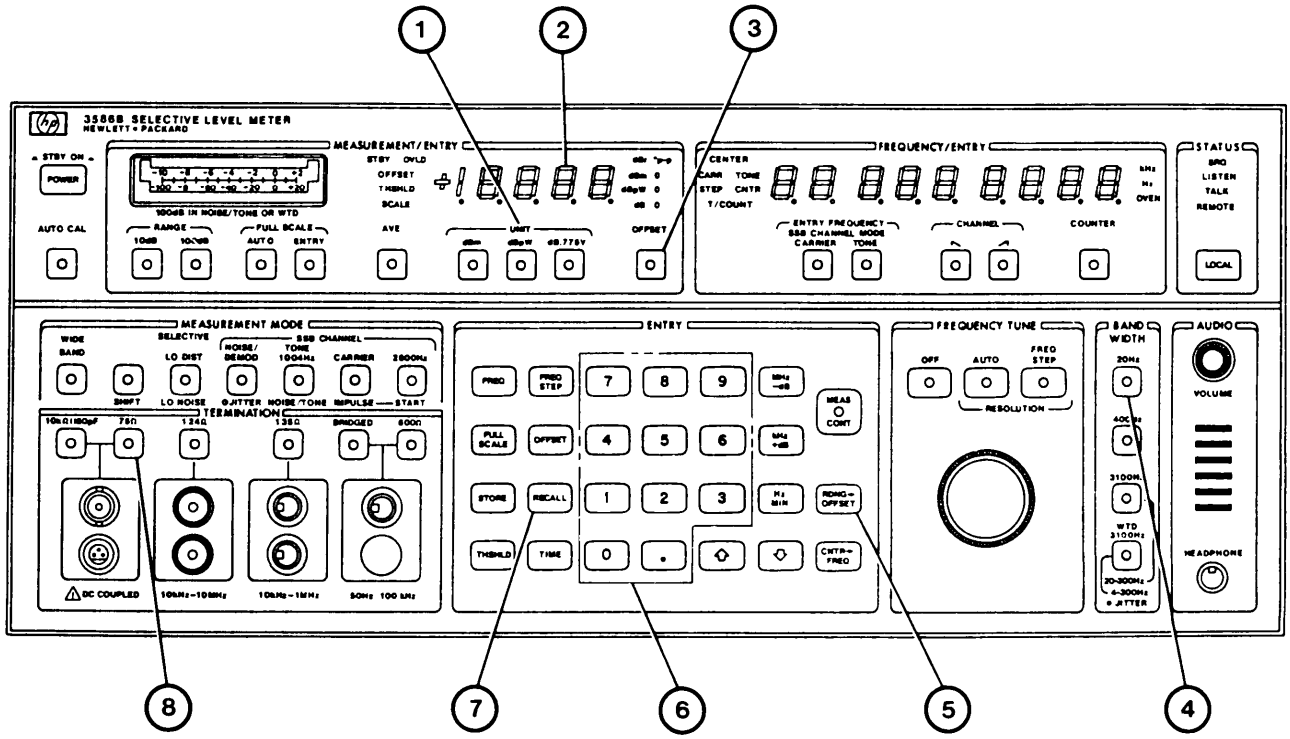
11. If MEASUREMENT/ENTRY display is unstable or constantly resets full scale level,
    - Press ENTRY (1),
    - Press FULL SCALE (20), UP ARROW (15) or DOWN ARROW (13) then MEAS CONT (11) push buttons until display is stable. Verify OVLD indicator (3) remains off.

NOTE

If OVLD indicator is on or “OL” appears in MEASUREMENT/ENTRY display, increase full scale level. If “UL” appears in MEASUREMENT/ENTRY display, decrease full scale level.

2-19. NETWORK ANALYSIS MEASUREMENT.

1. On Level Meter, press RECALL (7) then number 0 (6) push buttons.



CAUTION

The maximum input must not exceed ±27dBm or damage to internal circuitry may result

2. On Level Meter,

Select 75 Ωinput (8).

Connect rear panel Fo (0-32 .5MHz) output connector to front panel 75 Ω BNC input using 75 Ω cable supplied.

CAUTION

When using BNC input, use only 75 Ω BNC plugs. Use of other impedance plugs may damage Level Meter.

3. On Level Meter, select desired UNIT of measurement (1).

4. On Level Meter,

- Press 20Hz (4).
- Press RDNG—>OFFSET (5).

5. Disconnect cable from front panel 75 Ω BNC input.

6. On Level Meter, press OFFSET (3).

7. Connect the device that needs insertion loss measured between 75Ω cable and 75Ω BNC input.

8. MEASUREMENT/ENTRY display (2) indicates insertion loss of the device connected to BNC input plus output level shifts due to unequal source and termination impedance.

NOTE

If device impedance is not 75 Ω, impedance matching devices must be used between device to be measured and Level Meter.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-20. OPERATION IN EXTREME HEAT AND EXTREME COLD.

a. Operate the Level Meter only in a temperature range of 0 to +55° C (32 to 131° F).

b. Make sure the filter is clean and at least one inch of open space exists from the rear and side panels.

2-21. OPERATION IN WET WEATHER.

a. The Level Meter will operate normally in 95% relative humidity at +40° C.

b. If the Level Meter has gotten wet, allow it to dry completely before using.

2-22. OPERATION IN SANDY OR DUSTY AREAS.

a. Do not operate the Level Meter in sandy or dusty areas.

2-23. EMERGENCY PROCEDURES.

a. Reduction of power. The Level Meter will operate with power reduced from 90 to 105Vac, 108 to 126Vac, 198 to 231Vac or from 216 to 252Vac. The Level Meter will not operate with any further reduction of power.

CHAPTER 3
ORGANIZATION MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for organizational maintenance of Frequency Selective Level Meter AN/USM-490 are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

3-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

There are no special tools, TMDE, or support equipment required.

3-3. REPAIR PARTS.

Repair parts are listed and illustrated in the repair parts and special tools list, TM 11-6625-3087-24P.

Section II. SERVICE UPON RECEIPT

3-4. SERVICE UPON RECEIPT OF MATERIAL.

a. Unpacking. Special design reusable packing material inside this shipping carton provides maximum protection for Level Meter. Avoid damaging carton and packing material during equipment unpacking. Use the following steps for unpacking Level Meter

Cut and remove paper sealing tape on carton top and open carton.

Grasp Level Meter firmly while restraining shipping carton and lift equipment and packing material vertically.

Place Level Meter and end cap packing material on a suitable flat clean and dry surface.

Remove end cap packing material while firmly supporting Level Meter.

Remove protective plastic bag from Level Meter. Place desiccant bags back inside protective plastic bag.

Place protective plastic bag and end cap packing material inside shipping carton.

Return shipping carton to supply system.

b. Checking Unpacked Equipment.

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged report the damage on SF-364, Report of Discrepancy (ROD).

Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

Check to see whether the equipment has been modified.

3-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Perform all items under preparation for use (para 2-5).

b. Perform the turn-on procedures (para 2-6).

c. Perform operational test (para 3-7).

Section III. TROUBLESHOOTING

SYMPTOM INDEX

3-6. TROUBLESHOOTING TABLE.

Table 3-1 lists common malfunctions which you may find during operation or maintenance of the Level Meter or its components. You should perform the tests/inspections and corrective actions in the order listed.

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

Table 3-1. Troubleshooting.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. LEVEL METER WILL NOT TURN-ON.
Step 1. Check the fuse and fuseholder cap.
• Replace faulty component.
Step 2. Check to see if the power is available at the power receptacle.
• Move to a working receptacle.
Step 3. Check power cable.
• Replace faulty component.
• Notify next higher level of maintenance.

Table 3-1. Troubleshooting--Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. LEVEL METER QUITS DURING OPERATION

Step 1. Perform malfunction No. 1.

Step 2. Allow the Level Meter to cool and then try operating.

- If Level Meter operates normally, check air filter. Clean as required.
- If Level Meter does not operate, notify next higher level of maintenance.

3. FREQUENCY/ENTRY DISPLAY BLANK.

Step 1. Check to see if the Level Meter is in WIDEBAND mode.

- Select another mode.

Step 2. Check to see if an ERROR message is present in the MEASUREMENT/ENTRY display.

- If error is present, go to malfunction No. 4.
- If error is not present, proceed with step 3.

Step 3. Press AUTO CAL push button.

- If no calibration error is displayed, recheck operating instructions (para 2-9).
- If calibration error is displayed, notify next higher level of maintenance.

4. ERROR MESSAGE PRESENT IN MEASUREMENT/ENTRY DISPLAY.

Step 1. Check to see if error is listed in table 2-2.

- Perform required action as listed.

Step 2. Press MEAS CONT push button.

- If error disappears, resume normal operation.
- If error remains, notify next higher level of maintenance.

5. FREQUENCY TUNE KNOB WILL NOT CHANGE FREQUENCY.

Step 1. Check to see if AUTO or FREQ STEP push buttons are on.

- Select proper push button.
- Notify next higher level of maintenance.

Table 3-1. Troubleshooting-Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
6. AUDIO NOT OPERATIVE.
Step 1. Verify in LO DIST, LO NOISE, or NOISE/DEMOD measurement modes.
•Make proper selection.
Step 2. Check to see if the audio volume knob is fully CCW.
•Increase volume (CW).
Step **3.** Perform operational test (para 3-7).
• If audio present at end of test, recheck operating instructions.
• If audio is missing or weak, notify next higher level of maintenance.
7. LEVEL METER WILL NOT MEASURE INPUT SIGNAL.
Step 1. Check to see if the unit under test is on.
• Apply power.
Step **2.** Press AUTO CAL push button.
• If calibration error is displayed, notify next higher level of maintenance.
• If no calibration error is displayed, proceed with step 3.
Step 3. Perform operational test (para 3-7).
• If test passes, recheck operating instructions (para 2-9).
• If test fails, notify next higher level of maintenance.
8. OVLD INDICATOR FLASHING.
Step 1. Check full scale setting on Level Meter.
• Select AUTO or increase full scale setting.
Step 2. Check amplitude of input signal.
• Decrease amplitude until indicator goes out.
• Notify next higher level of maintenance.
9. OL/UL IN MEASUREMENT/ENTRY DISPLAY.
Step 1. Check amplitude of input signal.
•Adjust amplitude until indicator goes out.
Step 2. Press AUTO CAL push button.
• If no calibration error is displayed, recheck operating instructions.
• If calibration error is displayed, notify next higher level of maintenance.

Section IV. MAINTENANCE PROCEDURES

3-7. OPERATIONAL TEST.

DESCRIPTION

This procedure covers: Test.

INITIAL SETUP

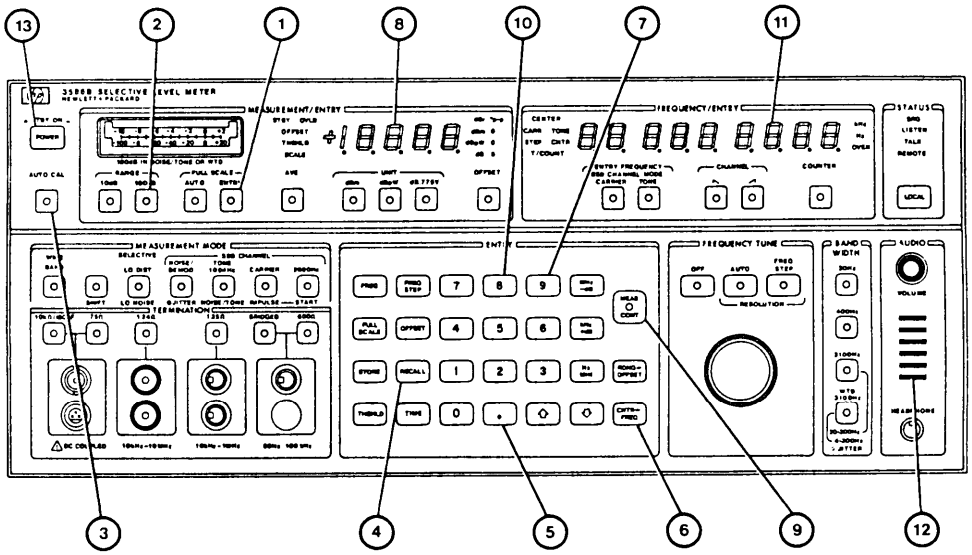
NOTE

PRELIMINARY PROCEDURES:

Perform turn on procedures (para 2-6).

TEST

1. Press ENTRY (1),100dB (2). Turn AUTO CAL (3) to off. Set full scale to –35dBm.
2. Press RECALL (4), . (decimal point) (5), CNTR—> FREQ (6), and number 9 (7) push buttons.
3. Verify that PASS is shown on the MEASUREMENT/ENTRY display (8)
4. Press MEAS CONT (9),
5. Press RECALL (4), . (decima point) (5), CNTR->FREQ (6), and number 8 (10) push buttons.
6. Verify that PASS is shown on the FREQUENCY/ENTRY display (11) for four tests, and musical tones are heard at the speaker (12).
7. Press POWER SWITCH (13).



END OF TASK

3-8. REPLACE FUSE.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE

1. Working at the front panel, set POWER switch (1) to STBY.

2. Working from rear, unplug power cable (2).

3. Rotate the fuseholder cap (3) counterclockwise until it stops.

4. Pull fuse (4) out of fuseholder cap (3).

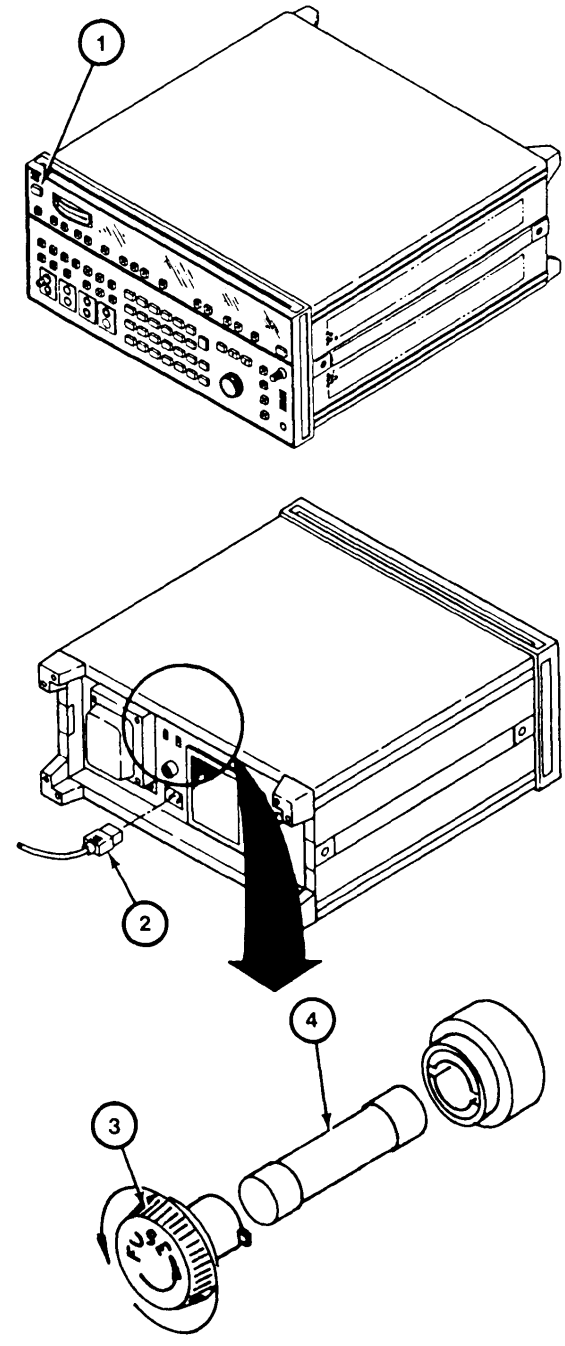
INSTALL

1. Working from rear, insert the fuse (4) into the fuseholder cap (3) and place it into the fuseholder body.

2. Push in and rotate the fuseholder cap (3) clockwise until it locks.

3. Replace power cable (2).

4. Working from front, set POWER switch (1) to ON.



END OF TASK

3-9. REPLACE FRONT PANEL CONTROL KNOBS.

DESCRIPTION

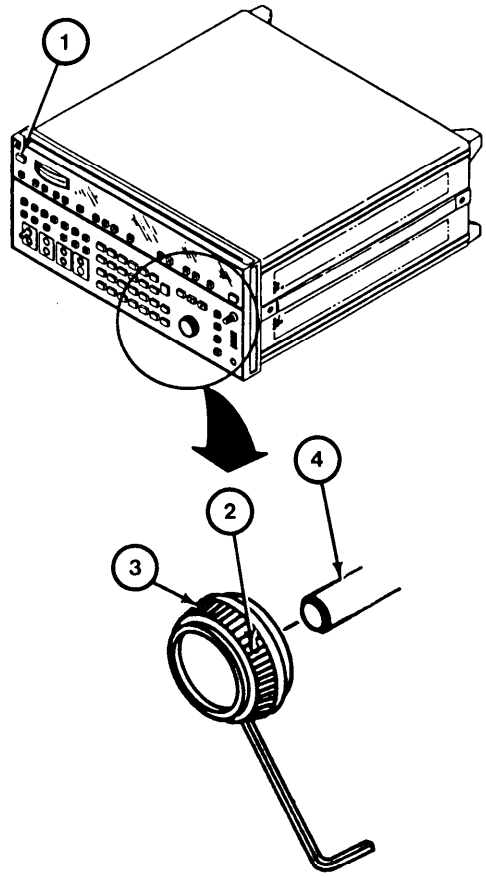
This rocedure covers:Remove. Install,

REMOVE

1. Set POWER switch (1) to STBY.
2. Loosen two setscrews (2).
3. Pull knob (3) off shaft (4).

INSTALL

1. Push knob (3) onto shaft (4).
2. Tighten two setscrews (2).
3. Set POWER switch (1) to ON.



END OF TASK

3-10. REPLACE FRONT PANEL PUSH BUTTONS.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE

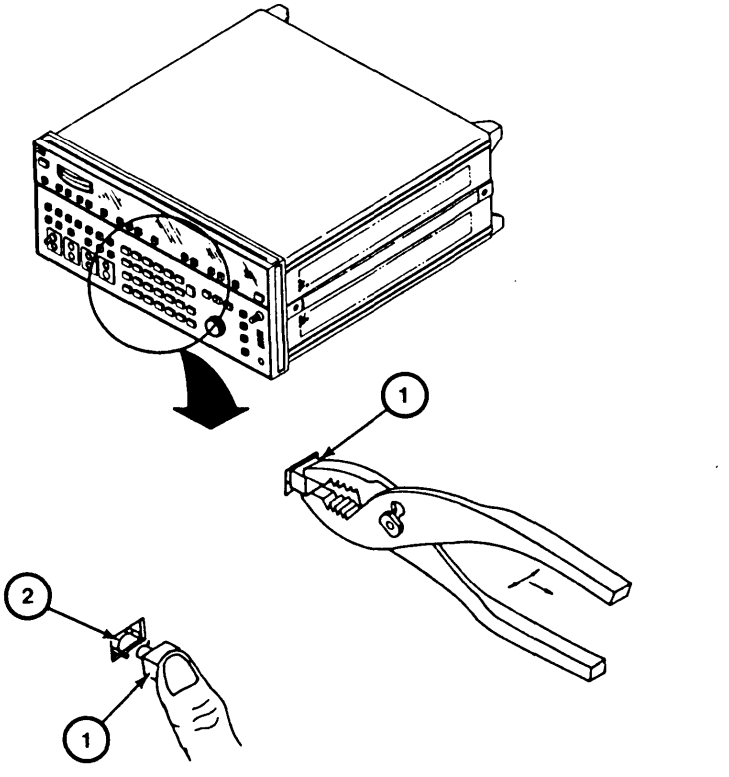
1. CAREFULLY pull push button (1) off actuator (2) using a small pliers.

INSTALL

1. Align the push button (1) on the switch actuator (2).

2. Press the new push button (1) until it seats fully on the switch actuator (2).

3. Check the push button for free movement and proper operation.



END OF TASK

3-11. REPLACE BOTTOM BUMPERS AND TILT STANDS.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE

1. Place equipment on side.

2. Lift tab (1) and slide bumper (2) inward.

3. Pull bumper (2) out of bottom cover (3).

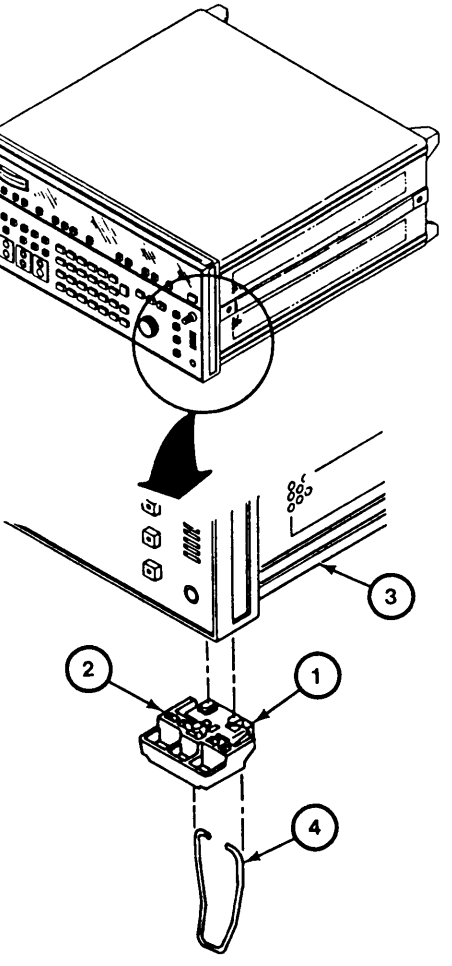
4. Remove stand (4) from bumper (2).

INSTALL

1. Replace stand (4) with bend facing away from bottom cover into bumper (2).

2. Align three studs on bumper (2) with three holes on bottom cover (3).

3. Slide bumper (2) outward until it locks.



END OF TASK

3-12. REPLACE AIR FILTER.

DESCRIPTION

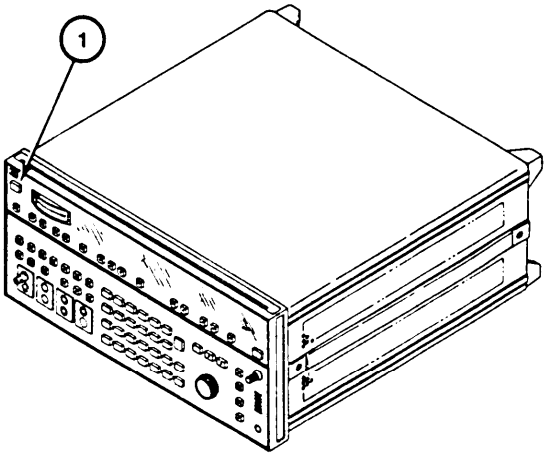
This procedure covers: Remove. Install.

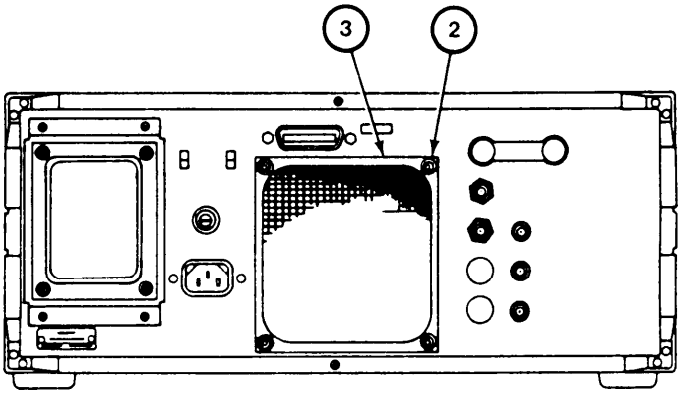
REMOVE

1. Set POWER switch (1) to STBY.
2. Working from rear, remove four thumb nuts (2).
3. Pull off air filter (3).

INSTALL

1. Position air filter (3) on four screws (4).
2. Install four thumb nuts (2).
3. Set POWER switch (1) to ON.





END OF TASK

3-13. REPLACE REAR BUMPERS.

DESCRIPTION

This procedure covers: Remove. Install.

REMOVE

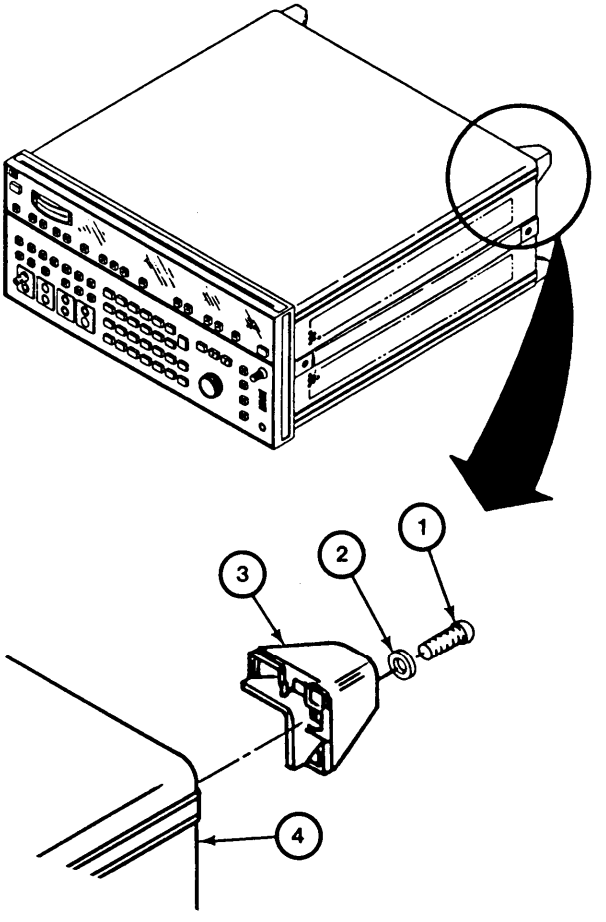
1. Working from rear, remove screw (1) and lock washer (2).

2. Pull bumper (3) from rear frame (4).

INSTALL

1. Working from rear, position bumper (3) on rear frame (4).

2. Install screw (1) and lock washer (2).



END OF TASK

3-14. REPLACE SIDE HANDLES.

DESCRIPTION

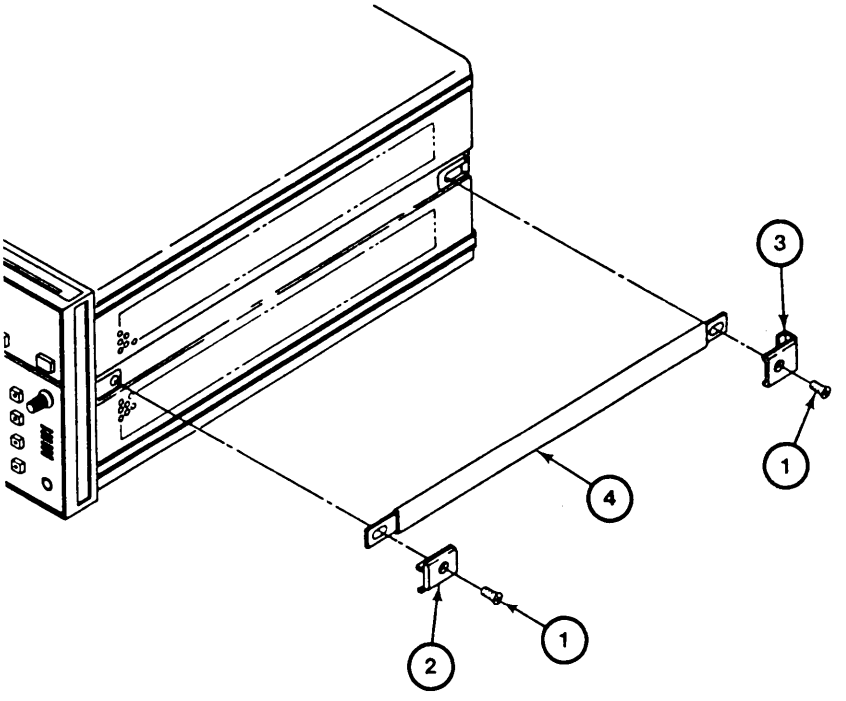
This procedure covers: Remove. Install.

REMOVE

1. Working from side, remove screws (1).
2. Remove front (2) and rear (3) retainers.
3. Remove side handle (4).

INSTALL

1. Working from side, position side handle (4), front (2) and rear (3) retainers.
2. Install screws (1).



END OF TASK

3-15. REPLACE FRONT HANDLES.

DESCRIPTION

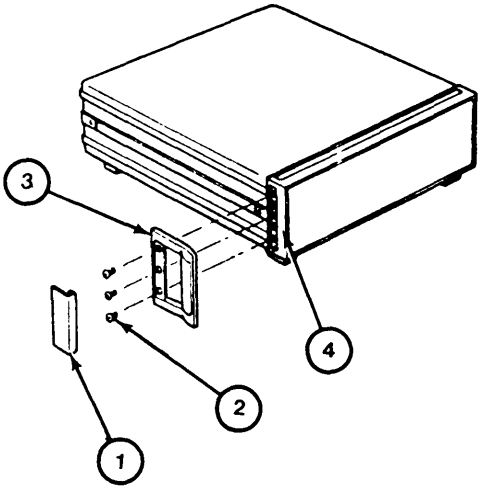
This procedure covers: Remove. Install.

REMOVE

1. Working from side, remove trim (1).
2. Remove screws (2).
3. Remove front handle (3).

INSTALL

1. Working from side, position side handle (3) on front frame (4).
2. Install screws (2).
3. Install trim (1).



END OF TASK

Section V. PREPARATION FOR STORAGE OR SHIPMENT

3-16. PACKAGING.

Package level meter in original shipping container. Refer to SB 38-100 for preservation, packaging, packing and marking materials

3-17. ADMINISTRATWE STORAGE.

Refer to TM 740-90-1 for administrative storage procedures.

3-18. ENVIRONMENT.

The level meter should be stored in aclean, dry environment. In high humidity environments, protect the level meter from temperature variations that could cause internal condensation. The following environmental conditions apply to both shipping and storage:

Temperature	-40° C to +75° C (-40” F to +158° F)
Relative Humidity	less than 95%
Altitude	less than 15,300 meters (50,000 feet)

APPENDIX A
REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Recommended Changes to Publications and Blank Forms ..... DA Form 2028

Recommended Changes to Equipment Technical Manuals ..... DA Form 2028-2

Discrepancy in Shipment Report (DISREP) ..... Form SF 361

Report of Discrepancy (ROD) ..... Form SF 364

Quality deficiency report ..... Form SF 368

A-3. TECHNICAL MANUALS.

The Army Maintenance Management System (TAMMS) ..... DA Pam 738-750

Procedures for Destruction of Electronics Materiel to prevent Enemy Use (Electronics Command) . . . . TM 750-244-2

Organizational, Direct Support, and General Support Repair Parts and Special Tools List, for Frequency Selective Level Meter AN/USM-490 ..... TM 11-6625-3087-24P

Administrative storage procedures TM740-90-1

A-4. MISCELLANEOUS.

Consolidated Index of Army Publications and Blank Forms ..... DA Pam 310-1

First Aid for Soldiers ..... FM 21-11

Safety Precautions for Maintenance of Electrical/Electronic Equipment ..... TB 385-4

Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents . . . . . MIL-STD- 12

Preservation, Packaging, Packing, and Marking Materials, Supplies and Equipment Used by the Army . . . . . SB 38-100

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

INTRODUCTION

The Army Maintenance System MAC

This introduction provides a general explanation of all maintenance and repair function authorized at the two maintenance levels under the Two-Level Maintenance System concept.

This MAC (immediately following the introduction) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component levels, which are shown on the MAC in column (4) as:

> Field – includes two columns, Unit maintenance and Direct Support maintenance. The Unit maintenance column is divided again into two more subcolumns, C for Operator or Crew and O for Unit maintenance.
> Sustainment – includes two subcolumns, general support (H) and depot (D).

The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

Maintenance Functions

Maintenance functions are limited to and defined as follows:

1. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g. by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of cannon tubes.

2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

3. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms. The following are examples of service functions:

   a. Unpack. To remove from packing box for service or when required for the performance of maintenance operations.
   b. Repack. To return item to packing box after service and other maintenance operations.
   c. Clean. To rid the item of contamination.
   d. Touch up. To spot paint scratched or blistered surfaces.
   e. Mark. To restore obliterated identification.

4. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

5. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

7. Remove/install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

8. Paint. To prepare and spray color coats of paint so that the ammunition can be identified and protected. The color indicating primary use is applied, preferably, to the entire exterior surface as the background color of the item. Other markings are to be repainted as original so as to retain proper ammunition identification.

9. Replace. To remove an unserviceable item and install a serviceable counterpart in its place "Repair" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

10. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.
Fault location/troubleshooting. The process of investigating and detecting the case of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).
Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).
Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

11. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

12. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Explanation of Columns in the MAC

Column (1) Group Number, Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

Column (2) Component/Assembly. Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

Column (3) Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions, refer to "Maintenance Functions" outlined above).

Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. The work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field:
- C Operator or Crew maintenance
- O Unit maintenance
- F Direct Support maintenance

Sustainment:
- L Specialized Repair Activity
- H General Support maintenance
- D Depot maintenance

NOTE

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Table 1. MAC for Frequency Selective Level Meter, AN/USM-490

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
00	Frequency Selective Level Meter, AN/USM-490	INSPECT		0.5				1	1
		TEST		0.5				1	2
		SERVICE		0.5				1	3
		INSPECT			1.0			2	4
		TEST			1.0			2, 5, 6, 7-43	5
		ADJUST			1.0			2-14,16-18,25,40-42	6
		CALIBRATE			1.0			2,5-7,14,16-18,25-42	7
		REPAIR			8.2			2-43	8
		REPAIR		1.0				1	
		REPAIR					10.0	2-43	9
01	Circuit Card Assembly A1 (Input Multiplexer)	INSPECT			0.2			2	
		TEST			0.5			2,4,6,8,12,17, 21,25	
		REPAIR			1.0			2,3,18,21	5
02	Circuit Card Assembly A2 (Input Amp)	INSPECT			0.2			2	
		TEST			0.5			2,4-8,13,17-18,21,25	
		REPAIR						2,3,5-7,12,18,21,25	5
03	Circuit Card Assembly A4 (Broadband Pwr/Cal/Overld)	INSPECT			0.2			2	
		TEST			0.5			2,4-6,8-12,17	
		REPAIR						2,3,5,6,12	5
04	Circuit Card Assembly A5 (Input Mixer)	INSPECT			0.2			2	
		TEST			0.5			2,4-6,8-10,12,17,18,25	
		REPAIR			1.0			2,3,5,6,10,12,18,25	5
05	Circuit Card Assembly A10 (Second Mixer)	INSPECT			0.2			2	
		TEST			0.5			2,4,5,8,11,12,14,18,18,25	
		REPAIR			1.0			2,3,5,6,11,12,14,17,25,33	5
06	Circuit Card Assembly A11 (Second LO)	INSPECT			0.1			2	
		TEST			0.5			2,4,5,6,8,10, 12,16,17	
		REPAIR			1.0			2,3,5,12	5
07	Circuit Card Assembly A15 (Tracking Output)	INSPECT			0.2			2	
		TEST			0.5			2,4,5,8,12,16, 17	
		REPAIR			1.0			2,3,5,12	5
08	Circuit Card Assembly A16 (10MHz Freq Ref)	INSPECT			0.2			2	
		TEST			0.5			2,4-6,8,10,12,16, 17	
		REPAIR			1.0			2,3,5,12	5
09	Circuit Card Assembly A20 (IF Filter)	INSPECT			0.1			2	
		TEST			0.5			2,4,5,8,11,12, 14,16,17	
		REPAIR			1.0			2,3,5,6,11,12,14.16,33	5
10	Circuit Card Assembly A21 (IF Gain/Det)	INSPECT			0.2			2	
		TEST			0.5			2,4,5,6,8,12,17	
		REPAIR			1.0			2,3,5,6,12	5
11	Circuit Card Assembly A22 (Analog-Digital Conv)	INSPECT			0.2			2	
		TEST			0.5			2,4-6,8, 12-16,17	
		REPAIR			1.0			2,3,5,12-17	5
12	Circuit Card Assembly A40 (Frequency Reference)	INSPECT			0.2			2	
		TEST			0.5			2,4-6,8-10, 12-16,17	
		REPAIR			1.0			2,3,5,12-16	5
13	Circuit Card Assembly A50 (Step Loop)	INSPECT			0.2			2	
		TEST			0.5			2,4,5,8,10,12,14,16,17	
		REPAIR			1.0			2,3,5,12,14,16	5
14	Circuit Card Assembly A60 (Controller)	INSPECT			0.2			2	
		TEST			0.5			2,4,5,8,12,16, 16	
		REPAIR			1.0			2,3,5,12	5

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
15	Circuit Card Assembly A70 (Impairments B)	INSPECT TEST REPAIR REPAIR			0.2 0.5 1.0			2 2,4-6,8,9,12,15,16 2,3,5,6,12	 5
16	Circuit Card Assembly A98 (Switch/Didplay)	INSPECT TEST REPAIR			0.2 0.5 1.0				
17	Circuit Card Assembly A99 (Motherboard)	INSPECT TEST REPAIR			0.2 0.5 1.0			2 2,8,12 2,3,12	 5

Table 2. Tools and Test Equipment for Frequency Selective Level Meter, AN/USM-490

(1) TOOLS OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
1	O	Tool Kit	5180-00-064-5178	TK-101/G
2	F,D	Tool Kit	5180-01-195-0855	JTK-17
3	F,D	Printed Circuit Repair kit or equiv for use on non-multi-layer CCA	5999-00-757-7042	MK-772/U
4	F,D	Transistor Test Set	6625-00-159-2263	TS-1836C/U
5	F,D	Circuit Card Extender Kit	6625-01-132-1715	03586-84401(28480)
6	F,D	Synthesizer/Level Generator	6625-01-151-8424	3335A-001
7	F,D	Frequency Synthesizer	6625-01-107-8152	3325A (TMDE D040015)
8	F,D	Oscilloscope	6625-01-034-3269	5440 (AN/GSM-286)
9	F,D	Plug-In Unit	4931-01-008-1478	5S14N (AN/GSM-286)
10	F,D	Spectrum Analyzer	6625-01-079-9495	AN/USM-489(V)/1
11	F,D	Signal Generaror	6625-01-233-8615	SG-1207/U
12	F,D	Digital Multimeter	6625-01-042-7415	3455A (TMDE A041022) (May use HP 3478A)
13	F,D	Power Meter	6625-01-191-7679	AN/USM-491 (AN/GSM-286)
14	F,D	Thermistor Mount	5985-01-257-9470	478A (AN/GSM-286)
15	F,D	Tester, Digital Circuit	6625-01-068-8641	TS-3791/U
16	F,D	Counter, Frequency	6625-00-531-4752	5345A (AN/GSM-286)
17	F,D	Voltage, DC Source		332 (AN/GSM-286)
18	F,D	Attenuator	5985-00-957-1860	355D (With CAL sheet)

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MAINTENANCE ALLOCATION CHART (MAC)

19	F,D	100 KHz Low Pass Filter	5915-01-212-4457	F2172 (19615)
20	F,D	10 MHz Low Pass Filter	5915-01-212-4456	F2171 (19615)
21	F,D	75 Ohm Directional Bridge	6625-01-132-7197	8721A/008 (28480)
22	F,D	124 Ohm Return Loss Coupler		5061-1137 (28480)
23	F,D	75 Ohm 0.5V Thermal Converter	6625-01-213-0421	11051A/003 (28840) (With CAL sheet)
24	F,D	Frequency Doubler		G-3 (15542)
25	F,D	50/75 Ohm Minimum Loss Pad (2 each)	6625-01-127-0094	11852A (28480)
26	F,D	BNC “T”, 2 each	5935-00-103-7571	31-2208-1020 (02660)
27	F,D	Adapter, 2 each	5935-01-183-3404	29PP110-1 (24931)
28	F,D	Adapter, 2 each		29JJ124-1 (24931)
29	F,D	WECO 310 Plug to (f) BNC Adapter (5each)	6625-00-107-8287	2798 (05276)
30	F,D	(m) BNC to single banana jack adapter (2 each)	5935-00-665-6544	UG1090U
31	F,D	600 OHM Feed Thru	6695-01-209-3205	7916916
32	F,D	Large WECO to (f) BNC adapter (3each)		WECO 372 (14949)
33	F,D	600 Ohm Balance Testing Apparatus	6695-01-209-1651	7916897
34	F,D	75 ohm to balanced 124 ohm matching pad	6695-01-209-1652	7916895
35	F,D	75 ohm to balanced 135 ohm matching pad	6695-01-209-1653	7916896
36	F,D	75 ohm to balanced 600 ohm matching pad	6695-01-209-1654	7916898
37	F,D	135 ohm balance testing apparatus	6695-01-209-3206	7916894
38	F,D	Power combiner	6695-01-209-1655	7916899
39	F,D	124 ohm balance testing apparatus	6695-01-209-3207	7916893
40	F,D	Attenuator	5985-00-763-7326	7910807
41	F,D	High Impedance Probe	7420-00-623-3211	1120A
42	F,D	Low Frequency Spectrum Analyzer	6625-01-118-9963	3585A (or equivalent)
43	F,D	RF Amplifier	5996-01-208-8517	QB-188-2 (55027) (or equivalent)

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Table 3. Remarks for Frequency Selective Level Meter, AN/USM-490

REMARKS CODE	REMARKS
1	Visual inspection of all external surfaces only.
2	Normal operational test.
3	Replacement of fuses, knobs, and any other maintenance on the external surface of the AN/USM-490.
4	Visual inspection of all internal and external areas.
5	Fault isolate to piece parts. Circuit cards tested as part of end item.
6	All mechanical and/or electrical adjustments need to return the AN/USM-490 to operational status.
7	Governed by TM-43-180 and the associated TB.
8	The following are repaired by replacement circuit card assemblies: A31, A32, A51, A52, A53, A61, A62, A80, and cable assemblies W1, W3-W15, W17 and W18.
9	To be returned to the depot only in the event that TSG is unable to repair the AN/USM-490 either due to a lack of parts or time factor.
10	Some procedures require the use of 75 ohm coaxial cables.
11	Tool number 5, circuit card extender kit, consists of the following: A. 44 pin extender board (2 each) PN 03586-66590 B. 30 pin extender board (2 each) PN 03586-66591

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of the end item and basic issue items for the AN/USM-490 to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The components of End Item and Basic Issue Items List (BII) are divided into the following sections:

a Section II-Components of End Item. This listing is for information purposes only and is not authority to requisition replacements. These are part of the end item, but are removed and/or separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III—Basic Issue I/ems. These are the minimum essential items required to place the AN/USM-490 in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the AN/USM-490 during operation and whenever it is transferred between property accounts. This manual is your authority to request,requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

a Column (1)-lllusfration Number (1/lus Number). This column indicates the number of the illustration in which the item is shown.

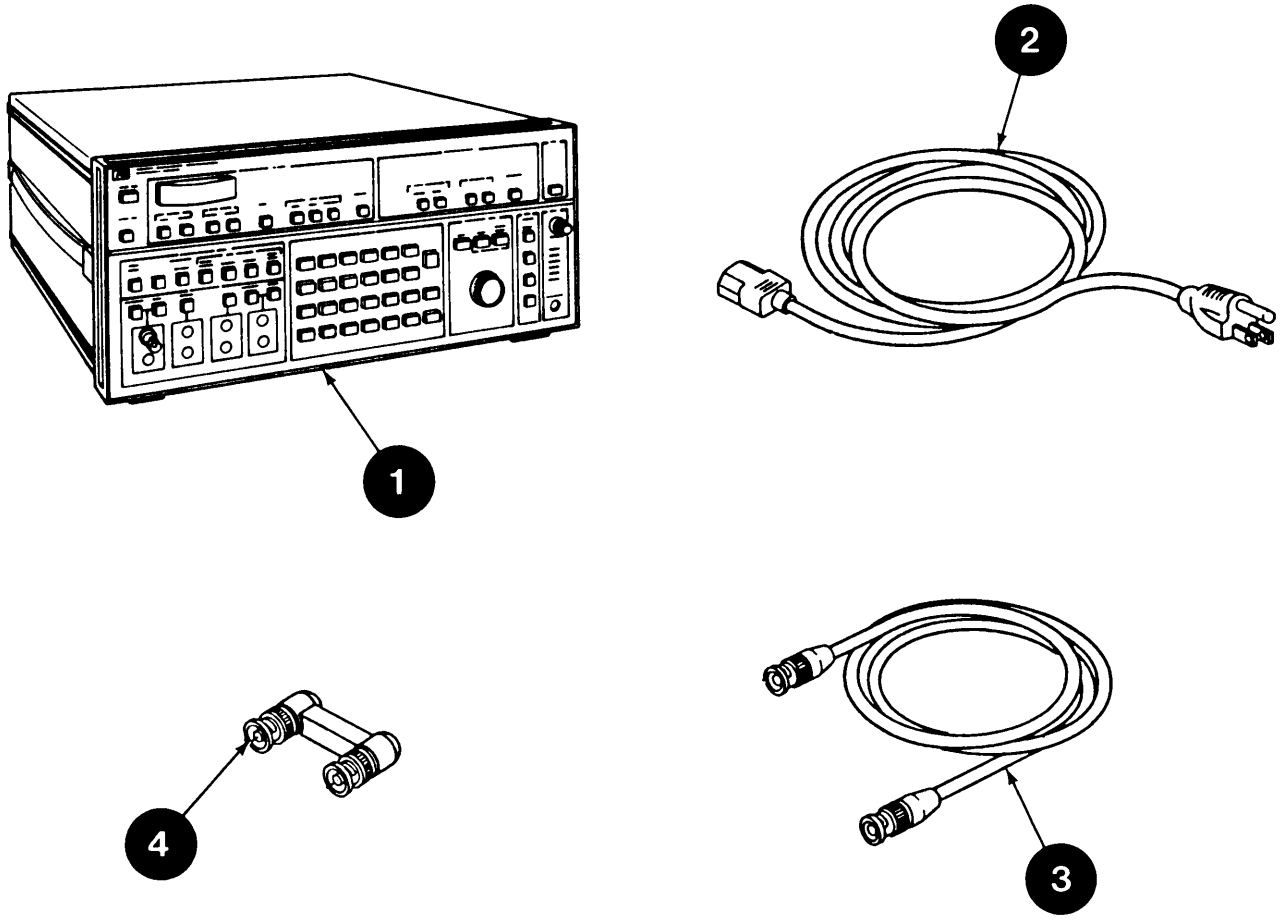
b. Column (2)--National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3)-Description. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d Column (4)-Unit of Measure (UIM). This column indicates the measure used in performing the actual operation/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5)-Quantity Required (Qty Rqr). This column indicates the quantity of the item authorized to be used with/on the equipment.

Section II. COMPONENTS OF END ITEM



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number	(4) U/M	(5) Qty Rqr
1		SELECTIVE LEVEL METER (28480) 3586B/001/001/003/004/907	EA	1
2	6150-00-041-5038	CABLE ASSEMBLY, POWER (70903) KH7147	EA	1
3		CABLE ASSEMBLY, BNC (28480) 8120-0688	EA	1
4	5935-01-149-2471	ADAPTER, ELECTRICAL CONN (94375) RF03152M	EA	1

APPENDIX D
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of the AN/USM-490.

D-2. GENERAL.

This list identifies items that do not have to accompany the AN/USM-490 and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING.

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TD, or JTA) which authorized the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM and PART NUMBER / USABLE ON CODE	(3) U/M	(4) QTY AUTH
	FUSE, CARTRIDGE (81349) F02A250B1A	EA	1
5920-00-280-4960	FUSE, CARTRIDGE (81 349) F02A250V2A	EA	1

APPENDIX E
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable supplies you will need for general support maintenance on frequency selective level meter AN/USM-490. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS.

a Column (1)---Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App. D").

b. Column (2)----Level. This column identifies the lowest level of maintenance that requires the listed item.

0- Organizational Maintenance.

c. Column (3)--National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

d Column (4)--Description. This column indicates the federal item name and if required, a minimum description to identify the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

e. Column (5)-Unit of Measure (U/M). This column indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., EA, IN, PR). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	0	8305-00-267-3015	Cloth, Cheesecloth, Cotton, Lintless, CCC-C-440, Type II, Class 2 (81349)	YD
2	0	6810-00-753-4993	Alcohol, Isopropyl, 8oz Can, MIL-A-10428, Grade A (81349)	CN

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By Order of the Secretary of the Army:

JOHN A, WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be districted **in** accordance with DA Form 12-51 literature requirements for AN/USM490.

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@wherever.army.mil>
To: 2028@redstone.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19−OCT−93
8. ***Pub no:*** 55−2840−229−23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04−JUL−85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123−123−1234
17. ***Problem:*** **1**
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE 8/30/02
TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, AL 35898	FROM: (*Activity and location)(Include ZIP Code)* MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9–1005–433–24	16 Sep 2002	Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

TO: (*Forward direct to addressee listed in publication)*	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**
Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, AL 35898	MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	8/30/02

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE
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ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C