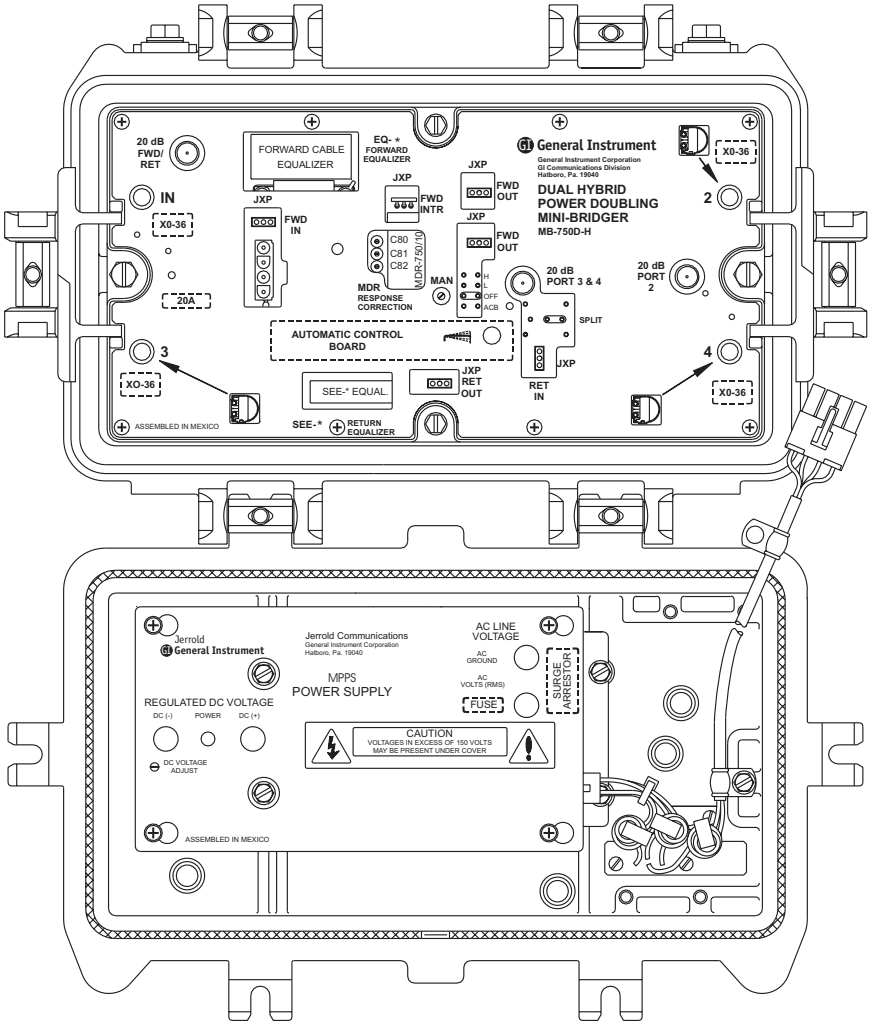
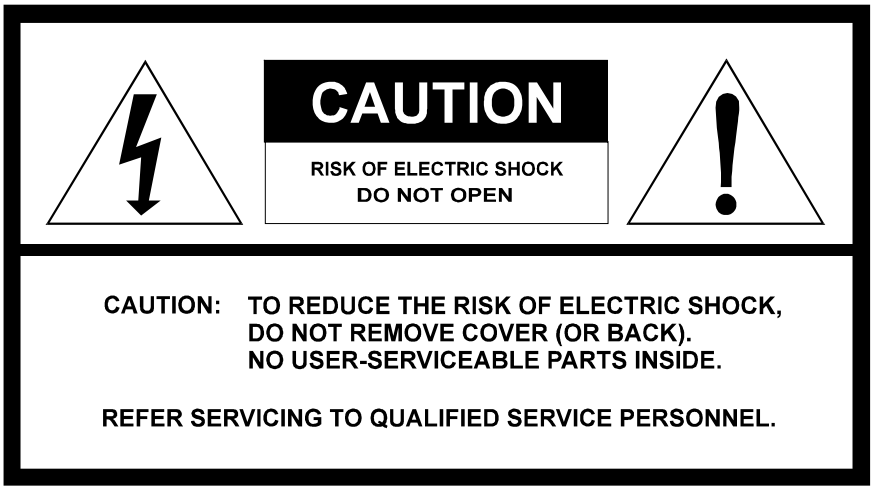
Dual-Output Amplifier
Model MB-750D-H
Model MB-750D-H/40
Installation Manual



General Instrument



Contents

List of Figures

Section 1
Introduction

The General Instrument STARLINE® Mini-Bridgers, models MB-750D-H and MB-750D-H/40 are versatile amplifiers used in modern television distribution systems for amplification of standard National Television Sytem Committee (NTSC) television carriers as well as high-definition digital channels. The MB-750D-H and MB-750D-H/40 amplify conventional signals carried in the bandpass between 50 MHz and 550 MHz as well as high-definition digital television signals carried in the bandpass between 550 MHz and 750 MHz. These digital carriers have their relative amplitude set at the headend and normally operate 10 dB below standard NTSC television channels.

Using This Manual

This manual provides instructions for the following tasks necessary to install, configure, and operate the MB-750D-H and MB-750D-H/40 mini-bridgers:

Section 1	Provides a brief review of the function of the product in a distribution system. Identifies the information contained in this manual, lists related documentation, and gives the helpline telephone number.
Section 2	Provides a detailed description of the various components used in the amplifier. It also provides instructions on proper installation of all options and subassemblies.
Section 3	Describes methods of bench alignment, testing, and configuration of the unit prior to installing it in the system.
Section 4	Describes the installation and field alignment procedures required to place the unit into service.
Appendix A	Lists the applicable specifications for the amplifier and options.

This installation manual assumes that all channels are standard NTSC analog channels. Refer to catalog specifications or *Appendix A, Specifications*, in this document for further details pertaining to signal levels of digital channels above 550 MHz.

The asterisk (*) indicates that there are several versions or model numbers, and the information applies to all models. When the information applies to a specific model, the full model number is given.

Related Documentation

This installation manual is complete and you should not require any additional documentation to install, test or operate the MB-750D-H and MB-750D-H/40 mini-bridgers.

If You Need Help

If you need assistance while working with the MB-750D-H or MB-750D-H/40, call the General Instrument Technical Response Center at **1-800-537-7653**. The Technical Response Center is open 8:00 am to 6:00 pm Eastern Standard Time, Monday through Friday. When the Technical Response Center is closed, emergency service *only* is available on a call-back basis.

When contacting the Technical Response Center from outside the United States, please use our main switchboard number, **1-215-674-4800**. After business hours, please use **1-215-581-9637**.

Calling for Repairs

If repair is necessary, call the General Instrument Repair Facility at **1-800-642-0442** for a Return for Service Authorization (RSA) number before sending the unit. The RSA number must be prominently displayed on all equipment cartons. The Repair Facility is open 7:00 am to 4:00 pm Pacific Standard Time, Monday through Friday.

If calling from outside the United States, dial your appropriate international access code, then dial **52-631-34000**, to contact the Repair Facility.

When shipping equipment for repair, follow these steps:

1. Pack the unit securely.
2. Enclose a note describing the exact problem.
3. Enclose a copy of the invoice that verifies the warranty status.
4. Ship the unit **PRE-PAID** to the following address:

   GI Communications
   c/o Fritz Company
   1451-1 Mariposa Industrial Drive
   Nogales, AZ 85621
   Attn: RSA #_____

Section 2
Overview

Product Description

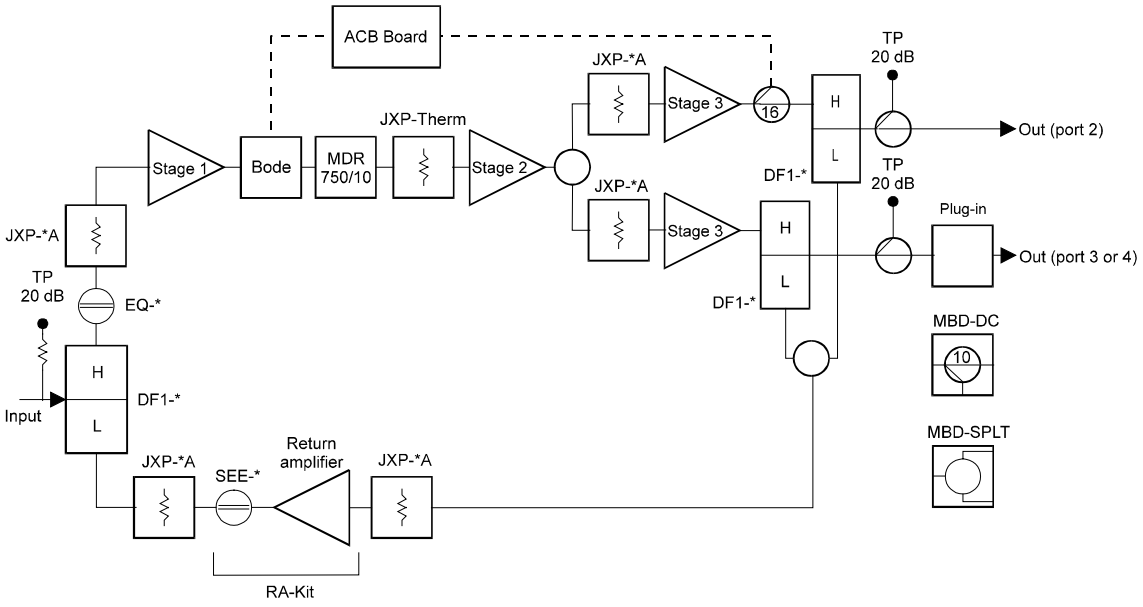
The model MB-750D-H and MB-750D-H/40 Mini-Bridgers are dual output, high gain, three-stage hybrid amplifiers designed to drive both a limited cascade as well as a local distribution system. These amplifiers provide 110-channel capability utilizing a forward bandpass of 50 to 750 MHz and a return path of either 5 to 30 MHz for model MB-750D-H and 5 to 40 MHz for model MB-750D-H/40. The high gain feature — 35 dB operational — makes the amplifiers suitable for drop-in replacement of trunk amplifiers that were originally spaced for 22 dB at 300 MHz. Use of the mini-bridgers eliminates the need for intermediate amplifiers normally required to modify a “tree-and-branch” system into a “fiber-to-the-feeder” architecture.

The attenuation of coaxial cable as used in CATV systems changes with variations in temperature. To assist in compensating for these changes, the MB-750D-H and MB-750D-H/40 include manual thermal gain compensation. The degree of thermal compensation is selectable by a plug-in jumper and can be set to 0, 17 or 26 dB of cable. Gain control through automatic temperature compensation is an available option.

The basic amplifier is shipped in housing model MB-HSG/60 and includes all necessary components for a fully functional one-way amplifier, with the exception of the forward cable equalizer, model EQ-750-*.

The block diagram in Figure 1 shows the functional interconnections of all stages in both amplifiers.

Figure 1
MB-750D-H and MB-750D-H/40 Mini-Bridger block diagram



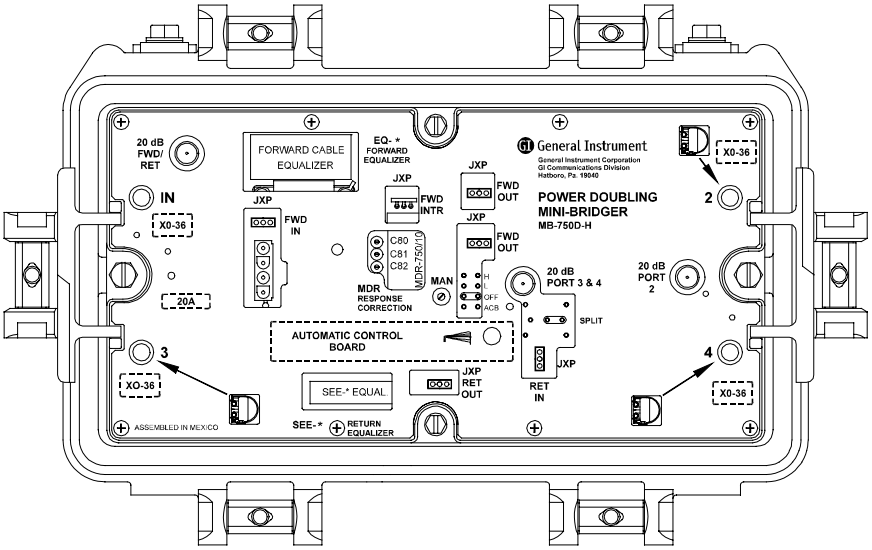
Optional Components and Accessories

The following table provides a list of optional equipment that can be selected to work in conjunction with the mini-bridgers to better satisfy individual system requirements. The table also provides a brief description and basic function of each item to assist the user in the selection process. All optional equipment can be installed at field locations by qualified technicians. Figure 2 is provided to show the location of common accessories and components.

Table 1
Summary of optional components available with the MB-750D-H* Mini-Bridger

Model Number	Description
MB-ACB/*	Auto control board module. Provides automatic output level control.
RA-Kit/40L	Return amplifier kit. Implements two-way service.
EQP1-1	Equalizer circuit board. Used for test purposes, or when a zero value equalizer is required.
EQ-750-*	Forward cable equalizer. Compensates for cable attenuation from 2 through 22 dB in 2 dB steps.
SX5B	Circuit breaker. Powers output port and provides protection against overcurrent.
SX7F/SX10FA	Feederline fuse. Powers output port and provides protection against overcurrent.
XO-36	Surge arrestor. Used with a circuit breaker or fuse to provide additional surge protection.
MBD-SPLT or MBD-DC	Output passives. Can be installed in place of the supplied MBD-JMP jumper to activate the third output of the amplifier.
MDR-750/FLT	Flatness control board. Used to replace the furnished MDR-750/10 interstage equalizer and flatness board when flatness without equalization is required.

Figure 2
Mini-Bridger amplifier module, showing location of accessories



Assemblies and Modules

This section describes each of the major components and subassemblies associated with the MB-750D-H and MB-750D-H/40 Mini-Bridgers.

Housing Model MB-HSG/60

The purpose of the housing is to protect the electronics from the elements and serve as a radiator to dissipate the internally generated heat. While the amplifiers are shipped with the model MB-HSG/60 housing, they can also be installed in an existing XLE-HSG housing.

Both housings can be strand mounted by using the included clamp and bolt assemblies, or surface mounted by using suitable auxiliary brackets. In addition, two 1/4 × 20 threaded holes are provided in the lower housing half for pedestal or surface mounting.

Each housing is equipped with a combination woven-wire/silicone-rubber gasket between the body and the cover for efficient ground continuity, RF shielding and weather protection. The input and output ports are protected by factory inserted plastic cap plugs which are discarded when the cable connectors are installed.

Model MPPS Power Pack

The model MPPS power pack is mounted within the cover of the amplifier housing. It provides 24 Vdc output at 2.0 amperes maximum over an ac input voltage range from 38 Vac to 60 Vac rms. The waveshape of the input voltage may be either a squarewave or a sinewave. The surge arrestor and the EMI filter protect the power pack and amplifier from transient spikes. Additional surge protection is built into the power pack by a fast acting zener diode. A 5 amp fast-blow fuse in the ac line offers further protection in case of catastrophic power pack failure.

The pre-regulator is a fixed frequency switching regulator that will present a near perfect power factor to the input line. It includes overvoltage as well as overcurrent protection. The precision output regulator is also protected against overcurrent and short circuits, thus providing a precise output voltage. If a short circuit is detected, the power supply shuts down and the regulator initiates a sequence of line test pulses at approximately one-half second intervals. The regulator will continue these pulses for the duration of the short circuit but will return to normal operation when the fault is cleared.

Figure 3 illustrates a block diagram of the MPPS power pack.

Figure 3
Block diagram of MPPS power pack

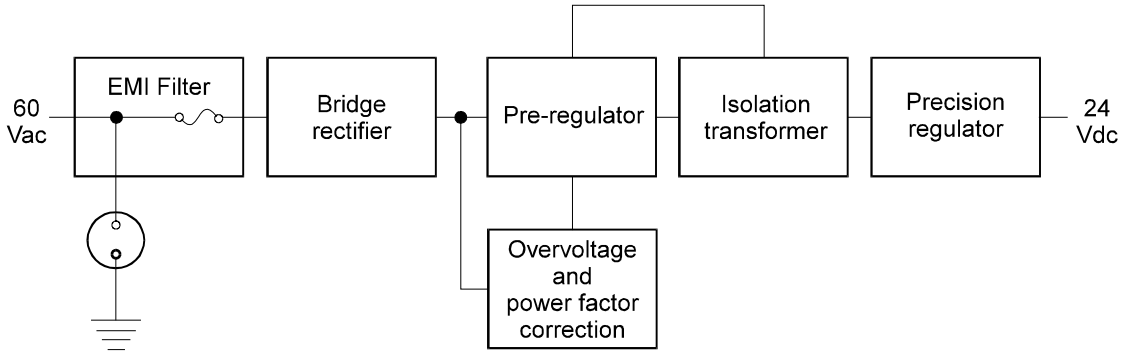
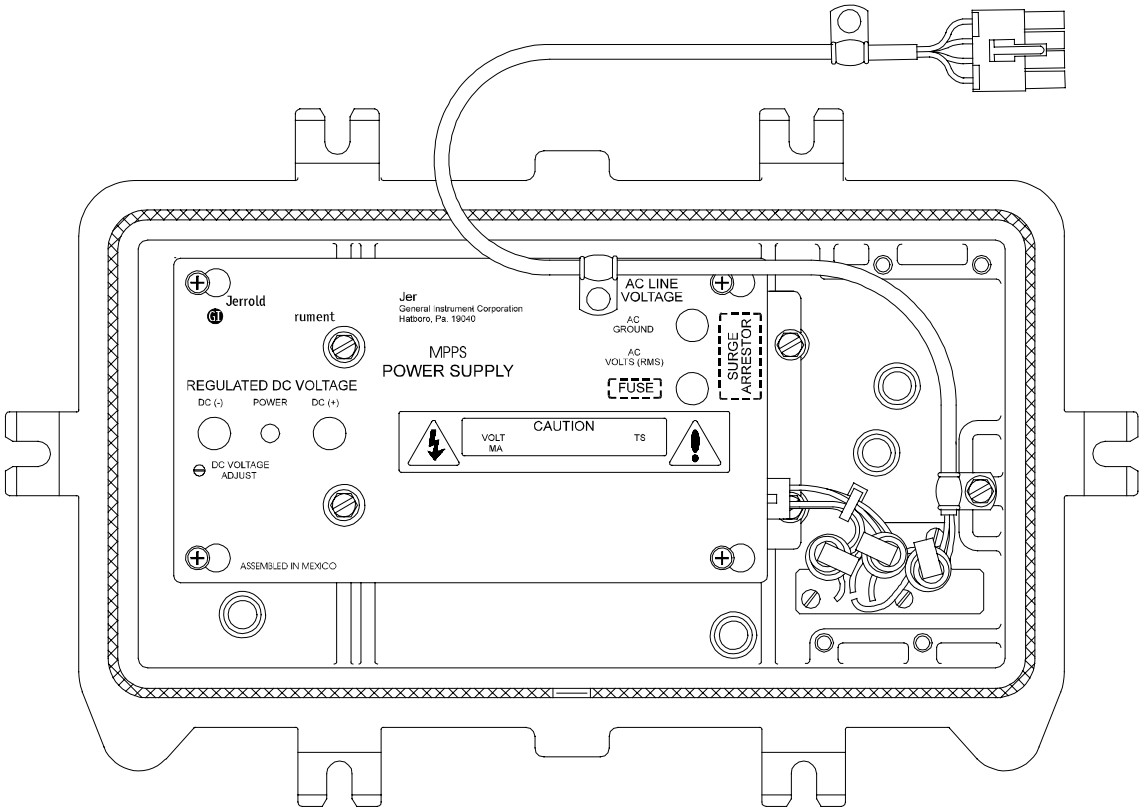


Figure 4 shows the MPPS power pack installed in the model MB-HSG/60 upper half housing.

Figure 4
MPPS Power pack



Forward Amplifier

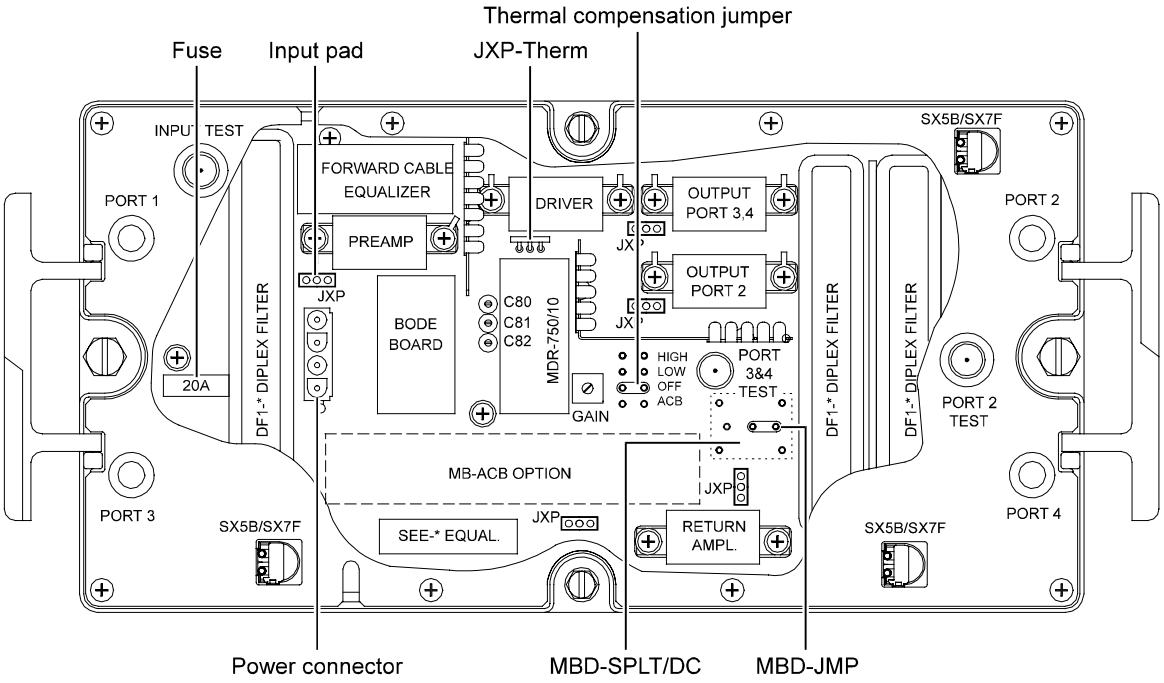
The forward amplifier's electronics consist of two parallel three-stage paths. The first two stages are common to both paths. The preamplifier stage has been selected for its low noise figure, while the output stage provides the desired power at low distortion. At the input of the amplifier there is a facility to install a cable equalizer and a socket for a Model JXP-*A attenuator. Both the attenuator and equalizer are customer installed options.

Intermediate amplifier stages are comprised of several circuits. One interstage circuit is the Bode equalizer which is a voltage controlled device that receives its input from the manual gain control in the standard configuration form. It may also receive its input from the MB-ACB/* board when this option is employed. A flatness control circuit follows the Bode board and allows optimization of the frequency response. This MDR-750/10 board serves two functions: the first is to control flatness, and the second is to provide equalization that produces 10 dB of tilt for the output of the amplifier. This tilt is equivalent to approximately 13.5 dB of cable at 750 MHz.

The JXP-THERM is a temperature controlled attenuator that complements the Bode equalizer in controlling amplifier flatness during temperature fluctuations.

Figure 5 illustrates the amplifier module with the cover partially cut away to show the location of major components.

Figure 5
Forward amplifier module



Models MBD-SPLT and MBD-DC

One amplifier path in the MB-750D-H* is dedicated to port two as shown in Figure 1. The other path can be used to feed either port three or four by appropriate installation of the furnished MBD-JMP jumper. Port numbers are marked on the housing ends, just above the connectors, as illustrated in Figure 2. The model MBD-SPLT splitter and model MBD-DC, which is a 10 dB directional coupler, are available to provide outputs at ports three and four. The MBD-SPLT provides equal output levels, while the MBD-DC provides one high level port and one low level port. The MBD-DC may be installed to provide the high level signal to either port three or to port four.

Return Signal Path

The MB-750D-H* amplifier can be equipped to pass signals in the return or upstream direction by installing the RA-Kit/40/L return amplifier kit. Model DF1-SS input and output bandsplitting filters are factory installed in the MB-750D-H. Model DF1-SS/40 bandsplitting filters are furnished with the MB-750D-H/40 amplifier and isolate the forward and return signal paths. The return amplifier kit includes a return amplifier hybrid and a selection of cable equalizers and jumpers to compensate for cable lengths with sub-split, 40 MHz split or European split systems.

Signal level control is provided through model JXP-*A attenuators. Return attenuators may be installed at both the input and the output of the return amplifier, as needed. The input

attenuator facility can be used to control the return amplifier input signal level when necessary. It may also be used as a return test point. The primary function of the output JXP-*A is to balance the return signal level into the next upstream amplifier from multiple distribution legs.

Forward Output Level Control

Forward output level and gain is controlled by two different methods, manually or automatically with use of the JXP-THERM. In the manual position of the thermal control jumper, the gain of the amplifier is controlled by the GAIN potentiometer. See Figure 5 for the location of this jumper. Note that if the amplifier cover is in place, the access hole to the GAIN potentiometer is labeled MAN. In the manual position, the gain will fluctuate in response to ambient temperature changes. The magnitude of change depends on the position of the thermal control jumper. In the HIGH position, the jumper compensates for approximately 26 dB of cable. This position can be used when more than 20 dB of cable exists at the input of the amplifier. The LOW position of the thermal compensation jumper will compensate for approximately 17 dB of cable. This position can be used when less than 20 dB of cable is present at the amplifier input. The OFF position is used in instances when the cable is installed underground and thermal compensation is not required. In underground installations, the cable attenuation is assumed to be constant and therefore compensation is not necessary.

The model JXP-THERM, installed in the mid-stage facility, is a variable attenuator which changes its correction factor in response to ambient temperature changes. This attenuator is flat and supplements the attenuation changes performed by the Bode equalizer. In buried plant installations, the JXP-THERM can be left in place and it will compensate for hybrid gain changes with temperature.

Power Control Options

Normally cable power is applied to the input of the distribution amplifier, and is directed toward the feeder port as required. Maximum permissible ac current through the input port is 10 amperes. A 20 ampere fuse is in series with the input to protect the amplifier from overcurrent. This fuse can also serve the additional function of being used as a switch. When it is desired to have the amplifier powered through the output port, the fuse is removed, thus eliminating conflicting power from the input.

Circuit breaker, part number SX5B, or fuses, part numbers SX7F and SX10FA, can be installed to control the power to the feeder output. The choice of circuit breaker or fuse is a user option; either protects against overcurrent on the feeder line. A heavy duty surge arrestor is included in the model MPPS power pack. An additional surge arrestor, model XO-36, can be installed at the cable port of the housing. Figure 2 shows the location of the optional power control components.

Automatic Control Board

The Automatic Control Board, General Instrument Model MB-ACB/*, is an optional plug-in board that monitors the amplitude of a designated pilot frequency and automatically adjusts the gain and slope in order to maintain a constant output. The asterisk indicates the user's choice of pilot channel frequency. The conversion from manual to automatic control is accomplished by simply relocating the suitcase jumper to the ACB position and inserting the ACB board. Typically, no additional insertion loss is incurred with use of this feature.

Available pilot frequencies include 499.25, 403.25 and 295.25 MHz.

Section 3
Preinstallation Procedures

Prior to installation, the MB-750D-H* amplifier must be equipped with several required accessory items. The required items are to be determined from the data in the system layout documentation. Addition of the required components and bench testing prior to installation is highly recommended. This procedure assures proper alignment of all components and significantly simplifies the field installation and balancing process.

Configuring the MB-750D-H*

The amplifier must be configured to suit system requirements prior to installation. Configuration includes the selection and installation of a number of components which are described in the following paragraphs. Major components include:

- Forward equalizer, model EQ-750-*
- Output passives — splitter or directional coupler, model MBD-SPLT or MBD-DC
- Power control options — Circuit breaker model SX5B or fuses model SX7F, or SX10FA
- Automatic control board option, model MB-ACB/*
- Two-way option, model RA-KIT/40L

To install selected options in the amplifier, unplug the power cord from the amplifier module by applying a pulling force while depressing the locking tab of the connector. Loosen the screws holding the cover in place and remove the cover. Component locations are now accessible.

Forward Equalizer, Model EQ-750-*

Cable equalizers are selected to compensate for cable attenuation versus frequency coupled with their use in achieving proper output tilt. The amplifier comes equipped with a model MDR-750/10 interstage equalizer and flatness board which compensates for 13.5 dB of cable at 750 MHz. Any additional cable loss beyond 13.5 dB must be compensated for by selecting and installing the appropriate cable equalizer, model EQ-750-*. Equalizers are available in 2 dB increments from 2 to 22 dB.

In instances when there is less than 13.5 dB of cable connected to the input of the amplifier, a flat interstage board with flatness controls is an available option. Since the equalizer selection process depends on specific circumstances, the following two examples illustrate some of the options.

Example 1:

The amplifier is to be installed in a location that includes 20 dB of cable (at 750 MHz) between its input and the preceding amplifier. Only cable loss should be considered, and any flat loss due to splitters or other passive devices must be excluded. The internal equalizer, model MDR-750/10, compensates for 13.5 dB of cable. This cable length must be subtracted from the 20 dB of this example (20 – 13.5 = 6.5). The EQ-750-6 is the proper equalizer in this case. With

this equalizer installed, the amplifier will reproduce the output tilt of the last upstream amplifier.

Example 2:

The MB-750D-H* amplifier is to be used in a link following a fiber node. The fiber receiver's output is flat and connects to the input of the amplifier through 18 dB of cable plus passive loss. Which is the proper equalizer to achieve the 10 dB output tilt from the amplifier?

In this instance, the equalizer value can be calculated by using the following method:

$SLOPE_{eq} = TILT_{out} + SIG_{lo} - SIG_{hi} - SLOPE_{ieq}$

where:

$SLOPE_{eq}$ = required EQ-750-* slope

$TILT_{out}$ = required amplifier output tilt

SIG_{lo} = signal input level at channel 2

SIG_{hi} = signal input level at 750 MHz

$SLOPE_{ieq}$ = interstage equalizer slope (10 dB)

From established references and manufacturer's catalogs, note that at an operating frequency of 750 MHz, 18 dB of cable will produce approximately 4.4 dB of loss at 54 MHz. This suggests that the channel 2 signal input to the MB-750D-H* amplifier is 13.6 dB greater (18 – 4.4 = 13.6) at channel 2 than at 750 MHz. Our example assumes that the high-end frequency level into the amplifier is + 12 dBmV.

Substituting this information into the above equation gives:

10 dB + 25.6 dB – 12 dBmV – 10 dB = 13.6 dB

The slope of the required equalizer is 13.6 dB. This can be translated into an equivalent cable value by using either Figure 6 or alternatively, by using the appropriate multiplier. The multiplier in this case is 1.37 dB (13.6 × 1.37 = 18.6). Therefore, the correct equalizer is the EQ-750-18, the closest available equalizer value.

Multipliers to convert tilt to cable equivalent are:

550 MHz = 1.46

650 MHz = 1.40

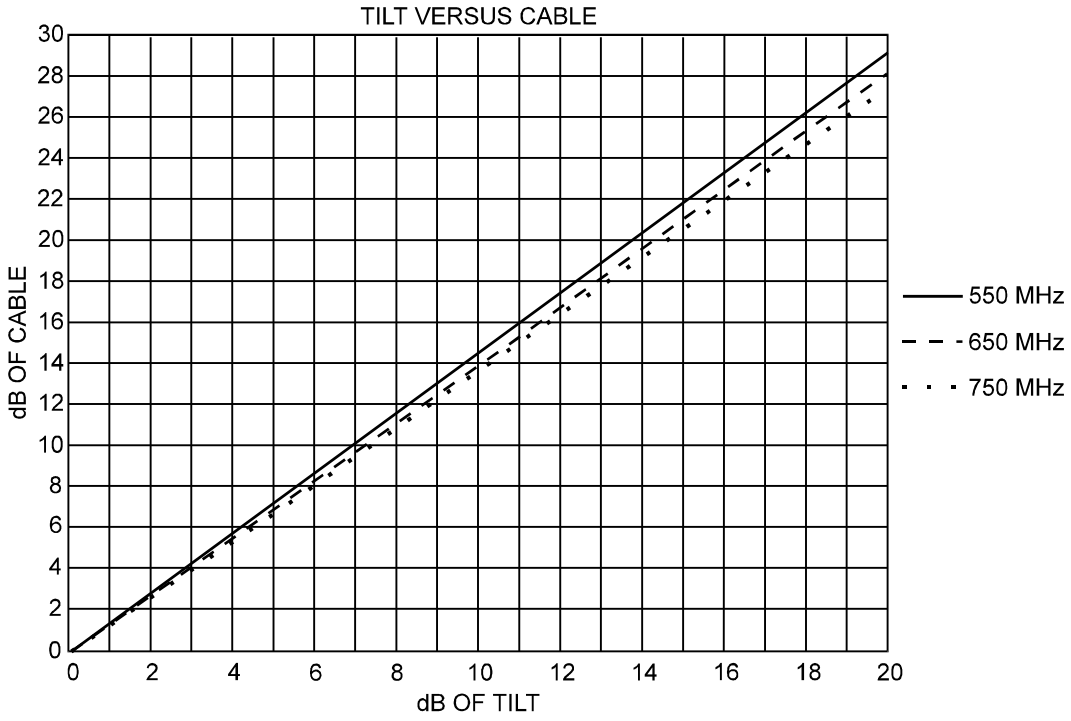
750 MHz = 1.37

The final choice of equalizer could vary somewhat when the amplifier is installed. This is due to a number of independent variables including errors in cable attenuation, slope in passive devices, and others.

In cases where the calculated equalizer value makes two choices possible, the lower value is to be preferred.

Figure 6, on the following page, graphically represents the relationship between dB of cable and dB of tilt.

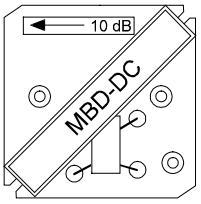
Figure 6
Tilt versus cable



Output Passives

The MBD-JMP jumper furnished with the amplifier allows the user to select either port three or port four as the output port. However, if it is desired to provide signal output to both ports, three and four, then the proper output splitter must be installed. Installation of the MBD-SPLT splitter provides equal output at ports three and four. If unequal outputs are desired, use of the MBD-DC, a 10 dB directional coupler, is required. It can be installed to provide a high level output at either port three or four and a 10 dB lower level at the other. The tap port, and therefore the lower level, is indicated by the arrow on the MBD-DC circuit board and is shown in Figure 7.

Figure 7
Model MBD-DC output directional coupler



Power Control Options

Install SX5B circuit breakers, SX7F fuses, or SX10FA fuses, as desired, to pass power from the cable input to the proper output ports. If the amplifier is to be powered from one of the output ports, ac must be prevented from entering through the input port and continuing into the amplifier. The 20 ampere fuse must be removed to block normal input power.

XO-36 surge arrestors can be installed to provide additional protection for the active input and output ports. A heavy duty surge arrestor is furnished with the model MPPS power pack.

The model FTEC/MB is a crowbar circuit that can be installed in the MPPS power pack. It is an electronic circuit that replaces the surge arrestor that is furnished with the power pack. This unit is also a customer option and serves the same function as the furnished heavy duty surge arrestor. It is the preferred method of surge protection in some cases.

Automatic Control Board Option, Model MB-ACB/*

The location of this circuit board within the amplifier was illustrated previously in Figure 2, *Section 2, Overview*. When inserting the board, care should be exercised to assure proper mating of the pins on the MB-ACB/* board with the socket on the main circuit board. The pins are keyed with the socket to permit entry in only one position. The MB-ACB/* is enabled by placing the thermal control jumper in the ACB position. Automatic level control can be disabled at any time by placing the thermal control jumper in the OFF, LO, or HI position.

The MB-ACB/*, as supplied, is tuned to the channel which is to be used as the pilot frequency. This channel must be present on the system continuously and may be modulated or unmodulated. Retuning the MB-ACB/* to an alternate frequency is not practical.

Two-Way Option

Two-way service can be implemented by installing the return amplifier kit, model RA-Kit/40L.

The return amplifier kit consists of a hybrid gain block, a selection of jumpers, and SEE-* cable equalizers. These items are installed in the module in the locations shown in Figure 5, *Section 2, Description*. Special care must be used when installing the hybrid gain block to ensure that all pins are straight and aligned with the appropriate sockets on the circuit board. Heatsink compound, General Instrument part number 663-008-000 or its equivalent, can be used between the hybrid flange and the housing to facilitate thermal conductivity. Use of the heatsink compound is not mandatory and is therefore not furnished with the kit. Secure the hybrid gain block to the circuit board using the furnished screws.

Two return equalizers are supplied in the kit. They are models SEE-40-7 and SEE-55-4.4.

Input signal measurement can be made by installing an F/JXP adapter in the three-pin JXP pad facility. The F/JXP adapter is also used for inserting a sweep signal into the return amplifier path for test and alignment of the return system. It should be noted that the return path is interrupted while the F/JXP is installed. The JXP pad or jumper should be replaced after measurements or tests are completed.

Output signal measurements can be made through the common test points near housing port 1. The test point signal level will be 20 dB below the actual level.

Bench Powering the MB-750S-H/40/E Amplifier

The recommended method of powering the amplifier on the bench is to apply ac from a 60 Vac supply through a model SSP-PI power combiner to the input port. Alternate methods, such as the use of a 24 Vdc power supply exist and can be used, but the method described here is preferred. Sweep equipment must be calibrated with the power combiner in the signal leads to avoid erroneous test results.

The sockets for the SX5B circuit breakers, or SX7F and SX10FA fuses should be vacant at this point to avoid damage to test equipment by unintentionally applying 60 Vac. Special care should be exercised to block power from test terminators which do not include a blocking capacitor. Failure to do this will likely result in a damaged termination and the consequence may be a misaligned amplifier.

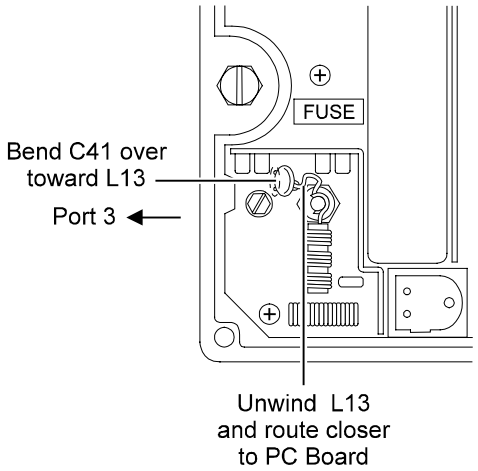
Installing DF1-SS/40 Diplex Filters

Existing MB-750D-H amplifiers can be equipped with the new DF1-SS/40 diplex filters to extend the bandpass of the return system to 40 MHz. The upgrade procedure is simple. To change filters, remove the amplifier cover, unplug the existing 30 MHz diplex filters and replace with the 40 MHz diplex filters.

The change in filters may degrade the impedance match on output ports 3 and 4, but there will probably be no effect on picture quality.

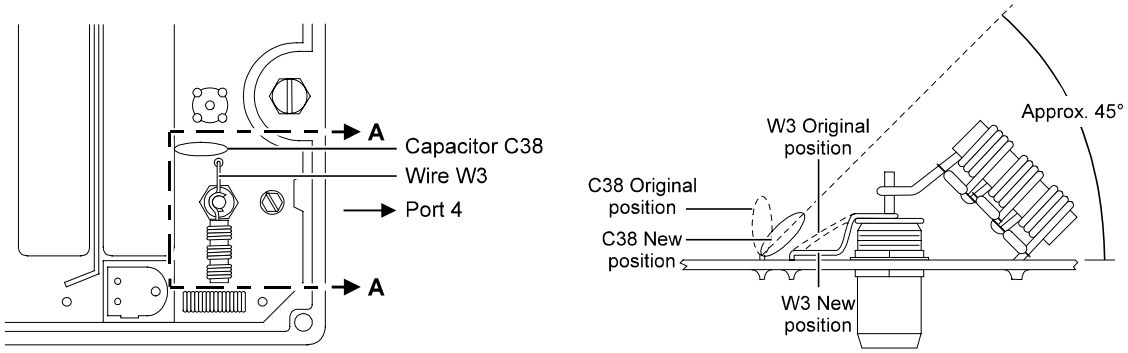
To improve the impedance match at port 3, unwind the single turn coil, L13, and dress the wire closer to the circuit board. Also, capacitor C41 should be bent slightly toward the connector. Note that the lead wire from the capacitor is not insulated and must not touch the connector or any other component. The components involved in this procedure are illustrated in Figure 8.

Figure 8
Restoring impedance match, port 3



To improve the match at port 4, merely bend capacitor C38 toward the adjacent connector. The wire which connects to the output connector should also be dressed as close to the circuit board as possible. The components involved in this procedure are illustrated to the left in Figure 9. A more detailed side view of section A-A is illustrated to the right in Figure 9.

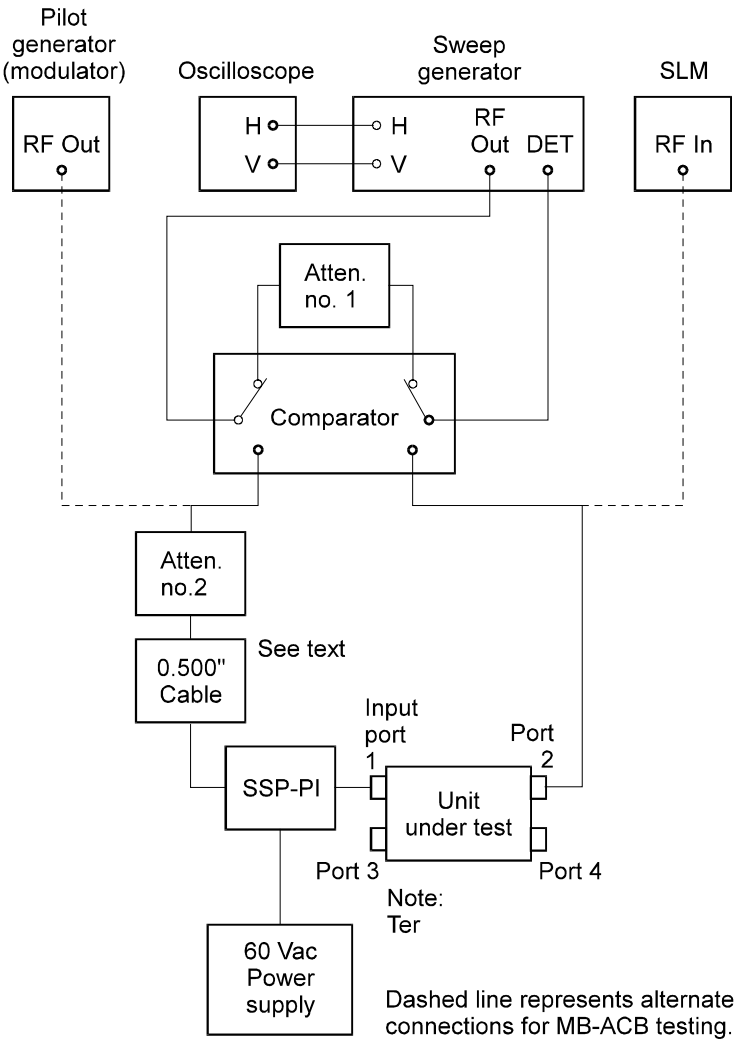
Figure 9
Restoring impedance match, port 4



Sweep Response and Gain Testing

Typical connection of test equipment for preinstallation testing is shown in Figure 10.

Figure 10
Typical test equipment and connections



Simulate the field location of the unit under test by applying the sweep signal through the equivalent cable loss on the bench. For example, if the amplifier will be installed in a location that will include 20 dB of cable between the previous amplifier and the unit under test, sweep through a length of cable that exhibits the same 20 dB loss at 750 MHz.

Check that the proper equalizer and all other options have been installed. Usually the proper equalizer can be calculated by subtracting the value of the interstage equalizer (13.5 dB) from the cable loss preceding the amplifier. Referring to the example of the previous paragraph, the proper equalizer should be 6 dB (20 – 13.5 = 6.5).

Manual Thermal Gain Control

Manual thermal gain compensation is standard in the amplifier and is designed to compensate for cable attenuation changes with temperature. Control is selectable and depends on the position of the thermal control selector. This jumper is located on the circuit board and can be positioned to HI, LO or OFF. The HI position is recommended for instances when 20 dB or more of cable precedes the amplifier. The LO position is used for less than 20 dB of cable, and the OFF position is recommended for buried cable plant. Refer to Figure 2 in *Section 2, Overview*, or the legend on the amplifier cover to locate the thermal control jumper. Position the jumper as required by the installation.

Apply power to the unit and check the output of the power supply. The voltage at the power supply test point should be + 24 Vdc ± 0.2 V.

Apply a sweep signal to the amplifier. Standard sweep testing procedures apply and should be executed by a qualified technician. Turn the gain control to maximum (fully CW) and then reduce the gain at 750 MHz as indicated by the required gain reserves in Table 2 for the current ambient temperature.

Table 2
Gain reserves versus temperature

Required Gain Reserve	Degrees Celsius	Degrees Fahrenheit
7.0 dB	– 29	– 20
6.0 dB	– 12	10
5.0 dB	4	40
4.0 dB	21	70
3.0 dB	35	95
2.0 dB	49	120

Flatness

The output of the amplifier at this point should be flat, i.e., the low end signal level (channel 2) is equal to the high end frequency signal level. Peak to valley response variations can be corrected by adjustment of the MDR board and trimmer capacitors C80, C81, and C82 on the main board. If the response exhibits tilt, an improper equalizer has been installed and should be replaced. Less gain at the low end frequencies indicates that the next lower value equalizer may be required, while loss of gain at the high frequencies indicates that the next higher value of equalizer needs to be installed.

Figure 11 shows the location of the controls, while Figure 12 shows the approximate effects on the frequency response of the amplifier. The changes in response, as they are shown, were obtained by comparison against a normalized trace to emphasize the effect of the various controls.

- Trimmer capacitors C4, C6 and C80, together with potentiometers R6 and R7, control the response at the low end frequency. These controls are used primarily to compensate for diplex filter roll. Capacitors C80, C81 and C82 are located on the main PC board (Figure 5).
- C81 and C82 control the high end bandpass.
- Trimmer capacitor C3 and potentiometer R4 are used to obtain overall flatness.

Figure 11
MDR-750/10 Board

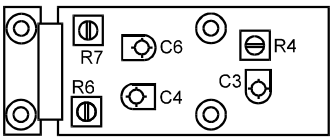
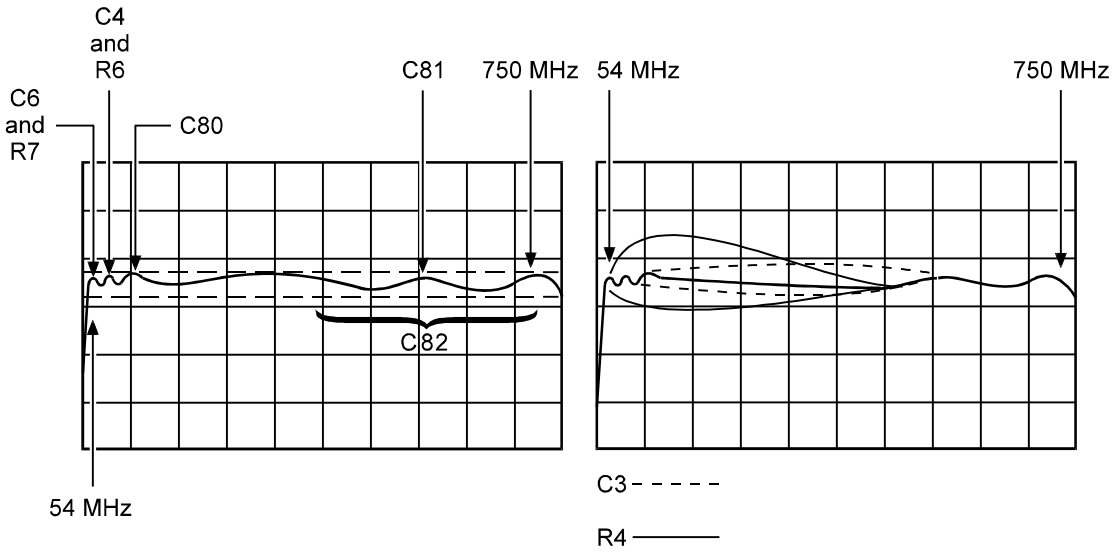


Figure 12
Effect of flatness controls



Operational Gain

After the required flatness has been obtained, the operational gain of the unit can be measured. Refer to *Appendix A, Specifications*, for proper operational gain values. The amplifier's gain is the measured gain plus the sum of all losses, including the power combiner and cable. Operational gain must meet advertised specifications. If it does not, re-check the gain reserves and re-check the loss associated with all external components, such as cable, test cables, and the power combiner.

Automatic Level Control

To test the operation of the MB-ACB/* Option, proceed with the following steps:

1. If necessary, refer to the steps for manual thermal control operation previously outlined on page 16. Switch to the ACB control mode by repositioning the thermal control jumper within the module.
2. Apply a signal at the pilot frequency of the MB-ACB/* board, to the input of the amplifier, while monitoring the output with a signal level meter. Refer to Figure 7 for the location of alternate test equipment connections.
3. Set the level control on the MB-ACB/* board to full CW, then adjust the pilot generator output level for an amplifier output which is equal to the operating level plus gain reserves. This will establish the proper input level of the pilot carrier. For example: the operating level of the amplifier was chosen to be + 44 dBmV with a room temperature of 70º F. Level would be set by use of the following procedure:

   44 + 4 (gain reserve at 70º F, Table 2) = 48 dBmV.
4. Reduce the output level by the gain reserve value shown in Table 2 for the appropriate ambient temperature by using the level control adjustment on the MB-ACB/* board.
5. Vary the pilot level by ± 2 dB while monitoring the output of the amplifier. The measured level should remain constant within 0.5 dB.

This completes the bench testing and final assembly of the MB-750D-H*. Record all calibration and setup data for possible later use. Prepare the unit for the field location by installing or double checking the following options:

- Output passives, models MBD-JMP, MBD-SPLT, or MBD-DC
- Circuit breaker, model SX5B, or fuses, models SX7F and SX10FA
- Surge arrestor, model XO-36
- Pads, model JXP-*A

Fold the module handles and close the housing with care to avoid pinching the power cable between the MPPS power pack and the module.

Record the unit's serial number and file safely with the setup and calibration data. Clearly mark the unit with its destination and store in a secure location.

All preinstallation procedures have been completed.

Section 4
Field Installation

Mechanical Installation

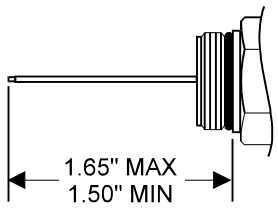
The conventional method of installation is to suspend the unit by clamping it to the strand installed for the support of the coax cable. Two factory equipped strand clamps are provided for this purpose and can be positioned on either side of the housing to permit convenient curb side entry.

An alternative method is to mount the housing on a pedestal. Mounting brackets are normally provided as part of the pedestal, and the strand clamp screws can be removed and used for mounting on a pedestal bracket. In the model MB-HSG/60 housing, two threaded holes spaced 7.7 inches apart are provided on the rear of the unit for this purpose.

Housing Connections

Connections to the MB-HSG/60 housing are made using standard housing entry port connectors. Pin-type connectors with a nominal center conductor diameter of .067 inches are required. The pin length of the center conductor is 1.50 inches minimum and 1.65 inches maximum as measured from the seating plane of the connector. If the amplifier is to be installed in an XLE-HSG housing, the center conductor length should be 1.375 inches. Figure 13 illustrates a typical pin type connector.

Figure 13
Pin connector



Mounting the Housing

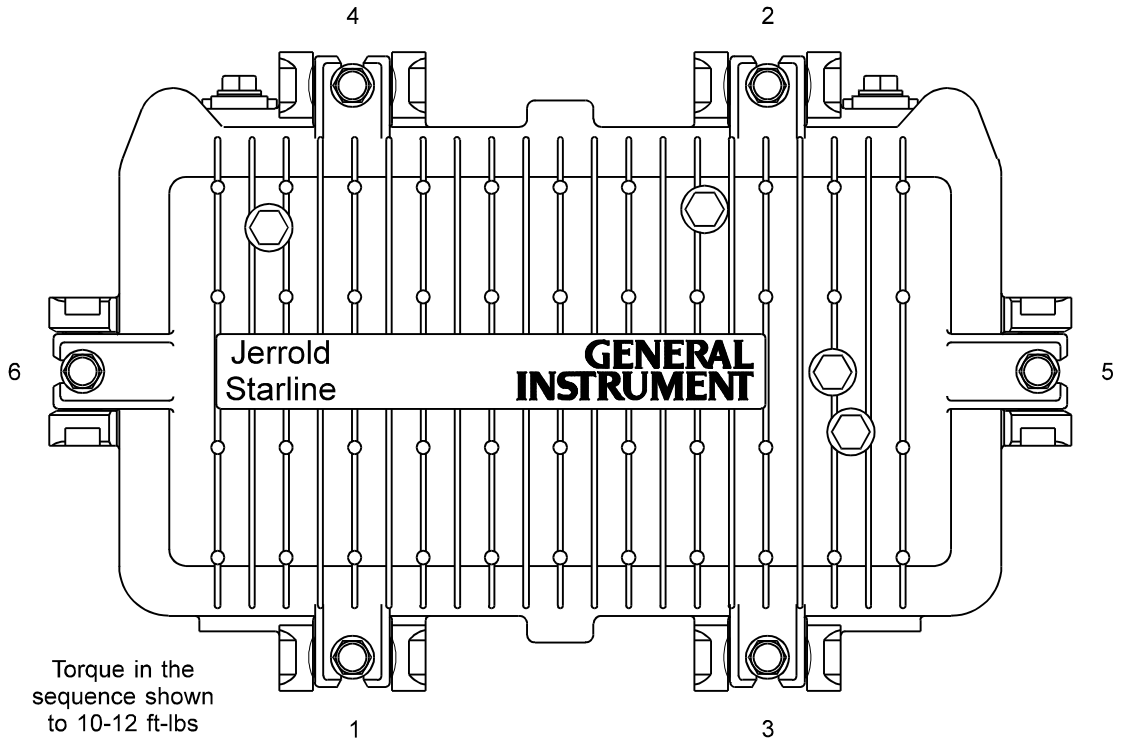
Remove the amplifier module from the housing prior to installation on the strand. Consider the entry point of the input cable and all output cables before deciding on the final location of the unit.

Mount the housing and make all connections. Aluminum connectors should be torqued to the specifications recommended by the connector manufacturer to avoid water ingress. Re-install the electronics and fasten the module to the housing using the four captured screws that have been provided. Re-attach the power cable from the power pack and support this cable with the existing cable clamps.

Power-up

Apply power to the unit and allow a period of time for warm up. Both the ac and the B+ voltage should be checked at this time. The ac input must be above 38 volts and may be checked at the input connector center conductor with a true rms voltmeter. The B+ voltage is required to be 24 Vdc ± 0.2 volts. The housing should be closed and torqued to protect the amplifier until final adjustments are made. Refer to Figure 14 below for the bolt tightening sequence and torque specifications.

Figure 14
MB-HSG/60 Housing



Balancing the Amplifier

Final adjustment of the amplifier includes setting the output signal level, setting the output tilt, and checking the flatness of response. Both the input and the output test points are 75 Ohm source impedance, and 20 dB below actual levels. A test probe, General Instrument model GFAL, facilitates connection to the test points and is recommended. All test probes that contain signal matching and attenuating electronics, such as General Instrument model SPD-30, cannot be used for this test as the value measured will be in error. Figure 5 in *Section 2, Overview*, shows the location of these test points.

Tilt and flatness can be checked conveniently through a test cable prepared for this purpose. Use of this cable results in a flat trace for ease of measurement. For example, a 750 MHz amplifier with 10 dB of output tilt can be checked through a 13.5 dB length of cable and the

resulting measurement will be flat. Figure 6 in *Section 3, Preinstallation Procedures*, provides a comparison of cable loss versus slope for three different operating frequencies.

Open the housing and check the ac and dc voltages to assure that both are within the required limits. The ac voltage should be between 38 Vac and 60 Vac as measured with a true rms voltmeter. The dc voltage should be 24V ± 0.2 volts.

Manual Thermal Gain Control

If the unit has been bench aligned, as described earlier, only minor changes should be expected at this point. The following steps are to be used in making final manual thermal gain control adjustments:

1. Connect a signal level meter to the output test point and tune the meter to the high end channel nearest 750 MHz.
2. Turn the MAN control to maximum (fully clockwise) then reduce the output according to the information provided in Table 2 in *Section 3, Preinstallation Procedures*.
3. The output level of the high end channel should be within 0.5 dB of the desired output signal level. Minor adjustments of less than 0.5 dB can be made by using the MAN control.
4. If the output signal level is greater than the required level after performing step 3, the input pad must be changed. Subtract the desired signal level from the measured level and the result is the required pad value. Remove the module cover and install the proper input pad. Replace the module cover and repeat step 3.
5. Output tilt, i.e., the difference in signal level between channel 2 and the high end, can be measured through the specially prepared test lead as described in the preceding topic, *Balancing the Amplifier*. The difference in signal level between channel 2 and the high end should be negligible when measured through the test cable if the proper equalizer has been installed. If the channel 2 signal level is greater than the high end, replace the cable equalizer with the next higher value. If the channel 2 level is less than the high end level, the next lower value equalizer must be installed.
6. Flatness can be measured if a sweep signal is present on the cable. The test cable described previously will be required. Flatness should meet applicable system requirements. A qualified technician can make minor adjustments on the MDR board to improve flatness.

Automatic Level Control

The thermal control jumper must be in the ACB position for the following steps. It is again assumed that the unit has been bench aligned and only minor adjustments are to be expected.

It is desirable, although not essential, to perform the steps outlined in the preceding section for adjusting the manual thermal gain control. Checking the gain reserve in the manual control positions, either LO or HI, assures that operation in this mode is available and preset, should it become necessary to revert to manual thermal gain control. The “reserves” in the manual or automatic control modes confirm that the amplifier is operating within its dynamic window of gain control.

To adjust the automatic gain control:

1. Connect the signal level meter to the output test point and tune the meter to the high end active channel; for example, tune to 745.25 MHz for a 750 MHz system.
2. Turn the LEVEL control on the MB-ACB/* board to maximum (fully CW). The measured level should be the operating level plus gain reserves for the present temperature as shown in Table 2 in *Section 3, Preinstallation Procedures*. If the level is greater, install a Model JXP-*A input pad to achieve the required level to within 0.5 dB. For example, the operating level of the amplifier is + 44 dBmV at 750 MHz. The measured level is + 49 dBmV, and the ambient temperature is 70° F. Table 2 shows that 4 dB of reserve is required at the present temperature. Using the calculation 49 – (44 + 4) = 1, the use of a 1 dB pad is indicated.

   The pad selected should be installed at the input of the amplifier, and is located in the upper left near the forward cable equalizer.
3. Adjust the LEVEL control on the MB-ACB/* board to achieve the desired output level (+ 44 dBmV in our example). The MB-ACB/* board controls the output of the amplifier for pilot levels from + 39 to + 50 dBmV.
4. Output tilt can be measured using the specially prepared test lead. The procedure for adjusting tilt is exactly as described on the previous page under the heading *Manual Thermal Gain Control.*

Closing the Housing

- Record all pertinent calibration data and store in a safe location for future reference.
- Check all module cover screws as well as module retaining screws for proper tightness.
- Close the housing with care to avoid pinching the cord between the power pack and the amplifier module.
- Progressively tighten the housing closure bolts in the sequence and to the torque specifications illustrated in Figure 14 for the model MB-HSG/60 housing. If the model XLE-HSG housing is in use, torque the bolts to 5.0 ft. lbs.

This completes the field installation.

Appendix A
Specifications

The specifications listed below apply to the MB-750D-H* amplifier as used without the return amplifier or automatic control board options.

Amplifier

Parameter	Specification
Passband	
MB-750D-H	50 to 750 MHz
MB-750D-H/40	52 to 750 MHz
Minimum full gain at 750 MHz	39 dB
Operational gain at 750 MHz	35 dB
Flatness	± 0.75 dB
Gain control range	8 dB
Noise figure	
at 52 MHz	13 dB
at 750 MHz	11.5 dB
Return loss	14 dB
Test points	
Input	20 dB ± 1.5 dB
Output	20 dB ± 0.5 dB
DC supply	1310 mA at 24 Vdc
Power consumption	39.3 W
AC current	
at 60 Vac	0.69 amps
at 53 Vac	0.80 amps
at 45 Vac	0.92 amps
at 38 Vac	1.09 amps
AC bypass current	10 amps maximum
Dimensions, MB-HSG	15.4"(l) x 5.5"(w) x 9.6"(h)
Operating temperature	– 40° to + 60° C

Automatic Control Board, MB-ACB/*

Parameter	MB-ACB/403.25	MB-ACB/499.25
Pilot frequency	403.25 MHz	499.25 MHz
Amplifier output range		
Minimum	+ 39 dBmV	+ 39 dBmV
Maximum	+ 50 dBmV	+ 50 dBmV
Control stiffness for level changes of – 3 to + 4 dB	± 0.75 dB	± 0.75 dB
DC supply	24 Vdc, 75 mA	24 Vdc, 75 mA
AC requirement	30 mA, 1.3 watts	30 mA, 1.3 watts

Return Amplifier Kit, RA-Kit/40L

Parameter	Specification
Passband	5 to 40 MHz
Minimum full gain	21 dB
Maximum noise figure w/o equalizer	6 dB
DC supply	24 V, 125 mA
AC requirement at 52 Vac	.08 amperes, 3.8 watts

Diplex Filters, DF1-SS/40 and DF1-SS

Model	DF1-SS/40		DF1-SS	
Parameter	Forward	Return	Forward	Return
Bandpass	52 to 1000 MHz	5 to 40 MHz	50 to 1000 MHz	5 to 30 MHz
Insertion loss				
at 30 MHz		n/a		0.6 dB
at 40 MHz		1.0 dB		n/a
at 50 MHz	n/a		0.6 dB	
at 52 MHz	0.9 dB		n/a	
at 1000 MHz	0.8 dB		0.6 dB	
Isolation (typical)	50 dB	50 dB	50 dB	50 dB
Return loss	18 dB	18 dB	18 dB	18 dB

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