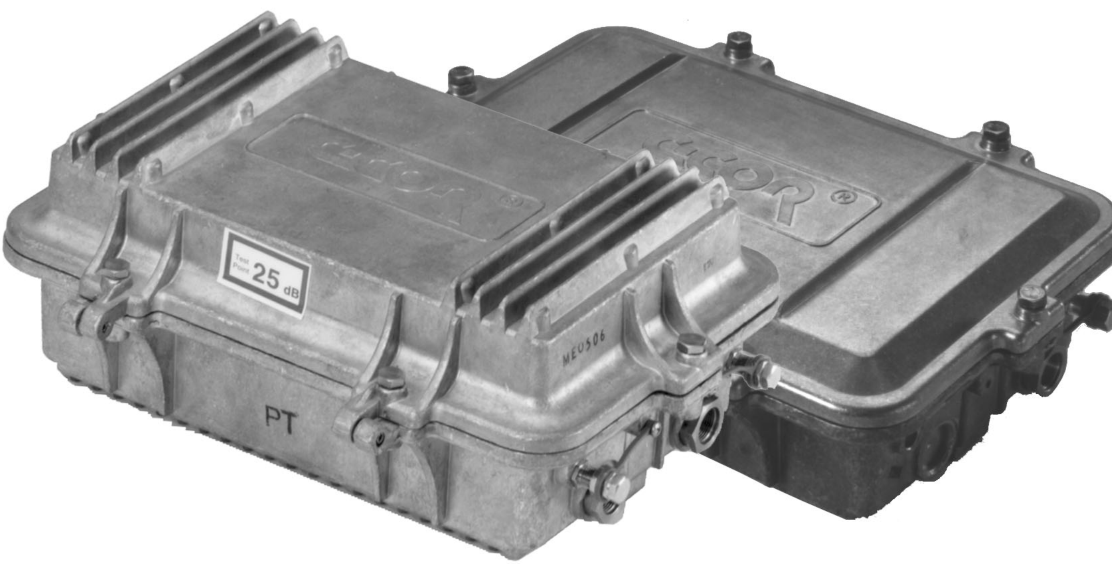
E7 FlexNet® 700 Series

(E7 & E629) Line Extender Amplifiers

Procedures Manual



Procedures Manual

for

E7 FlexNet® 700 Series

(E7 & E629)

Line Extender Amplifiers

C-COR.net

E7 FlexNet® 700 Series (E7 & E629) Line Extender Amplifiers

C-COR.net Document Number: MX0507 Revision E

Trademarks

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Chapter 1

1

Introduction

This chapter includes an overview of the E7 FlexNet line extender amplifier characteristics, warranty information, and suggested tools and materials required when working with the line extender.

1.1 Conventions

Labels printed on the amplifier faceplates are shown in a different typeface (for example, **ALC**).

This manual uses the following notes, cautions, and warnings:

WARNING: *Personal injury could result if instructions are not followed.*
CAUTION: *Equipment damage may result if instructions are not followed.*
Note: *Read for added information and reminders. A note can tell you when a service interruption could occur.*

1.2 Statements of Compliance

FCC Compliance:

This device complies with the Code of Federal Regulations Title 47, Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this device not expressly approved by C-COR.net may cause the operation of this device to be in violation of Part 76 of the FCC Rules, voiding the user's authority to operate the equipment.

CE Compliance:

This device conforms to the protection requirements of Council Directive 89/336/EEC[1] on the approximation of the laws of the Member States relating to electromagnetic compatibility.

UL Listed:

117 Volt line extender models have met the Professional Video and Audio Equipment safety requirements of UL and cUL Standard 1419.

1.3 Warranty

C-COR.net shall, at its expense, correct any defect in material and workmanship in products manufactured by C-COR.net which may appear within the warranty period, as set forth herein. C-COR.net MAKES NO OTHER REPRESENTATION OR WARRANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, WITH RESPECT TO THE GOODS, WHETHER AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER MATTER.

The "warranty period" is as follows:

1. Distribution electronics, such as amplifiers, main line passives, and power supplies: five (5) years from date of shipment.
2. AM fiber optic products: three (3) years from date of shipment.
3. Cable Network Manager (CNM™) network management software and associated equipment: fifteen (15) months from date of shipment. Network Management Transponders (NMT): warranted as unit in which they are installed for a maximum of three (3) years. When installed in units already in the field, NMT will have remaining warranty of that unit, up to three (3) years and no less than one (1) year.
4. Terminal, modem, and translator products: one (1) year from date of shipment.
5. Specialty goods manufactured in the C-COR.net Equipment Service Center: CATV products: three (3) years from date of shipment; DATA products: one (1) year from date of shipment.
6. All other goods: ninety (90) days from date of shipment.

The C-COR.net warranty shall not cover fuses, batteries, and lamps. It does cover transistors and integrated circuits to the extent that C-COR.net is warranted by the original manufacturer. Modifications or alterations of C-COR.net products (including but not limited to installation of non-C-COR.net equipment or computer programs) except as performed by C-COR.net or its authorized representative, will void this limited warranty.

1. Except the E7 862 MHz/117 VAC line extender.

1.4 Overview

The FlexNet® 700 Series Line Extenders (E7 & E629) are broadband amplifiers for use in broadband systems. The E70C and E71C amplifiers are single output, low gain amplifiers designed to “express” between cascaded trunk amplifiers. The E629, E72, and E73C amplifiers are single output, high gain amplifiers designed to extend the reach of feeders. General characteristics of the FlexNet line extenders are given in Table 1.1. The power supplies and housings are listed in Table 1.2. The line extender assemblies are illustrated in Figures 2.1 to 2.5.

Table 1.1 Line Extender RF Module Characteristics[1]

Characteristic	E77D[2] (117 VAC)	E70C	E71C	E72C	E73C	E73C (117 VAC)	E729C	E629C
Bandwidth	862 MHz	750 MHz	750 MHz	750 MHz	750 MHz	750 MHz	550 MHz	550 MHz
Spacing	35 dB	21 dB	28 dB	30 dB	33 dB	33 dB	30/31 dB	32 dB
Level Control	NLC	ALC	ALC	ALC, TLC	none	none	none, ALC	none
Reverse	none, passive 20 dB	none, passive, 18 dB		none, passive, 18 or 20 dB		20 dB	none, passive, 18 or 20 dB	none
Input/output configuration	1 input, 1 output							
Testpoints	-25 dB loss. For balancing the forward RF path							
Power Passing	10 A maximum continuous current for units with 60 VAC Supplies; 13 A for 90 VAC and 117 VAC Supplies							
Operating Temperature Range	-40 to +140°F (-40 to +60°C)							

ALC = Automatic level control
TLC = Thermal level control
NLC = No level control
passive = no amplification (11 dB loss) (5 dB loss for E77 passive)
18 dB = active standard reverse gain
20 dB = active high reverse gain

1. The listed characteristics are for current and previous models. Some models and characteristics may no longer be available. Contact your C-COR.net sales representative for specific information.
2. To reduce the risk of fire or electrical shock, do not expose this appliance to rain or moisture.

Table 1.2 Line Extender Power Supplies and Housings

Line Extender	Powering	Housing
E77D (117 VAC)	d	j
E70C	a, b, e	f, g, h
E71C	a, b, e	f, g, h
E72C	a, b, c, e	f, g, h
E73C	a, b, c, e	f, g, h
E73C (117 VAC)	d	i
E729	a, b	f, g, h
E629	a, b	f, g, h

Powering

a. 60 VAC, 60 Hz linear power supply
b. 60 VAC, 50/60 Hz linear power supply
c. 60 VAC, 60 Hz linear power supply
d. 117 VAC, 60 Hz linear power supply*
e. 90 VAC, 60 Hz H.E. power supply (transformerless)*

*requires a full lid housing

Housing

f. 4 port, 1 GHz full lid housing
g. 2 port, 1 GHz full lid housing
h. 2 port, 1 GHz flat lid housing
i. 2 port, 1 GHz full lid housing modified for 117 VAC power supply
j. 2 port, 1 GHz full lid housing modified for 117 VAC power supply and detachable AC power cord

Table 1.3 Housing Dimensions

Dimension	Measurement
Height	9.7 inches (24.5 cm)
Width	12.4 inches (31.5 cm)
Depth, full lid	4.8 inches (12.2 cm)
Depth, flat lid	3.4 inches (8.64 cm)
Weight, full lid	15 lbs (6.8 kg)

Table 1.4 E700 Series Line Extender Inputs and Outputs [1]

Model Information		Forward										Reverse			
		Minimum Inputs (dBmV)					Outputs[2] (dBmV)					Minimum Inputs (dBmV)		Outputs (dBmV)	
Model Number	Operational Gain @ max MHz	862 MHz	750 MHz	550 MHz	250 MHz	54 MHz[1,3]	862 MHz	750 MHz	550 MHz	250 MHz	54 MHz[3]	dBmV @ MHz	dBmV @ 5 MHz	dBmV @ MHz	dBmV @ 5 MHz
E629A-NA1Axxx	31 dB	—	—	15	—	8@ 42	—	—	46	—	39@ 42	—	—	—	—
E70CLxKB4Bxxx	21 dB	—	10	9	8.5	8.5	—	31	28	24.5	21	17@ 40	17	35@ 40	35
E70CJxxx4Bxxx	21 dB	—	10	9	8.5	8.5	—	31	28	24.5	21	17@ 42	17	35@ 42	35
E71CLxxx4Bxxx	28 dB	—	11.5	10.5	8	7.5	—	39.5	36	30.5	27	17@ 40	17	35@ 40	35
E71CJxxx4Bxxx	28 dB	—	11.5	10.5	8	7.5	—	39.5	36	30.5	27	17@ 42	17	35@ 42	35
E72CL-xx4Cxxx	30 dB	—	17.5	15	10.5	8	—	47.5	44	38.5	35	17@ 40	17	35@ 40	35
E72CL-xx5Cxxx	30 dB	—	17.5	15	10.5	8	—	47.5	44	38.5	35	17@ 40	17	37@ 40	37
E72CJ-xx4Bxxx	28 dB	—	11.5	10.5	8	7.5	—	39.5	36	30.5	27	17@ 42	17	35@ 42	35
E72CJ-xx4Cxxx	30 dB	—	17.5	15	10.5	8	—	47.5	44	38.5	35	17@ 42	17	35@ 42	35
E72CJ-xx5xxxx **E72CJPA15C9K**	30 dB	—	17.5	15	10.5	8	—	47.5	44	38.5	35	17@ 42	17	37@ 42	37
E72CJPxx4C9Kx **E72CJPxx5C9Kx**	30 dB	—	17.5	15	10.5	8	—	47.5	44	38.5	35	17@ 42	17	35@ 42	35

Table 1.4 E700 Series Line Extender Inputs and Outputs (cont'd)[1]

Model Information		Forward										Reverse			
		Minimum Inputs (dBmV)					Outputs[2] (dBmV)					Minimum Inputs (dBmV)		Outputs (dBmV)	
Model Number	Operational Gain @ max MHz	862 MHz	750 MHz	550 MHz	250 MHz	54 MHz[1,3]	862 MHz	750 MHz	550 MHz	250 MHz	54 MHz[3]	dBmV @ MHz	dBmV @ 5 MHz	dBmV @ MHz	dBmV @ 5 MHz
E72CJRxx5D1xx	30 dB	—	15	15	—	15@ 53	—	45	43	—	34@ 53	20@ 42	20	39.5 @42	39.5
E73CLPN5AC9Kx	33 dB	—	14.5	12	7.5	5	—	47.5	44	38.5	34	17@ 40	17	37@ 40	37
E73CLxNA4Cxxx	33 dB	—	14.5	12	7.5	5	—	47.5	44	38.5	34	17@ 40	17	35@ 40	35
E73CLxNA5C	33 dB	—	14.5	12	7.5	5	—	47.5	44	38.5	35	17@ 40	17	37@ 40	37
E73CJxNA5Cxxx	33 dB	—	14.5	12	7.5	5	—	47.5	44	38.5	35	17@ 42	17	37@ 42	37
E73CN-NA4C8xx	33 dB	—	14.5	12	7.5	5	—	47.5	44	38.5	35	26@ 65	26	44@ 65	44
E73CQPNA5C9Kx	33 dB	—	14.5	11.5	7.5	5.5@ 70	—	47.5	44	38.5	35.5 @70	17@ 55	17	37@ 55	55
E729B[4]	30 dB	—	—	16	—	9	—	—	46	—	39	26@ 30	26	44@ 30	44
E729B-NA4Axxx	31 dB	—	—	15	—	8	—	—	46	—	39	26@ 30	26	44@ 30	44
E729J-NA4E1xx	30 dB		—	16	—	11	—	—	46	—	39	26@ 42	26	44@ 42	44
E729L-xx5E1xx[5]	30 dB		—	16	—	11	—	—	46	—	39	17@ 40	17	37@ 40	37
E729L-NA5E1xx	31 dB		—	15	—	10	—	—	46	—	39	17@ 40	17	37@ 40	37

Table 1.4 E700 Series Line Extender Inputs and Outputs (cont'd)[1]

Model Information		Forward										Reverse			
		Minimum Inputs (dBmV)					Outputs[2] (dBmV)					Minimum Inputs (dBmV)		Outputs (dBmV)	
Model Number	Oper-ational Gain @ max MHz	862 MHz	750 MHz	550 MHz	250 MHz	54 MHz[1,3]	862 MHz	750 MHz	550 MHz	250 MHz	54 MHz[3]	dBmV @ MHz	dBmV @ 5 MHz	dBmV @ MHz	dBmV @ 5 MHz
E75DJRL05F2xx	32 dB	14	14	14	—	14	46	45	43	—	34	17@ 42	17	37@ 42	37
E77DJ-NAxE6Dx	35 dB	14.5	13	12	11	6.5	49.5	47.5	46	44	35	17@ 42	17	37@ 42	37

1. Refer to the specification sheet for more information about the specific amplifier in question.
2. The outputs reflect unadjusted system tilts. System personnel should consider their system tilt to arrive at actual outputs.
3. @ 54 MHz unless shown otherwise in the 54 MHz column.
4. See also E729B-NA4A1.
5. See also E729L-NA5E1.

Table 1.5 E7 FlexNet 700 Series Line Extender Part Number Designators (Model Options)

Designator	Options	Part Number E7	2	C	J	P	A1	2	C	6	D	1
E7	FlexNet® 700 Series PHD Line Extender Amplifier	**Series**										
2 **3**	30 dB PHD 33 dB PHD	**Spacing**										
C	750 MHz	**Bandwidth**										
J **L**	42/54 MHz 40/54 MHz	Frequency Split										
- **P**	Integrated Power Supply Lid-Mounted Power Supply	Module Designator										
NA **A1** **KB** **LO**	None TLC 439.25 TV 499.25 TV	**Level Control**										
1 **2** **4** **5**	None Passive Standard Gain 18 dB High Gain 20 dB	Reverse										
C	4 dB	Factory Equalization										
0 **1** **6** **8** **9** **A**	No Power Supply 60 V 60 HZ 117 V, UL/CSA 60 V 50/60 Hz 1.0 Amp 90 V H.E. Transformerless 90 V Transformered	Powering										
A **D** **K** **L**	A None 2 Port, 1 GHz, Full Lid, 117 V Powering 2 Port, 1 GHz, Full Lid, 2 Port, 1 GHz, Flat Lid,	**Housing**										
1 **4**	Standard (or NA) Corrosion Protected	**Housing Finish**										

Based on the model options in Table 1.5, an E7 Line Extender with the part number, **E72CJPA12C6D1**, has the following options:

- 700 Series Line Extender—**E7**
- 30 dB PHD—**2**
- 750 MHz—**C**
- 42/54 MHz split—**J**
- Lid-mounted power supply—**P**
- TLC—**A1**
- passive reverse—**2**
- factory equalization of 4 dB—**C**
- 117 V, UL/CSA power supply—**6**
- 2 Port, 1 GHz, full lid housing with 117 V powering—**D**

Consult your C-COR.net Price List or contact your C-COR.net sales representative at 800-233-2267 for further information.

1.5 Required Equipment, Tools, and Supplies

Table 1.6 lists the supplies, tools, and test equipment needed to operate, maintain, and test the Line Extender Amplifier. Equipment with equivalent or better specifications may be substituted for those listed in the table.

1

Table 1.6 Equipment, Tools, and Supplies

Tools/Equipment	Required Characteristic	Use
Signal Level Meter	5 MHz to 1 GHz, –35 to +60 dBmV (25 to 120 dBμ V)	Input and output signal testing
Signal Generator	5 MHz to 1 GHz, 10 to 60 dBmV (70 to 120 dBμ V)	Signal input during reverse balancing
Multimeter	True rms-AC-coupled. Ranges including: 0 to 200 VDC, 0 to 200 VAC, 0 to 200 mVAC	Power supply testing
Fixed Slope Feed thru (MEQ Stripline)	Zero slope adjustment (P/N MEQ-550-0)	Amplifier alignment if EQ jumpers are cut
Fixed Attenuator Feed thru (PAD Stripline)	Zero gain adjustment (P/N SPB-0)	Amplifier alignment if PAD jumpers are cut
Clamps and Bolts	C-COR.net, HB0214 or HB0216 (Supplied with the amplifier)	Amplifier installation
Extension Mounting Brackets (EMBs)	3.2 or 6 inch (8 or 15 cm) length with mounting hardware (P/Ns 172187-01 and 172187-03)	Installation application
Heat gun or approved torch and heatshrink tubing, or weathersealing tape or compound	—	Weatherproofing RF cable and fiber optic stub cable connectors
Tuning Wand	Non-conductive	**ALC** alignment
Fuse puller	Non-conducting fuse puller (P/N FP-1)	Fuse installation and removal
Socket	7/16 inch (11 mm) socket for torque wrench	Housing closing
Dust Cap	C-COR.net, P/N MX0008	Cover unused ports
Torque Wrench	Range including 0 to 40 in-lb (4.5 N·m)	Close housing
Nutdriver[1]	7/16 inch (11 mm)	Open and Close Housing
Standard Diagonal Cutting Pliers	medium size	Jumper cutting
Phillips Screwdriver	#1	Reverse kit installation

Table 1.6 Equipment, Tools, and Supplies (cont'd)

Tools/Equipment	Required Characteristic	Use
Tape Measure		Mounting EMBs on wall/ pedestal
Phillips Screwdriver	#2	Loosening and tightening centerseizure screws Reverse kit installation
Flat Blade Screwdriver	3/16 inch (5mm)	RF module removal
Needle Nose Pliers	—	Jumper removal Reverse kit installation
Reverse Upgrade Kit	(See Table 4.5)	Reverse kit installation
Nutdriver	¼ inch	Reverse kit installation
Soldering Iron	small	Reverse kit installation
Thermal Joint Compound	—	Reverse kit installation
2 diplex filters	C-COR.net P/N 162198-01	Reverse kit installation in E629
IC extractor tool	—	Reverse kit installation in E629

1. An 11 mm nutdriver or wrench can normally be used in place of a 7/16 inch tool if the bolt and nutdriver are manufactured to nominal "across the flat" tolerances. A non-fit can occur if the nutdriver is manufactured to minimum dimensions and the bolt head to maximum dimensions.

1.6 Related Documents

Document Number	Title
MX0443	Amplifier Installation Instructions (for 1 GHz 4-Port Housings)

Physical Identification

In this chapter, Figures 2.1 to 2.5 and Table 2.1 identify the user-accessible testpoints, plug-in locations, connections, and parts for FlexNet 700 Series Line Extenders. Identical items in the same location as in Figure 2.1 are not identified again in Figures 2.2, 2.3, 2.4, and 2.5.

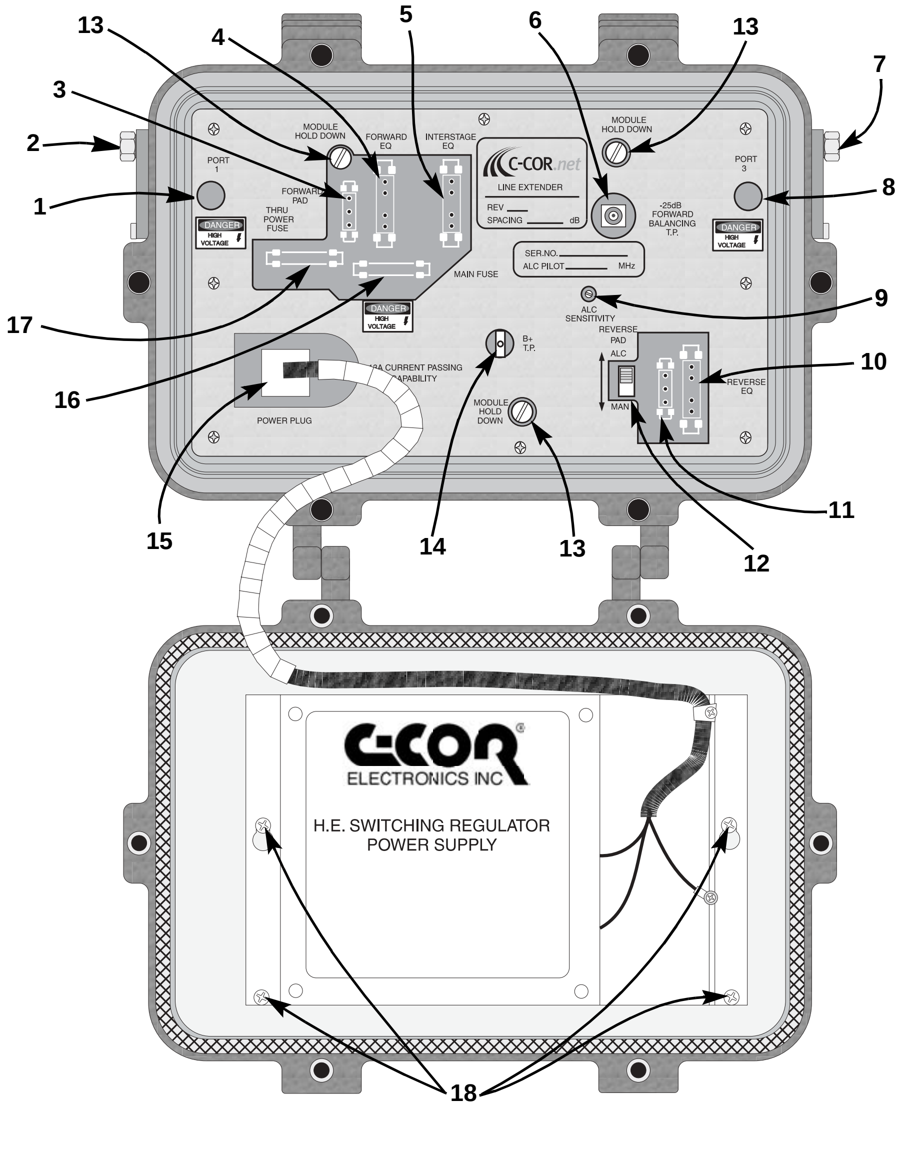


Figure 2.1 E7 Line Extender w/ H.E. Power Supply

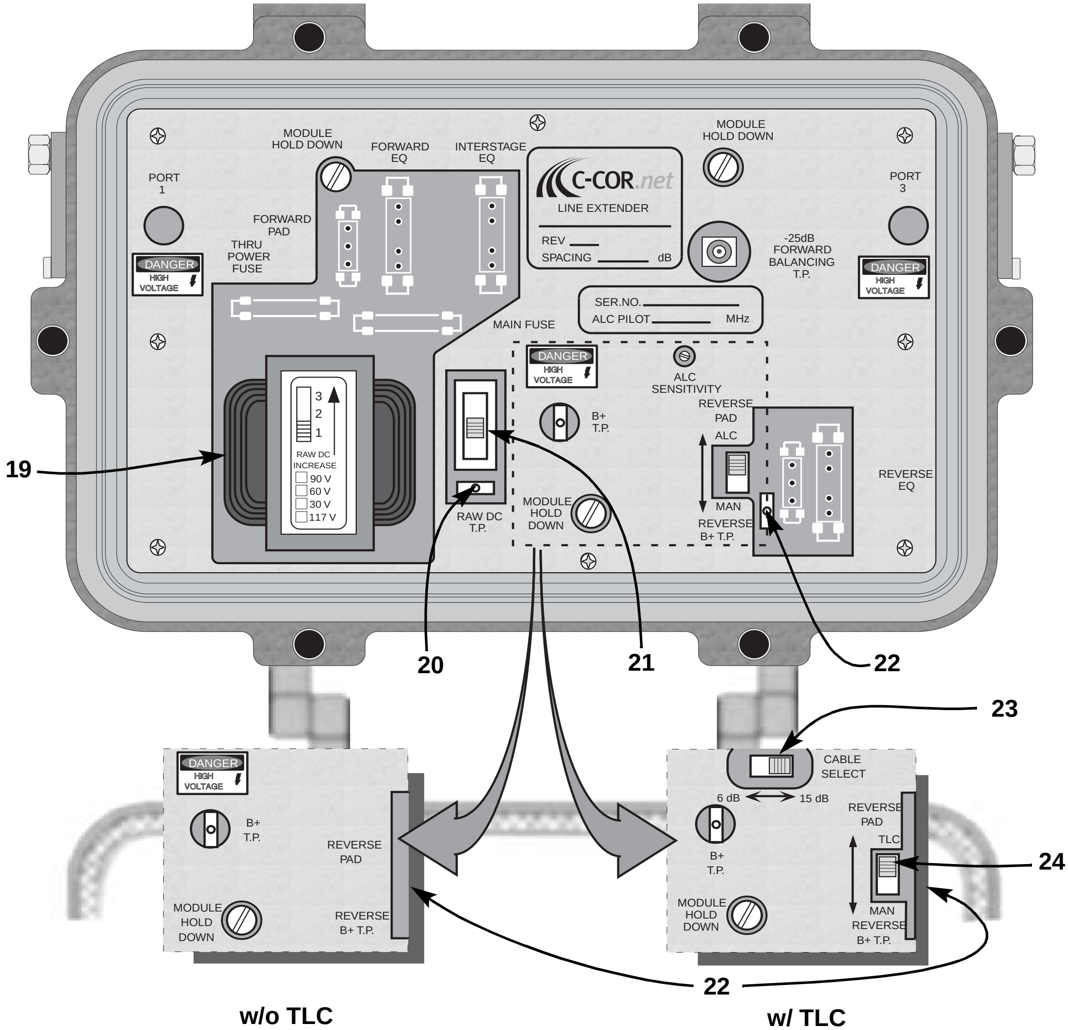


Figure 2.2 E7 Line Extender w/ Linear Power Supply

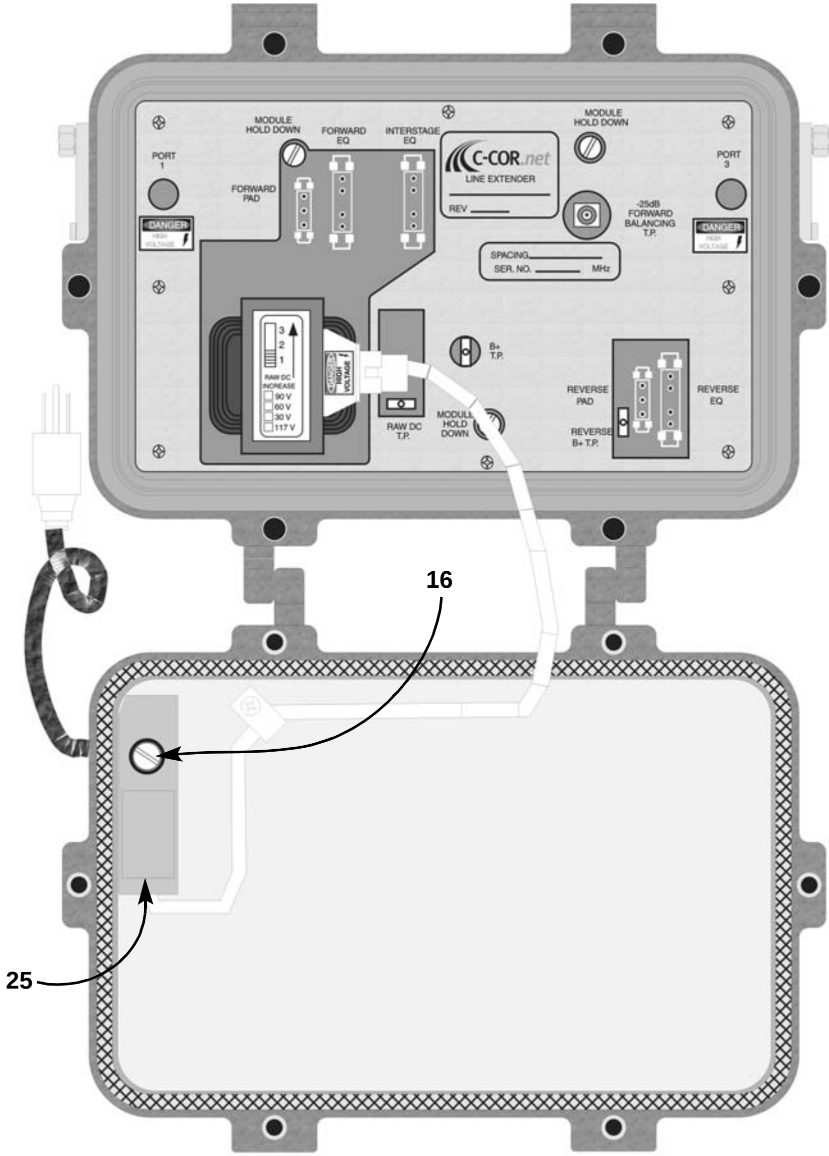


Figure 2.3 E7 Line Extender w/ 117 VAC Linear Power Supply

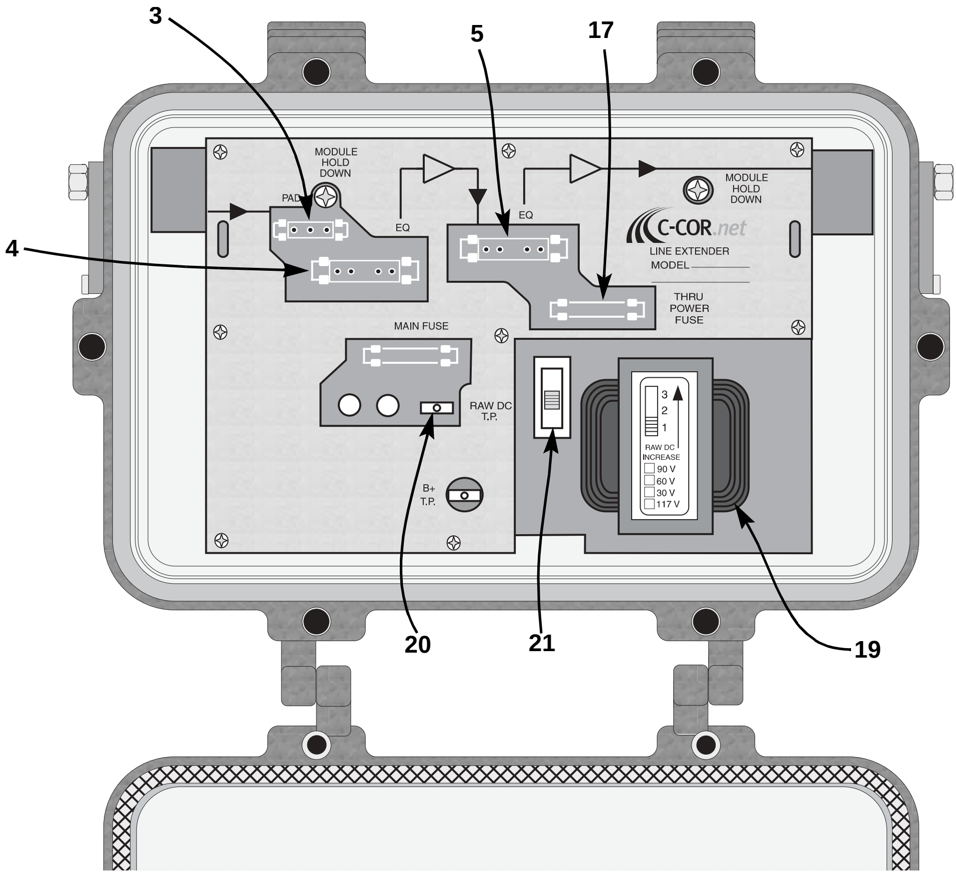


Figure 2.4 E629 Line Extender

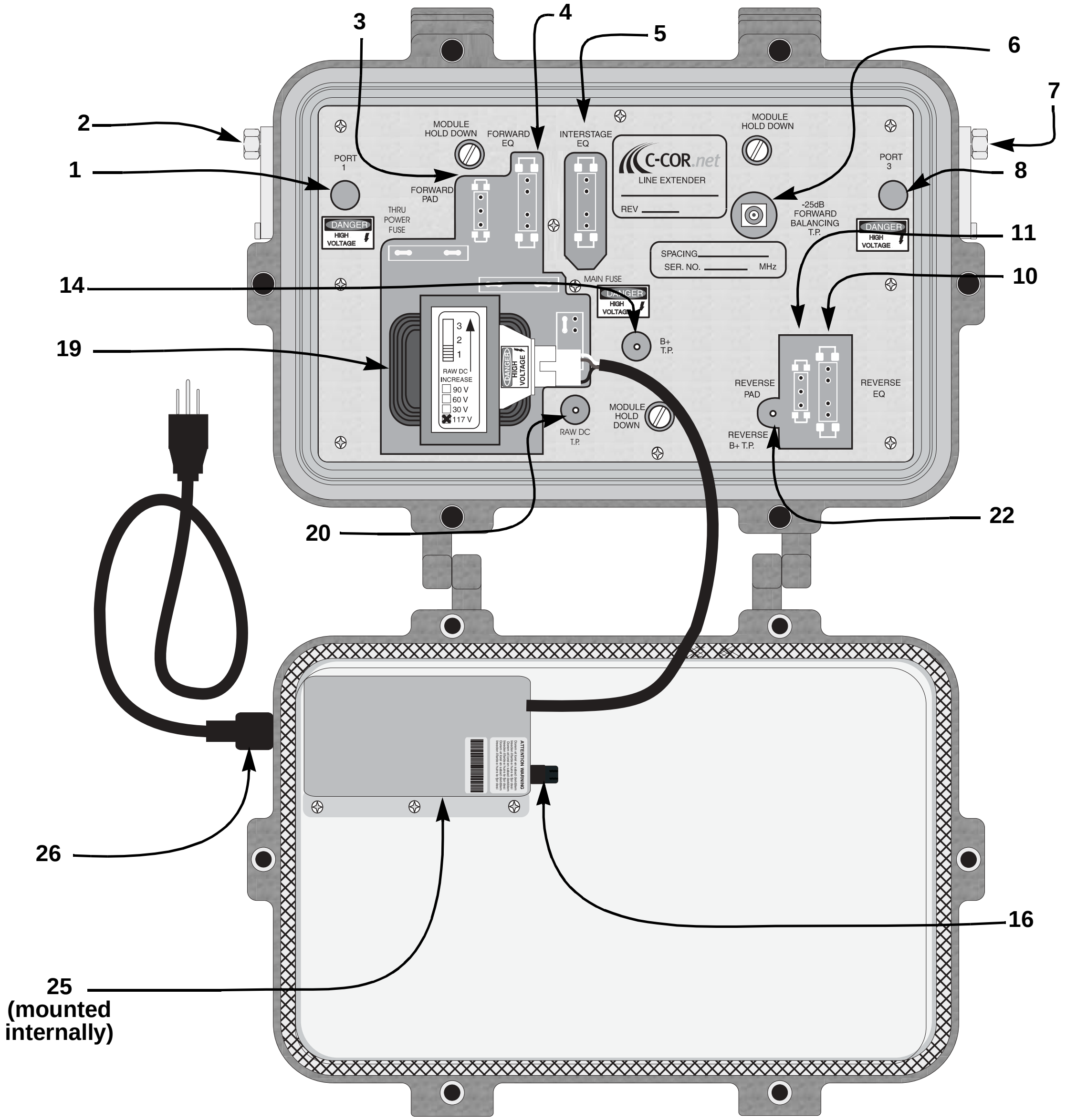


Figure 2.5 E7 862 MHz/117 V Line Extender

Table 2.1 Testpoints, Plug-in Locations, Connections, and Parts

Item Number	Label	Function
1	**PORT 1**	Allows access to the Port 1 centerseizure screw.
2	Port 1 Testpoint	Forward signal input/reverse signal output testpoint 25dB below the signal for 1GHz housings which have a **25dB** label.
3	**FORWARD PAD**	Plug-in location for a fixed attenuator accessory for fixed flat loss adjustment of the forward signal.
4	**FORWARD EQ**	Plug-in location for a fixed slope accessory for fixed slope adjustment of forward RF signals. Use to compensate for cable preceding the amplifier.
5	**INTERSTAGE EQ**	Plug-in location for a fixed slope accessory to set the slope of the amplifier output. Install the accessory specified on the System Map. Do not use this position to compensate for cable preceding the amplifier. This accessory can be a signature correction device.
6	**-25dB FORWARD BALANCING TP**	Internal testpoint for balancing the forward path. The testpoint level is 25dB below the signal.
7	Port 3 Testpoint	Forward signal output/reverse signal input testpoint 25dB below the signal for 1GHz housings which have a **25dB** label.
8	**PORT 3**	Access to the Port 3 centerseizure screw.
9	**ALC SENSITIVITY**	Adjustment of the amplifier output when the amplifier is operating in **ALC** mode. This has no affect when the amplifier is switched to **MAN** mode.
10	**REVERSE EQ**	Plug-in location for a fixed slope accessory for fixed slope adjustment of reverse RF signals.
11	**REVERSE PAD**	Plug-in location for a fixed attenuator accessory for fixed flat loss adjustment of reverse RF signals.
12	**ALC/MAN**	Switch to enable or disable **ALC**. The **MAN** (manual) setting provides a constant gain; **ALC** causes the amplifier to monitor preselected pilot carrier levels to maintain preselected output levels.
13	**MODULE HOLD DOWN**	Hold down screws that secure the module in the housing.
14	**B+ T.P.**	Testpoint to measure the forward power supply regulated DC voltage. This should be 24VDC±5% (22.8 to 25.2VDC).
15	**POWER PLUG**	Connection for H. E. Power Supply to the RF module.

Table 2.1 Testpoints, Plug-in Locations, Connections, and Parts (cont'd)

Item Number	Label	Function
16	**MAIN FUSE**[1]	Amplifier AC power overcurrent protection. The amplifier will not operate without this fuse installed.
17	**THRU POWER FUSE**[2]	Overcurrent protection for AC power passed to the next amplifier. No AC power passes through to the next amplifier without this fuse installed.
18	Power Supply Mounting Screws	8-32x5/16 pan head screws (4) for securing the H.E. Switching Regulator Power Supply in the housing lid.
19	Linear Power Supply	Converts AC power to regulated DC voltage for operation of the amplifier. (Only the transformer is visible.)
20	**RAW DC T.P.**	A testpoint to measure the unregulated DC voltage from the transformer and rectifier. This should be between 28 and 35VDC.
21	RAW DC Voltage Selector Switch	Adjusts the Power Supply transformer to the input AC voltage in order to provide RAW DC between 28 and 35 VDC.
22	**REVERSE B+ T.P.**	Testpoint to measure the reverse power supply regulated DC voltage. This should be 24VDC ±5% (22.8 to 25.2VDC). Not available in units with an HEPSE90 power supply.
23	**CABLE SELECT**	**TLC** only. Switch to match the temperature compensation circuit to the cable preceding the amplifier. Use **6dB** for up to 10dB of preceding cable loss; use **15dB** for over 10dB of preceding cable loss.
24	**TLC/MAN**	Switch to enable or disable **TLC**. **MAN** provides a constant gain; **TLC** causes the amplifier to monitor temperature to maintain preselected output levels. **TLC** setting requires appropriate setting of the **CABLE SELECT** switch.
25	RFI Filter	Blocks transmission of any RF signals into the 117VAC line. Used in 117VAC powered models only.
26	Detachable AC Power Cord	Connection from 117V power supply to 110V wall socket

1. Although labeled on the faceplate, the 862MHz/117V E7 line extender does ***not*** have a main fuse located on the PCB. It is mounted on the RFI filter.
2. Although labeled on the faceplate, the 862MHz/117V E7 line extender does ***not*** have a through power fuse.

Chapter 3

Housing Instructions

The electronic components of the FlexNet E7 Series Line Extender are enclosed in a specialized, diecast aluminum housing. Proper installation and other housing related procedures are important to ensure the integrity of the electronics in the housing. The following sections describe proper opening and closing techniques to be used when accessing the internal components, as well as recommended cable attachment procedures.

3.1 Housing Opening

	***WARNING**: Hazardous voltages are present. Use approved safety equipment and procedures.*
	***CAUTION**: Amplifier electronic components can be damaged by the environment. Close the housing whenever it is left unattended to keep moisture out of the station and to protect the network from RF interference.*

1. Loosen the six captive lid bolts with a 7/16 inch (11 mm) nutdriver.
2. Hand loosen and release the two captive cover bolts next to the cover hinges. Hand loosen and release the captive cover bolts at the ends of the unit.
3. While holding the cover closed with one hand, release the last two captive cover bolts, and open (lower) the cover.

3.2 Preparing for Installation

	***Note**: Check the unit for damage. If there is shipping damage, contact the shipping company and the C-COR.net Shipping Department.*

1. Ensure that the following are included with each housing:
   - one (1) mounting hardware kit (P/N HB0214) consisting of:
     - two strand clamps
     - two split lock washers
     - two 1-inch-long ¼ x20 bolts
     - two rubber O-ring (retaining)
   - dust caps (P/N MX0008) for each unused port
2. Inspect the outside of the housing.:
   a. Check the convection fins, cable entry ports, cover bolts, and all testpoint connectors for damage (refer to Figure 3.1).
   b. Make sure that each port hole is plugged with a plastic insert.
3. Open the housing (instructions in Section 3.1).
4. Inspect the rubber gasket on the housing base and the metal mesh gasket on the lid. Be certain they are firmly seated and unbroken.

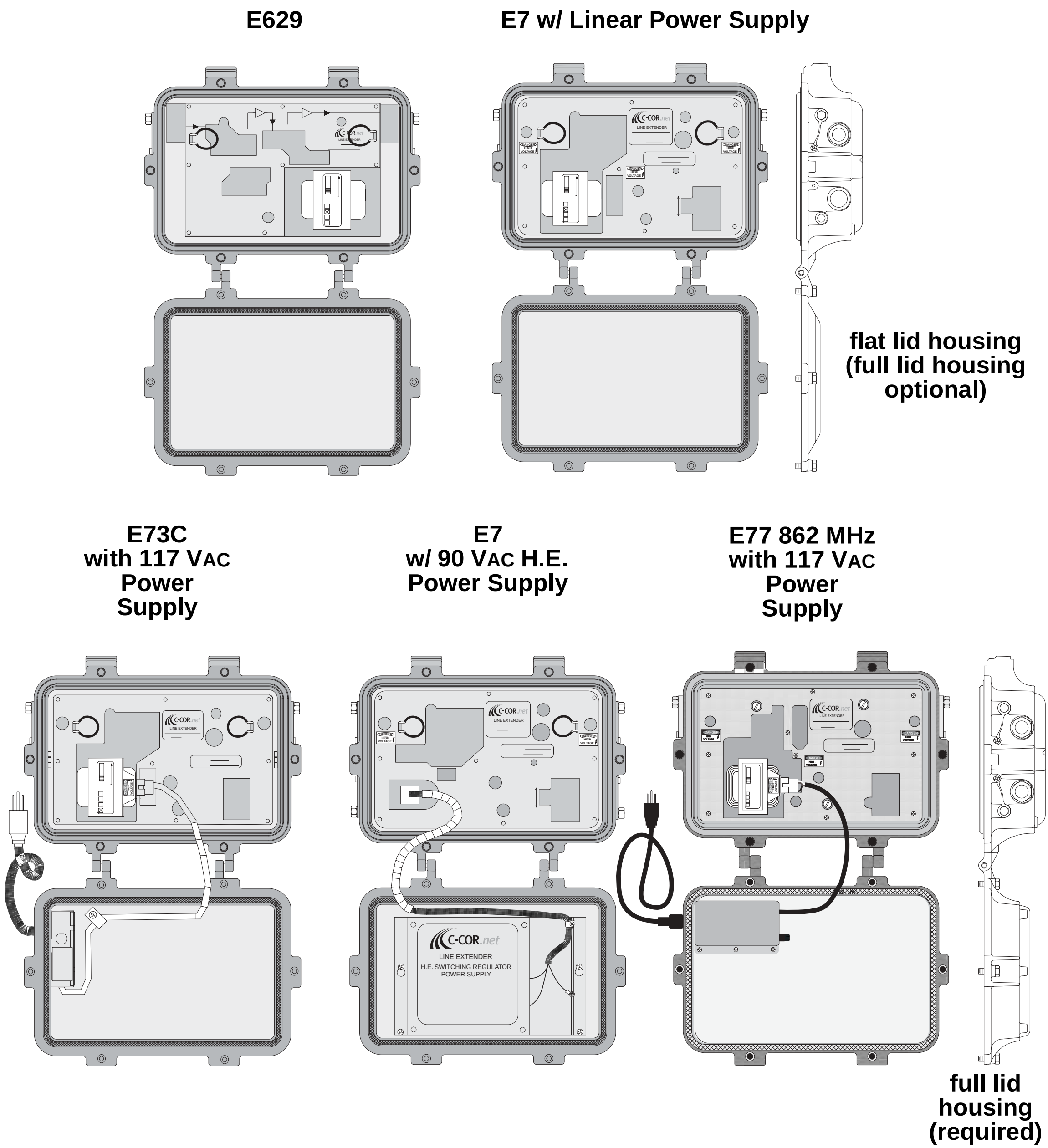


Figure 3.1 Line Extender Assemblies

5. The housing may be mounted with or without the RF module installed. Cable attachment may be easier without a module installed. Refer to Section 6.3 beginning with Step 4 for instructions on installing an RF module.
6. If desired, install plug-in accessories. Installing accessories at this point is often more convenient than after the housing is mounted. Accessory values can be found on system maps.
7. Close the housing. Refer to Section 3.5, *Closing and Tightening*, for instructions.

3.3 Housing Mounting

> ***Note***: *Use Extension Mounting Brackets (EMBs) if additional clearance is required between the unit and the strand or structure. This clearance may be needed to install the cabling or to provide access to the testpoints.*
>
> ***Note***: *EMBs are not included with the unit, but may be purchased separately. Each EMB includes additional mounting hardware (½-inch-long bolt, split-lock washer, nut). Contact C-COR.net or refer to the C-COR.net Products and Services price list for ordering information. The following sizes are available:*
>
> - *3.2 inch (8 cm) EMB (P/N 172187-01)*
> - *6 inch (15 cm) EMB (P/N 172187-03)*

If using EMBs, attach the EMB to the housing Back or Top Strand Clamp Bosses (see Figure 3.2) using the ½ inch-long bolt and split lock washer provided with the EMB assembly. The inset in the lower left of Figure 3.3 shows EMBs attached to the Top Strand Clamp Bosses for wall mounting.

3.3.1 General Strand Mounting

1. Attach the strand clamp assemblies to the top strand clamp bosses, or to the EMBs if used, with the 1 inch clamp bolts and washers (see Figure 3.2), threading the bolts four or five turns.
2. Hoist the housing to the strand and hang it in position. Use the hardware kit HB0214 to attach the strand to the Top Strand Clamp Bosses.
3. Tighten the clamp bolts enough that the housing cannot come off of the strand, but is still free for adjustment.
4. Position the housing at a location on the strand that is accessible for attaching cables and performing maintenance and balancing, and that complies with the requirements of the system.
5. Torque the clamp bolts to between 40 and 66 in-lbs (4.5 to 7.5 N·m). The bolts should tighten at three to four full turns into the housing.

3.3.2 Strand Mounting With EMBs

1. Attach the EMBs to the top strand clamp bosses with the ½-inch EMB bolts and lock washers provided with the EMB assembly as shown in Figure 3.2. Finger tighten the bolts against the EMBs.
2. Attach the strand clamp assemblies to the EMBs with the 1-inch clamp bolts and washers (see Figure 3.2), threading the bolts four or five turns.

3. Hoist the housing to the strand and hang it in position.
4. Tighten the clamp bolts enough that the housing cannot come off of the strand, but is still free for adjustment.
5. Position the housing at a location on the strand that is accessible for attaching cables and performing maintenance and balancing, and that complies with the requirements of the system.
6. Torque both the clamp and EMB bolts to between 40 and 66 in-lbs (4.5 to 7.5 N·m).

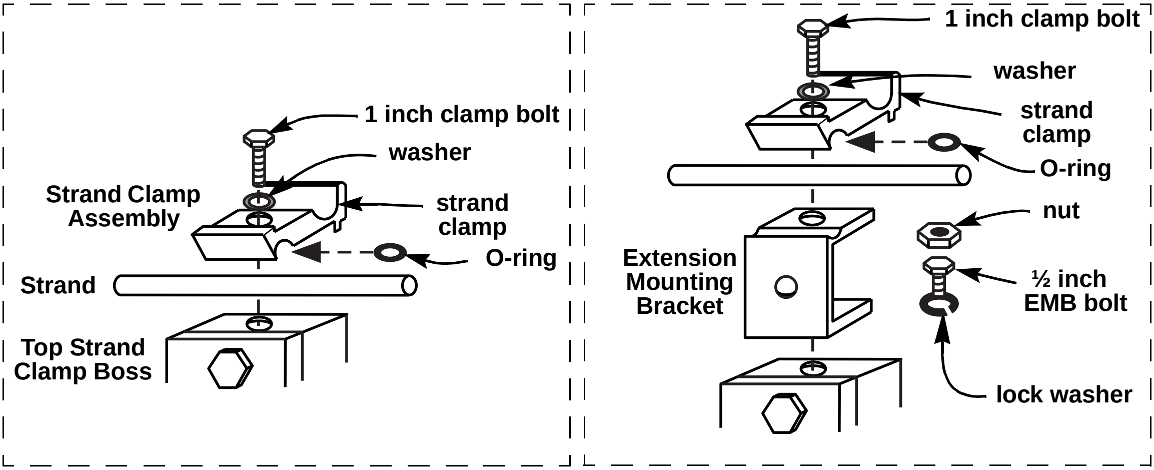


Figure 3.2 Strand Mounting

3.3.3 Direct Wall/Pedestal Mounting Using Back Mounting Bosses

1. Measure the thickness of the surface on which the housing will be located.
2. Plan the installation to provide enough clearance around the housing to install the cable and cable connectors and to ensure access to all housing testpoints and internal electronic components. You may need to shim, drill access holes, or provide cut-outs.
3. Drill mounting holes in the mounting surface if required. Use a 9/32 inch (7 mm) diameter drill for ¼ inch diameter bolts. See Figure 3.3 for distances between mounting holes for back mounting bosses
4. Select appropriate length ¼-20 UNC mounting bolts (not supplied), washers, and a split lock washer to allow a threaded bolt length of 1/4 to 3/8 inch (6 to 10mm) to extend into the housing. See Table 3.1, *Mounting Bolt Selection*, for several examples.

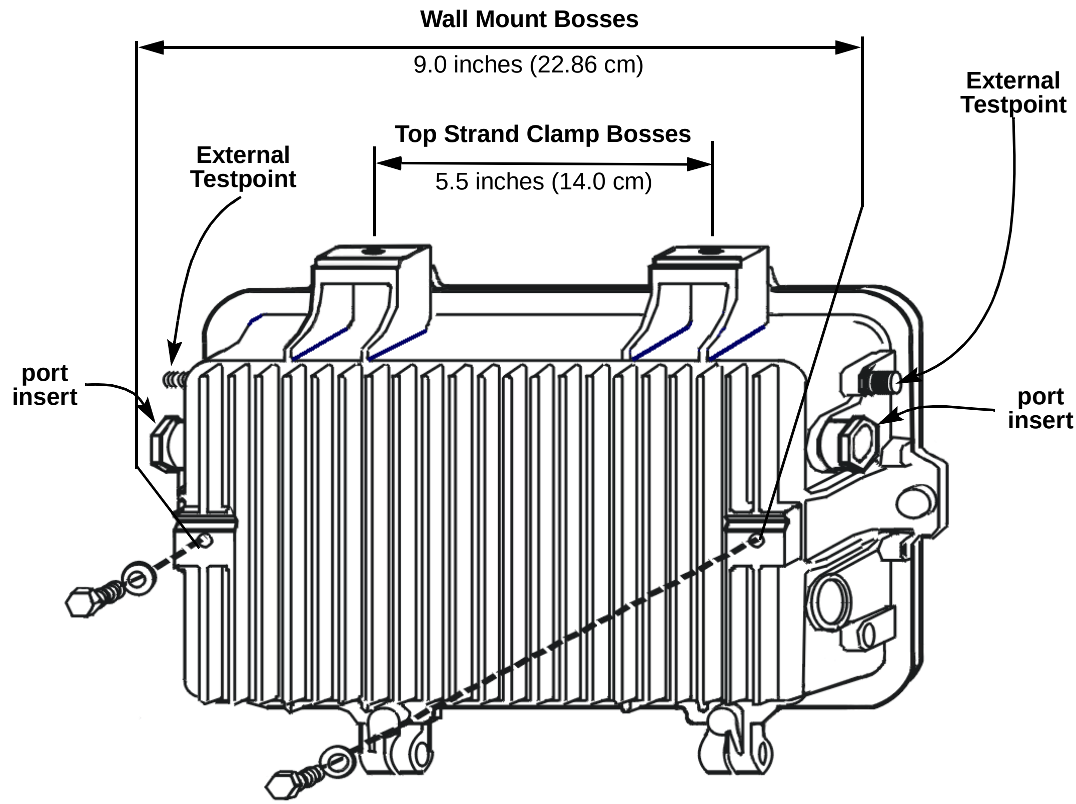
> ***CAUTION****: Bolts must be installed with at least three (but not more than nine) full turns of thread engagement. Any less, and the bolt may not hold. Bolts extending more than 3/8 inch (10 mm) into the housing could damage the housing. Do not torque mounting bolts more than 66 in-lbs (7.5 N·m).*

5. Install as shown in Figure 3.3.

6. Tighten the mounting bolts. Use no more than 66 in-lbs (7.5 N·m) torque. The amount of torque required will depend on the mounting surface used.

3.3.4 Wall/Pedestal Mounting With EMBs

1. Place the lock washers on the bolts supplied with the EMBs and bolt the EMBs to the top bosses as shown in Figure 3.3. Tighten the bolts until the EMBs are snug, but not fully torqued.
2. Measure the thickness of the surface on which the housing will be located.
3. Plan the installation to leave enough clearance around the housing to install the cable and cable connectors, and to ensure access to all housing testpoints and internal electronic components.
4. Drill mounting holes in the mounting surface as required. Use a 9/32 inch (7 mm) diameter drill for ¼-inch diameter bolts. See Figure 3.3 for distances between mounting holes.
5. Select appropriate length ¼-20 UNC mounting bolts and nuts (not supplied), washers, and a split lock washer to allow a threaded bolt length of 1/4 to 3/8 inch (6 to 10mm) to extend into the housing. See Table 3.1, *Mounting Bolt Selection*, for several examples. Use flat washers on the back side of any mounting surface that is made of compressible material.
6. Align the EMB flange holes with the wall mounting holes. Insert the bolts through the aligned holes, slip a lock washer over the end of each bolt, and thread and finger tighten the nuts onto the bolts.
7. Tighten the mounting bolts. Use no more than 66 in-lbs (7.5 N·m) torque. The amount of torque required will depend on the mounting surface used.



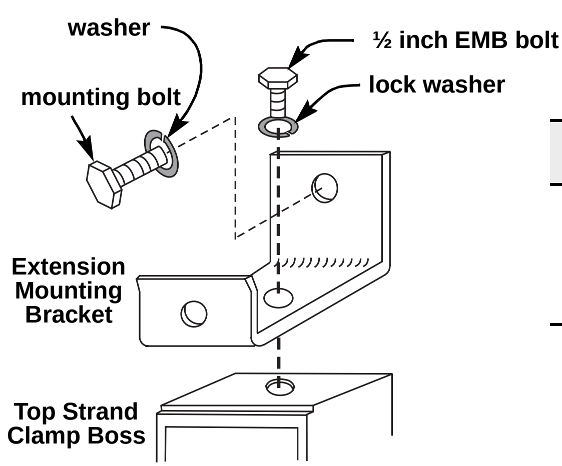


Table 3.1 Mounting Bolt Selection

Minimum Wall Thickness	Bolt Length
1/16 inch (1.6mm)	3/8 inch (10mm)
1/4 inch (6mm)	5/8 inch (16mm)
1/2 inch (13mm)	7/8 inch (22mm)

Figure 3.3 Wall/Pedestal Mounting

3.4 Cable Attachment

	WARNING: *Hazardous voltages are present. Use approved safety procedures. Turn off all power sources feeding into the unit before installing the cable and connectors.*
	CAUTION: ***Do not back centerseizure screws out more than two full turns****.Centerseizure screws are not captive. If backed out more than two full turns, the screws may fall out into the housing and under the RF module, possibly causing short circuits and definitely requiring removal of the RF module and service interruption.*

1. For each port, use a #2 Phillips screwdriver to turn the centerseizure screw clockwise until it just seats, then loosen it no more than two turns. Refer to Figure 3.4 as needed.
2. Remove the plastic cap or threaded plug from the cable entry port. Refer to Figure 3.3 as needed.

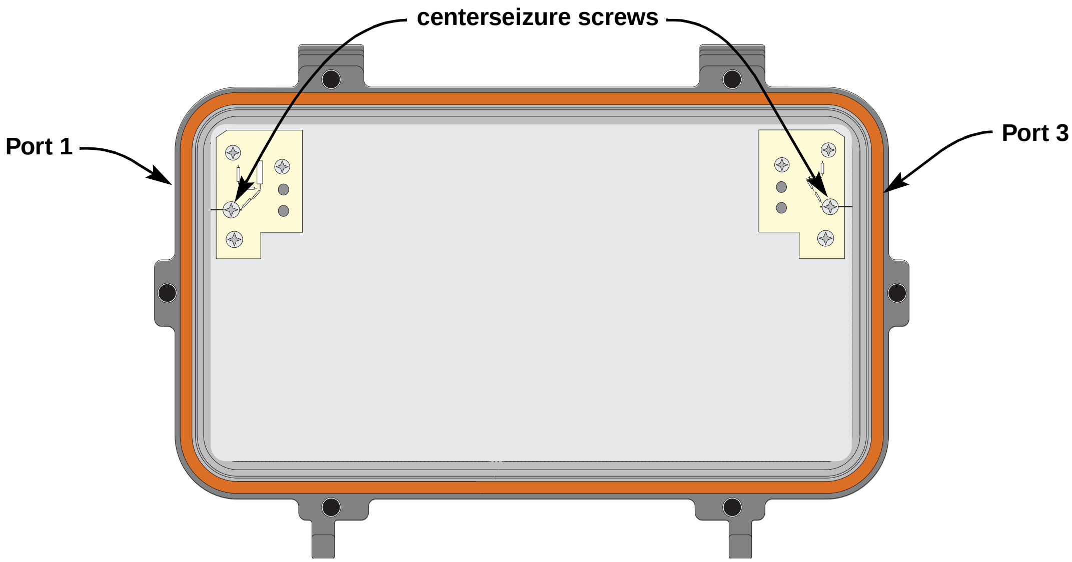


Figure 3.4 Cable Attachment Ports (with RF module removed)

3. If using heatshrink tubing, prepare a heatshrink boot according to specifications supplied by the manufacturer. Be sure that the boot covers the cable entry port insert and the entire connector. The boot must also extend at least two inches (5 cm) beyond the back nut.
4. Slide the boot further onto the cable to allow access to the end of the cable.
5. Prepare the cable end as recommended by the connector manufacturer.

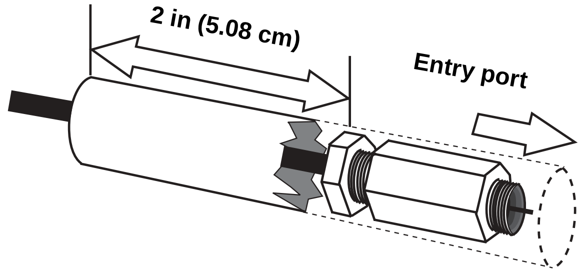


Figure 3.5 Heatshrink Boot

> ***CAUTION***: *Do not use feed-through type connectors. Use pin type connectors only. Using connectors with center conductors exceeding 0.080 inches (2.03 mm) in diameter will damage the centerseizure mechanism.*

6. Measure the pin length as shown in Figure 3.6.
7. If the pin is longer than 1.5 inches (3.81 cm), trim it to 1.5 inches (3.81 cm) with wire cutters to eliminate the possibility of shorting the signal to ground.

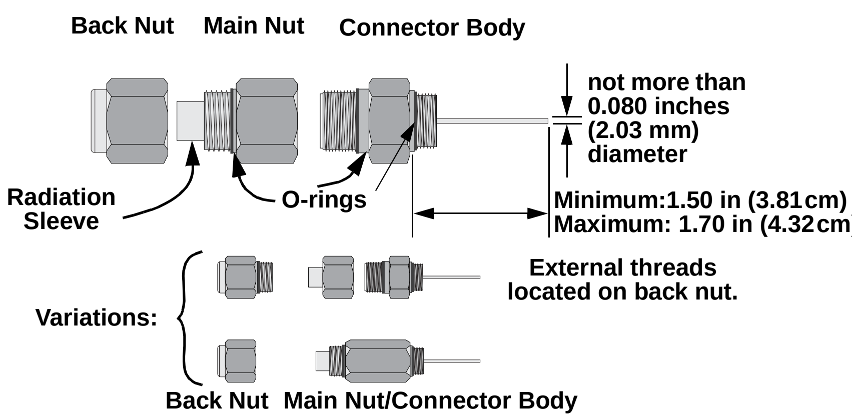


Figure 3.6 Cable Connector Assembly

8. Apply anti-seize compound to threads and O-ring. Do *not* use spray lubricant.

> ***CAUTION***: *Avoid contact of the connector pin to the chassis. Be certain the pin extends beyond the centerseizure screw but does not touch the RF chassis or housing. Ensure that no wire scraps or foreign materials remain within the housing.*

9. Thread the connector body into the cable entry port. Be sure that the pin extends through the centerseizure block but does not touch anything else inside the housing.

10. Slide the back nut onto the cable and away from the end. Make sure the threaded end of the nut is facing the cable entry port.
11. Slide the cable into the main nut with the outer conductor (shield) outside the radiation sleeve. Make sure the end of the cable shield bottoms against the main nut.
12. Thread, tighten, and torque the cable connector assembly according to specifications supplied by the manufacturer. Hold the cable firmly in position while tightening the connector hardware.

CAUTION*: Avoid damage to the seizure block or connector pin. Torque the centerseizure screw to no more than 8 in-lbs (0.9 N·m).*

13. Tighten the centerseizure screw down to the pin. Torque to between 6 and 8 in-lbs (0.7 and 0.9 N·m). The centerseizure screw must be tight enough to ensure good electrical contact.
14. Connect cable to the remaining cable entry ports by repeating steps 1 through 13.

CAUTION*: The Teflon strap securing the testpoint cap to the housing will melt if exposed to an open flame. Shield the strap from the flame when heating the heatshrink boot.*

15. Apply the weathersealing tape or compound to each connector and cable entry port, or if using heatshrink, slide each heatshrink boot over the entire connector and cable entry port. Heat the boot to shrink it securely around the insert, connector, and cable as specified by the shrink tubing manufacturer.

3.5 Closing and Tightening

***CAUTION**: Ensure that no wire scraps or foreign materials remain within the housing.*

***Note**: Close the housing whenever it is left unattended to keep moisture out of the unit and protect the network from RF interference.*

1. Examine the rubber gasket and mesh seal. Remove any foreign material that could interfere with proper sealing. Dry any moist areas.
2. Close the lid until it is flush with the rubber gasket. Thread all six bolts finger tight to hold the lid in place. Ensure that the lid seats evenly on the rubber gasket.
3. Begin partially tightening the lid bolts with a 7/16 inch (11 mm) nutdriver following the pattern shown in Figure 3.7. Ensure that the lid seats evenly on the rubber gasket.

***CAUTION**: Do not torque the lid bolts to more than 40 in-lbs (4.5 N·m). Overtightening may warp the housing, allowing moisture to enter and damage the components.*

4. Continue the tightening sequence, finally torquing to between 35 and 40 in-lbs (4.0 and 4.5 N·m) with a torque wrench. The lid should now seat evenly and compress the rubber gasket to create a weatherproof seal.
5. Install testpoint caps on all testpoint and finger tighten. Then use a wrench to tighten the caps an additional one quarter to one half turn.

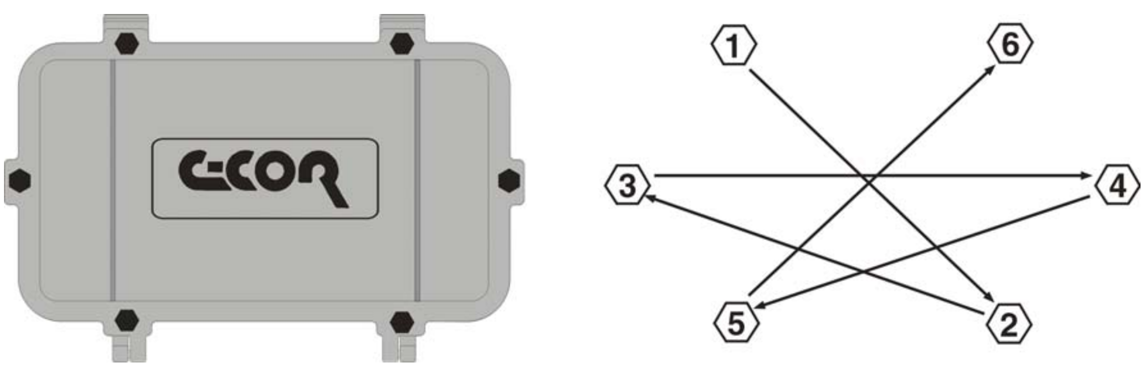


Figure 3.7 Housing Closing and Tightening Sequence

Chapter 4

Configuration

This chapter contains the procedures for the initial setup of the FlexNet E7 Series Line Extender. Included are power supply set up and testing, balancing carrier levels, temperature compensation, forward and reverse balancing, as well as various kit installation instructions.

4.1 Power Supply Configuration

CAUTION: *To prevent hybrid damage, C-COR.net recommends that all amplifiers in a power supply group have PADS and equalizers installed in the forward RF path before energizing. The initial recommended accessory values are shown on the system map.*

4.1.1 Power Supply Setup

Refer to Section 6.2 for all fuse removal and installation procedures.

WARNING: *Hazardous voltages are present. Use approved safety equipment and procedures.*

1. Open the amplifier housing (refer to Section 3.1 if necessary).
2. Verify that an appropriate **MAIN FUSE** is installed. Table 4.1 lists the appropriate **MAIN FUSE** values for line extender amplifiers. Inspect the fuse for visual defects.
   - In E7 units with 117 VAC powering, the **MAIN FUSE** is located in the RFI filter and must be removed for inspection. Refer to Section 6.2 for removal and installation instructions.
   - All other units have a **MAIN FUSE** located in the RF module (see Figure 2.1) which can be inspected without removing.
3. Check the system map to determine whether the amplifier requires through powering. If so, verify that the required fuse, buss bar (slug), or surge terminator is installed in the **THRU POWER FUSE** location (see Figure 2.1 on page 2-2). Table 4.1 lists the maximum continuous AC current passing approved for these amplifiers.

Table 4.1 Fusing/Power Passing Considerations

Power Supply	Recommended MAIN FUSE (power supply fuse)	Maximum Continuous AC Current Passing
60 Volt Linear	2 A, slow blow	E629 and E729: 10 A All other E7: 13 A
90 Volt Linear	2 A, slow blow	13 A
90 Volt H.E.	6.25 A, slow blow	13 A
117 Volt Linear	1 A, slow blow	N/A

4.1.2 Voltage Testing

Note: *AC measurements may read up to 10% error if a true-rms meter is not used. AC ripple measurements cannot be made without an AC-coupled meter.*

Check the power distribution system as follows.

For amplifiers with 117 VAC powering, begin with Step 3.

1. Measure AC voltages: Take the measurements shown in Table 4.2 and compare the measured voltages to the range given in Table 4.3.
   a. If the measurements are out of the acceptable range, take the appropriate action shown in the table.
   b. If the measurements are within the acceptable range, record the values on the Amplifier Data Sheet located in Appendix C.

Tip: *For Linear Power Supplies: Cold weather conditions reduce the resistance of the cable, raising the AC input voltage and resulting Raw DC voltage. If the measured value of the Raw DC is near the bottom of the acceptable range (28 VDC) and the aerial cable carrying the power is currently subjected to very cold conditions, set the Raw DC Voltage Selector Switch to the next higher position. This will compensate for increased resistance when the cable is warmer.*

For amplifiers with an H.E. Power Supply, skip to Step 3.

2. Measure and adjust Raw DC voltage.
   a. Set the multimeter to DC Voltage, 0 to 200 VDC range. Connect multimeter ground lead to the amplifier housing.
   b. Set the Raw DC Voltage Selector Switch to position 1, the bottom position.
   c. Measure the DC voltage at the **RAW DC T.P.**
      – If the voltage measured is less than 28 VDC, move the Switch to the next higher position and remeasure.
      – If the voltage is greater than 35 VDC and the Selector Switch is in the bottom position, replace the RF module.
3. Take the measurements shown in Table 4.4.
   a. If the measurements are out of the acceptable range, take the appropriate action shown in the table.
   b. If the measurements are within the acceptable range, record the values on the Amplifier Data Sheet located in Appendix C.

Table 4.2 AC Testpoints

Testpoint[1]	Test Values	Troubleshooting when Unacceptable
Port 1 Centerseizure Screw	See Table 4.3	Verify that the center conductor pin and power cable are not shorted to ground. Check the tightness of the centerseizure screw. Check cable plant powering.
MAIN FUSE or **THRU POWER FUSE**[2] inputs (left fuseclip)	See Table 4.3	If power is acceptable at the centerseizure screw, but unacceptable at the fuse inputs, replace the RF module.
MAIN FUSE or **THRU POWER FUSE**[2] outputs (right fuseclip)	See Table 4.3	If power is present at a fuse input, but not at the output, check for a blown or misaligned fuse. Replace or reinsert the fuse. If the fuse blows when reinserted, check the distribution system for short circuits.
Port 3 Centerseizure Screw (if thru powering)	See Table 4.3	If power is acceptable at the **THRU POWER FUSE** output, but unacceptable at the Port 3 centerseizure screw, replace the RF module.

1. Attach the ground lead to the amplifier housing.
2. Not applicable to units with a 117 VAC linear power supply.

Table 4.3 AC Test Values

Powering Option	Multimeter Setting	Acceptable Range
60 Volt Linear Power Supply	AC voltage (0-200 VAC)	40-60 VAC
90 Volt Linear Power Supply	AC voltage (0-200 VAC)	60-95 VAC
90 Volt H.E. Power Supply	AC voltage (0-200 VAC)	40-95 VAC

Table 4.4 DC Testpoints and Test Values

Testpoint[1]	Multimeter Setting	Power Supply	Acceptable Range	Troubleshooting when Unacceptable
RAW DC T.P.	DC voltage (0-200 VDC)	Linear P.S. Only	28 - 35 VDC	Adjust the Raw DC selector switch. Replace the RF module.
B+ T.P.	DC voltage (0-200 VDC)	Linear P.S.	22.8 - 25.2 VDC	Replace the RF module.
		H.E.P.S.	23.5 - 24.5 VDC	Replace the power supply.
REV B+ T.P.	DC voltage (0-200 VDC)	Linear P.S. Only	22.8 - 25.2 VDC	Replace the RF module.
B+ T.P. (AC Ripple)	AC voltage (0-200 mVAC)	Linear P.S.	< 20 mVAC	Replace the RF module.
		H.E.P.S.	< 15 mVAC	Replace the power supply.

1. Attach the ground lead to the amplifier housing.

4.2 Calculating Balancing Carrier Levels (for Linear Output Tilt Operation)

Typically, only the Forward High Balancing Carrier level will need to be calculated (if it is not provided by the system manager). All other balancing carrier levels are near enough to the signal levels of the bandedge carriers that bandedge levels may be used for balancing.

Perform this calculation only when the Forward High Balancing Carrier is not at the high bandedge frequency. This calculation method can speed the process of balancing and needs to be done only once for all similar amplifiers within a cascade.

1. Obtain a copy of the Amplifier Data Sheet from the system manager. If not available, copy the sample located in Appendix C.
2. Calculate the Forward High Balancing Carrier Level using the following equation.

$$L_C = \left[\frac{L_H - L_L}{F_H - F_L}\right] \times (F_C - F_L) + L_L$$

L_C = Forward High Balancing Carrier level (dBmV)

L_H = System Output Level at the High Bandedge Frequency (dBmV)

L_L = System Output Level at the Low Bandedge Frequency (dBmV)

F_H = System High Bandedge Frequency (MHz)

F_L = System Low Bandedge Frequency (MHz)

F_C = Forward High Balancing Carrier frequency (MHz)

3. Copy the Forward High Balancing Carrier level to the appropriate box in the Map Signal Information section of the Amplifier Data Sheet.

4.3 Temperature Correction

> ***Note**: Temperature correction only applies to aerial coaxial cable. Use a 0dB Temperature Correction Value for all underground cable.*

Typically, only the forward balancing carriers require temperature correction. The effect of temperature on the cable attenuation associated with the low frequency reverse balancing carriers is minimal except in extreme conditions.

If the temperature surrounding an amplifier is between 50°F and 90°F (10°C and 32°C), balancing carrier levels do not require temperature correction.

If the temperature is below 50ºF (10ºC) or above 90ºF (32ºC), perform temperature correction as follows:

1. Record the System Forward High and Low Balancing Carrier levels from the Amplifier Data Sheet below. Perform the calculation to get the adjusted output levels.

______________	+	______________	=	______________
System Forward High Balancing Carrier Level		TCV For High Carrier		Adjusted Forward High Balancing Carrier Level
______________	+	______________	=	______________
System Forward Low Balancing Carrier Level		TCV For Low Carrier		Adjusted Forward Low Balancing Carrier Level

2. For both forward balancing carriers, note the loss (in dB at the carrier frequency) due to the cable preceding the unit under test. Also note the air temperature. Use these values and the TCV (temperature correction value) chart on page 4-8 to obtain a temperature correction value for this section of cable for each balancing carrier. Record both TCVs in the calculation box in Step 1 and on the Amplifier Data Sheet.

> ***Note**: To obtain the temperature correction value on the TCV Chart (page 4-8): Find the point on the chart corresponding to your cable loss and temperature values. Then find the TCV line nearest this point. The dB value label on that line is your TCV.*
>
> ***Note**: Example: Your cable loss is 25dB. The air temperature is 25°F (-5°C). The point on the graph corresponding to these two values is between the 0.5 and 1.0dB lines, but closer to the 1.0dB line. (The dotted lines mark the halfway-between-lines points on the graph.) The TCV is then 1.0dB.*

1. Use the temperature corrected forward balancing carrier levels for Forward Balancing or Forward Field Testing.
2. **Optional**: repeat Steps 2 and 1 for the reverse balancing carriers. Use these temperature corrected levels for Reverse Balancing or Reverse Field Testing.

4

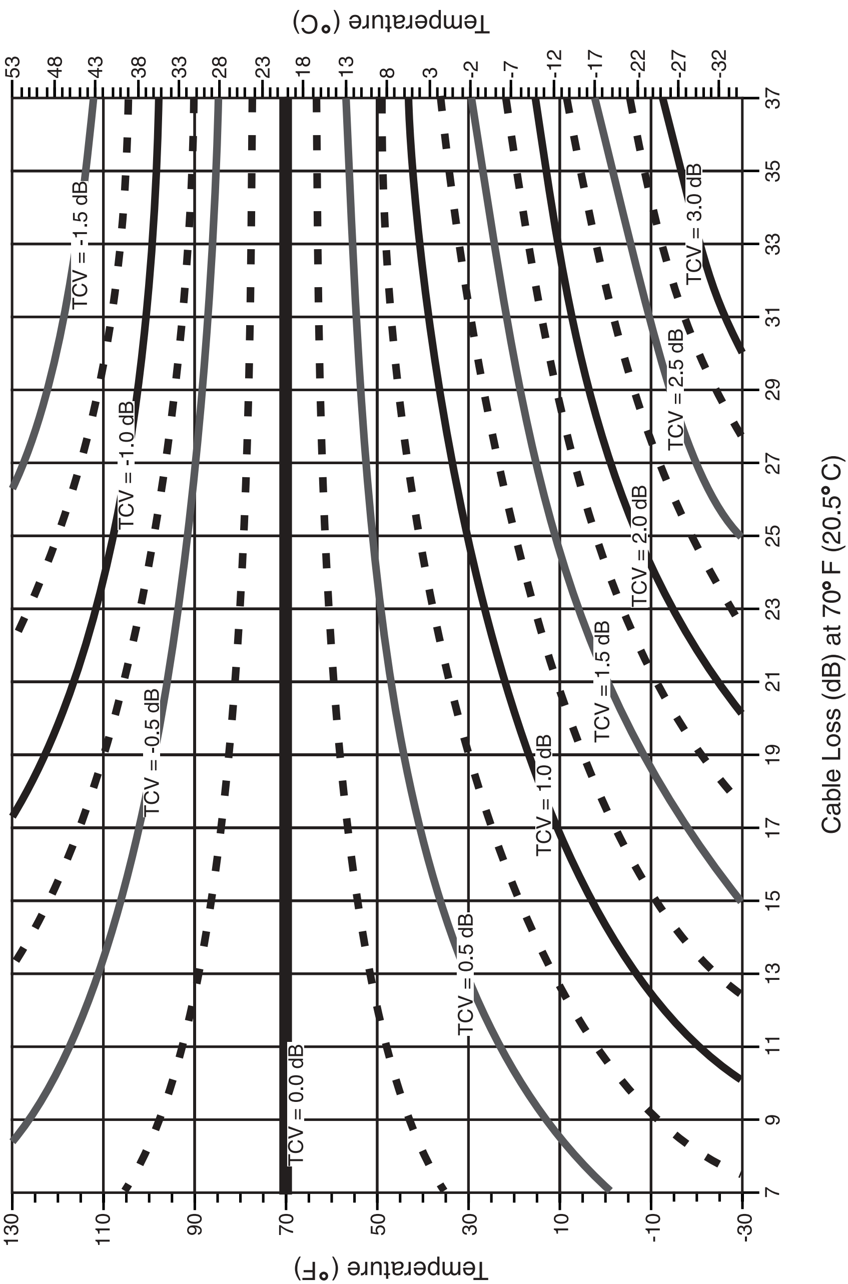


Figure 4.1 Temperature Correction Value Chart

4.4 Forward Balancing

	***CAUTION**: RF signal levels greater than +30dBmV @ 1 NTSC channel loading at the hybrid can damage amplifier active components. Do not use test signal levels that will be greater than 30dBmV at the hybrid (+30dBmV = +90dBμV).*
	***Note**: System values are the recommended values shown on the system map. Measured values are the signal levels actually measured at the amplifier.*

4.4.1 Forward Balancing Requirements

Make sure that the following conditions are valid for the amplifier before you start to balance:

- The system map is marked with amplifier output levels for bandedge frequencies.
- Forward balancing carriers set at the proper levels are injected into the cable network from the headend.
  - One forward balancing carrier is available at a lower bandedge.
  - One forward balancing carrier is available at a higher bandedge.
- Operating voltages are correct (refer to Section 4.1.2 if necessary).
- All tap outlets, ends of feeder cables, and unused active RF ports are terminated with a 75Ω impedance.
- Unscrambled ALC carriers are injected into the system at the assigned frequency for the amplifier (if ALC is to be used).
- Preceding amplifiers have been properly balanced and provide the desired forward band signals to the amplifier for forward balancing.

4.4.2 Forward Balancing Procedure

Refer to Figures 2.1 to 2.5 and Table 2.1 for control and accessory locations.

1. Determine the System Forward High and Low Balancing Carrier Levels:
   - If bandedge carriers are used for balancing, copy the amplifier bandedge carrier output levels from the system map to the Map Signal Information table on the Amplifier Data Sheet located in Appendix C.
   - If other than the bandedge carriers are used for balancing, calculate the balancing carrier levels (see Section 4.2 if not already done). Record these levels in the Map Signal Information table on the Amplifier Data Sheet located in Appendix C.

2. Temperature correct the System Forward High and Low Balancing Carrier Levels.
    a. Record the current air temperature on the Amplifier Data Sheet.
    b. Follow the procedure outlined in the following table.

Temperature	Need Compensation?	Procedure
above 90°F (32°C) or below 50°F (10°C)	Yes	Perform temperature correction according to Section 4.3. Record the corrected values in the System High and Low Balancing Carrier Levels calculation boxes as shown in steps 5 and 7. If the air temperature changes more than 20° F (11° C) while balancing the amplifier, recalculate the temperature compensation.
between 50° F and 90° F (10° C and 32° C)	No	Copy the Forward High/Low Balancing Carrier Levels from the Map Signal Information table on the Amplifier Data Sheet to the calculation boxes in steps 5 and 7.

***Note**: The carriers adjacent to the ALC pilot carrier affect the performance of the ALC circuit. If these adjacent carriers will be used in the active system, ensure that either the adjacent carriers are on during ALC circuit adjustment, or the ALC carrier level has been adjusted to compensate for the absence of these carriers. Otherwise, the ALC circuit or carrier will need readjustment after these carriers are turned on.*

***Note**: Using an adjusted ALC pilot carrier as the Forward High Balancing Carrier will result in an improperly balanced amplifier. Do not adjust the ALC pilot carrier level if it is also used as the Forward High Balancing Carrier.*

3. If the carriers adjacent to the ALC pilot carrier will be used in the active system, ensure that they are on when balancing the amplifier. If these carriers cannot be turned on, perform the following steps to adjust the ALC pilot carrier to compensate for the adjacent carriers. If the ALC pilot carrier is the Forward High Balancing Carrier, proceed to Step 5 and **do not** adjust ALC level.
    a. At the headend, verify that the ALC pilot carrier is adjusted properly. Record the initial level of the ALC pilot carrier.
    b. Increase the ALC pilot carrier level as follows:
        - 1 dB if both adjacent carriers are turned off during balancing
        - 0.75 dB if only the upper adjacent carrier is turned off during balancing
        - 0.25 dB if only the lower adjacent carrier is turned off during balancing.

4. Set the amplifier in factory-aligned condition as follows:
   - If the amplifier has ALC or TLC, set the **ALC/MAN** Switch or **TLC/MAN** Switch to the **MAN** position.
   - Remove any SEQ and SPB accessories installed in the **FORWARD EQ** and **FORWARD PAD** plug-in areas and replace them with striplines, SEQ-0, or SPB-0 accessories.
   - If an Interstage SEQ is specified on the System Map, cut out the factory installed jumper from the **INTERSTAGE EQ** plug-in area. Install the required SEQ accessory.
5. If the amplifier has TLC: determine the amount of cable loss preceding the amplifier in dB at the highest system frequency. For 10 dB or less preceding cable loss, set the **CABLE SELECT** Switch to **6 dB**; for greater than 10 dB, set to **15 dB**.

> ***Note**: Testpoint losses are 25 dB for 1 GHz housings.*

6. Connect the Signal Level Meter (SLM) to the **-25dB FORWARD BALANCING T.P.** testpoint.
7. Measure the signal levels of both forward balancing carriers. These levels will be referred to as the Measured High and Low Balancing Carrier Levels. Record these levels as shown in the box that follows. Calculate System Tilt, Measured Tilt, and Equalization Value.

System Forward High Balancing Carrier Level	–	System Forward Low Balancing Carrier Level	=	System Tilt
Measured Forward High Balancing Carrier Level	–	Measured Forward Low Balancing Carrier Level	=	Measured Tilt
System Tilt	–	Measured Tilt	=	Equalization Value

8. If the Equalization Value is positive, an SEQ is needed. If negative, an SCS is needed. Using the appropriate tables in Appendix A, *Reference Tables*, select an accessory with a tilt as close to the Equalization Value as possible. For a full explanation of the selection process and accessories, see Section A.1.2, *Using the "Insertion Loss in dB at Frequency" Columns.*
9. If necessary, remove the accessory or stripline from the **STATION FWD EQ** area and install the selected cable equalizer or cable simulator.
10. Measure the new Forward High Balancing Carrier Level and record the adjusted value as shown in the box that follows. Calculate the PAD Value.

______________	–	______________	=	______________
Measured Forward High Balancing Carrier Level		System Forward High Balancing Carrier Level		PAD Value

11. Select an SPB PAD that has a flat loss within ±0.5 dB of the PAD Value.
12. If necessary, remove the accessory or stripline from the **FORWARD PAD** and install the selected attenuator (PAD).
13. Measure both forward balancing carrier levels and verify that the signal level of the Forward High Balancing Carrier is within acceptable tolerance (typically ±0.5 dB) of the specified system level. If the signal level is not within tolerance, rebalance or troubleshoot the amplifier.
14. Record both forward balancing carrier levels in the ‘Internal TP (MAN)’ box of the Forward Signal Levels table on the Amplifier Data Sheet. Record the Forward EQ and Forward Pad values on the Amplifier Data Sheet.
15. For amplifiers with TLC, set the **TLC/MAN** Switch to the **TLC** position. Record both forward balancing carrier levels in the ‘Internal TP (ALC/TLC Active)’ box in the Forward Signal Levels table on the Amplifier Data Sheet located in Appendix C.

> ***Note**: The change in output level will not be proportional to the amount of adjustment of the* **ALC SENSITIVITY** *control. Several complete rotations of the control can be required to produce an observable change in the output level, but when the control setting nears the operating range, small adjustments produce large changes in output level.*

16. For amplifiers with ALC:
    a. Set the **ALC/MAN** switch to the **ALC** position. Wait 30 seconds.
    b. Adjust the **ALC SENSITIVITY** control while observing the system high carrier on the signal level meter (SLM). Rotate the control clockwise to decrease the signal level and counterclockwise to increase the signal level. Stop adjusting when the output at the high carrier reaches the Forward High Balancing Carrier Level. If Temperature Compensation was used, balance in ALC mode for the levels calculated before Temperature Correction Values were determined.
    c. Record both forward balancing carrier levels in the ‘Internal TP (ALC/TLC Active)’ box in the Forward Signal Levels table on the Amplifier Data Sheet located in Appendix C.
17. Measure the signal levels of both forward balancing carriers at the Port 3 external testpoint and record these levels in the Forward Signal Levels table on the Amplifier Data Sheet located in Appendix C.

18. If the ALC pilot carrier level was adjusted in Step 3a, it should remain at the set level if the upper and lower adjacent channels are not active. If the adjacent channels become active after initial balancing, decrease the ALC pilot carrier to the level initially measured in Step 3a to ensure proper ALC tracking.
19. Close the housing and replace the caps on all external testpoints. Refer to Section 3.5, *Closing and Tightening*, as necessary.

> ***Note***: *It may take 15 minutes for the TLC output levels to stabilize after the cover is closed.*

4.5 Reverse Balancing

The reverse path transmission is becoming more important as new services are added. For signals on the reverse path to arrive at the headend at the correct level and with as little distortion as possible, the reverse path must be properly balanced. In a network that is properly reverse balanced, the reverse signals on each leg arrive at each succeeding amplifier at the same level and tilt; this is called unity gain. A cascade with unity gain keeps signal distortions to the lowest levels possible. In most systems, the reverse band will have a tilt of 0 dB between the low and high reverse bandages. The following sections cover the single person and the two person reverse balancing procedures.

These procedures assume the forward Balancing Requirements of Section 4.4.1 are met. When balancing the reverse path keep in mind the following:

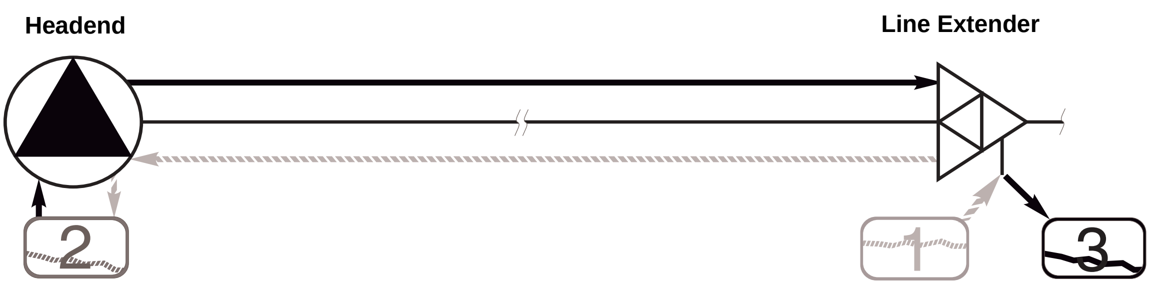
- Balance the forward path first and ensure that it is trouble free.
- The network must be free of ingress.
- You are trying to achieve constant inputs at the *reverse input port* of each amplifier. To do this you must adjust signal level and tilt in the reverse path through the use of reverse port pads, equalizers, and distribution accessories.
- With the single person method, turn off the ALC, if present, in the reverse rack mount receiver at the headend.
- The first amplifier or node must be balanced correctly. If balanced incorrectly, all amplifiers after it will be affected.

4.5.1 Single Person Reverse Balancing Procedure

Single person reverse balancing, which is becoming the standard method of reverse balancing in the cable industry, requires the use of more sophisticated equipment compared to the two person reverse balancing method. Figure 4.2 shows the typical single person configuration of the test equipment used in the single person reverse balancing procedure.

Because these are sweep systems, ingress may affect the outcome. Terminating reverse ports or keeping all amplifiers terminated until activation will limit ingress.

The test equipment also has a “noise/ingress” feature which can be used for troubleshooting. This displays the noise seen in the headend. Tech Note TD0079 provides a generalized procedure using Wavetek Stealth equipment (3ST/3HRV and 3SRV), Hewlett-Packard CaLan equipment (3010H and 3010R), and the method using relatively inexpensive video equipment (spectrum analyzer, signal generator, video camera, video signal modulator, and monitor). For specific instructions on operation of the equipment, refer to the manufacturer’s user manual.



❷ A device (usually rack mounted) at the headend analyzes the incoming signal and transmits the results back to the head-held unit.

❶ A hand-held sweep device transmits a signal to the headend through the reverse path of the amplifier being balanced.

❸ The hand-held unit receives the data from the headend unit and displays a trace of the signal as it would appear at the headend

Figure 4.2 Typical Configuration of Single Person Reverse Balancing Equipment

4.5.2 Two Person Reverse Balancing Procedure

	***CAUTION**: RF signal levels greater than +30dBmV at the hybrid can damage amplifier active components. Do not use signal levels greater than +30dBmV at the hybrid. (+30dBmV = +90dBμV).*
	***Note**: The two person method of reverse balancing requires two technicians communicating between two successive amplifier locations. Balancing signals are injected into a forward path output testpoint of the Balancing Amplifier and measured at the reverse input testpoint of the Measuring Amplifier.* ***Note**: FlexNet 700 Series amplifier testpoints are -25dB referenced to the associated port input or output level. Stickers on the amplifier housing indicate testpoint value.* ***Note**: C-COR.net provides a plug-in terminator (SPB-99) in the reverse path to prevent a buildup of noise that can be transmitted through the reverse path. The reverse path is not active until the plug-in terminator is removed and striplines, PADs, or accessories are installed.*

1. Obtain the Reverse High and Low Balancing Carrier Levels from the System Map for both amplifiers. Record these levels in the corresponding boxes on the Amplifier Data Sheet and as indicated in the calculation boxes of Steps 3, 4, and 7.
2. At the Balancing Amplifier, ensure that factory jumpers (stripline) or SPB-0 /SEQ-0 accessories are installed in the **REVERSE PAD** and **REVERSE EQ** locations. If present, remove the plug-in terminator (SPB-99).
3. At the Balancing Amplifier, connect a signal generator to the Port 3 testpoint. Calculate the Signal Generator Levels as shown in the following calculation box. Set the signal generator to these levels and frequencies.

________________	+	________________	=	________________
System Reverse High Balancing Carrier Level (Balancing Amp)		Testpoint Loss		Signal Generator Level: Reverse High Balancing Carrier
________________	+	________________	=	________________
System Reverse Low Balancing Carrier Level (Balancing Amp)		Testpoint Loss		Signal Generator Level: Reverse Low Balancing Carrier

4. At the Measuring Amplifier, connect a Signal Level Meter (SLM) to the external testpoint for that port. Measure the Reverse High and Low Balancing Carrier Levels and record them as shown in the following calculation box.

______________	–	______________	=	______________
System Reverse High Balancing Carrier Level (Measuring Amp)		System Reverse Low Balancing Carrier Level (Measuring Amp)		System Tilt of Measuring Amp
______________	–	______________	=	______________
Measured Reverse High Balancing Carrier Level (Measuring Amplifier)		Measured Reverse Low Balancing Carrier Level (Measuring Amplifier)		Measured Tilt
______________	–	______________	=	______________
System Tilt		Measured Tilt		Equalization Value

5. Calculate the Equalization Value. Using the appropriate table in Appendix A, select an MEQ plug-in accessory that has a tilt as close to the Equalization Value as possible. For a full explanation of the selection process, see Section A.1.2.
6. If necessary, at the Balancing Amplifier, remove the SEQ-0 or factory jumper (stripline) from the **REVERSE EQ** plug-in area. Install the selected MEQ into the **REVERSE EQ** plug-in area.
7. At the Measuring Amplifier, measure the adjusted Reverse High Balancing Carrier Level and record it as shown in the box below. Calculate the PAD Value.

______________	–	______________	=	______________
Measured Reverse High Balancing Carrier Level		System Reverse High Balancing Carrier Level		PAD Value

8. Select an SPB PAD that has a flat loss as close to the PAD Value as possible.
9. If necessary, at the Balancing Amplifier, remove the SPB-0 PAD or factory installed jumper (stripline) from the **REVERSE PAD** plug-in area. Install the selected SPB PAD into the **REVERSE PAD** plug-in area.
10. At the Balancing Amplifier, measure the signal levels of both reverse balancing carriers at the Port 1 and Port 3 external testpoints and record these levels on the Amplifier Data Sheet.
11. Close the housing and replace the caps on all external testpoints. Refer to Section 3.5, *Closing and Tightening*, if necessary.

4.6 Active Reverse Kit Installation Instructions

***CAUTION**: Modifications or alterations of C-COR.net products except as performed by C-COR.net or its authorized representative will void the product warranty. Contact the C-COR.net Equipment Service Center for more information (1-814-231-4437 or -4444).*

4.6.1 Introduction

These installation instructions provide bench procedures for installing the following Active Reverse Upgrade Kits:

Table 4.5 Active Reverse Upgrade Kits

Part Number	Models Covered	Reverse Gain	Reverse Hybrid
173342-02	E729B with linear power supply[1]	18 dB	UX0124
173342-03	E7xx with linear power supply	18 dB	UX0124
173342-05	E7xx with linear power supply	20 dB	DRM
173342-06	E7xx with H.E. power supply	20 dB	DRM
173342-07	E7xx with H.E. power supply	18 dB	UX0124

1. **E729B** line extenders require the installation of diplex filters. Diplex filters are not provided with reverse upgrade kits and must be purchased separately. Contact your C-COR.net sales representative for details.

4.6.2 Installation

***CAUTION**: Observe electrostatic discharge precautions when handling electronic components.*

4.6.2.1 Preparation for Reverse Kit Installation (All Reverse Kits)

1. Open the housing and remove the RF module, referring to the instructions in Sections 3.1 and 6.3 as necessary.
2. Using a #2 Phillips screwdriver, remove the eight screws securing the faceplate to the RF module. Remove the faceplate to expose the circuit board.

***Note**: After the installation of a Reverse Hybrid, amplifier performance should be verified. Realignment may be necessary.*

4.6.2.2 DRM Installation (Kits 173342-05/06)

1. *For E7 with Passive Reverse only*:
   a. Locate the capacitor across the Reverse Hybrid location. Refer to Figure 4.7 if necessary.
   b. Using needle nose pliers, remove the capacitor. It is not soldered to the circuit board.
2. Examine the pins on the reverse hybrid supplied in the kit. Ensure that the pins are straight.
3. Apply a thin coat of thermal joint compound to the bottom of the reverse hybrid. Align the pins of the reverse hybrid with the holes on the motherboard. Firmly press the reverse hybrid down to the motherboard.
4. Insert the two hybrid mounting screws supplied in the upgrade kit through the bottom of the RF module as shown in Figure 4.3.
5. Using the #2 Phillips screwdriver, tighten the screws to secure the reverse hybrid to the RF module. Torque to between 15 and 18 in-lbs (1.7 and 2.0 N·m).
6. Remove any excess thermal joint compound from the perimeter of the hybrid.

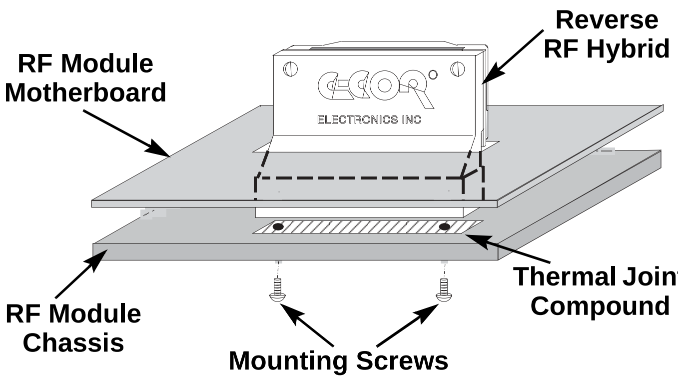


Figure 4.3 DRM Installation

4.6.2.3 UX0124 Installation (Kits 173342-02/03/07)

1. **For E7 with Passive Reverse only:**
   a. Locate the capacitor across the Reverse Hybrid location. Refer to Figure 4.7 if necessary.
   b. Using needle nose pliers, remove the capacitor. It is not soldered to the circuit board.
2. Examine the pins on the UX0124 reverse hybrid supplied in the kit. The pins should be cut to the length shown in Figure 4.4. Ensure that the pins are straight.
3. Apply a thin coat of thermal joint compound to the bottom of the reverse hybrid. Align the pins of the reverse hybrid with the holes on the motherboard. Firmly press the reverse hybrid down to the motherboard.
4. Insert the two hybrid mounting screws supplied in the upgrade kit through the bottom of the RF module as shown in Figure 4.5. Install a combination nut/lock washer on each screw.

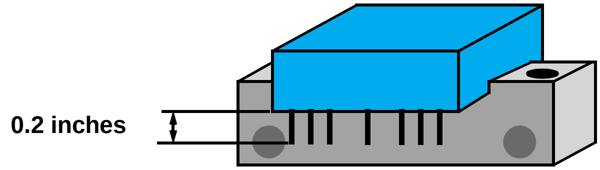


Figure 4.4 UX0124 Lead Lengths

5. Using the nutdriver, tighten the nuts onto the screws to secure the reverse hybrid to the RF module. Use a flat blade screwdriver to keep the screw from turning. Torque to between 12 and 18 in-lbs (1.4 and 2.0 N·m).
6. Remove any excess thermal joint compound from the perimeter of the hybrid.

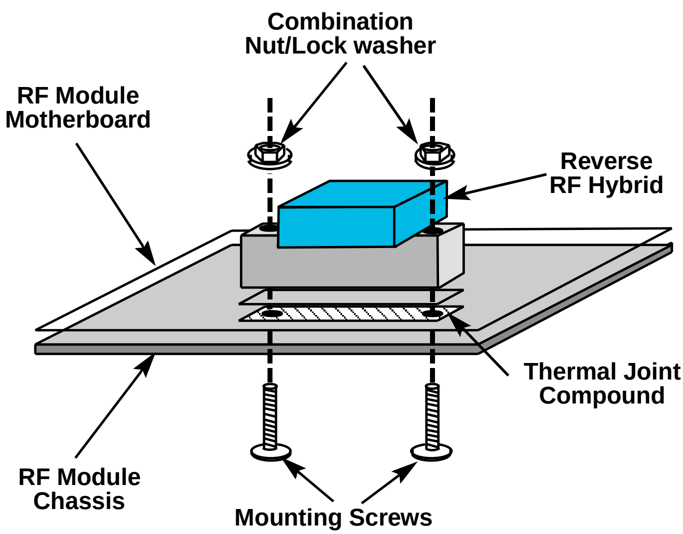


Figure 4.5 UX0124 Installation

4.6.2.4 Regulator Installation (kits 173342-02/03/05 only)

1. Locate the hole in the chassis indicated in Figure 4.6. Place the small insulator pad in the orientation shown.
2. Ensure that the regulator leads are straight.
3. Place sleeves on the regulator pins as shown in Figure 4.6.
4. Orient the regulator as shown. Insert the regulator pins into the holes labeled **U8** until the regulator mounting screw hole lines up with the hole in the insulator pad and chassis.

5. Insert the binder head Phillips screw from the outside of the RF module as shown in Figure 4.6. Secure the regulator with the neoprene washer, then the metal washer and nut.

> ***CAUTION**: Overtightening the regulator mounting screw can short the regulator to the chassis. Torque to between 4 and 6 in-lbs (.45 and .68N·m).*

6. Use the #1 Phillips screwdriver to keep the screw from turning while tightening the nut. Torque to between 4 and 6 in-lbs (.45 and .68N·m).

> ***CAUTION**: Solder bridges will short the regulator. Do not allow solder to bridge between leads.*

7. Solder the regulator leads being very careful that the solder does not bridge between leads.

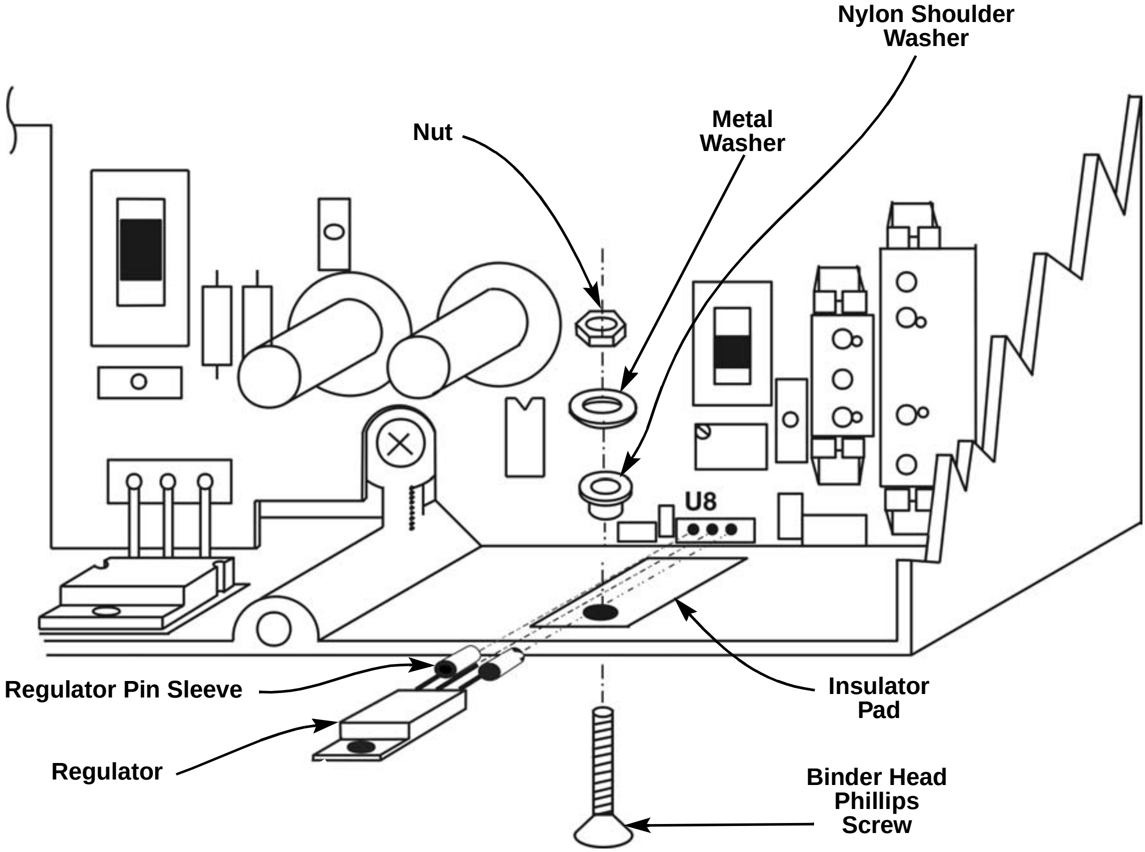


Figure 4.6 Regulator Installation

4.6.2.5 Diplex Filter Installation (for E729B)

> ***Note**: Installing diplex filters without realigning the amplifier may degrade signal quality. Diplex filters add insertion loss, which decreases spacing. Installing diplex filters may also cause bandedge rolloff and degrade return loss at input and output ports. Amplifier realignment is required after installing diplex filters to meet factory specifications and to prevent these problems.*
>
> ***Note**: Contact the C-COR.net Equipment Service Center for more information (tel. 1-814-231-4437 or -4444).*

1. Referring to Figure 4.7, locate the two capacitors and one inductor installed at each diplex filter location:
   - Input Diplex Filter location: C55, L19, and C54
   - Output Diplex Filter location: C59, L22, and C60

> ***CAUTION**: When installing diplex filters, do not disturb any components on the diplex filter circuit board.*

2. Carefully cut away these capacitors and inductors. Do not disturb or remove any other components.
3. Orient the diplex filters so that their pins align with receptacles on the module motherboard. Firmly press the diplex filters down onto the motherboard.

4.6.2.6 Completing Reverse Kit Installation (all kits)

> ***Note**: Marking the faceplate of a modified amplifier may assist future maintenance efforts.*

1. Position the faceplate on the RF module and secure it using the screws removed in Section 4.6.2.1.
2. Install the RF module and close the housing, referring to the instructions in Sections 3.5 and 6.3 as necessary.
3. Verify the performance of the amplifier on both the forward and reverse paths. Field-test procedures are provided in Sections 5.4 and 4.4.

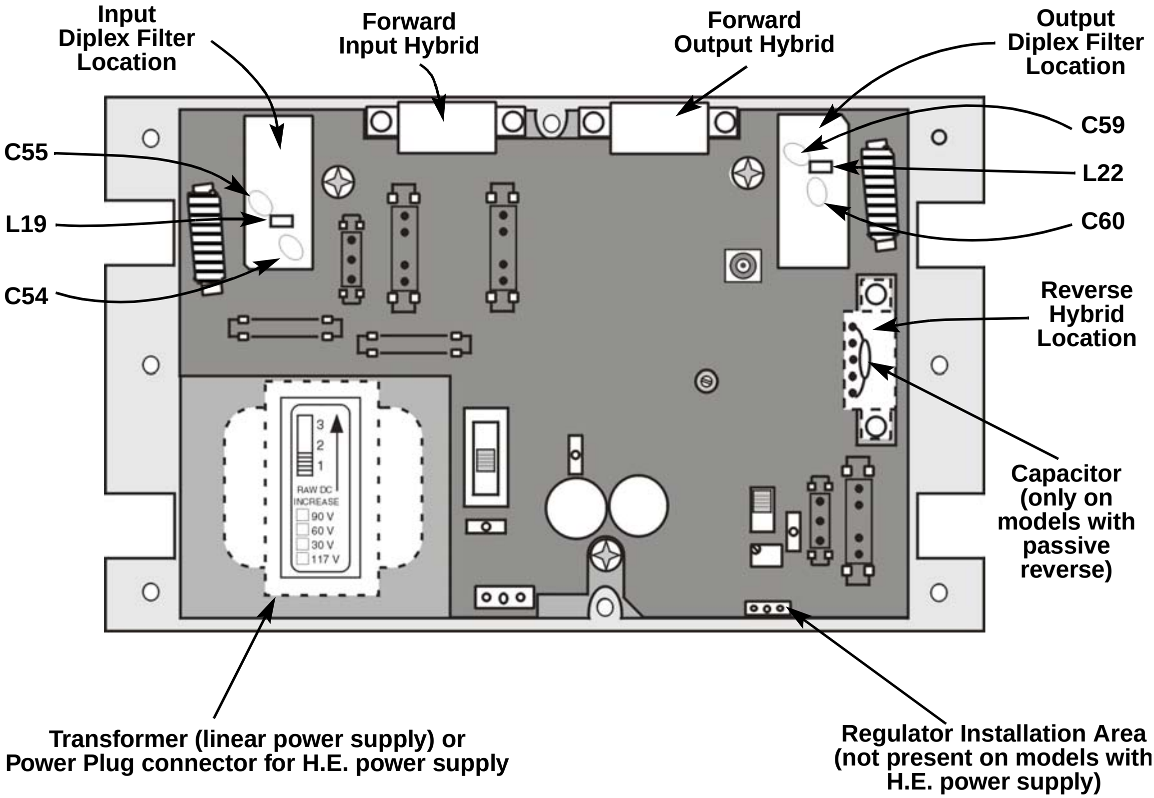


Figure 4.7 E7 Motherboard

Chapter 5

Troubleshooting Test Procedures

This chapter contains procedures that check all operational characteristics of an E7 FlexNet line extender amplifier that is suspected of being faulty.

5.1 Field Testing Requirements

The following are required for Forward and Reverse field testing:

- the operational gain of the amplifier (see C-COR.net Amplifier Specification Sheets)
- System Forward and Reverse High and Low Balancing Carrier Levels for the amplifier being tested (see the System Map or Amplifier Data Sheet)

> ***Note**: Most System Maps list the input and output signal levels at bandedge frequencies established for 68º F (20º C). If necessary, refer to Section 4.2, Calculating Balancing Carrier Levels (for Linear Output Tilt Operation) and Section 4.3, Temperature Correction.*

If available, historical Amplifier Data Sheets will aid in troubleshooting a faulty amplifier.

Verify the following prior to beginning any test procedure:

- the amplifier is grounded
- all tap outlets, active unused ports, ends of cables, and branch points are terminated with a 75Ω impedance
- a true-RMS, AC-coupled voltmeter is available for AC voltage measurements. Non-true-RMS AC voltmeters will read up to 10% higher than actual value. DC voltage measurements will not be affected.

5.2 Quick Forward Outage Check

This check is not a comprehensive test of all amplifier functions. The steps listed here can help you quickly determine whether or not an amplifier is causing a signal outage to subscribers downstream in the forward path, especially when no automated status monitoring is used. Do the following at a suspect amplifier:

1. Measure the output signal from Port 3 at the external testpoint using a signal level meter. Measure an active frequency/channel that has historical (or designed) values to compare against.
2. If the output signal is at a reasonable level, check devices further down the signal path. If not, check the input signal level at the Port 1 external testpoint.
3. If the input signal is at a reasonable level, but the output signal is not, use the following troubleshooting sections in the book to see if this amplifier is the source of the outage. If the input signal is not at a reasonable level, check amplifiers closer to the signal source or headend.

Reasonable levels are determined by the system design. Your system map and Amplifier Data Sheets can give you the designed and historical levels. When trying to fix an outage quickly, a much wider range of values may be accepted than when balancing or sweeping a system. You can usually fix smaller problems after service is restored.

When you have many amplifiers to check, a good general method for finding the source of an outage is the 50/50 method. The 50/50 method consists of testing for RF signals and power problems at a device halfway through the cascade (or problem leg). Keep dividing the problem sections in half until you isolate the malfunction. You can combine this method with other methods.

An amplifier that outputs reasonable RF signal levels may not pass power to the next device (likely due to a blown fuse). The lack of power passing is then caught when the next active device in the signal path is checked, which leads you back to the causative amplifier.

5.3 Power Troubleshooting

Use the procedure given in Section 4.1.2 to troubleshoot the power supply.

5.4 Forward Path Field Testing

This procedure verifies that the amplifier:

- is balanced to the correct forward signal levels
- delivers the specified gain to forward RF signals.

These procedures require the use of a signal level meter (SLM). A more comprehensive test involves sweeping the entire bandwidth with an appropriate sweep generator/receiver—especially desirable when response problems are suspected.

1. If present, set the **ALC/MAN** switch to the **MAN** position.

> ***Note****: All measured signal levels must be temperature compensated to a common temperature before they can be accurately compared. Refer to Section 4.3 for information on temperature compensation.*

2. Connect an SLM to the Port 1 external testpoint and measure the input signal levels of both forward balancing carriers. Verify that the input signal levels are within reasonable tolerance of the measurements made during the initial balancing procedure. If not, find the cause of the variation external to the amplifier. Correct if necessary, then rebalance the amplifier.

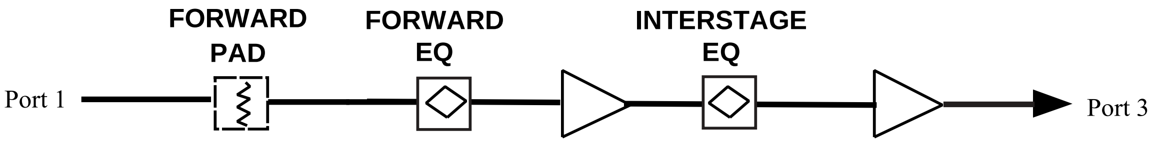


Figure 5.1 Simplified Forward Path Block Diagram

3. Connect a SLM to the Port 3 external testpoint and measure the output signal levels of both forward balancing carriers. Compare the present levels to the measurements made when the amplifier was previously balanced. If the current measurements are unacceptable, verify that the proper accessories or striplines are still installed in all forward plug-in locations and replace any accessories not in compliance with the Amplifier Data Sheet. If necessary, rebalance the amplifier.

5

> ***Note**: The Operational Gain listed on a C-COR.net Amplifier Specification Sheet is the gain at the high bandedge frequency and includes 1 dB of loss for the forward equalizer.*

4. Calculate the true amplifier gain by subtracting the input high balancing carrier signal level measured at Port 1 from the output signal level measured at Port 3. The difference should equal the operational gain of the amplifier (at the balancing carrier) minus insertion losses from accessories installed in the forward path. Refer to Section A.1.2 to determine insertion losses at the high carrier frequency. Replace the RF module if the amplifier gain measured at any port is out of tolerance.
5. If present, reset the **ALC/MAN** Switch or **TLC/MAN** Switch to **ALC** or **TLC.**
6. If necessary, adjust the **ALC SENSITIVITY** control as described in Section 4.4.2.

5.5 Return Path Field Testing

> ***CAUTION**: RF signal levels greater than +30 dBmV @ 1 NTSC channel loading at the hybrid can damage amplifier active components. Do not use test signals greater than +30 dBmV at the hybrid (+30 dBmV = 90 dBμV).*

This procedure verifies that the amplifier:

- is balanced to the correct reverse signal levels
- provides the specified gain of reverse RF signals.

The following procedure requires the use of a signal level meter (SLM). A more comprehensive test involves sweeping the entire bandwidth with an appropriate sweep generator/receiver—especially when response problems at specific frequencies are suspected.

> ***Note**: All measured signal levels must be temperature compensated to a common temperature before they can be accurately compared. Refer to Section 4.3.*

1. Connect a signal generator to the Port 3 external testpoint. Set the signal generator to output the correct Reverse High Balancing Carrier Level + 25 dB (to overcome testpoint loss) at the proper frequency.
2. Connect a signal level meter to the Port 1 external testpoint and measure the output signal level of the Reverse High Balancing Carrier. Compare the current level to the measurements made when the amplifier was previously balanced. If the current measurement is unacceptable, verify that the proper accessories or striplines are still installed in all reverse plug-in locations and replace any accessories not in compliance with the Amplifier Data Sheet. If necessary, rebalance the amplifier.

> ***Note**: The Operational Gain listed on a C-COR.net Amplifier Specification Sheet is the gain at the high bandedge frequency and includes 1 dB of loss for the reverse equalizer.*

3. Calculate the true reverse amplifier gain by subtracting the input signal level (set in Step 1) from the output level measured at Port 1. The difference should equal the operational gain of the amplifier (at the balancing carrier) minus insertion losses from accessories installed in the reverse path. Refer to Section A.1.2 to determine insertion losses at the high carrier frequency. Replace the RF module if the amplifier gain measured at Port 1 is outside of acceptable tolerance.

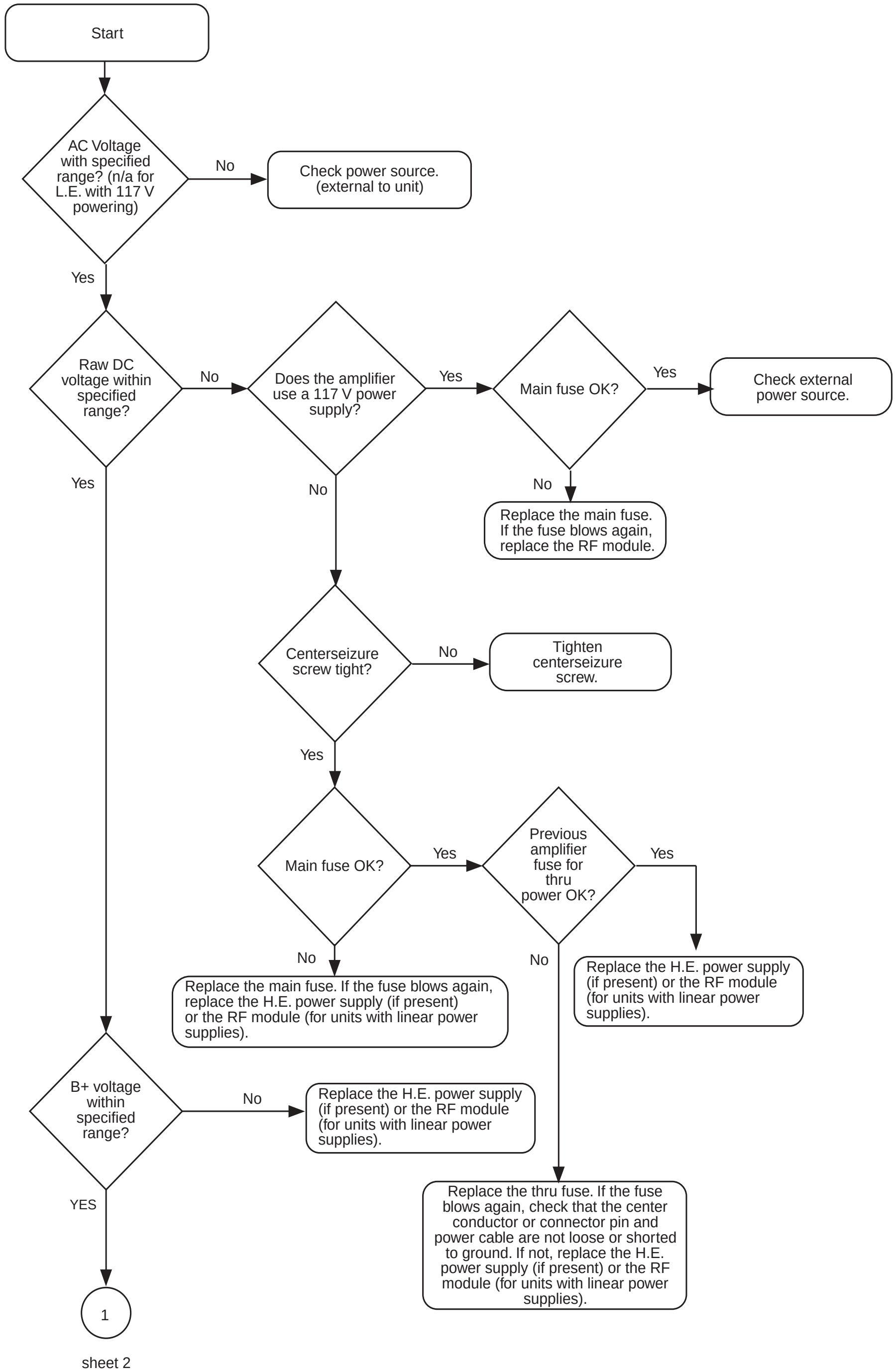


Figure 5.2 Troubleshooting Flow Diagram (1 of 2)

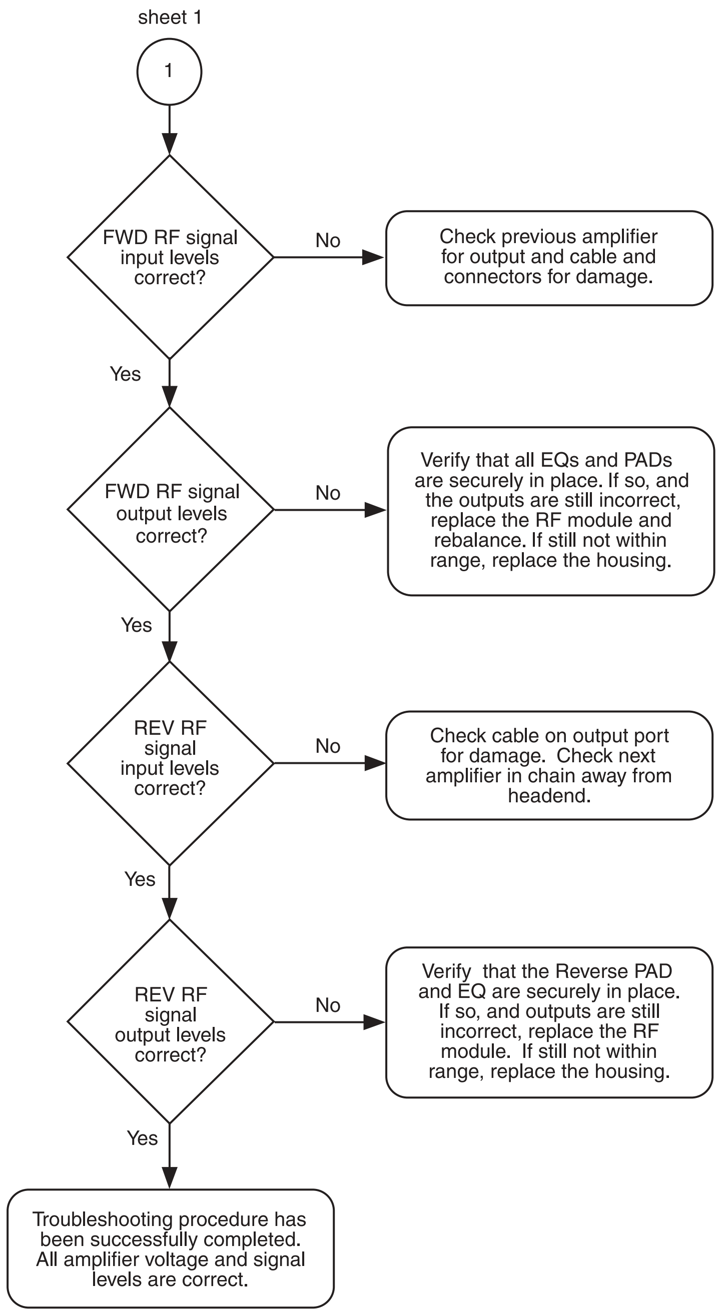


Figure 5.3 Troubleshooting Flow Diagram (2 of 2)

Maintenance

This chapter discusses the installation and/or replacement of fuses, power supplies, RF modules, and housings.

6.1 General Inspection

Inspect the entire unit for the following each time maintenance and adjustments are done:

- damaged or missing gaskets (rubber in the base or metal mesh in the lid)
- loose modules or assemblies
- missing, open (blown), loose or misaligned fuses
- heat damage (burn marks, charred components)
- water damage

6.2 Fuse/Brass Shorting Bar (Slug) Replacement

WARNING*: Hazardous voltages are present. Use approved safety equipment and procedures. Do not energize any station until all other stations in the power supply group have been installed.*

CAUTION*: Improper fuse installation can:*

- *damage the amplifier*
- *fail to power the amplifier*
- *fail to distribute thorugh power.*

Damaged fuseclips or misaligned fused can cause heat damage. Do not force or misalign the fuse when installing.

Removal:

1. Remove the fuse/slug using a fuse puller. In 117 VAC powered units, remove the fuse cap by turning the cap counter-clockwise about ¼ turn using your fingers or a screw driver as needed. The fuse will pop up for easy removal. Refer to Chapter 2, Figures 2.1 to 2.5, for fuse locations.
2. Inspect for the following:
   - fatigue cracks or corrosion in both leaves of the fuseclips
   - broken connections between the fuseclips and the circuit board
   - heat damage on the circuit board
3. If power supply damage is evident, replace the damaged power supply (see Section 6.4).

Installation:

For non-117 VAC powered units:

1. Using a fuse puller, center the fuse or slug across the fuseclip. Be sure that the metal tips of the fuse/slug do not extend beyond the fuse guides of the holder on either side.
2. Apply even, steady pressure to the tool until both ends of the fuse or slug snap into the holder simultaneously.

For 117 VAC powered units:

1. Replace the fuse into its holder.
2. Replace the fuse cap by positioning it over the fuse, pressing the fuse down into the holder, and turn the cap clockwise about ¼ turn to lock in place. Use fingers or screwdriver as needed.

6.3 RF Module Replacement

	WARNING: *Hazardous voltages are present. Use approved safety equipment and procedures.*
	CAUTION: *Arcing between the RF module and the housing will damage the unit. Disconnect power to the unit before removing the RF module.*

1. If an H. E. Power Supply is present, disconnect the Power Plug from the RF module **POWER PLUG** connector. Release the plug by squeezing the tabs on the Power Plug.
2. Use a flat-blade screwdriver to loosen and release the captive Module Hold Down screws.
3. Grasp the RF module handles and pull the RF module straight out of the housing.
4. Ensure that the **MAIN FUSE** is removed from the new RF module. If not, remove it. Refer to Section 6.2 for fuse removal and installation procedures.
5. Orient the replacement RF module so that the RF module banana pins align with the receptacles located on the centerseizure assemblies.

6. Firmly press the replacement RF module into the housing until the back of the RF module bottoms against the inside of the housing.
7. Using a flat-blade screwdriver, start the captive Module Hold Down screws into the housing. Alternately tighten the screws to prevent stressing the module or housing. Torque to between 25 and 27 in-lbs (2.8 and 3.1 N·m).
8. Install the **MAIN FUSE** and/or the **THRU POWER FUSE**. Refer to Section 6.2 for fuse removal and installation procedures.
9. Remove the plug-in accessories from the old RF module and install them into the replacement RF module.
10. Perform the Forward and Reverse Field Tests. Refer to Chapter 5.

6.4 H. E. Power Supply Replacement

WARNING*: Hazardous voltages are present. Use approved safety equipment and procedures.*

1. Disconnect the Power Plug from RF module **POWER PLUG** connector by squeezing the tabs on the Power Supply module Power Plug and pulling straight out.
2. Use a flat-blade screwdriver to loosen, but not remove, the four Power Supply Module Hold Down screws.
3. Firmly grasp the Power Supply module, slide it toward the RF module, and pull it straight out of the housing.
4. Orient the replacement Power Supply module so that the four Hold Down screw holes align with the four captive Module Hold Down screws in the housing cover. Install the Power Supply module onto the screws and slide it away from the RF module.
5. Tighten the Power Supply Module Hold Down screws with a flat-blade screwdriver. Reconnect the Transponder power cable if present.
6. Connect the Power Supply Plug to RF module **POWER PLUG** connector.
7. Configure the Power Supply according to Section 4.1.

6.5 Housing Replacement

***WARNING**: Hazardous voltages are present. Use approved safety equipment and procedures. Sheath currents may flow through the amplifier housing. Establish a second current path around the housing before disconnecting any cables. Automotive jumper cables are recommended.*

***CAUTION**: Amplifier electronic components can be damaged by the environment. Close the housing whenever it is left unattended to keep moisture out of the amplifier and to protect the network from RF interference.*

***CAUTION**: DO NOT back centerseizure screws completely out of the seizure mechanism. Centerseizure screws are not captive. Screws loose in the housing can cause short circuits.*

1. Remove the RF module and power supply module as described in Sections 5.3 and 5.4.
2. Beginning at Port 1 and using a #2 Phillips screwdriver, loosen the centerseizure screw no more than two full turns.
3. Loosen the connector back nut and main nut on the external cable connector.
4. Pull the cable with connector main nut straight out of the connector body.
5. Loosen and remove the connector body from the housing cable entry port.
6. Disconnect Port 3 by repeating steps 2 through 5.
7. When all cabling is disconnected, loosen the attaching bolts that secure the housing to the strand, or remove bolts for housings mounted to EMBs, a pedestal, or a wall.
8. Install the replacement housing in accordance with installation procedures given in Section 3.3.
9. Install the RF module and power supply as described in Sections 6.3 and 6.4.

Appendix A

Reference Tables

This section presents product tables that support the balancing procedures of Sections 4.4 and 4.5.

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A.1 Use Of Accessory Tables

The following sections describe two methods for using the Accessory Tables to select the correct values needed to balance an amplifier. The procedure given in Section A.1.1 takes into account cable losses and the internal equalization of the amplifier. The procedure outlined in Section A.1.2 assumes prior calculation of the Equalization Value as defined in the Forward Balancing procedure.

A.1.1 Using the “dB of cable equalized at highest frequency” Column

To use the “dB of cable equalized at highest frequency” (for cable equalizers) and “dB of cable simulated” (for cable simulators) columns of the Accessory Tables, the amount of factory installed alignment of the amplifier (if any) must be known. This information is found on the Amplifier Specification sheet.

1. Note the amount of cable loss the amplifier is designed to accommodate at the highest system frequency as listed under “Factory Alignment/Cable Loss” on the Amplifier Specification sheet.
2. To determine the actual system cable loss at the highest frequency: Refer to the System Map and note the cable insertion loss in dB preceding the amplifier being balanced, or calculate the cable loss using cable length and the Manufacturer's Cable Loss Charts. Either method will give the “system cable loss.”
3. Subtract the amplifier's factory-installed alignment from the system cable loss to determine the dBs of cable equalization/simulation required at the highest frequency.

   (System Cable Loss) – (Factory Alignment/Cable Loss) = XdB

4. If **XdB** is positive (+), refer to the SEQ table that lists the accessories being used in the system. Select the SEQ having a value as close to **XdB** as possible, as listed in the “dB of cable equalized at highest frequency” column.

5. If **XdB** is negative (–), refer to the SCS table that lists the accessories being used in the system. Select the SCS with a value as close to **XdB** as possible, as listed in the “dB of cable simulated at highest frequency” column.

A.1.2 Using the “Insertion Loss in dB at Frequency” Columns

A.1.2.1 Equalizer Selection (positive Equalization Value)

Select the equalizer from the appropriate equalizer table in Section A.3 that has a tilt as close as possible to the desired Equalization Value. The tilt for a particular accessory is calculated as follows:

Insertion Loss at Low Balancing Carrier

– <u>Insertion Loss at High Balancing Carrier</u>

= SEQ/MEQ Tilt

A.1.2.2 Cable Simulator Selection (negative Equalization Value)

Select a cable simulator from the appropriate table in Section A.3 that has a tilt as close as possible to the desired Equalization Value. The tilt for a particular accessory is calculated as follows:

Insertion Loss at Low Balancing Carrier

– <u>Insertion Loss at High Balancing Carrier</u>

= SCS Tilt

A.2 Installing Plug-in Accessories

Equalizers are keyed so they can only be installed one way.

The amplifiers may have factory installed jumper wires that provide a continuous signal path across accessory plug-in areas. The jumpers must be removed before accessories can be installed. Some jumpers are soldered to the motherboard and must be cut out, while others are plug-ins and must be pulled out. Before installing any accessories, remove these jumper wires. When the jumper wires are removed, use an SPB-0 or SEQ-0 to provide continuity (zero loss) for the signal path.

A.3 Accessory Tables

SEQ-750 series cable equalizers and SCS-750 cable simulators are designed for forward balancing 750 MHz systems, but may also be used with 550 MHz amplifiers. Similarly, 862 series cable equalizers and simulators are designed for 862 MHz systems, but may be used with 750 and 550 MHz amplifiers.

MEQ-550 series cable equalizers and MCS-550 series cable simulators are designed for forward balancing 550 MHz systems.

MEQ/MEQT-65, 55, 42, 33, and 30 cable equalizers are designed for reverse balancing and should be selected according to the reverse path bandwidth.

SPB-xx series cable attenuators may be used for both forward and reverse balancing in any system.

SEQPB series cable attenuators are attenuators (PADs) built on an equalizer footprint.

Table A.1 SEQ-862 Series Cable Equalizers

	Insertion Loss in dB at Frequency (MHz)										
Model Number	**42**	**54**	**70**	**80**	**222**	**500**	**600**	**700**	**800**	**862**	*****
SEQ-862-02	2.0	1.9	1.9	1.9	1.8	1.4	1.3	1.2	1.1	1.0	1.0
SEQ-862-03	3.0	2.9	2.8	2.8	2.4	1.6	1.5	1.4	1.2	1.0	2.0
SEQ-862-04	4.0	4.0	4.0	4.0	3.2	1.9	1.6	1.4	1.2	1.0	4.0
SEQ-862-05	5.0	4.8	4.6	4.5	3.4	2.1	1.7	1.4	1.2	1.0	5.0
SEQ-862-06	6.0	5.9	5.6	5.6	4.2	2.6	2.1	1.6	1.2	1.0	6.5
SEQ-862-07	7.0	6.9	6.6	6.6	5.4	3.1	2.5	1.9	1.4	1.0	7.8
SEQ-862-08	8.0	7.8	7.5	7.4	5.6	3.4	2.7	2.1	1.4	1.0	8.7
SEQ-862-09	9.0	8.8	8.4	8.3	6.3	3.6	2.8	2.0	1.4	1.0	10.5
SEQ-862-10	10.0	9.6	9.1	8.9	6.9	3.8	2.9	2.1	1.4	1.0	11.0
SEQ-862-11	11.0	10.8	10.3	10.2	7.6	4.4	3.5	2.5	1.6	1.0	13.0
SEQ-862-12	12.0	11.6	11.1	10.8	8.2	4.7	3.7	2.7	1.7	1.0	14.5
SEQ-862-13	13.0	12.8	12.4	12.0	8.8	5.0	3.9	2.8	1.7	1.0	15.5
SEQ-862-14	14.0	13.6	12.9	12.7	9.6	5.2	4.0	2.9	1.8	1.0	16.5
SEQ-862-15	15.0	14.5	13.9	13.5	10.4	5.6	4.2	3.0	1.8	1.0	17.5
SEQ-862-16	16.0	15.3	14.7	14.3	10.8	6.1	4.7	3.3	2.0	1.0	19.0
SEQ-862-17	17.0	17.5	16.8	16.4	12.2	6.5	5.1	3.5	2.0	1.0	21.3
SEQ-862-18	18.0	18.4	17.5	17.2	12.7	6.8	5.2	3.6	2.0	1.0	22.4
SEQ-862-19	19.0	19.5	18.6	18.2	13.6	7.2	5.7	3.8	2.0	1.0	23.9
SEQ-862-20	20.0	20.3	19.4	19.0	14.2	7.6	5.8	3.9	2.0	1.0	24.9

Passband Flatness: 0.6 dB P-V

Return Loss I/O: 20/18 dB

*dB of cable equalized at highest frequency

Document number: 600438, Revision: G

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Table A.2 SCS-862 Series Cable Simulators

Model Number	Insertion Loss in dB at Frequency (MHz)								dB of cable simulated at					
	54	70	80	222	550	750	806	862	300	450	550	750	806	862
SCS-862-02	1.0	1.0	1.0	1.3	1.7	1.9	2.0	2.0	0.7	0.8	1.0	1.2	1.2	1.3
SCS-862-03	1.0	1.0	1.0	1.6	2.4	2.8	2.9	3.0	1.3	1.7	1.9	2.3	2.5	2.6
SCS-862-04	1.0	1.1	1.2	1.9	3.2	3.8	3.9	4.0	2.0	2.6	2.9	3.5	3.8	3.9
SCS-862-05	1.0	1.0	1.1	2.3	3.9	4.7	4.9	5.0	2.7	3.4	3.9	4.7	5.0	5.2
SCS-862-06	1.0	1.0	1.2	2.6	4.6	5.5	5.8	6.0	3.3	4.2	4.8	5.7	6.2	6.4
SCS-862-07	1.0	1.2	1.4	3.1	5.2	6.3	6.6	7.0	4.3	5.4	6.0	7.1	7.4	7.7
SCS-862-08	1.0	1.3	1.4	3.3	6.0	7.3	7.6	8.0	5.0	6.2	6.9	8.2	8.6	8.9
SCS-862-09	1.0	1.3	1.6	3.7	6.6	8.1	8.5	9.0	5.7	7.1	7.9	9.4	9.8	10.2
SCS-862-10	1.0	1.4	1.6	3.9	7.3	9.0	9.4	10.0	6.4	8.0	8.9	10.6	11.1	11.5
SCS-862-11	1.0	1.5	1.7	4.4	8.0	10.0	10.3	11.0	7.1	8.9	9.9	11.8	12.3	12.8
SCS-862-12	1.0	1.5	1.7	4.8	8.7	10.9	11.4	12.0	7.9	9.8	11.0	13.1	13.6	14.1
SCS-862-13	1.0	1.5	1.8	5	9.5	11.9	12.4	13.0	8.6	10.7	12.0	14.3	14.8	15.4
SCS-862-14	1.0	1.6	1.9	5.5	10.0	12.9	13.4	14.0	9.3	11.5	12.9	15.4	16.0	16.6
SCS-862-15	1.0	1.7	2.0	5.9	10.6	13.7	14.3	15.0	10.0	12.4	13.9	16.6	17.3	17.9

Passband Flatness: 0.4 dB P-V (-2 through -13); 0.6 dB P-V (-14 and -15)   Document number: 600662, Revision: B

Return Loss I/O: 18/16 dB (-2 through -13); 16/16 dB (-14 and -15)

Table A.3 SEQ-750 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz) 54	70	80	222	350	450	550	650	750	dB of cable equalized at highest frequency
SEQ-750-02	2.0	2.0	2.0	1.8	1.4	1.3	1.3	1.2	1.0	1.5
SEQ-750-03	3.0	2.8	2.7	2.4	1.9	1.7	1.5	1.3	1.0	2.5
SEQ-750-04	3.9	3.9	3.8	3.1	2.4	2.0	1.7	1.4	1.0	4.0
SEQ-750-05	4.9	4.6	4.5	3.5	2.9	2.3	1.8	1.4	1.0	5.0
SEQ-750-06	5.9	5.7	5.6	4.2	3.3	2.7	2.0	1.5	1.0	6.5
SEQ-750-07	7.0	6.8	6.6	5.0	3.6	2.8	2.0	1.6	1.0	8.0
SEQ-750-08	8.0	7.9	7.6	5.5	4.2	3.3	2.5	1.8	1.0	9.0
SEQ-750-09	9.0	8.8	8.6	6.3	4.8	3.8	2.7	2.0	1.0	10.5
SEQ-750-10	9.8	9.4	9.2	6.7	5.0	3.8	2.8	2.0	1.0	12.0
SEQ-750-11	11.0	10.5	10.2	7.5	5.5	4.2	3.0	2.0	1.0	13.5
SEQ-750-12	11.8	11.3	11.0	8.1	6.0	4.6	3.3	2.2	1.0	14.5
SEQ-750-13	12.9	12.4	12.2	8.9	6.6	5.1	3.7	2.5	1.0	16.0
SEQ-750-14	14.0	13.5	13.2	9.7	6.9	5.3	3.8	2.5	1.0	17.0
SEQ-750-15	14.9	14.3	13.9	10.1	7.5	5.8	4.3	2.6	1.0	18.5
SEQ-750-16	15.8	14.9	14.5	10.5	8.0	6.1	4.4	2.7	1.0	20.0
SEQ-750-17	16.8	16.0	15.6	11.3	8.2	6.2	4.4	2.6	1.0	21.0
SEQ-750-18	17.9	17.1	16.6	11.9	8.6	6.6	4.6	2.6	1.0	22.4
SEQ-750-19	18.8	17.8	17.4	12.3	9.1	6.9	4.8	2.7	1.0	23.7
SEQ-750-20	19.8	19.0	18.5	13.2	9.5	7.2	5.0	2.8	1.0	25.0
SEQ-750-21	20.8	19.8	19.3	13.4	10.0	7.5	5.2	2.9	1.0	26.3
SEQ-750-2-2	2.8	2.8	2.8	2.5	2.3	2.2	2.1	2.1	2.0	1.1
SEQ-750-4-2	4.5	4.4	4.3	3.6	3.1	2.8	2.5	2.2	2.0	3.3
SEQ-750-4-3	5.5	5.4	5.3	4.7	4.1	3.8	3.5	3.2	3.0	3.3
SEQ-750-5-5	8.9	8.6	8.6	7.6	6.9	6.3	5.8	5.4	5.0	5.0

Passband Flatness: ±0.3 dB

Return Loss I/O: 18/16 dB

Document number: 600563, Revision: H

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Table A.4 SCS-750 Series Cable Simulators

	Insertion Loss in dB at Frequency (MHz)									dB of cable simulated at				
Model Number	**54**	**70**	**80**	**222**	**350**	**450**	**550**	**650**	**750**	**350**	**450**	**550**	**650**	**750**
SCS-750-02	1.0	1.0	1.0	1.3	1.5	1.6	1.7	1.8	1.8	0.7	0.8	0.9	1.0	1.1
SCS-750-03	1.0	1.0	1.0	1.6	2.0	2.2	2.4	2.6	2.8	1.5	1.7	1.9	2.1	2.3
SCS-750-04	1.0	1.0	1.1	1.9	2.4	2.7	3.0	3.3	3.5	2.2	2.5	2.8	3.0	3.3
SCS-750-05	1.0	1.1	1.2	2.3	3.0	3.4	3.9	4.3	4.6	3.2	3.6	4.0	4.4	4.8
SCS-750-06	1.0	1.1	1.3	3.1	3.9	4.5	5.1	5.7	6.2	4.6	5.2	5.8	6.4	7.0
SCS-750-07	1.0	1.1	1.3	3.3	4.2	4.9	5.6	6.2	6.8	5.0	5.7	6.4	7.0	7.6
SCS-750-08	1.0	1.1	1.5	3.4	4.7	5.6	6.3	7.1	7.8	5.9	6.7	7.5	8.2	9.0
SCS-750-09	1.0	1.2	1.5	4.0	5.4	6.4	7.3	8.2	9.0	6.9	7.9	8.8	9.7	10.5
SCS-750-10	1.0	1.2	1.5	4.1	5.7	6.7	7.7	8.7	9.5	7.4	8.4	9.4	10.4	11.2
SCS-750-11	1.0	1.2	1.5	4.3	6.4	7.6	8.7	9.8	10.7	8.4	9.6	10.7	11.9	12.8
SCS-750-12	1.1	1.6	2.0	5.1	7.0	8.3	9.5	10.7	11.8	9.4	10.7	11.9	13.2	14.2
SCS-750-13	1.1	1.6	2.0	5.4	7.5	8.9	10.2	11.6	12.7	10.1	11.6	12.9	14.3	15.4
SCS-750-14	1.1	1.6	1.7	5.7	8.2	9.8	11.3	12.8	14.1	11.3	12.9	14.4	15.9	17.2
SCS-750-15	1.1	1.6	1.7	5.8	8.7	10.4	12.0	13.6	15.0	12.1	13.8	15.4	17.0	18.4

Passband Flatness: 0.6 dB, P-V
Document number: 600647, Revision: B

Return Loss I/O: 18/16 dB

Table A.5 SEQ-625 Series Cable Equalizers

	Insertion Loss in dB at Frequency (MHz)									dB of cable equalized at highest frequency
Model Number	**54**	**70**	**80**	**222**	**350**	**450**	**550**	**600**	**625**	
SEQ-625-02	1.9	1.8	1.8	1.5	1.4	1.2	1.1	1.0	1.0	1.3
SEQ-625-03	2.9	2.8	2.7	2.1	1.7	1.4	1.2	1.1	1.0	2.7
SEQ-625-04	3.8	3.7	3.6	2.7	2.1	1.7	1.3	1.1	1.0	4.0
SEQ-625-05	4.8	4.6	4.5	3.4	2.5	1.9	1.4	1.1	1.0	5.4
SEQ-625-06	5.8	5.5	5.3	3.6	2.8	2.1	1.5	1.1	1.0	6.7
SEQ-625-07	6.8	6.4	6.2	4.4	3.2	2.3	1.5	1.2	1.0	8.0
SEQ-625-08	7.8	7.4	7.2	5.1	3.5	2.5	1.6	1.2	1.0	9.4
SEQ-625-09	8.8	8.4	8.1	5.6	3.9	2.8	1.7	1.2	1.0	10.7
SEQ-625-10	9.8	9.3	8.9	6.1	4.3	3.0	1.8	1.3	1.0	12.1
SEQ-625-11	10.7	10.2	10.0	6.9	4.6	3.2	1.9	1.3	1.0	13.4
SEQ-625-12	11.6	11.0	10.6	7.3	5.0	3.4	2.0	1.3	1.0	14.7
SEQ-625-13	12.7	12.1	11.7	8.2	5.4	3.6	2.1	1.4	1.0	16.1
SEQ-625-14	13.9	13.2	12.8	8.8	5.7	3.9	2.2	1.4	1.0	17.4
SEQ-625-15	14.6	13.8	13.4	9.1	6.1	4.1	2.3	1.4	1.0	18.8
SEQ-625-16	15.7	14.9	14.5	10.0	6.4	4.3	2.4	1.4	1.0	20.1
SEQ-625-17	16.7	15.9	15.4	10.4	6.8	4.5	2.5	1.5	1.0	21.4
SEQ-625-18	17.5	16.6	16.1	10.8	7.2	4.7	2.5	1.5	1.0	22.8
SEQ-625-19	18.5	17.5	17.0	11.5	7.5	5.0	2.6	1.5	1.0	24.1

Passband Flatness: 0.4 dB, P-V
Document number: 600911, Revision B

Return Loss I/O: 18/16 dB

Table A.6 MEQ-550 and MEQT-550 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz) 54	70	80	222	300	400	450	500	550	dB of cable equalized at highest frequency
MEQ-550-02	2.0	2.0	1.9	1.4	1.4	1.2	1.1	1.1	1.0	1.4
MEQ-550-03	3.0	3.0	3.0	2.2	1.8	1.4	1.3	1.1	1.0	2.8
MEQ-550-04	4.0	3.9	3.7	2.6	2.2	1.7	1.4	1.2	1.0	4.2
MEQ-550-05	4.9	4.5	4.4	3.1	2.6	1.9	1.6	1.3	1.0	5.6
MEQ-550-06	5.9	5.6	5.5	3.7	2.9	2.1	1.7	1.3	1.0	6.9
MEQ-550-07	6.9	6.5	6.3	4.0	3.3	2.3	1.9	1.4	1.0	8.3
MEQ-550-08	7.8	7.4	7.1	4.7	3.7	2.6	2.0	1.5	1.0	9.7
MEQ-550-09	8.9	8.4	8.1	4.6	4.1	2.8	2.2	1.6	1.0	11.1
MEQ-550-10	9.8	9.3	9.1	6.1	4.5	3.0	2.3	1.6	1.0	12.5
MEQ-550-11	10.8	10.2	9.9	6.0	4.9	3.2	2.4	1.7	1.0	13.9
MEQ-550-12	11.7	11.1	10.7	6.6	5.3	3.5	2.6	1.8	1.0	15.3
MEQ-550-13	12.7	12.0	11.5	7.1	5.7	3.7	2.7	1.8	1.0	16.7
MEQ-550-14	13.8	13.0	12.6	7.8	6.1	3.9	2.9	1.9	1.0	18.1
MEQ-550-15	14.6	14.0	13.5	8.8	6.5	4.1	3.0	2.0	1.0	19.5
MEQ-550-16	15.3	14.5	14.1	9.0	6.8	4.3	3.2	2.0	1.0	20.8
MEQ-550-17	16.7	15.9	15.4	10.3	7.3	4.6	3.3	2.1	1.0	22.2
MEQ-550-18	17.5	16.8	16.3	10.4	7.7	4.8	3.5	2.2	1.0	23.6
MEQT-550-4	7.0	6.9	6.8	5.3	4.5	3.9	3.7	3.4	3.0	5.5
MEQT-550-8	10.9	6.8	6.6	5.3	6.1	4.8	4.1	3.7	3.0	11.1
MEQT-550-11	13.7	13.0	12.7	8.9	7.2	5.4	4.6	4.0	3.0	15.2

Passband Flatness: MEQ-550 (-02 thru -09): 0.3 dB, P-V
MEQ-550 (-10 thru -18): 0.4 dB, P-V
MEQT-550: 0.4 dB, P-V

Return Loss I/O: 18/16 dB

MEQ-550 Document number: 600564, Revision: B
MEQT-550 Document number: 600600, Revision: B

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Table A.7 MCS-550 Series Cable Simulators

Model Number	Insertion Loss in dB at Frequency (MHz) 50	150	300	330	400	450	500	550	dB of cable simulated at 300	330	400	450	500	550
MCS-550-2	1.0	1.3	1.6	1.7	1.8	1.8	1.9	2.0	1.0	1.1	1.2	1.2	1.3	1.4
MCS-550-3	1.0	1.6	2.2	2.3	2.5	2.7	2.8	3.0	2.0	2.1	2.3	2.5	2.6	2.8
MCS-550-4	1.0	1.9	2.8	3.0	3.3	3.5	3.8	4.0	3.0	3.2	3.5	3.7	4.0	4.2
MCS-550-5	1.0	2.2	3.4	3.6	4.1	4.4	4.7	5.0	4.0	4.2	4.7	5.0	5.3	5.6
MCS-550-6	1.0	2.4	4.0	4.3	4.9	5.2	5.6	6.0	5.0	5.3	5.8	6.2	6.6	6.9
MCS-550-7	1.0	2.8	4.6	4.9	5.6	6.1	6.5	7.0	6.0	6.4	7.0	7.5	7.9	8.3
MCS-550-8	1.0	3.0	5.2	5.6	6.4	6.9	7.5	8.0	7.0	7.4	8.2	8.7	9.2	9.7
MCS-550-9	1.0	3.3	5.8	6.3	7.2	7.8	8.4	9.0	8.0	8.4	9.3	10.0	10.6	11.1

Passband Flatness: 0.4 dB, P-V

Return Loss I/O: 18/16 dB

Document number: 600569, Revision: 50

Table A.8 MEQ-65 and MEQT-65 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz) 5	65	dB of cable equalized at 65	300	400	450	550	750
MEQ-65-02	2.0	1.0	1.3	3.0	3.5	3.7	4.2	5.0
MEQ-65-03	2.9	1.0	2.7	6.0	7.0	7.5	8.3	9.9
MEQ-65-04	3.9	1.0	4.0	9.0	10.5	11.2	12.5	14.9
MEQ-65-05	5.2	1.0	5.8	13.0	15.2	16.2	18.1	21.5
MEQ-65-06	6.2	1.0	7.1	16.0	18.7	19.9	22.2	26.5
MEQ-65-07	7.1	1.0	8.5	19.0	22.2	23.6	26.4	31.5
MEQT-65-02	4.4	2.5	2.7	6.0	7.0	7.5	8.3	9.9
MEQT-65-03	5.4	2.5	4.0	9.0	10.5	11.2	12.5	14.9
MEQT-65-04	6.7	2.5	5.8	13.0	15.2	16.2	18.1	21.5
MEQT-65-05	7.7	2.5	7.1	16.0	18.7	19.9	22.2	26.5
MEQT-65-06	8.6	2.5	8.5	19.0	22.2	23.6	26.4	31.5
MEQT-65-07	9.6	2.5	9.8	22.0	25.7	27.4	30.6	36.4

Passband Flatness: MEQ-65 (±0.1dB)
MEQT-65 (±0.2dB)
Return Loss I/O: 18/16dB

MEQ-65 Document number: 600615, Revision B
MEQT-65 Document number: 600616, Revision B

Table A.9 MEQ-55 and MEQT-55 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz) 5	55	dB of cable equalized at 55	300	400	450	550	750
MEQ-55-2	1.9	1.0	1.2	3.0	3.5	3.7	4.2	5.0
MEQ-55-3	2.7	1.0	2.5	6.0	7.0	7.5	8.3	9.9
MEQ-55-4	3.6	1.0	3.7	9.0	10.5	11.2	12.5	14.9
MEQ-55-5	4.5	1.0	4.9	12.0	14.0	14.9	16.7	19.9
MEQ-55-6	5.6	1.0	6.6	16.0	18.7	19.9	22.2	26.5
MEQ-55-7	6.8	1.0	8.2	20.0	23.4	24.9	27.8	33.1
MEQT-55-2	4.2	2.5	2.5	6.0	7.0	7.5	8.3	9.9
MEQT-55-3	5.1	2.5	3.7	9.0	10.5	11.2	12.5	14.9
MEQT-55-4	6.0	2.5	4.9	12.0	14.0	14.9	16.7	19.9
MEQT-55-5	7.1	2.5	6.6	16.0	18.7	19.9	22.2	26.5
MEQT-55-6	8.3	2.5	8.2	20.0	23.4	24.9	27.8	33.1
MEQT-55-7	9.5	2.5	9.9	24.0	28.0	29.9	33.3	39.8

Passband Flatness: 0.2dB, P-V
Return Loss I/O: 18/16dB

MEQ-55 Document number: 600695, Revision 50
MEQT-55 Document number: 600696, Revision 50

Table A.10 MEQ-42 and MEQT-42 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz) 5	42	dB of cable equalized at 42	300	400	450	550	750
MEQ-42-2	3.0	1.0	3.0	8.0	9.4	10.2	11.3	13.4
MEQ-42-3	4.0	1.0	4.6	12.6	15.0	15.8	17.7	21.0
MEQ-42-4	5.0	1.0	6.1	16.7	19.4	20.7	23.0	27.0
MEQ-42-5	6.0	1.0	7.6	20.4	23.8	25.4	28.3	33.0
MEQ-42-6	7.0	1.0	9.1	24.6	29.0	30.4	34.0	39.6
MEQ-42-7	8.0	1.0	10.6	27.0	31.5	33.0	36.4	45.5
MEQT-42-2	3.6	2.5	3.2	9.0	10.5	11.2	12.5	14.9
MEQT-42-3	5.6	2.5	4.7	13.0	15.2	16.2	18.1	21.5
MEQT-42-4	6.8	2.5	6.5	18.0	21.0	22.4	25.0	29.8
MEQT-42-5	8.4	2.5	9.0	25.0	29.2	31.1	34.7	41.4
MEQT-42-6	8.7	2.5	9.4	26.0	30.4	32.4	36.1	43.1
MEQT-42-7	10.1	2.5	11.5	32.0	37.4	39.8	44.5	53.0

Passband Flatness: 0.2 dB, P-V
0.3 dB, P-V
Return Loss I/O: 18/16 dB

MEQ-42 Document number: 600540, Revision: C
MEQT-42 Document number: 600595, Revision: D

MEQ-33 and MEQT-33 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz) 5	33	dB of cable equalized at 33	300	400	450	550	750
MEQ-33-2	2.3	1.0	2.2	7.0	8.2	8.7	9.7	11.6
MEQ-33-3	3.1	1.0	3.5	11.0	12.8	13.7	15.3	18.2
MEQ-33-4	3.8	1.0	4.5	14.0	16.4	17.4	19.4	23.2
MEQ-33-5	5.1	1.0	6.7	21.0	24.5	26.1	29.2	34.8
MEQ-33-6	6.5	1.0	8.9	28.0	29.5	34.8	38.7	46.4
MEQ-33-7	7.5	1.0	10.5	33.0	38.5	41.0	45.8	54.7
MEQT-33-02	4.7	2.5	3.5	11.0	12.8	13.7	15.3	18.2
MEQT-33-03	5.3	2.5	4.5	14.0	16.4	17.4	19.4	23.2
MEQT-33-04	6.6	2.5	6.7	21.0	24.5	26.1	29.2	34.8
MEQT-33-05	7.8	2.5	8.9	28.0	29.5	34.8	38.9	46.4
MEQT-33-06	9.0	2.5	10.5	33.0	38.5	41.0	45.8	54.7
MEQT-33-07	9.6	2.5	11.5	36.0	42.0	44.8	50.0	59.6

Passband Flatness: 0.2 dB, peak to valley
Return Loss I/O: 18/16 dB

MEQ-33 Document number: 600598, Revision: B
MEQT-33 Document number: 600686, Revision: A

A

MEQ-30 AND MEQT-30 Series Cable Equalizers

Model Number	Insertion Loss in dB at Frequency (MHz)		dB of cable equalized at				
	5	30	30	300	450	550	750
MEQ-30-2	3.1	1.0	3.4	11.0	13.7	15.3	18.2
MEQ-30-3	3.9	1.0	4.9	16.0	19.9	22.2	26.5
MEQ-30-4	4.8	1.0	6.4	21.0	26.1	29.2	34.8
MEQ-30-5	5.5	1.0	7.6	25.0	31.1	34.7	41.4
MEQ-30-6	6.4	1.0	8.9	29.0	36.1	40.3	48.0
MEQ-30-7	7.1	1.0	10.1	33.0	41.1	45.8	54.7
MEQT-30-2	5.1	2.5	4.3	14.0	17.4	19.4	23.2
MEQT-30-4	6.3	2.5	6.4	21.0	26.1	29.2	34.8
MEQT-30-6	7.6	2.5	8.5	28.0	34.8	38.9	46.4

Passband Flatness: MEQ-30: 0.2 dB, p-v
MEQT-65: 0.4 dB, p-v
Return Loss I/O: 18/16 dB

MEQ-30 Document number: 600597, Revision: A
MEQT-30 Document number: 600599, Revision: A

Table A.11 SEQPB Series Cable Attenuators (PADs)

Model Number	5-1000 MHz Flat Loss (dB)
SEQPB-01	1.0
SEQPB-1.5	1.5
SEQPB-02	2.0
SEQPB-03	3.0
SEQPB-04	4.0
SEQPB-05	5.0
SEQPB-06	6.0
SEQPB-07	7.0
SEQPB-08	8.0
SEQPB-09	9.0
SEQPB-10	10.0

Passband Flatness: ±0.3 dB

Document number: 600668, Revision: F

Return Loss: 19 dB (SEQPB-01 to SEQPB-06)
18.5 dB (SEQPB-07, SEQPB-10)

Slope: -0.2 to -0.7 dB

Table A.12 SPB Series Cable Attenuators (PADs)

Model Number	5-1000 MHz Flat Loss (dB)	Model Number	5-1000 MHz Flat Loss (dB)	Model Number	5-1000 MHz Flat Loss (dB)	Model Number	5-1000 MHz Flat Loss (dB)
SPB-0	0.0	**SPB-5.5**	5.5	**SPB-11**	11.0	**SPB-16.5**	16.5
SPB-0.5	0.5	**SPB-6**	6.0	**SPB-11.5**	11.5	**SPB-17**	17.0
SPB-1	1.0	**SPB-6.5**	6.5	**SPB-12**	12.0	**SPB-17.5**	17.5
SPB-1.5	1.5	**SPB-7**	7.0	**SPB-12.5**	12.5	**SPB-18**	18.0
SPB-2	2.0	**SPB-7.5**	7.5	**SPB-13**	13.0	**SPB-18.5**	18.5
SPB-2.5	2.5	**SPB-8**	8.0	**SPB-13.5**	13.5	**SPB-19**	19.0
SPB-3	3.0	**SPB-8.5**	8.5	**SPB-14**	14.0	**SPB-19.5**	19.5
SPB-3.5	3.5	**SPB-9**	9.0	**SPB-14.5**	14.5	**SPB-20**	20.0
SPB-4	4.0	**SPB-9.5**	9.5	**SPB-15**	15.0		
SPB-4.5	4.5	**SPB-10**	10.0	**SPB-15.5**	15.5		
SPB-5	5.0	**SPB-10.5**	10.5	**SPB-16**	16.0		

Passband Flatness: 0.3 dB, P-V

Return Loss: 19 dB

Document number: 600437 Revision: C

A

Appendix B

Functional Block Diagrams

This appendix provides functional block diagrams to support the identification and balancing of the E7 FlexNet line extender.

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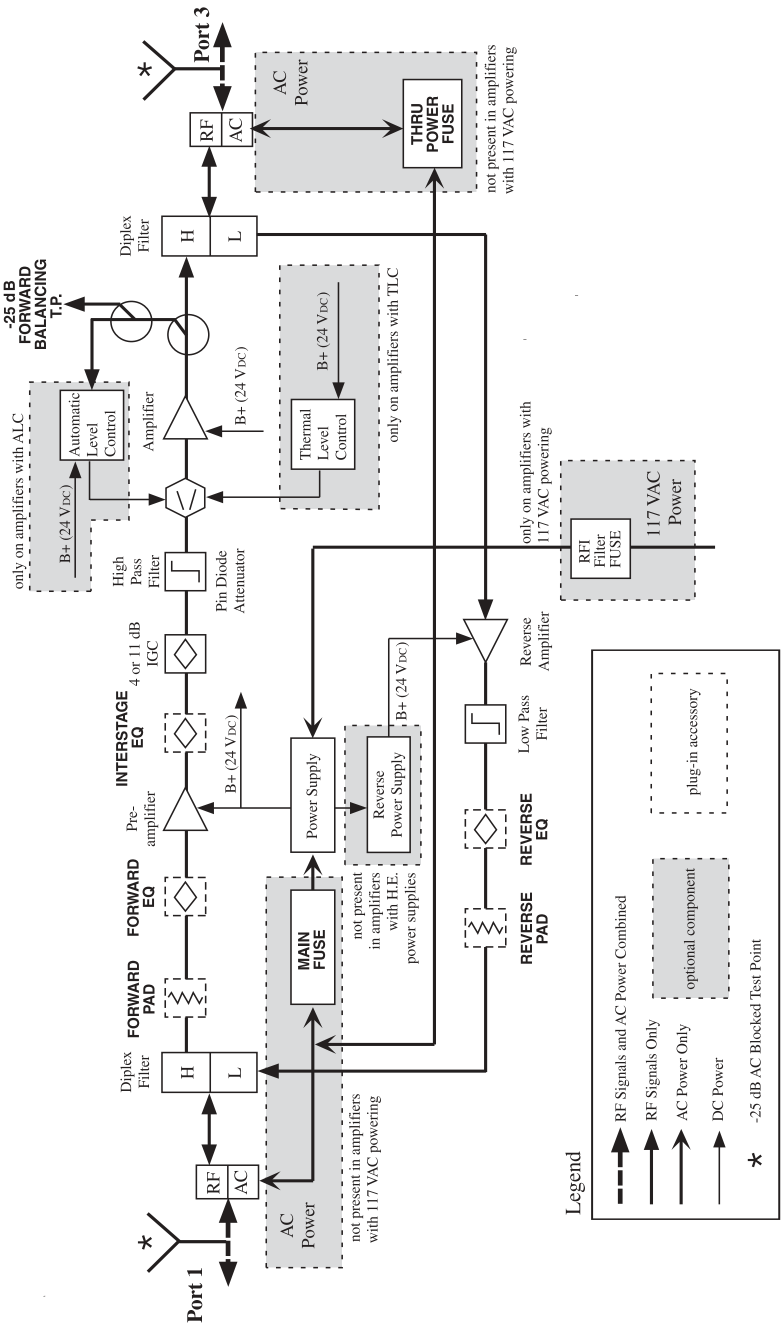

Figure B.1 E7 Functional Block Diagram

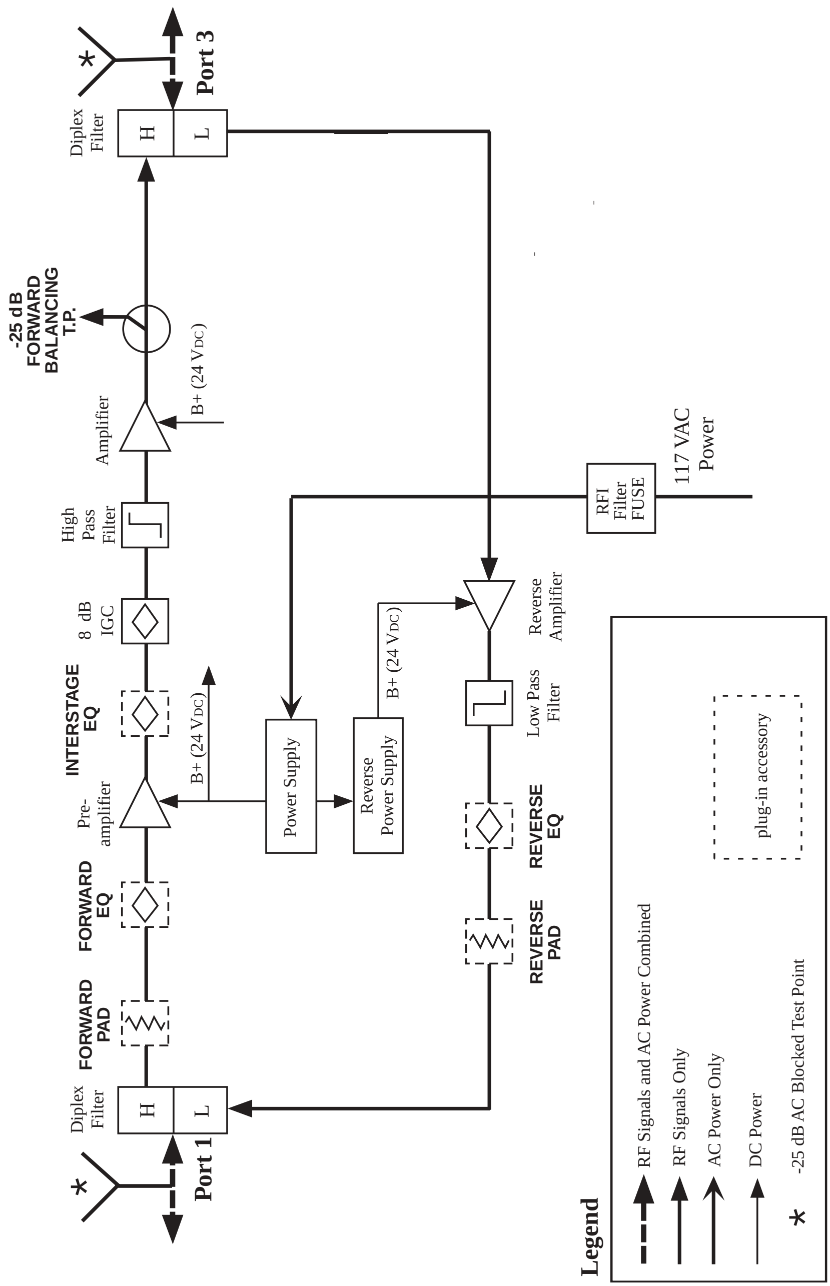

Figure B.2 E7 862 MHz/117 V Functional Block Diagram

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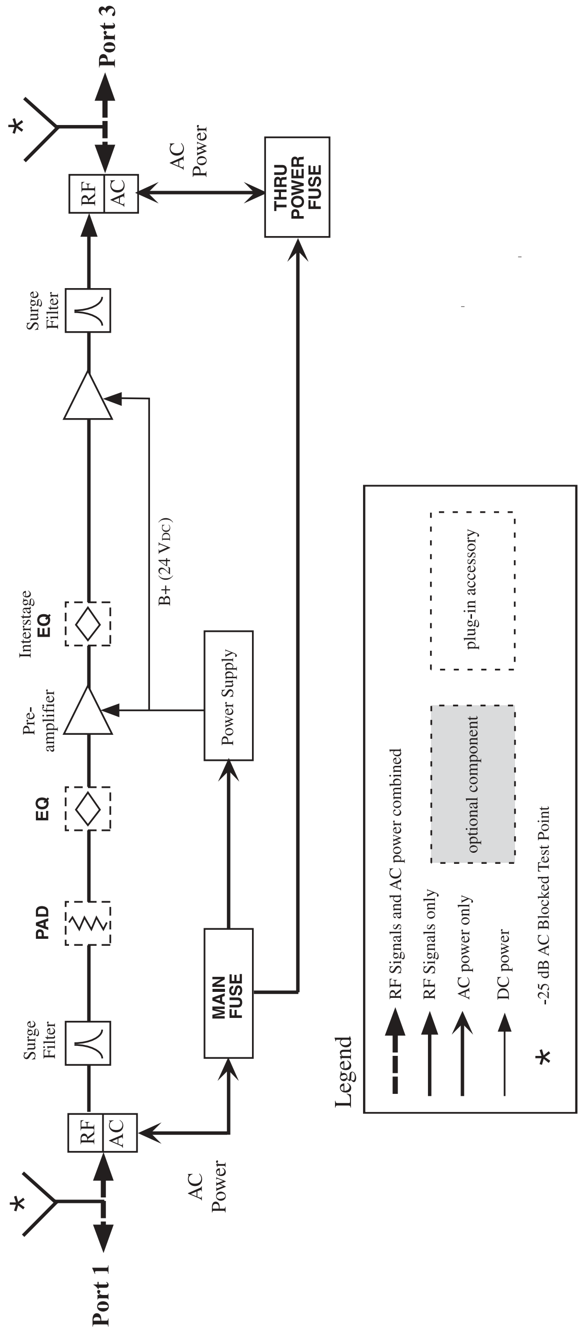

Figure B.3 E629 Functional Block Diagram

Appendix C

FlexNet® 700 Series Line Extender Amplifier Data Sheet

This appendix provides a Data Sheet that can be used for recording specific information for each E7 line extender. Keep a copy of the Data Sheet for each line extender in your system. Data Sheets are particularly helpful for providing historical information when troubleshooting the line extender.

__Tip__: Information collected on the E7 line extender is useful for assembling a database for CNM as well as troubleshooting line extender.

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FlexNet® 700 Series
Line Extender Amplifier Data Sheet

System Map Information

Amplifier Model # ____________________

Map #	________	Serial #	________	Amplifier #	________
System	________	P/S #	________	Cascade	________
Location	________	Air Temp	________		

Map Signal Information

	Forward High/Low Balancing Carriers	TCV	Reverse High/Low Balancing Carriers
Frequency or Channel	/	n/a	/
Signal Levels	/		/

Pre-Selected Accessories

INTERSTAGE EQ: ________

Measured Data

Technician-Selected Accessories

FORWARD EQ ____________ **REVERSE EQ** ____________

FORWARD PAD ____________ **REVERSE PAD** ____________

Measured Signal Information

Forward Signal Levels

Testpoint	Forward High Carrier	Forward Low Carrier
P1 (input)		
P3 (dist output)		
Internal TP (MAN)		
Internal TP (ALC/TLC Active)		

Reverse Signal Levels

Testpoint	Reverse High Carrier	Reverse Low Carrier
P1 (output)		
P3 (input)		

Power Supply Information

Power Supply Type

Fuse Values

MAIN FUSE ____________

THRU POWER FUSE ____________

Voltages

AC Volts ________ Raw DC ________

B+ ________ Ripple ________

Reverse B+ ________

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World Headquarters
60 Decibel Road
State College, PA 16801-7580 USA
Tel: 800-233-2267, +1-814-238-2461   Fax: +1-814-238-4065
www.c-cor.net

European Office
P.O. Box 10.265
1301 AG Almere
The Netherlands
Tel: +31-36-5461111   Fax: +31-36-5364255

Canadian Office
981 Mountview Court, Oshawa,
Ontario, L1K 2M1, Canada
Tel: 905-427-0366   Fax: 905-428-0927
800-427-2559 (Toll free for Canadian call only)