

DIGITAL CLOCK DISTRIBUTOR

LOCAL PRIMARY REFERENCE

INSTALLATION

CONTENTS	PAGE	Figures (Cont'd)	Page
1. GENERAL	2	5. DCD-LPR with GTR System Parts (for Dual Lightning Protectors)	14
2. GPS ANTENNA INSTALLATION	3	6. Metallic Conduit Bonding	16
A. Pre-installation Considerations	3	7. GTR Lightning Protector and Grounding Plate	18
B. Cables Required	4	8. Shielded GTR Power Cable	18
C. Tools and Materials	5	9. Spade Lug Connector	18
D. Unpacking	9	10. GTR Lightning Protector Connections (Single Lightning Protector)	19
E. Assembly and Mounting	10	11. GTR Grounding Plate Connections	20
F. Lightning Protector(s)	17	12. GTR Lightning Protector Connections (Dual Lightning Protector - Inside Installation)	23
3. LORAN ANTENNA INSTALLATION	33	13. GTR Grounding Plate Connections (Dual Lightning Protector - Inside Installation)	24
A. Pre-installation Considerations	33	14. GTR Lightning Protector Connections (Dual Lightning Protector - Outside Installation)	27
B. Cables Required	33	15. GTR Power Cable Connector Assembly ..	29
C. Tools and Materials	33	16. Fiber Termination Test	30
D. Unpacking	36	17. Pulling Grip and Flange (for Strain Relief) ..	32
E. Assembly and Mounting	36	18. LORAN Antenna System Parts	37
F. Lightning Protector(s)	44	19. Conduit-T and Cable Connections	39
4. DCD-LPR INSTALLATION	55	20. Twinax BNC Connector Assembly	42
A. Pre-installation Considerations	55	21. Grounding Wire Connections	43
B. Cables Required	56	22. Grounding Wire with Two-Hole Lugs	43
C. Tools and Materials	57	23. LORAN Type 1 Lightning Protector	45
D. Unpacking	58	24. LORAN Type 2 Lightning Protector	46
E. Assembly and Mounting	59	25. LORAN Antenna Power Cable Connector Preparation	48
F. GTR to DCD-LPR Connections	66	26. LORAN Type 1 Lightning Protector Connections (Single Lightning Protector) ..	50
G. LORAN Antenna to DCD-LPR Connections	70	27. LORAN Type 2 Lightning Protector Connections (Single Lightning Protector) ..	50
H. DCD-LPR to DCD Shelf Connections ..	74	28. LORAN Type 1 Lightning Protector Connections (Dual Lightning Protectors) ..	53
I. Alarm and Status	81	29. LORAN Type 2 Lightning Protector Connections (Dual Lightning Protectors) ..	54
J. Ground and Power Connections ..	84	30. DCD-LPR Shelf Mounting Ears (Top View)	59
K. ST3E Thermal Insulators	86	31. TOD Adapter and Shelf Flange	61
5. TEST AND ACCEPTANCE	86	32. DCD-LPR Shelf (Front and Rear Views) ..	62
6. INDEX	93		
Figures			
1. Junction Box Drain	10		
2. GTR Mounting	11		
3. Examples of GTR Mast Configurations ..	12		
4. DCD-LPR with GTR System Parts (for Single Lightning Protector)	13		

Figures (Cont'd)	Page
33. Adapter Positioning and Connections . . .	63
34. RS-422-to-RS-232 Converter and Connections	64
35. GTR to DCD-LPR Connections (Single Lightning Protector)	67
36. GTR to DCD-LPR Connections (Dual Lightning Protectors)	68
37. GTR to DCD-LPR Power Cable Connectors	69
38. GTI Fiber I/O Module	69
39. LORAN Antenna to DCD-LPR Connections (Single Lightning Protector, Type 2)	71
40. LORAN Antenna to DCD-LPR Connections (Dual Lightning Protectors, Type 2)	72
41. LORAN Antenna to DCD-LPR Power Connectors	73
42. Timing Interface Module Connections	74
43. Isolation Modules and Cables	78
44. DCD Shelf to Isolation Module to DCD-LPR Shelf Connection	80
45. DCD-519 or DCD-523 Shelf Backplane	82
46. DCD-LPR Shelf Backplane with TOD Adaptor	83
47. DCD-LPR Shelf Backplane without TOD Adaptor	83
48. DCD-LPR Ground and Power Connections	85

Tables

A. Separately Ordered Cables	4
B. Customer Provided Tools and Materials (for GTR Installation)	6
C. Customer Provided Tools and Materials (for LORAN Antenna Installation)	34
D. Customer Provided Tools and Materials (for DCD-LPR Shelf Installation)	57
E. Adapter DB9 Connector (J3 and J4) Pin Assignments	64
F. Converter DB9 Connector Pin Assignments	65
G. Converter DB25 Connector Pin Assignments	65
H. GTI and LTI Module Timing Output Connections	75
I. Stratum Clock Connections	76
J. Stratum Clock Connections to the DCD-LPR	79
K. Alarm and Status Connections	81

Tables (Cont'd)	Page
L. Parts List	87
M. Kit Details	90

1. GENERAL

1.01 This section provides installation procedures for the Symmetricom Digital Clock Distributor—Local Primary Reference (DCD-LPR) System equipped with the GPS Timing Interface (GTI) card and/or the LORAN-C Timing Interface (LTI) card Systems, including the GPS antenna/receiver (GTR) and LORAN-C antenna.

1.02 This section was reissued for the reasons listed below. Additions and changes are marked by change bars.

- Revised information on three-conductor power cable.
- Revised information on avoiding hard corner turns and unnecessary turns.
- Updated Table A.

1.03 All product names, service marks, trademarks, and registered trademarks used in this document are the property of their respective owners.

1.04 The following abbreviations are used in this section:

DCD	Digital Clock Distributor
GPS	Global Positioning System
GTI	GPS Timing Interface
GTR	GPS Timing Antenna/Receiver
LORAN-C	Long Range Navigation-Version C
LOU	LPR Oscillator Unit
LPR	Local Primary Reference
LTI	LORAN-C Timing Interface
OCXO	oven-controlled crystal oscillator
OPGP	office principal grounding point
pps	pulses per second
ST2	Stratum-2 Clock
ST2E	Enhanced Stratum-2 Clock
ST3E	Enhanced Stratum-3 Clock
TI	timing interface card or slot
TNC	Transit Node Clock
TNC-E	Enhanced Transit Node Clock
TOD	Time-of-Day
UTC	Universal Coordinated Time

Notes:

1. Where information is common to all GTI cards, these cards are collectively referred to as GTI cards.
2. Where information is common to the TNC-E, ST2, ST2E, TNC, and ST3E cards, these cards are collectively referred to as clock cards.
3. Where information is common to the TNC-E, ST2, and ST2E cards, these cards are collectively referred to as rubidium clock cards.
4. Where information is common to the TNC and ST3E cards, these cards are collectively referred to as quartz clock cards.
5. Where information is common to both LOU cards, these cards are collectively referred to as LOU cards.

1.05 The installation steps included in this section assume that the DCD master shelf equipped with the appropriate clocks is installed and providing timing. For additional installation information regarding the DCD master shelf, refer to the manual provided with the DCD Shelf.

Notes:

1. ST3E and TNC clocks can only be used with -13 and above GTI cards. If using a rubidium and quartz clock combination in the DCD Shelf, ensure that the ST2E is installed, and its ACTIVE lamp is lit, prior to installing the quartz clock card. This ensures that the rubidium clock is the clock supplying the timing.
2. The installation procedures provided are intended as guidelines; actual techniques may be amended as required by local office code. If problems are encountered, contact Symmetricom Customer Assistance Center (CTAC) at one of the following numbers:
 - +44 1483 510300 (U.K.)
 - +1 408 428 7907 (U.S.A.)

The following toll-free number is available in some countries to access Symmetricom's Inside Sales and CTAC in the U.S.A.: +1 888 367 7966 (U.S.A.).

1.06 If installing a GPS antenna/receiver (GTR), proceed to Part 2. If installing a LORAN antenna, proceed to Part 3.

2. GPS ANTENNA INSTALLATION

2.01 Prior to installing the GTR, a site survey should have been performed. The survey determines the exact equipment and materials needed for installation. The Installation Job Specification determines how the installation should proceed.

2.02 For information on how to perform a site survey, refer to the Engineering Guidelines section of this manual.

A. Pre-installation Considerations

2.03 Prior to installation, verify the quality of ground within the building; consult with the office grounding specialist as to the quality of ground and grounding protection methods.

2.04 There are two methods of lightning protection:

- A single inside lightning protector when the inside and outside grounds are not bonded to building steel or the Office Principal Ground Point (OPGP), or when the GTR is located in a high lightning area
- Two lightning protectors, one installed inside, and one installed outside the building, when a proper roof ring ground system is available

Note: The single lightning protector method may be used whether or not a roof ring ground is available.

2.05 The following is optional: for communications with technical support, or other members of the installation team, ensure there is at least one phone line available within 3 meters (10 feet) of the DCD-LPR.

B. Cables Required

Notes:

1. Throughout this section, the “xx” noted in a cable part number is used in place of the number indicating the length. For example, the part number for a 122 meter (400 foot) section of fiber optic cable is -04, a 91 meter (300 foot) section is -03, etc.
2. For detailed information regarding the cables and ordering instructions, refer to the Engineering Guidelines section of this manual. For cable requirements, refer to the Installation Job Specifications.

- Fiber optic cable
- Three-conductor power cable (shielded)
- 4.115 mm (6 AWG) (or larger) copper grounding wire

2.07 Fiber optic cable is used for passing clocking information between the GTR and the GTI. Symmetricom recommends a two-strand Riser-rated cable. (Refer to Table A.)

Note: ST type connectors must be purchased from Symmetricom if not using connectorized cable. A fiber ST terminator connector tool will be required for crimping on the connectors. (Refer to Table A.)

2.06 Three cables are required for the operation of the GTR in conjunction with the GTI card. The cables required are:

Table A. Separately Ordered Cables

QTY	ITEM	PART NUMBER	MANUFACTURER	COMMENTS
1	Riser-rated connectorized fiber cable	060-45110-xx	Symmetricom	—
		BP05522-xx	SpecTran	
	Riser-rated unconnectorized fiber cable (optional)	060-45100-xx	Symmetricom	
		AC02405-xx	SpecTran	
1	Fiber Optic Connector Kit (six connectors are included) (optional)	093-42100-20	Symmetricom	A termination kit is required to attach the connectors to the fiber cable
1	Fiber ST Terminator Connector Tool (optional)	TK-230-ST	SpecTran	
1*	Shielded 3-conductor power cable (for single lightning protector installations) for GTR to lightning protector connection	060-45125-xx	Symmetricom	Terminated at one end with a power connector
		9366	Belden	Unterminated at both ends
1	Twinax cable for LORAN antenna to DCD-LPR Shelf connection	9272 or 89272, or equivalent	Belden	9272 is Riser-rated; 89272 is Plenum-rated
*Two cables of this type are required for dual lightning protector installations, for the additional cable between lightning protectors.				

2.08 To power the GTR, and for a single lightning protector installation, Symmetricom recommends a 1.47 mm (16 AWG) shielded three-conductor power cable with a built-in 1.47 mm (16 AWG) drain wire for the GTR to lightning protector connection. (This cable is available from Symmetricom; contact Symmetricom's Customer Service Department for additional information.)

2.09 Symmetricom recommends an unterminated, shielded three-conductor power cable for the lightning protector-to-DCD Shelf connection. This must be provided by the user. (An unterminated, shielded three-conductor power cable is available from Symmetricom; contact Symmetricom's Customer Service Department for additional information.)

2.10 For the dual lightning protector installation, the same cabling materials are required as for the single lightning protector installation, plus an additional shielded cable is required to connect the inside lightning protector to the outside lightning protector.

Notes:

1. The three-conductor power cable used to connect the inside and outside lightning protectors does not use its ground wire. Do not ground both protectors together with one common ground wire; the outside and inside protectors must have separate ground points.
2. For outdoor cable runs, the cable should be run in weather-resistant conduit. *Avoid hard (tight) corner small radius turns and any unnecessary turns. The minimum bending radius is eight inches. All bends must be 90 degrees or greater.*

2.11 For grounding the lightning protector(s), 4.115 mm (6 AWG) if less than 30.3 meters (100 feet), 5.189 mm (4 AWG) if more than 30.3 meters (100 feet), copper grounding wire is recommended. This is not available from Symmetricom, and must be provided by the user.

2.12 The ground wire should be as short (less than 4.5 meters [15 feet] is recommended) and straight as possible, and grounded to outside building (ring) ground if using nonmetallic conduit for cable runs; if ring ground is not available, the best alternative is to use the shielded power cable and the single lightning protector scheme installed in the building. Other acceptable alternatives are to ground the lightning protector to building steel, or other metallic items known to be well-grounded per national or local code (e.g., metal conduits, air conditioner ducts, etc.). If using metallic conduit for cable runs, ground the outside lightning protector to the metal conduit, if possible. Consideration should be given to installing the grounding wires without any bends or turns.

2.13 The inside protector should be grounded to a C.O. ground bar that is bonded to the office principal ground point (OPGP). The ground wire should be as short as possible (less than 4.5 meters [15 feet] is recommended). Other acceptable alternatives are to ground it to building steel, metal conduits, air conditioner ducts, or other metallic items known to be well-grounded per national or local code.

C. Tools and Materials

2.14 Ensure that the user-provided tools and materials listed in Table B are on hand for installation of the GTR.

Table B. Customer Provided Tools and Materials (for GTR Installation)

ITEM	COMMENT
TOOLS	
(Optional) 15.9 mm (0.625 in. [5/8 in.]) open-end wrench	For attaching power connector plug if unterminated power cable was ordered
17.5 mm (0.6875 in. [11/16 in.]) open-end wrench	For tightening connector assembly
9.5 mm (0.375 in. [3/8 in.]) open-end wrench (or deep-socket nutdriver)	For attaching GTR to flange
6.4 mm (0.25 in. [1/4 in.]) open-end wrench (or deep-socket nutdriver)	For securing grounding plate to lightning protector
Ladder	To reach lightning protector(s) and GTR
(Optional) Power extension cord	
Hand drill with 12.7 mm (0.5 in.) drill bit	To drill drain holes in junction box
Soldering iron and solder	For preparing GTR power cable
Cable cutting tools	—
Volt-ohm meter (Digital Multimeter)	—
Diagonal pliers	Required if using connectorized fiber cable purchased from Symmetricom
9.5 mm (0.375 in. [3/8 in.]) nut driver	For attaching GTR to flange
If using unterminated fiber cable, a fiber ST terminator connector tool	For crimping on the ST type connectors Refer to Table A
(Optional) Hand-held GPS receiver	Available at most local marine boat stores
(Optional) Two walkie-talkie sets	For cable pulling and testing operations
(Optional) One Wilcom FS850 fiber optic power source (or equivalent)	For testing fiber cable termination quality
(Optional) One Wilcom FM850 fiber optic power meter test set (or equivalent)	For testing fiber cable termination quality

Table B. Customer Provided Tools and Materials (for GTR Installation) (Cont'd)

ITEM	COMMENT
MATERIALS	
<p>Weather-resistant junction box(es), large enough to house lightning protector with sufficient space to perform necessary connections</p>	<p>One junction box optional, but recommended, for inside lightning protector. For dual lightning protector configurations, one junction box mandatory for outside lightning protector, and additional junction box optional, but recommended, for inside lightning protector.</p> <p>It is recommended that Carlon (Lamson and Sessions) 360 mm x 360 mm x 180 mm (14 in. x 14 in. x 7 in.) weather-resistant junction box, p/n E989R, or equivalent, be used.</p> <p>It is recommended that for cable slack, weather-resistant junction box should be large enough to hold excess fiber cable and lightning protector.</p> <p>Note: The GTR power cable must not have any complete loops in it.</p>
<p>(Optional) Two each #8 screws and nuts for mounting lightning protector in junction box</p>	<p>Screw length shall be determined locally, depending on type of junction box provided.</p>
<p>Strain relief devices, as desired, to be installed in junction box</p>	<p>Mounting flange for GTR provides built-in strain relief devices; if additional strain relief devices are desired, these may be installed in junction box.</p>
<p>Expansion joint sleeves</p>	<p>For preventing breaks in non-metallic conduit due to expansions and contractions</p>
<p>Two weather-resistant conduit fittings per box</p>	<p>For connecting junction box to conduit</p>
<p>Weather-resistant conduit, metal or PVC conduit; use minimum 50.8 mm (2 in.) rigid UL Listed #651 PVC (minimum Schedule 40) if PVC is chosen, also for elbows, tees, sleeves, plugs, Ys, etc., for cable runs on the roof</p>	<p>If metal conduit is used, conduit joints must be bonded and, at minimum, both ends of the conduit run must be connected to building structural ground via ring ground, metal conduits, air conditioning ducts, etc. It is recommended that an intermediate point along the conduit also be grounded.</p> <p>If a valid ring ground or bonding to building structure steel is not available, it is recommended that the single lightning protector installation method be used.</p>
<p>Ground bonding clamps, gutter taps, etc.</p>	<p>For connecting 4.115 mm (6 AWG) (or larger) ground wires to protective and ring ground</p>
<p>Either 102 mm (4 in.) or 50.8 mm (2 in.) PVC or metal conduit may be used as mast to mount GTR; length and type depends on individual installation requirements</p>	<p>It is recommended that rigid UL Listed #651 PVC conduit (minimum Schedule 40) if PVC is chosen. Mast should be long enough to position GTR at least 1.2 m (4 ft) higher than any reflective object on the roof. If proper grounding on the roof is not available, it is not recommended to use a metallic mast.</p>

Table B. Customer Provided Tools and Materials (for GTR Installation) (Cont'd)

ITEM	COMMENT
MATERIALS (Contd)	
Weather-resistant pipe reducer, either metal or PVC—101.6 mm to 50.8 mm (4 in. to 2 in.)	For connecting mast to conduit and/or Changing from 101.6 mm (4 in.) mast to 50.8 mm (2 in.) mast (or 73.2 mm [2.88 in.] if using a Prodelin Corp. mast [p/n 0800-101]). If proper grounding on roof not available, it is not recommended to use metallic reducers.
One fitting per junction box	For 4.115 mm (6 AWG) (or larger) ground wire to enter junction box for connection to lightning protector
4.115 mm (6 AWG) (or larger) ground wires. The wires should be long enough to reach from inside lightning protector to Central Office (C.O.) ground and, if applicable, from outside lightning protector to outside building (ring) ground	For grounding lightning protector(s). Symmetricom recommends using 4.115 mm (6 AWG) if cable distance is <30 m (<100 ft), 5.189 mm (4 AWG) if cable distance is >30 m (>100 ft)
Fiber cable innerduct from DCD-LPR Shelf to inside lightning protector or junction box	Riser-rated fiber cable should be treated like copper cable; fiber cable innerduct normally not required for this type of cable. Installation of innerduct required only if necessitated by company practice.
Pulling wire or cord	To pull fiber cable and GTR power cable through conduit and/or innerduct
25.4 mm (1 in.) black electrical tape	Required if using terminated fiber cable from Symmetricom
One sheet of fine-grain sandpaper	To provide bare metal surface for ground connections
Spaghetti insulation for 1.47 mm (16 AWG) wire	Required for single lightning protector installation. Used to insulate shield drain wires on shielded cables
Small roll of vinyl or aluminum fine mesh window screen material and appropriate adhesive (may be found at hardware or home improvement stores)	To screen water drain holes in junction box and conduit to keep living creatures out
Fire-stopping material	To block fire from crossing through cable/conduit hole in roof and walls
Electrically conductive antioxidant compound (Kopr-Shield or equivalent)	To coat any connection exposed to weather, to prevent oxidation at connection
ABS to PVC cement	For connecting ABS/PVC to ABS/PVC; e.g., metal to ABS/PVC connections are made with ABS/PVC connector threaded on one end for metallic connection to ABS/PVC. Other end cemented for ABS/PVC to ABS/PVC connection.

Table B. Customer Provided Tools and Materials (for GTR Installation) (Cont'd)

ITEM	COMMENT
MATERIALS (Contd)	
Hardware to mount GTR Assembly to roof, tower, parapet, or side of building, such as brackets, clamps, U-bolts, nuts, washers, etc.	Caution: Clamps that form a complete circle around the power cable, or the cable conduit, are not allowed. The ring clamp acts like a choke coil to induced currents which resists current flow, and hampers proper lightning protection.
Weatherproofing material (pipe thread tape, silicon sealer)	—
Ring terminal or spade lug connectors to fit 1.47 mm (16 AWG) wire, 6.4 mm (0.25 in.) wide, and a #6 stud	Minimum 15 lugs needed

D. Unpacking

2.15 This procedure checks for items for installation of the GTR.

Note: Save packing material. All equipment returned must be packed in the original packing material. Contact Symmetricom’s Customer Service Department at +44 1483 510300 (U.K.), or +1 408 428 7907(U.S.A.), if additional packaging is needed.

1. Unpack equipment carefully.

2. Inspect equipment for shipping damage, including bent or loose hardware, and broken connectors or pins on the backplane.
3. Verify all items have been received. For a parts list, refer to Table L, at the end of this section.
4. Notify Symmetricom and the carrier if equipment was damaged in transit and/or any items are missing.

Note: If installing only one GTI card, only one antenna is required; if installing two GTI cards, two antennas are required.

E. Assembly and Mounting

2.16 To assemble and mount the GTR (refer to the Engineering Guidelines section of this manual for recommended location and mounting considerations), use company practices to perform the following:

Warning: *Ensure that the lightning protectors are placed away from electrical devices or cabling that may induce arcing.*

Caution: *When routing fiber cable, do not have less than 50.8 mm (2 inches) bending radius; 25.4 mm (1 inch) for stripped (un-sheathed) fiber cable. Less could cause fiber breakage or excessive fiber loss.*

Note: For single lightning protector installations, this procedure pertains to sites where the lightning protector is located within 15 meters (50 feet) of where the GTR power cable enters the building. The shielded cable must not be run more than 15 meters (50 feet) inside the building without being grounded to a C.O. ground bar that is bonded to the OPGP. If the lightning protector is located at a cable distance more than 15 meters (50 feet) from the cable entrance, either relocate it to within 15 meters (50 feet) of the entrance, or contact Symmetricom CTAC for an alternate method.

1. Optional: mount a junction box for the inside lightning protector. The inside lightning protector should be mounted as near to the cable entrance point as possible. If using the single lightning protector scheme, it must be installed no more than 15 cable meters (50 cable feet) from the cable entrance point.
2. If installing dual lightning protectors, mount the weather-resistant junction box for the outside lightning protector according to company Installation Job Specification. It should be mounted as near to the cable entrance point as possible that permits the ground terminal of the lightning protector to be bonded as direct and short as possible to the ring ground system.

Warning: *Ensure that the lightning protectors are placed away from electrical devices or cabling that may induce arcing.*

Note: The factory-provided mounting flange for the GTR provides built-in strain relief devices; if additional strain relief devices are desired, install in the junction box. The junction box can also be used for fiber cable slack.

Warning: *Do not attempt to coil excess GTR power cable into the junction box. The power cable must not have complete loops in it. Failure to observe this caution may result in increased damage if a lightning strike occurs.*

3. If installing additional junction box(es) for cable slack and/or strain relief, mount at this time.
4. Drill a hole, approximately 12.7 mm (0.5 inch) in diameter, centered in the lowest side of the junction box(es); the hole will be used to drain excess moisture that may accumulate in the box (Figure 1).
5. Glue a piece of fine mesh window screen over the hole on the inside of the junction box, to keep insects, etc., out of the box.

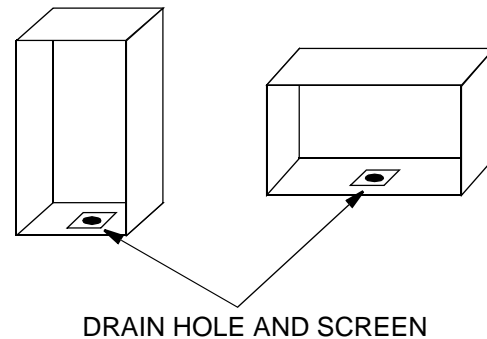
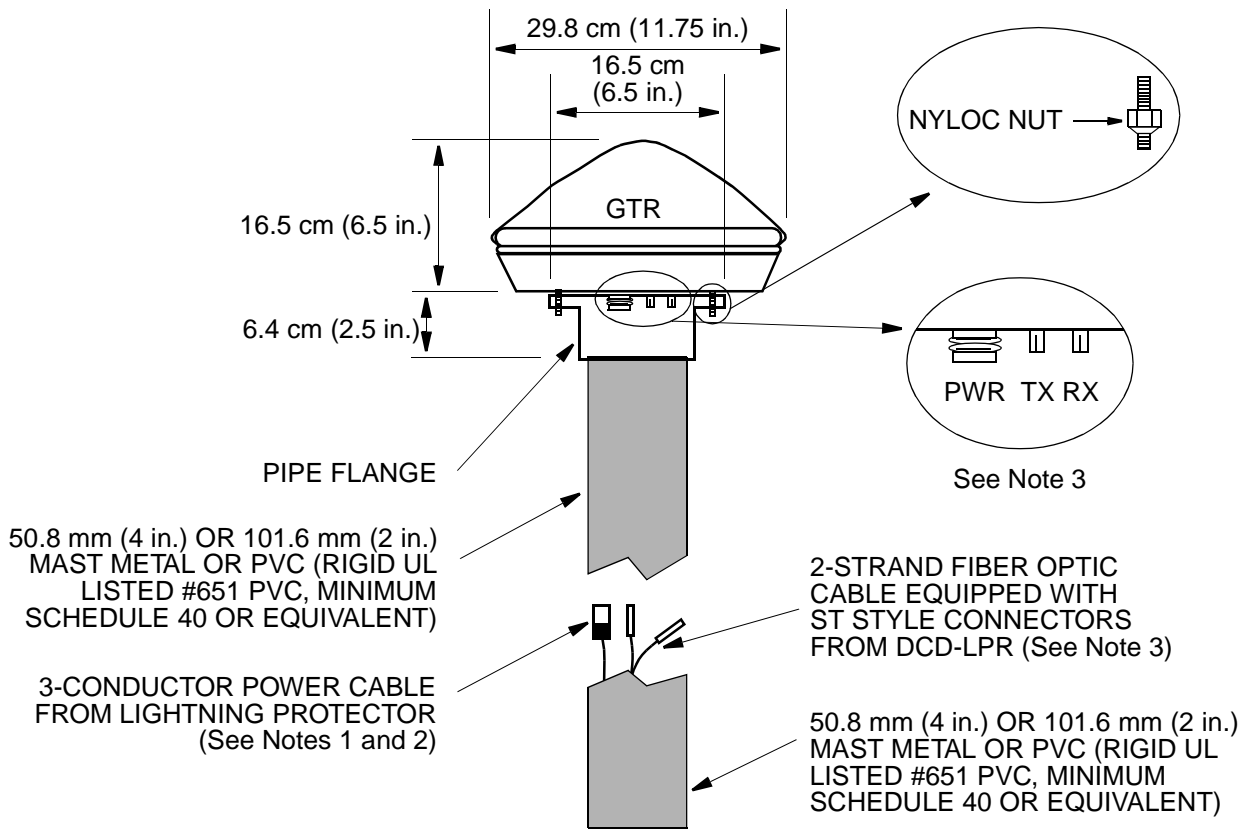


Figure 1. Junction Box Drain

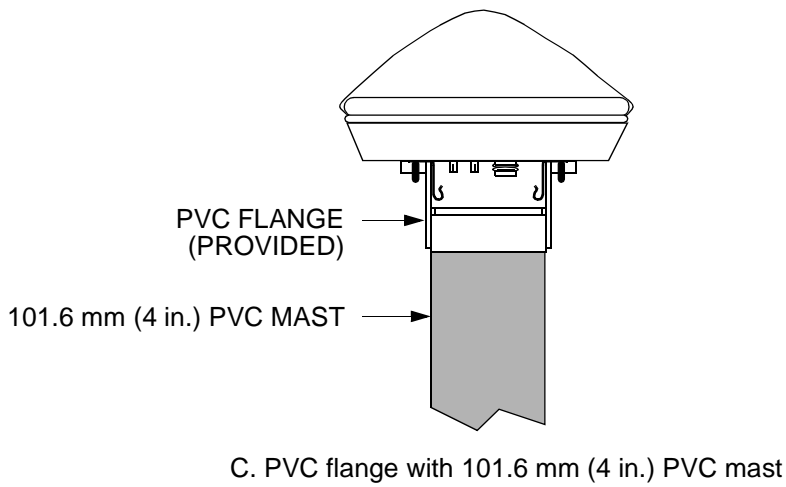
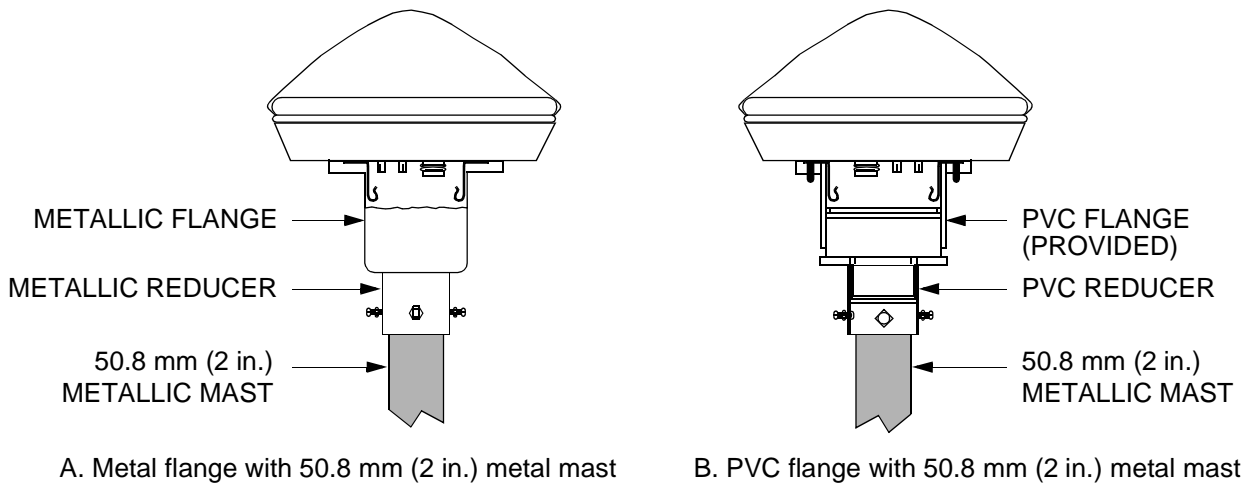
Note: For the following steps, refer to Figure 2 through Figure 5.



Notes:

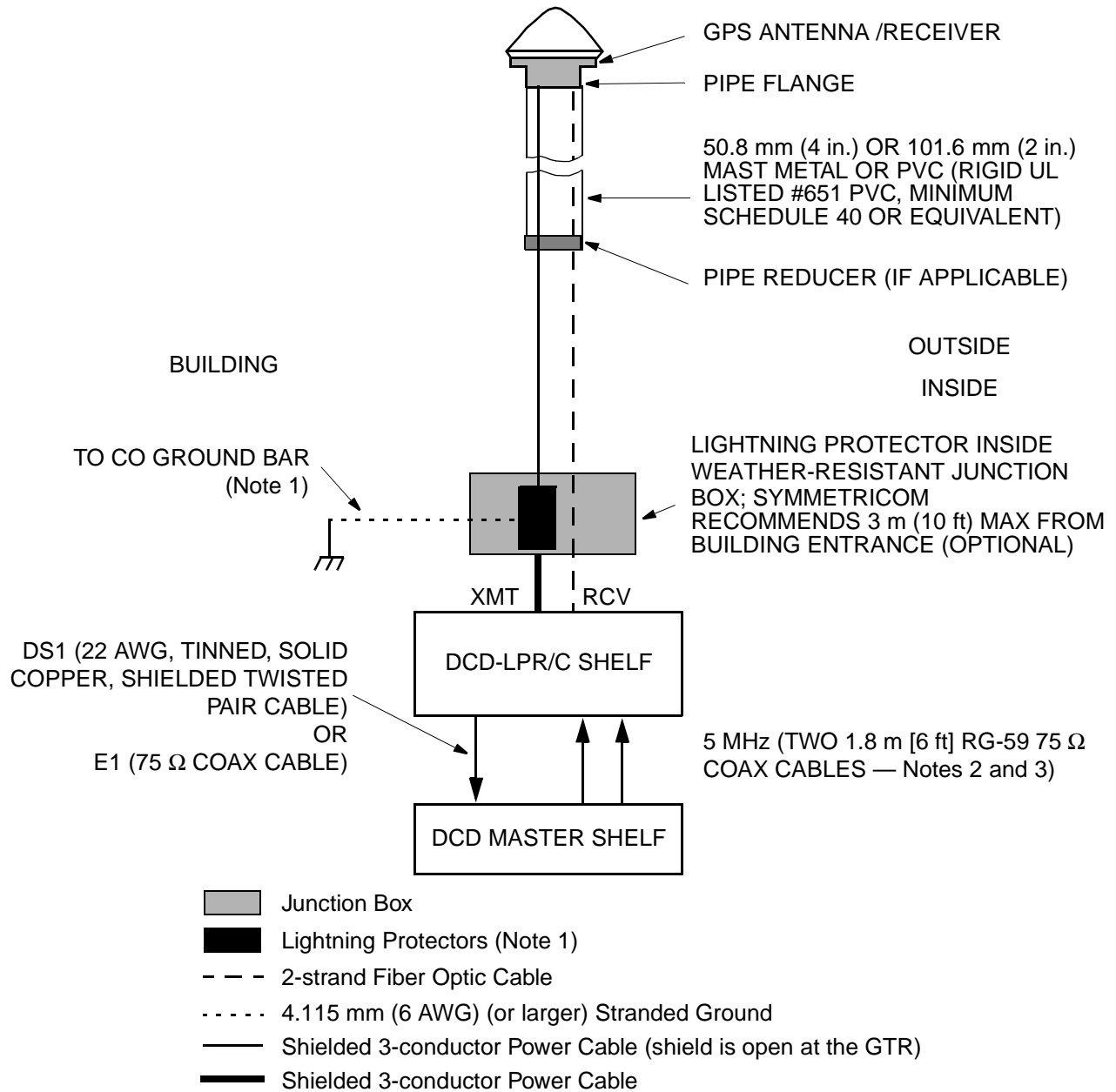
1. Allow enough cable slack to reach the GTR connectors.
2. The shield is open at the GTR.
3. The TX and RX connectors are plastic; use care when connecting to these connectors, because the locking screw may break off if tightened too much.

Figure 2. GTR Mounting



Note: These are examples only. Not all parts are available from Symmetricom.

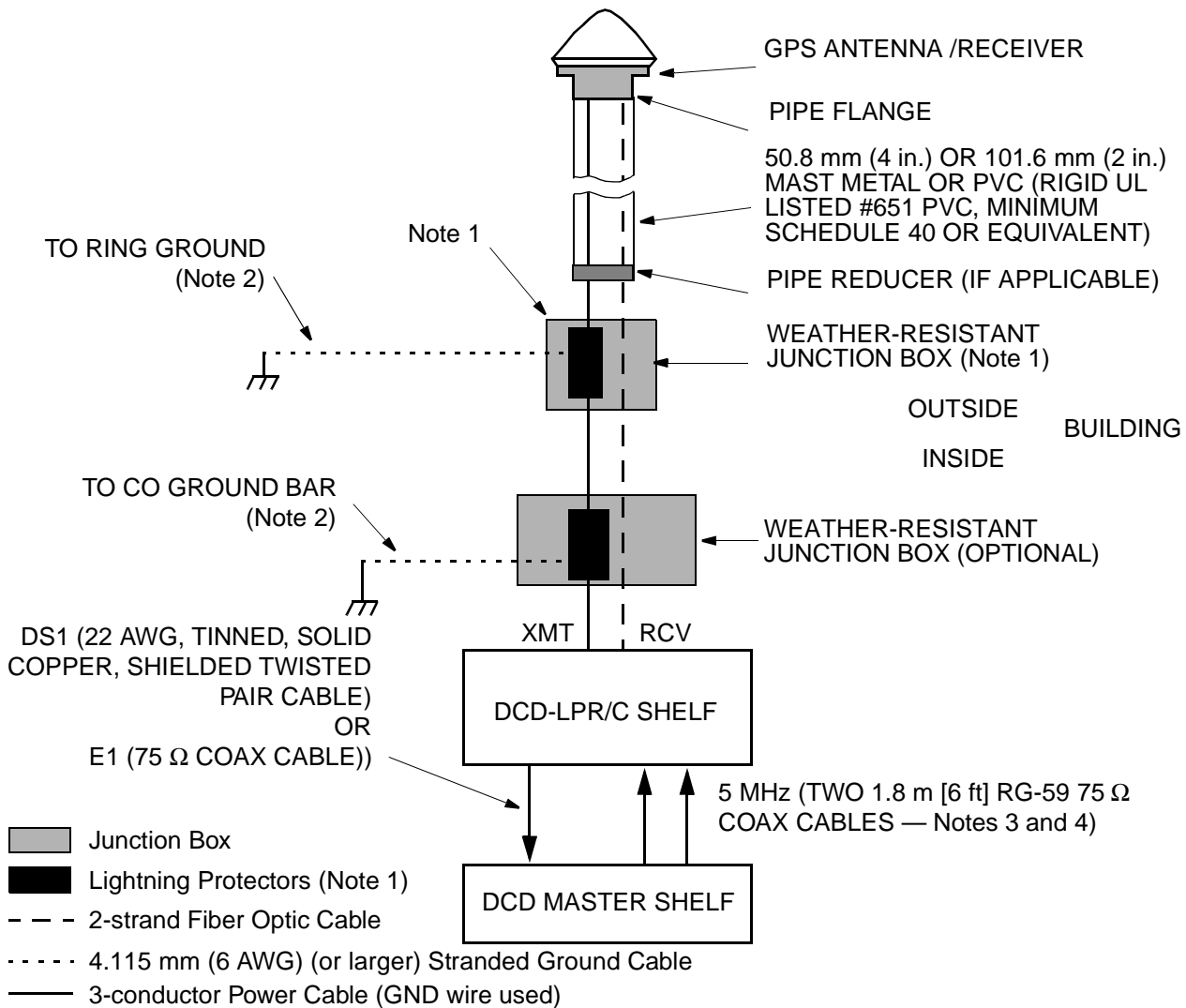
Figure 3. Examples of GTR Mast Configurations



Notes:

1. The lightning protector is connected to a C.O. ground bar bonded to the office principal ground point (OPGP). If such a ground is not available, an acceptable alternative is to run a cable from the lightning protector grounding plate direct, and bond to the OPGP. 4.115 mm (6 AWG) or larger; run as straight and direct as possible.
2. Provided with each DCD-LPR Shelf are two 1.8 m (6 ft) coaxial cables to make the 5 MHz input connections from the DCD Shelf to the DCD-LPR Shelf. If longer cables are required, cables (not to exceed 15.2 m [50 ft]) must be provided by the user.
3. An isolation module may be required at this connection, depending on the type and revision of DCD Shelf used. Refer to paragraph 4.29 for information regarding the isolation module.

Figure 4. DCD-LPR with GTR System Parts (for Single Lightning Protector)



Notes:

1. The lightning protector located outside the building must be installed in a weather-resistant junction box. If using PVC mast to PVC conduit, or metal to metal, it should be located as close to the building entry point as possible. If using PVC mast to metal conduit, or metal to PVC, it should be located as close to the transition point from PVC to metal as possible.
2. The inside lightning protector is connected to the C.O. ground bar that is bonded to the OPGP, and the outside lightning protector is connected to the metal conduit (if used) or outside building (ring) ground. If bonded to the metal conduit, the metal conduit must be grounded to the ring ground system, at least at both ends of the conduit. Common ground connection between the inside and outside lightning protectors is not permitted.
3. Provided with each DCD-LPR Shelf are two 1.8 m (6 ft) coaxial cables to make the 5 MHz input connections from the DCD Shelf to the DCD-LPR Shelf. If longer cables are required, cables (not to exceed 15.2 m [50 ft]) must be provided by the user.
4. An isolation module may be required at this connection, depending on the type and revision of DCD Shelf used. Refer to paragraph 4.29 for information regarding the isolation module.

Figure 5. DCD-LPR with GTR System Parts (for Dual Lightning Protectors)

6. Install the hardware for mounting the mast on which the GTR is mounted.
7. Using a plumb line or bubble level, position the flange for mounting the GTR on top of the mast. Ensure that the flange is within 5 degrees of level (with the horizon) by using a plumb line or bubble level.

Note: When the GTR is attached to the flange, the GTR must be within 5 degrees of level (with the horizon).

8. Cement the flange for GTR mounting to the top of the mast.
9. Mount the GTR assembly on the mounting hardware.
10. Lay out the weather-resistant conduit, sleeves, elbows, pipe reducer (if applicable), etc., from the building entrance to the junction box (if an outside lightning protector is installed) to the mast. Do not cement together at this time.

Note: The conduit route should be as direct as possible. *Avoid hard (tight) corner small radius turns and any unnecessary turns. The minimum bending radius is eight inches. All bends must be 90 degrees or greater.*

11. Attach and cement sections to both sides of the weather-resistant junction box (if applicable) and at the building entrance. Seal and waterproof the conduit section where it enters the building.
12. Insert pulling wires or cords in all conduit sections. Ensure the pulling wire or cord is routed through all conduit elbows, tees, sleeves, plugs, Ys, etc., that are not yet cemented to the conduit.
13. If fiber cable innerduct is installed inside the building, between the DCD-LPR Shelf and the lightning protector junction box (installed inside the building), attach the fiber cable, three-conductor power cable, and pulling wire or cord (if required) to the inside conduit pulling wire or cord at the DCD-LPR end.

Note: Fiber cable innerduct is not required if Riser-rated fiber cable is used; Riser-rated cable may be treated like copper cable. Installa-

tion of innerduct is required only if necessitated by company practice.

14. Pull or run the fiber and power cables from the DCD-LPR Shelf to the lightning protector junction box (installed inside the building), if provided.
15. Detach the cables from the pulling wire or cord.
16. At the lightning protector or junction box (installed inside the building), cut the power cable and pulling wire or cord. Allow sufficient slack in the power cable, to secure it per company practice, and permit future replacement of lug connectors, if required.
17. Attach the fiber cable, power cable, and pulling wire or cord to the pulling wire or cord in the conduit to the junction box for the lightning protector installed outside the building, if provided.
18. Pull the cables to the outside lightning protector junction box; if not, proceed to the next step.
19. Detach the cables from the pulling wire or cord.
20. Cut the power cable and pulling wire or cord, allowing sufficient slack for securing, connecting, and future lug connector replacement, if required.
21. Attach fiber and power cables, and pulling wire or cord, to the pulling wire or cord in the conduit to the mast.

Warning: *In the next step, install the GTR power cable with approximately 0.3 meters (1 foot) of extra length beyond the end of the conduit where the GTR will be mounted. After connection to the GTR, this excess cable can be pushed down into the conduit. Do not attempt to coil excess GTR power cable into the junction box. Failure to observe this caution may result in increased damage if a lightning strike occurs.*

22. Pull the cables through the conduit, uncemented conduit elbows, tees, sleeves, plugs, Ys, etc., and through the top of the mast. Allow sufficient slack (approximately 0.3 meters [1 foot]) for securing, connection to the GTR, and future lug connector or ST type connector replacement.

Temporarily secure at the top of the conduit. The fiber cable should be long enough to pull back slack loops at junction box(es).

Caution: When routing fiber cable, do not have less than 50.8 mm (2 inches) bending radius; 25.4 mm (1 inch) for stripped (un-sheathed) fiber cable. Less could cause fiber breakage or excessive fiber loss.

Note: Within the junction box(es) used for cable slack or strain relief, coil the fiber optic cable a few times, and bundle together with nylon ties. An extra coil of cable provides the slack for GTR removal if necessary.

Warning: Do not attempt to coil excess GTR power cable into the junction box. Failure to observe this caution may result in increased damage if a lightning strike occurs.

- 23. Cement all conduit ends to conduit elbows, tees, sleeves, plugs, Ys, etc., on the rooftop conduit run.

Note: If the GTR is not to be installed immediately, it is recommended that the conduit or mast be covered, to ensure that moisture or undesirable elements do not get inside the conduit or mast.

- 24. If metal conduit is used, use company practice and ground conduit joints, as shown in Figure 6A.
- 25. If metal conduit is used, use company practice, and at both ends of the conduit run, connect to building structural ground via the OPGP, ring ground, metal conduits, air conditioning ducts, etc. (Figure 6B).
- 26. Install fire-stopping material in all holes opened in the roof and/or walls during this procedure.
- 27. Ensure the GTI is not installed in the DCD-LPR Shelf before proceeding.

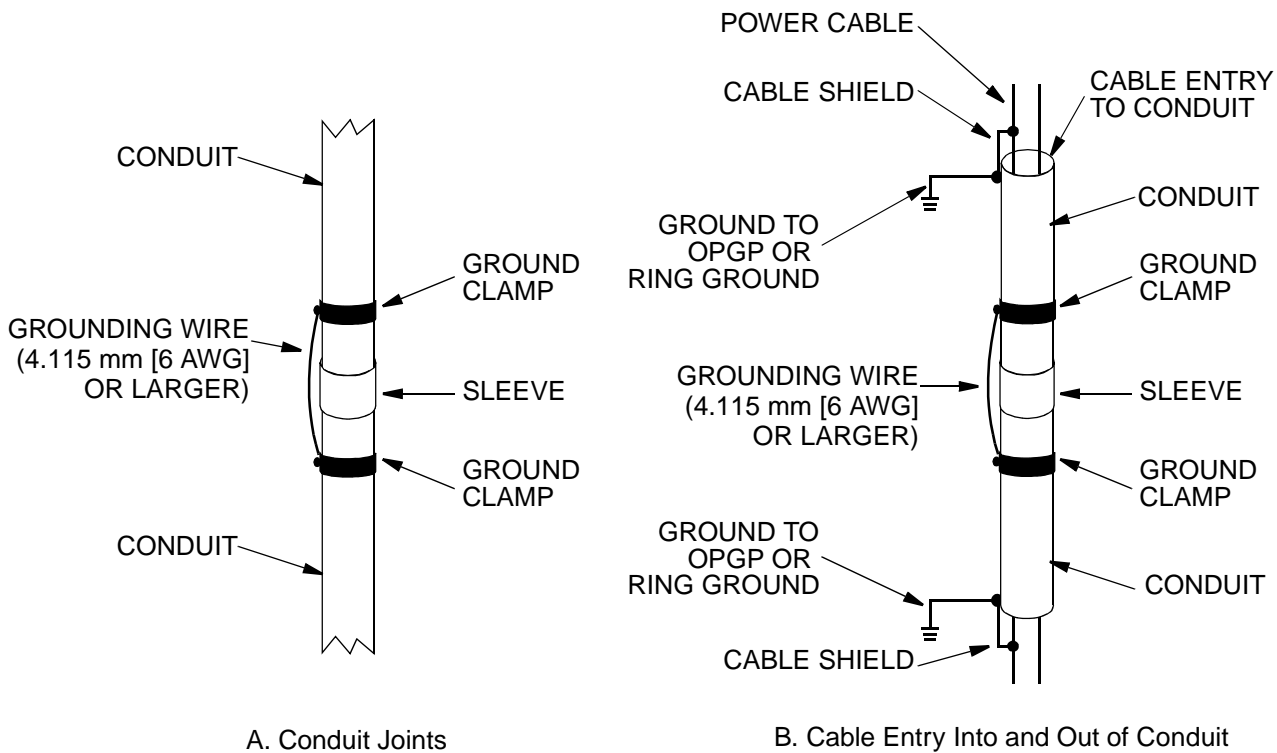


Figure 6. Metallic Conduit Bonding

F. Lightning Protector(s)

Caution: *If installing more than one antenna (GTR or LORAN), under no circumstances are the two systems to be grounded together. Each system must have its own connection to ground.*

Single Lightning Protector Installations

Note: The single lightning protector scheme is recommended for locations which do not have the inside and outside ground points connected to an OPGP.

2.17 This procedure pertains to initial installations at sites where the lightning protector is located within 15 meters (50 feet) of where the GTR power cable enters the building. If the lightning protector is located at a distance more than 15 meters (50 feet) from the cable entrance, either relocate it to within 15 meters (50 feet) of the entrance, or if this is an upgrade to an existing site, contact Symmetricom CTAC for information.

Note: Symmetricom recommends that the inside lightning protector be located within 3 meters (10 feet) of the cable entry location.

2.18 The screw connections for the lightning protector and lightning protector grounding plate connections are designed to accommodate spade lug connectors. The spade lugs should be the type to accommodate a 1.47 mm to 0.64 mm (16 AWG to 22 AWG) stranded wire, with a #6 stud size, and no more than 6.4 mm (0.25 inch) wide.

2.19 Inside the building, within 15 meters (50 feet) from the cable entry point, following company installation and grounding procedures, perform the following:

Note: The lightning protector should be mounted such that the GTR end is pointed towards the entrance of the GTR cable into the building, and the LPR end is pointed in line with the GTR cable from the DCD-LPR Shelf.

1. Using Figure 7, install the flat washer onto the GND stud, and mount the lightning protector grounding plate onto the GND stud.

2. Install one of the two nuts onto the GND stud. Tighten the nut with the open-end wrench, to secure the plate to the lightning protector.
3. Install and tighten the second nut, to lock the first nut in place. Use an anti-oxidation agent on all connections.
4. Install the lightning protector in the junction box (if provided), securing it inside, following company installation practices.
5. If using power cables other than ones purchased from Symmetricom, write down the color of each lead connected to the PWR+, PWR-, and CMN (GND) terminals for making connection to the lightning protector and the GTR.

Note: The GTR power cable wire colors (purchased from Symmetricom) are: + is red, - is black, ground is white, and the built-in drain wire is silver. If power cables are purchased from another source, the colors may vary. If this is the case, ensure that wiring continuity is maintained when making power cable connections. See Figure 8 for an illustration of the Symmetricom's GTR power cable.

Caution: *In the next step, care must be taken to ensure that when stripping the sheath and foil shield from the power cable, the built-in drain wire is not inadvertently cut off or damaged.*

6. Strip the sheath and shield from the power cable (from the GTR) — do not cut off the drain wire.

Note: Allow sufficient pigtail length of the PWR+, PWR-, CMN (GND), and drain wire leads, for ease of connection to the lightning protector and ground terminal. Consider future maintenance when determining the pigtail length (no wire or cable should have a complete loop in it).

7. Strip the PWR+, PWR-, and CMN leads, and crimp spade lugs on the ends (Figure 9).
8. Strip the drain wire, and install spaghetti insulation on the drain wire. Crimp a spade lug on the end.

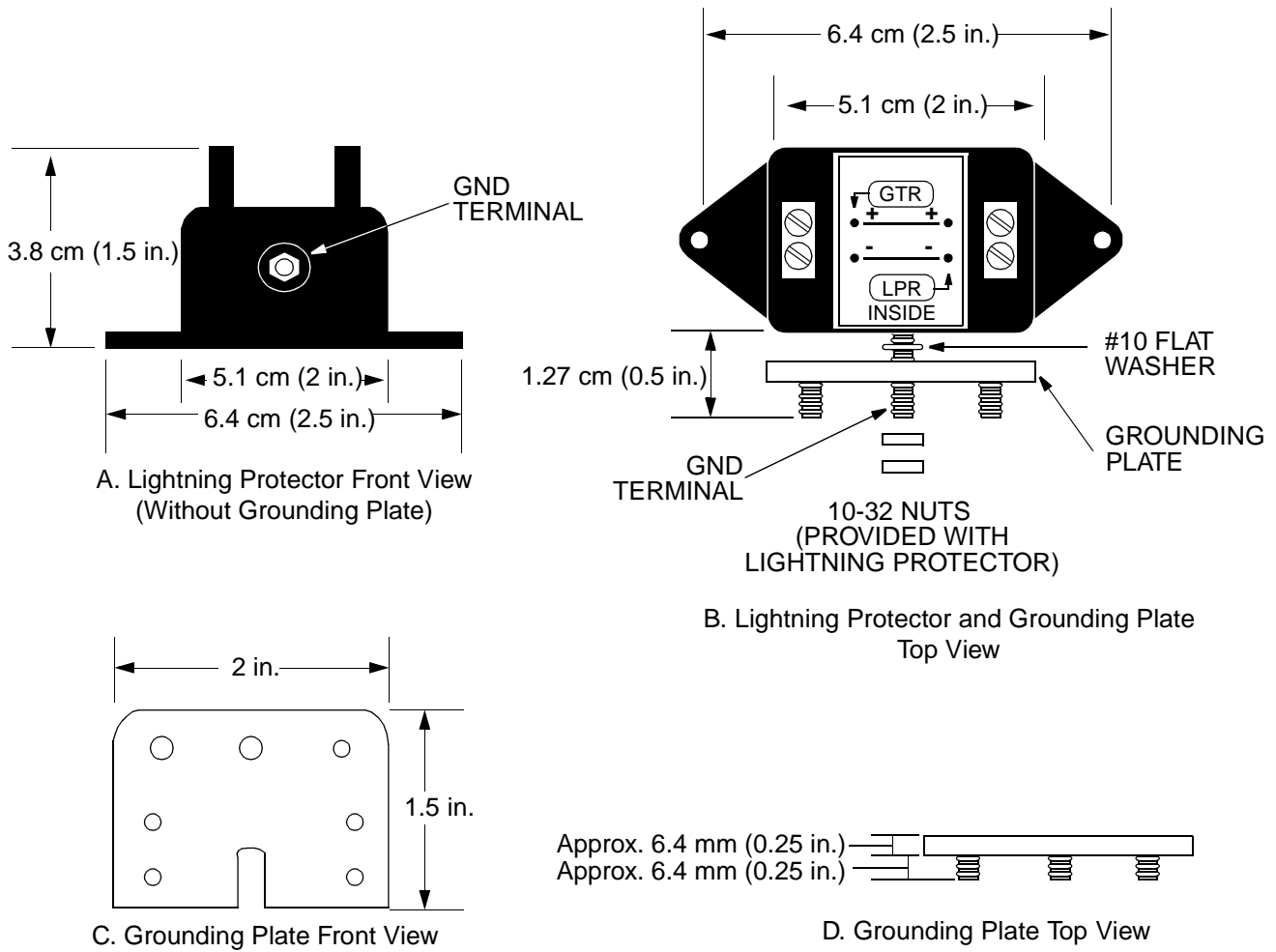


Figure 7. GTR Lightning Protector and Grounding Plate

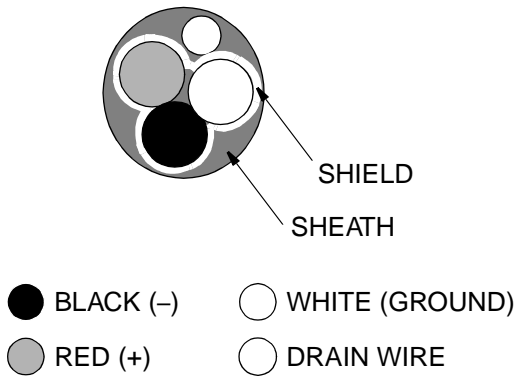


Figure 8. Shielded GTR Power Cable

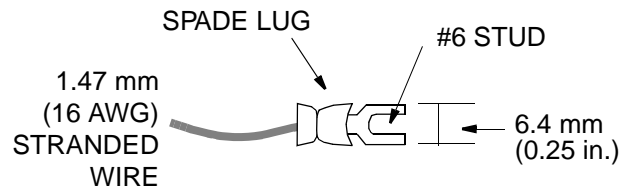
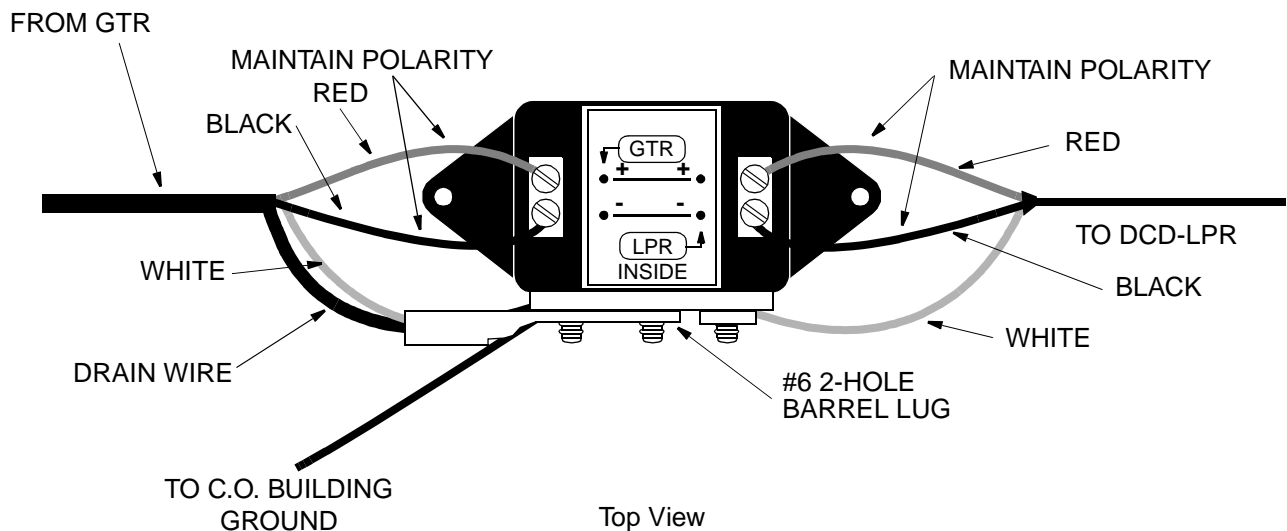


Figure 9. Spade Lug Connector

9. Connect the PWR+ and PWR- leads to the GTR side of the lightning protector, ensuring that the PWR+ lead connects to the “+” terminal, and the PWR- lead connects to the “-” terminal (Figure 10). Use an anti-oxidation agent on all connections.
10. Obtain the drain wire and CMN leads of the power cable from the GTR. Install an external-toothed lockwasher over the two #6 studs (the small studs) on the GTR end of the grounding plate (Figure 11).
11. Install the drain wire and CMN leads spade lugs on each stud, and secure them in place by installing and tightening a self-locking “KEPS” nut on each of the two studs.
12. Ensure that the spade lugs are seated in the grooves around the studs, to prevent lateral movement. Use an anti-oxidation agent on all connections.
13. Obtain the CMN lead of the shielded power cable from the DCD-LPR, and cut off the ring terminal lug on its end. Crimp a spade lug on its end.
14. Install an external-toothed lockwasher over one of the #6 studs (the small studs) on the LPR end of the grounding plate (Symmetricom recommends using the stud directly across from the CMN lead of the GTR cable).
15. Install the CMN lead spade lug on the stud, and secure it in place, by installing and tightening a self-locking “KEPS” nut on the stud.
16. Ensure that the spade lug is seated in the groove around the stud, to prevent lateral movement. Use an anti-oxidation agent on all connections.
17. Obtain the 4.115 mm (6 AWG) C.O. ground cable, and cut off the ring terminal lug on its end. Crimp a two-hole lug on its end.



Notes:

1. Refer to Figure 11 for the grounding plate connections.
2. The drain wire from the GTR is connected to the grounding plate on the lightning protector; the power cable shields from the GTR and the DCD-LPR are cut off, and secured per company practice.
3. The CMN leads from the GTR and the DCD-LPR are connected to the grounding plate.

Figure 10. GTR Lightning Protector Connections (Single Lightning Protector)

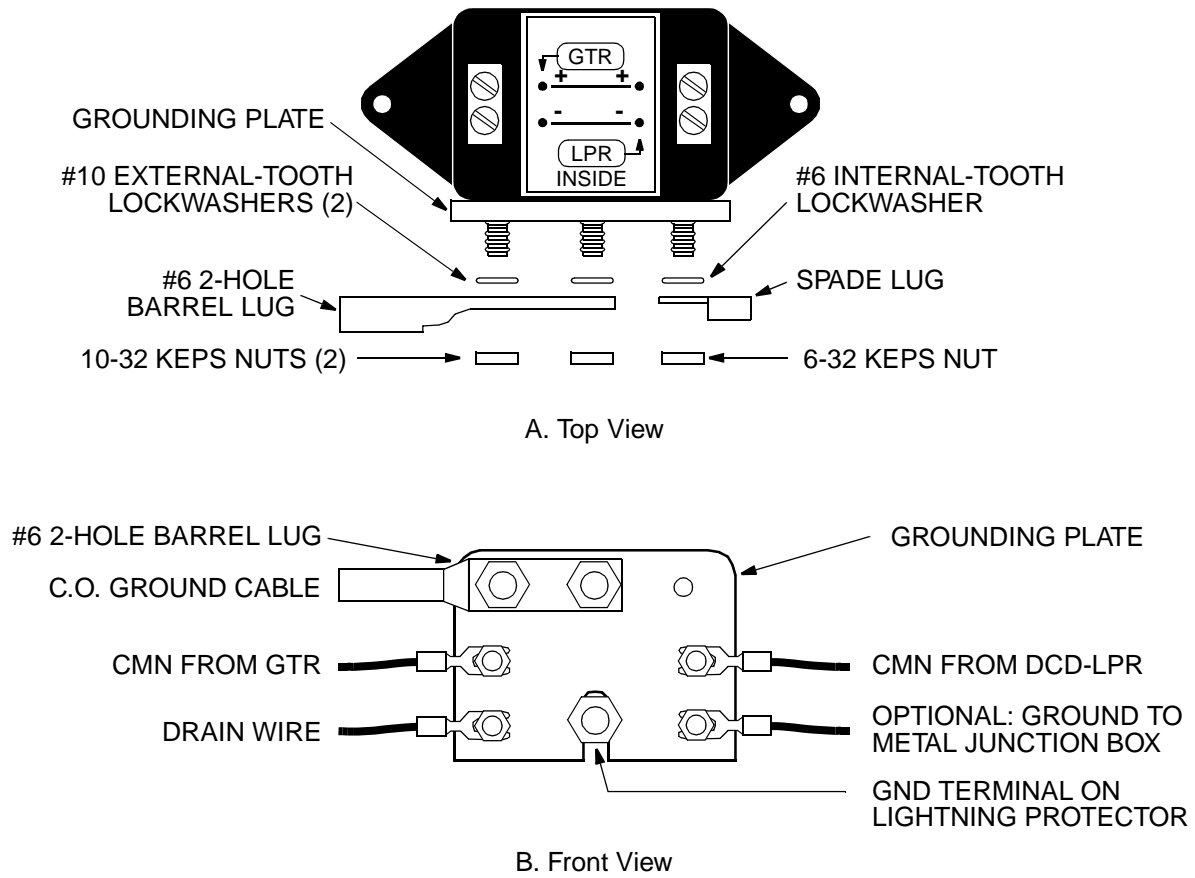


Figure 11. GTR Grounding Plate Connections

18. Install an external-toothed lockwasher on two of the three #10 studs (the two that will cause the least bend in the C.O. ground cable).
19. Install the two-hole lug over the two studs (noted in Step 18), and secure in place, by installing and tightening a self-locking “KEPS” nut on the studs. Use an anti-oxidation agent on all connections.

Notes:

- a. The C.O. ground cable, in some cases, may be larger than 4.115 mm (6 AWG), such as 6.54 mm (2 AWG). The two-hole lug provided in the GPS power cable ground kit is for 4.115 mm (6 AWG) cable. If a different gauge cable is used for the C.O. ground cable, a two-hole lug for that cable size must be provided locally.
 - b. Ensure that the grounding wire is run as short and straight as possible. Do not run grounding wire through cable ducts. If grounding wires to the protector connect to any other type of grounding wire, i.e., to ring or building ground, it is necessary that the connection be bonded (following company installation practices), to prevent arcing. Also, ensure that no unnecessary loops (no coiling) or hard turns on any ground wire occur.
 - c. The other end of the C.O. ground cable must be connected to a C.O. ground bar that is bonded to the OPGP. If such a ground is not available, an acceptable alternative would be to bond the end of the C.O. ground cable from the lightning protector to the nearest commercial AC green wire ground. The OPGP C.O. ground is the recommended ground, even if it is further away than the AC ground.
20. Using Figure 7, secure the lug connectors to the “LPR +” and “-” side of the lightning protector, following the color code saved previously (if not using Symmetricom cable), or if using Symmetricom cable: + is red, - is black, and ground is white.

Caution: DC polarity must be maintained. If not, the DCD-LPR / GTR will not function.

21. If the junction box is metal, ground the box to the spare #6 stud on the grounding plate.
22. Check all connections for tightness, to prevent arcing and intermittent operation.
23. Secure and seal the cover on the junction box.
24. Spray all exposed connectors with an electrically conductive antioxidant compound (e.g., Kopr-Shield).

Dual Lightning Protector Installations

Caution: If installing more than one antenna (GTR or LORAN), under no circumstances are the two systems to be grounded together with one common wire. Each system must have separate ground points.

Caution: Do not ground both protectors together with one common wire; the outside and inside protectors must have separate ground points.

Note: The dual lightning protector scheme can be used in locations that have the inside and outside ground points connected to an OPGP.

2.20 In dual lightning protector installations, the GTR is provided with two lightning protectors, one specifically designated for use outside the building, and the other for inside the building. Ensure that the outside protector is only installed outside the building, and the inside protector is only installed inside the building.

2.21 Install lightning protectors, following company installation and grounding procedures, Installation Job Specification, and the following procedures.

Warning: Ensure that the lightning protectors are placed away from electrical devices or cabling that may induce arcing.

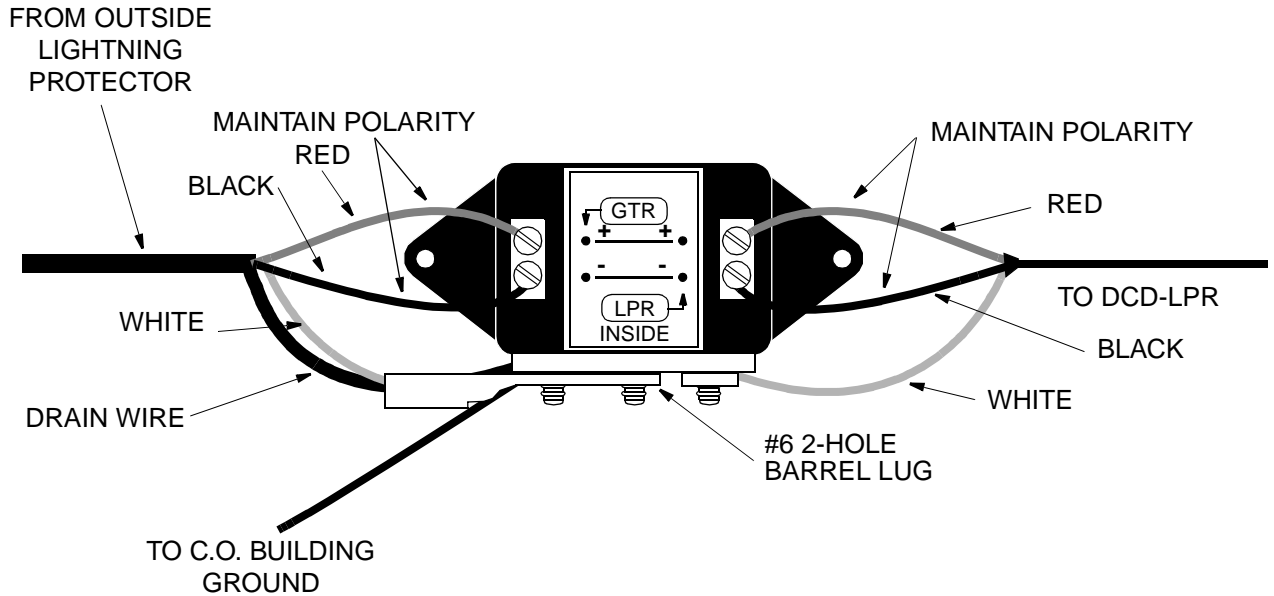
Inside Installation

2.22 The screw connection for the lightning protectors are designed to accommodate spade lug connectors. The spade lugs should be the type to accommodate a 1.47 mm (16 AWG) stranded wire, with a #6 stud size, and no more than 6.4 mm (0.25 inch) wide (Figure 7A).

2.23 Inside the building, as close as possible to the cable entry point, following company installation and grounding procedures, perform the following:

1. Using Figure 7, install the flat washer onto the GND stud, and mount the inside lightning protector grounding plate onto the GND stud.
 2. Install one of the two nuts onto the GND stud. Tighten the nut with an open-end wrench, to secure the plate to the lightning protector.
 3. Install and tighten the second nut, to lock the first nut in place. Use an anti-oxidation agent on all connections.
 4. Install the inside lightning protector in the junction box (if provided), securing it inside, following company installation practices.
 5. Strip the sheath from the three-conductor power cable from the DCD-LPR Shelf.
 6. Strip the PWR+, PWR-, and CMN leads, and crimp lug connectors on each lead (Figure 9).
7. If using power cables other than ones purchased from Symmetricom, write down the color of each lead connected to the PWR+, PWR-, and CMN (GND) leads for making connection to the inside and outside lightning protectors, and the GTR.

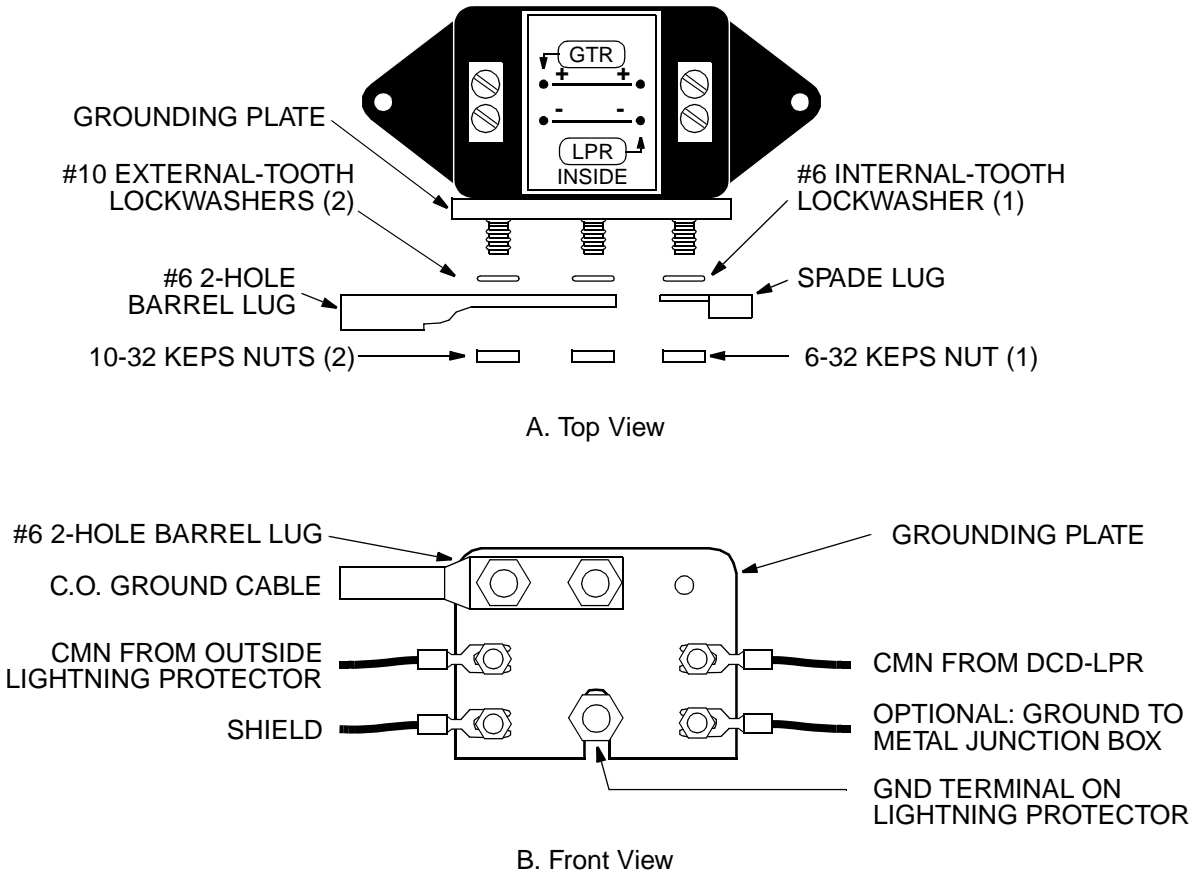
Note: The GTR power cable wire colors (purchased from Symmetricom) are: + is red, - is black, and ground is white. If power cables are purchased from another source, the colors may vary. If this is the case, ensure that wiring continuity is maintained when making power cable connections.
 8. Connect the PWR+ and PWR- leads to the LPR side of the lightning protector, ensuring that the PWR+ lead connects to the “+” terminal, and the PWR- lead connects to the “-” terminal (Figure 12). Use an anti-oxidation agent on all connections.
 9. Install an external-toothed lockwasher over one of the #6 studs (the small studs) on the LPR end of the grounding plate (it is recommended to use the stud that is directly across from the CMN lead of the GTR cable). (See Figure 13.)
 10. Install the CMN lead spade lug on the stud, and secure it in place, by installing and tightening a self-locking “KEPS” nut on the stud.
 11. Ensure that the spade lug is seated in the groove around the stud, to prevent lateral movement. Use an anti-oxidation agent on all connections.



Notes:

1. Refer to Figure 13 for grounding plate connections.
2. The drain wire from the GTR is connected to the grounding plate on the lightning protector; the power cable shields from the GTR and the DCD-LPR are cut off and secured per company practice.
3. CMN leads are connected to the grounding plate.

**Figure 12. GTR Lightning Protector Connections
(Dual Lightning Protector - Inside Installation)**



**Figure 13. GTR Grounding Plate Connections
(Dual Lightning Protector - Inside Installation)**

12. Strip the sheath and shield from the power cable (which will come from the outside lightning protector) — do not cut off the drain wire.

Note: Allow sufficient pigtail length of the PWR+, PWR-, CMN (GND), and drain wire leads, for ease of connection to the lightning protector and ground terminal. Consider future maintenance when determining the pigtail length (no wire or cable should have a complete loop in it).

13. Strip the PWR+, PWR-, and CMN leads, and crimp spade lugs on the ends (Figure 9).
14. Strip the drain wire, and install spaghetti insulation on the drain wire. Crimp a spade lug on the end.
15. Following the color code saved previously (if not using Symmetricom cable), strip the ends of the colored wires for PWR+ and PWR- from the outside lightning protector, and crimp lug connectors on each lead. The ground colored wire should not be connected, but dressed and secured as a future spare wire, should it be needed to replace a broken PWR+ and PWR- wire.
16. Connect the PWR+ and PWR- leads to the GTR side of the lightning protector, ensuring that the PWR+ lead connects to the “+” terminal, and the PWR- lead connects to the “-” terminal (Figure 12). Use an anti-oxidation agent on all connections.

Caution: Do not ground both protectors together with one common wire; the outside and inside protectors must have separate ground points.

Caution: DC polarity must be maintained. If not, the DCD-LPR / GTR will not function.

17. Obtain the drain wire and CMN leads of the power cable from the inside lightning protector. Install an external-toothed lockwasher over the two #6 studs (the small studs) on the GTR end of the grounding plate (Figure 13).
18. Install the drain wire and CMN leads spade lugs on each stud, and secure them in place, by installing and tightening a self-locking “KEPS” nut on each of the two studs.

19. Ensure that the spade lugs are seated in the grooves around the studs, to prevent lateral movement. Use an anti-oxidation agent on all connections.

20. Refer to Figure 7, and connect a 4.115 mm (6 AWG) (or larger) wire from the GND terminal on the side of the inside lightning protector to the building ground (primary protection ground) in the building.

Note: Ensure that the grounding wire is run as short and straight as possible. Do not run grounding wire through cable ducts. If grounding wires to the protector connect to any other type of grounding wire, i.e., to ring or building ground, it is necessary that the connection be bonded (following company installation practices), to prevent arcing. Also, ensure that no unnecessary loops (no coiling) or hard turns on any ground wire occur.

21. Check all connections for tightness, to prevent arcing and intermittent operation.
22. Secure and seal the cover on the junction box.
23. Spray all exposed connectors with an electrical-conductive antioxidant compound (e.g., Kopr-Shield).

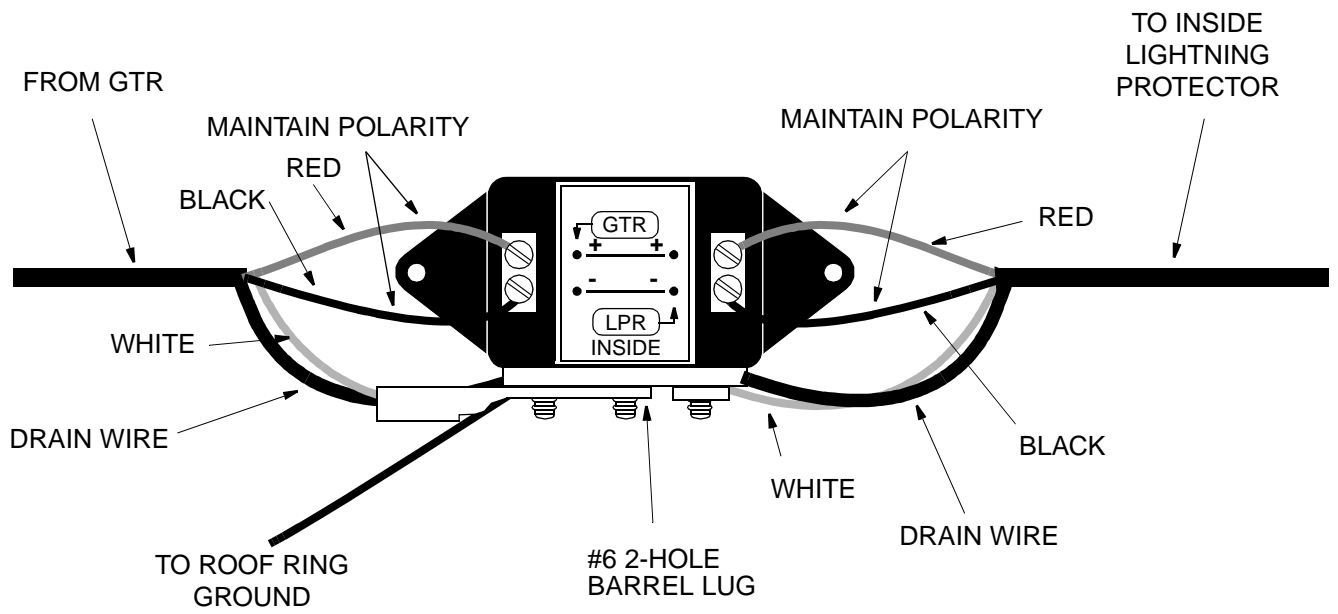
Outside Installation

2.24 Mount the outside lightning protector in a weather-resistant junction box (i.e., a Carlon [Lamson and Sessions] 30 cm x 30 cm x 15 cm [12 inches x 12 inches x 6 inches] weather-resistant junction box, [refer to Table B]).

Note: The weather-resistant junction box must be large enough to house the lightning protector and grounding plate, with enough space to allow for performing the various connections to the lightning protector. If large enough, the junction box housing the lightning protector can also be used to hold excess fiber optic cable.

Warning: Do not attempt to coil excess GTR power cable into the junction box. Failure to observe this caution may result in increased damage if a lightning strike occurs.

1. Using Figure 7, install the flat washer onto the GND stud, and mount the outside lightning protector grounding plate onto the GND stud.
 2. Install one of the two nuts onto the GND stud. Tighten the nut with the open-end wrench, to secure the plate to the lightning protector.
 3. Install and tighten the second nut, to lock the first nut in place. Use an anti-oxidation agent on all connections.
 4. Insert the outside lightning protector into the weather-resistant junction box, securing it inside, following company installation practices.
- Note:** The GTR is provided with two solid-state lightning protectors, one specifically designated for use outside the building, and the other for inside the building. Ensure that the outside protector is only installed outside the building, and the inside protector is only installed inside the building.
5. Following the color code saved previously (if not using Symmetricom cable) or using Symmetricom cable colors, strip the ends of the wires for the PWR+, PWR-, and CMN from the inside lightning protector, and crimp lug connectors on each lead.
 6. Using Figure 7, connect the PWR+ and PWR- leads to the “LPR +” and “-” side of the outside lightning protector, following the color code saved previously (if not using Symmetricom cable), or use the Symmetricom cable colors.
- Caution: Do not ground both protectors together with one common wire; the outside and inside protectors must have separate ground points.**
7. Strip the ends of the three-conductor power cable from the GTR, and crimp lug connectors on each lead.
 8. Using Figure 7, secure the lug connectors to the “GTR +” and “-” side of the outside lightning protector and GND terminals, following the color code saved previously (if not using Symmetricom cable), or if using Symmetricom cable: + is red, - is black, and ground is white.
 9. Make the appropriate grounding connections, using Figure 14 for reference, and the following guidelines:
 - a. The ground connection to the lightning protector should be made, following company installation procedures, and be connected to a metal conduit, or ring ground, with a 4.115 mm (6 AWG) (or larger) wire. A hole should be drilled through the outside of the box, to accommodate a locally obtained screw, nut, and set of lock washers.
 - b. When attaching a ground wire to building ground, drill a hole in the weather-resistant junction box, and secure the ground lug (following company installation practices).
 - c. If grounding wires cross any other type of principal grounding wire, it may be necessary to bond the two wires together (at the intersection) to prevent arcing (following company installation practices). Also, ensure that there are no unnecessary loops or hard turns on any ground wire (this will minimize inductance).
 10. Check all connections for tightness, to prevent arcing and intermittent operation.
 11. Secure and seal the cover on the weather-resistant junction box.



**Figure 14. GTR Lightning Protector Connections
(Dual Lightning Protector - Outside Installation)**

Installing Power Cable to GTR

1. If the GTR power cable was purchased from Symmetricom, skip to Step 2. If the cable was purchased from another source, the power connector must be attached. To attach the power connector to the cable end, use Figure 15 as reference, and perform the following:

Note: A 15.9 mm (0.625 inch [5/8 inch]) open-end wrench is required for attaching the connector to the cable.

- a. Slide the compression nut, cable grip, compression sleeve, barrel, clamp, notched ring, and nylon sleeve onto the power cable, in the order shown in Figure 15A.
- b. Prepare the cable end, as shown in Figure 15B, removing all plastic covering and thread. If using shielded cable, trim the shield even with the plastic covering.
- c. Remove the insulation from the three conductors for a length of approximately 6.35 mm (0.25 inch), and tin the exposed copper wire.
- d. Solder the wires into the pin holder, as shown in Figure 15C, and use the color code saved previously (if not using Symmetricom cable), or if using Symmetricom cable: + is red, - is black, and ground is white.

Note: Power polarity must be maintained, or the GTR will not operate correctly. If wiring polarity is incorrect, "GTR PWR FAULT" appears on the GTI LCD display.

- e. Slide and lock the nylon sleeve into the pin holder, using the tabs.
- f. Align the grooves in the pin holder, nylon sleeve, and ring. These must be aligned, to enable correct placement in the outer sleeve.

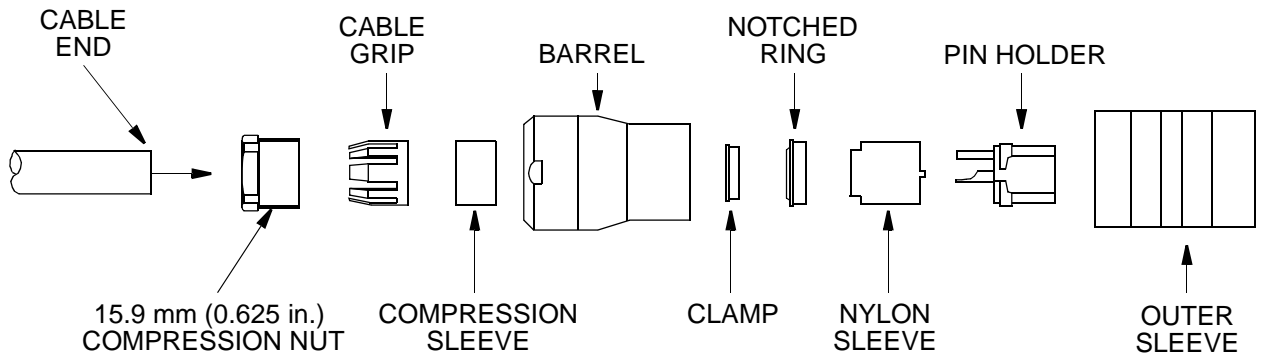
Note: In the next step, if using shielded cable, the shield will be covered by the barrel.

- g. Slide the barrel up and over the ring and clamp, ensuring the clamp is seated firmly. Ensure that the alignment of the grooves in the pin holder, nylon sleeve, and ring is maintained.
- h. Locate the pin holder into the outer sleeve, and align the grooves (in the pin holder, nylon sleeve, and ring) to the ridge in the sleeve. Screw the barrel assembly into the sleeve, ensuring a tight fit.

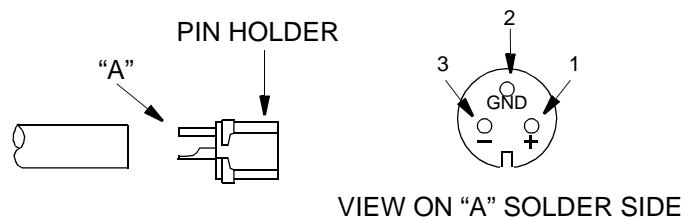
Note: When tightening, it is important that the barrel assembly rotate around the pin holder and cable; the pin holder and cable do not rotate.

- i. Slide the compression sleeve, cable grip, and compression nut into the barrel, and tighten.

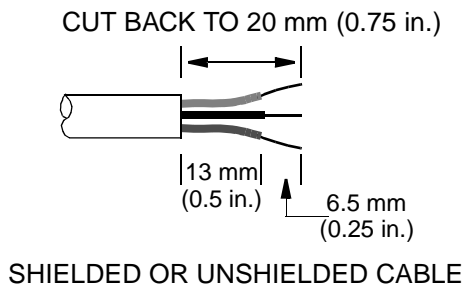
Note: The barrel assembly is notched to accept a 17.5 mm (0.6875 inch [11/16 inch]) open-end wrench. The compression nut accepts a 15.9 mm (0.625 inch [5/8 inch]) open-end wrench.



A. Order of Connector Parts on Cable



VIEW ON "A" SOLDER SIDE

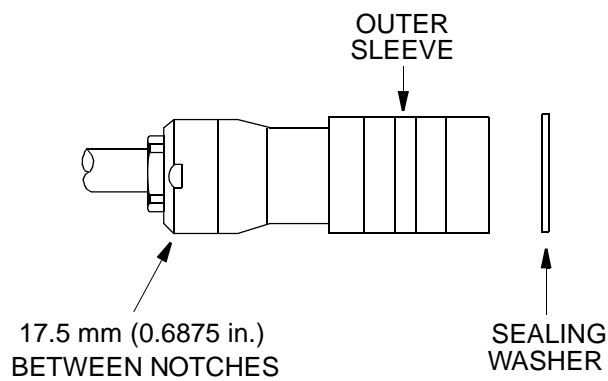


SHIELDED OR UNSHIELDED CABLE

B. Cable Preparation

PIN NO.	WIRE COLOR	FUNCTION
2	White	GND or Common
1	Red	(+)
3	Black	(-)

C. Pin Holder and Cable Function



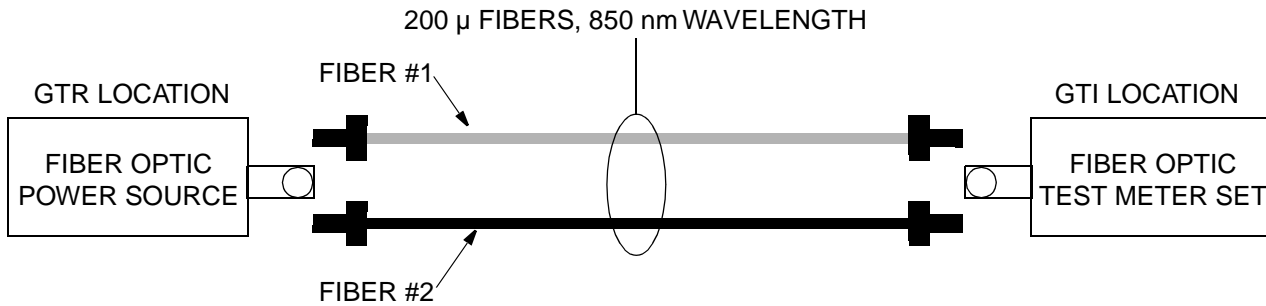
D. Outer Sleeve Components

Figure 15. GTR Power Cable Connector Assembly
 (For reference - use only if not purchasing pre-connectorized cable from Symmetricom)

- j. Insert the sealing washer into the front of the connector, over the pin holder, to complete assembly.
- 2. At the GTR, obtain the power cable, and lightly apply the lubricant (provided in the GTR hardware kit) to the threads of the power cable connector, enabling an easier connection to the GTR. The lubricant also serves as a corrosion preventative.
- 3. Attach the power cable connector to the PWR connector on the GTR.
- 4. At the GTR, obtain the fiber optic cable. If ST type connectors are not already attached to the ends of the fiber cable, use the fiber ST terminator connector tool, and follow the instructions provided with the tool, to attach a connector to each fiber end.

Note: If the fiber connectors are terminated in the field, the quality of the termination must be determined. The fiber optic cable contains two 200 micron diameter fibers; the GTR-to-DCD-LPR communication system operates in the 850 nm spectrum. The total fiber loss cannot exceed 7 dB (including connectors). To determine the quality of the connector terminations, use a Wilcom FS850 fiber optic power source (or equivalent) and a Wilcom FM850 fiber optic meter test set (or equivalent), and perform the following steps:

- a. Measure each of the fibers end to end, using a known output level source at one end, and the test set at the other end; record the readings.
- b. Subtract the known source output level from the #1 and/or #2 fiber measurements, to determine the fiber loss (see Figure 16 for examples); the fiber loss should not exceed 7 dB.



Typical losses for 200 μ cable lengths:

- 30 m (100 ft) 2.0 dB
- 152 m (500 ft) 2.7 dB
- 305 m (1000 ft) 3.6 dB
- 457 m (1500 ft) 4.5 dB
- 610 m (2000 ft) 5.4 dB

Typical examples for 152 m (500 ft) of 200 μ cable (losses have been calculated in the following examples):

Step a.	Output level	-17.0 dB (source)	
	Fiber #1	-19.7 dB (receive)	
	Fiber #2	-20.1 dB (receive)	
Step b.	Fiber #1	-19.7 dB (receive)	
	Output level	-17.0 dB (source)	
	Fiber Loss	-2.7 dB	Fiber #1 Acceptable
Step c.	Fiber #2	-20.1 dB (receive)	
	Output level	-17.0 dB (source)	
	Fiber Loss	-3.1 dB	Fiber #2 Acceptable

Figure 16. Fiber Termination Test

- c. If the loss in Step b exceeds 7 dB, the ST connector should be inspected and replaced (if necessary). After the connector is replaced, retest the fiber, repeating Steps a and b.
5. If the fiber cable was purchased from Symmetri-com with the connectors and pulling mechanism already attached, follow the steps below, to position the pulling grip for strain relief:
 - a. Using diagonal pliers, carefully remove the shrink tubing covering the grip and connectors (Figure 17A), and discard.
 - b. Remove the black electrical tape, and discard.
 - c. Slide the grip down until the “eye” is even with the end of the fiber cable outer jacket (Figure 17B). To loosen the grip, squeeze the mesh part of the grip together to move, and when in place, release the grip.
 - d. Using black electrical tape, secure the grip in place; tape the bottom of the grip to the cable (Figure 17B).
 - e. Securely place the eye into one of the hooks in the flange (Figure 17C).
6. Connect one fiber optic cable to the TX connector on the GTR. Connect the other fiber to the RX connector on the GTR.

Note: The TX and RX connectors are made of plastic; use care when connecting to these connectors, because the locking screw may break off if over-tightened.

7. Record the color of the fiber connected to the TX connector on the GTR. The same color fiber connected to the TX connector will be connected to the RCV connector on the GTI fiber I/O module. The other color fiber will be connected from the RX connector on the GTR to the XMT connector on the GTI fiber I/O module.

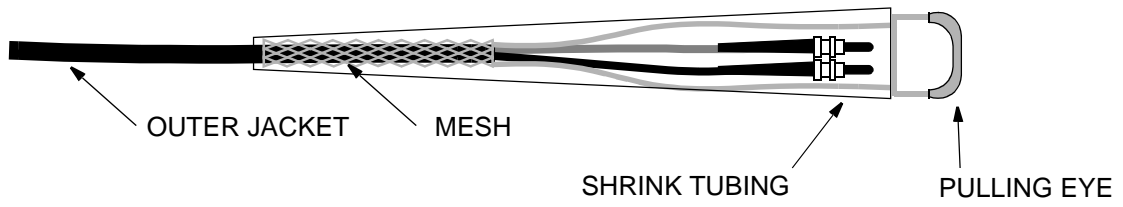
Note: Fiber polarity must be maintained, or the GTR will not operate correctly. If wiring polarity is incorrect, “GTR COMM” appears on the GTI LCD display, and the DS1 lamp on the DCD-LPR I/O module will not be lit.

8. Remove the four 10-24 Nyloc nuts from the threaded studs of the GTR, then align the threaded studs on the GTR with the holes on the mounting flange on the mast, and insert.

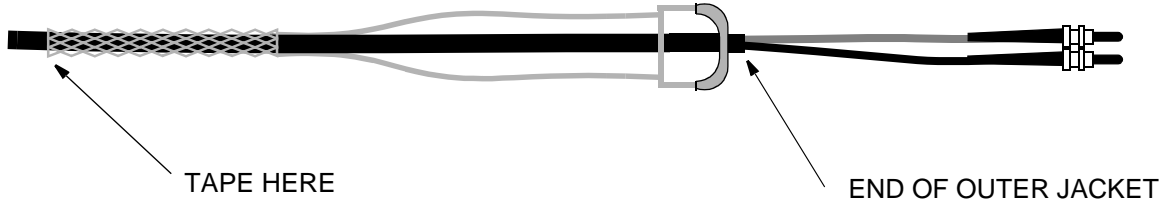
Note: Ensure that the cables are not caught between the flange and the GTR.

9. At this point, using a plumb line or bubble level, manipulate the GTR into position. Ensure that the GTR is within 5 degrees of level (with the horizon). If within 5 degrees, proceed to the next step. If not, use company practice to manipulate the GTR to within 5 degrees of level.
10. Once level, ensure that the cables are not caught between the flange and the GTR, and secure the GTR in place, using the four Nyloc nuts removed in Step 8.
11. After the GTR installation is completed, weatherproof ALL openings of the weather-resistant junction boxes, side plate openings, weather-resistant conduit, etc. Use an appropriate waterproofing material, e.g., silicone glue and sealer.
12. Spray all exposed connectors with an electrically conductive antioxidant compound (e.g., Kopr-Shield).

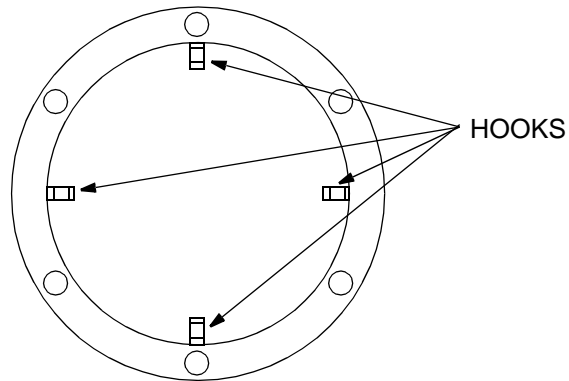
2.25 At this point, if installing a LORAN-C System, proceed to Part 3, LORAN Antenna Installation; if not, proceed to Part 4, DCD-LPR Installation, for instructions on mounting the DCD-LPR Shelf, and connecting the GPS System to the DCD-LPR. Instructions for connecting the fiber cables to the I/O module at the DCD-LPR are in Part 4.



A. Pulling Grip Assembly



B. Repositioned Pulling Grip



C. Flange

Figure 17. Pulling Grip and Flange (for Strain Relief)

3. LORAN ANTENNA INSTALLATION

3.01 Prior to installing the LORAN antenna, a site survey should have been performed. The survey determines exactly what equipment and materials are needed for installation. The Installation Job Specification determines how the installation should proceed.

3.02 For information on how to perform a site survey, refer to the Engineering Guidelines section of this manual.

Note: If problems are encountered during installation, contact Symmetricom's CTAC.

A. Pre-installation Considerations

3.03 Prior to installation, verify the quality of ground within the building; consult with the office grounding specialist as to the quality of ground and grounding protection methods.

3.04 There are two methods of lightning protection:

- A single inside lightning protector, when the inside and outside grounds are not bonded to building steel or the Office Principal Ground Point (OPGP), or when the antenna is located in a high-lightning area
- Two lightning protectors, one installed inside, and one installed outside the building, when a proper roof ring ground system is available

Note: The single lightning protector method may be used whether or not a roof ring ground is available.

3.05 The following is optional: for communications with technical support, or other members of the installation team, ensure there is at least one phone line available within 3 meters (10 feet) of the DCD-LPR.

B. Cables Required

Note: Throughout this section, the "xx" suffix noted in a cable part number is used in place of the number indicating the length. For example, the part number suffix for a 122 meter

(400 foot) section of fiber optic cable is -04, a 91 meter (300 foot) section is -03, etc.

Note: For detailed information regarding the cables and ordering instructions, refer to the Engineering Guidelines section of this manual. For cable requirements, refer to the Installation Job Specifications.

3.06 Two cable types are required for installing the LORAN antenna:

- Twinax
- Grounding wires

3.07 A twinax, RG-108A (or equivalent) cable is required for connecting the LORAN antenna to the DCD-LPR Shelf.

3.08 For single lightning protector installations, this cable must be long enough to be separated into two sections for installation: from the antenna to the lightning protector, and from the lightning protector to the DCD-LPR Shelf.

3.09 For dual lightning protector installations, this cable will be separated into three sections for installation: from the LORAN antenna to the outside lightning protector, outside lightning protector to the inside lightning protector, and inside lightning protector to the DCD-LPR Shelf.

3.10 For grounding the lightning protectors and the relay rack containing the DCD-LPR Shelf, a 4.115 mm (6 AWG) (or larger) copper grounding wire is recommended (user provided).

3.11 For grounding the antenna and the conduit-T, a 4.115 mm (6 AWG) copper grounding wire with two-hole lugs on either end is provided by Symmetricom.

C. Tools and Materials

3.12 Ensure that the user-provided tools and materials listed in Table C are on hand for installation of the LORAN antenna.

Table C. Customer Provided Tools and Materials (for LORAN Antenna Installation)

ITEM	COMMENT
TOOLS	
Flat-blade screwdriver (medium and small)	—
Phillips screwdriver (medium and small)	—
Ladder	To reach lightning protector(s) and antenna
(Optional) Power extension cord	—
Hand drill with 12.7 mm (0.5 in.) drill bit	To drill drain holes in junction box
Cable cutting tools	—
Flat-nose pliers	—
Wire-wrap tools	—
Hand drill	—
Soldering iron and solder	—
Volt-ohm meter	—
MATERIALS	
Additional fuses (Bussman-type 3 A, 5 mm x 20 mm or 0.25 in. x 1.75 in. cartridge fuse, or equivalent)	For power distribution panel fuse replacement
4.115 mm (6 AWG) (or larger) ground wires. Wires should be long enough to reach from inside lightning protector to Central Office (C.O.) ground and from outside lightning protector to outside building (ring) ground	For grounding lightning protectors
Weatherproofing material (pipe thread tape, silicon sealer, etc.)	—
Electrically conductive antioxidant compound (Kopr-Shield or equivalent)	To coat any connection exposed to weather, to prevent oxidation at connection
19 mm (0.75 in.) U-bolts or other mounting hardware	For attaching provided 0.6 m x 19 mm (2 ft x 0.75 in.) conduit section to another conduit, tower, or other fixtures
Spade lug connectors to fit 1.02 mm (18 AWG) wire, 6.3 mm (0.25 in.) wide, and fit to #6 stud	—
Spade lug connectors to fit 1.62 mm to 1.29 mm (14 AWG to 16 AWG) wire, 6.3 mm (0.25 in.) wide, and fit to #6 stud	—

Table C. Customer Provided Tools and Materials (for LORAN Antenna Installation) (Cont'd)

ITEM	COMMENT
MATERIALS (Contd)	
(Optional) One weather-resistant junction box, large enough to house lightning protector, with sufficient space to perform necessary connections	It is recommended that Carlon (Lamson and Sessions) 30.5 cm x 30.5 cm x 15.2 cm (12 in. x 12 in. x 6 in.) weather-resistant junction box, p/n E989R, or equivalent, be used. Weather-resistant junction box should be large enough to hold excess cable. An extra coil of cable provides slack for antenna removal if necessary.
(Optional) If two lightning protectors are installed, provide second box. Provide two each #8 screws and nuts for mounting lightning protector in junction box.	Screw length shall be determined locally, depending on type of junction box provided.
Strain relief devices, as desired	For installing in junction box
Weather-resistant conduit, metal or PVC. It is recommended that minimum 50.8 mm (2 in.) rigid UL Listed #651 PVC (minimum Schedule 40) conduit be used if PVC is chosen, as well as elbows, tees, sleeves, plugs, Ys, etc., for cable runs on roof. Also, provide appropriate weather-resistant conduit cement.	If metal conduit is used, conduit joints must be bonded and, at minimum, both ends of conduit run must be connected to building structural ground via ring ground, metal conduits, air conditioning ducts, etc. It is recommended that an intermediate point along conduit also be grounded. If valid ring round or bonding to building structure steel not available, it is recommended that single lightning protector installation method be used.
Expansion joint sleeves	For preventing breaks in non-metallic conduit due to expansions and contractions
Two weather-resistant conduit fittings per weather-resistant junction box	For connecting junction box to conduit
One sheet of fine-grain sandpaper	To provide bare metal surface for ground connections
Small roll of vinyl or aluminum fine mesh window screen material and appropriate adhesive (may be found at hardware or home improvement stores)	To screen water drain holes in junction box and conduit to keep living creatures out
Fire-stopping material	To block fire from crossing through cable/conduit hole in roof and walls
Pulling wire or cord	For pulling twinax (power) cable through conduit and junction box

D. Unpacking

3.13 The LTI card, Antenna Assembly, and Antenna Mounting Kit are shipped separately from the LPR Shelf; this procedure checks for items pertinent to the installation of the LORAN-C antenna.

Note: Save packing material. *All equipment returned must be packed in the original packing material.* Contact Symmetricom Customer Service Department if additional packaging is needed.

1. Unpack equipment carefully.
2. Inspect equipment for shipping damage, including bent or loose hardware, and broken connectors. Inspect the pins on the backplane, to ensure that none are bent or broken. Notify Symmetricom and the carrier if equipment was damaged in transit. Contact Symmetricom's Customer Service Department.
3. Verify all items have been received. For a parts list, refer to Table M, at the end of this section.
4. Notify Symmetricom if any items are missing.

Note: If installing only one LTI card, only one antenna is required; if installing two LTI cards, two antennas are required.

E. Assembly and Mounting

Note: The installation steps provided in this section are intended as guidelines. Actual techniques may be amended, as required by company installation procedures.

3.14 To assemble and mount the LORAN antenna (refer to the Engineering Guidelines section of this manual for recommended location and mounting considerations), use company practices to perform the following:

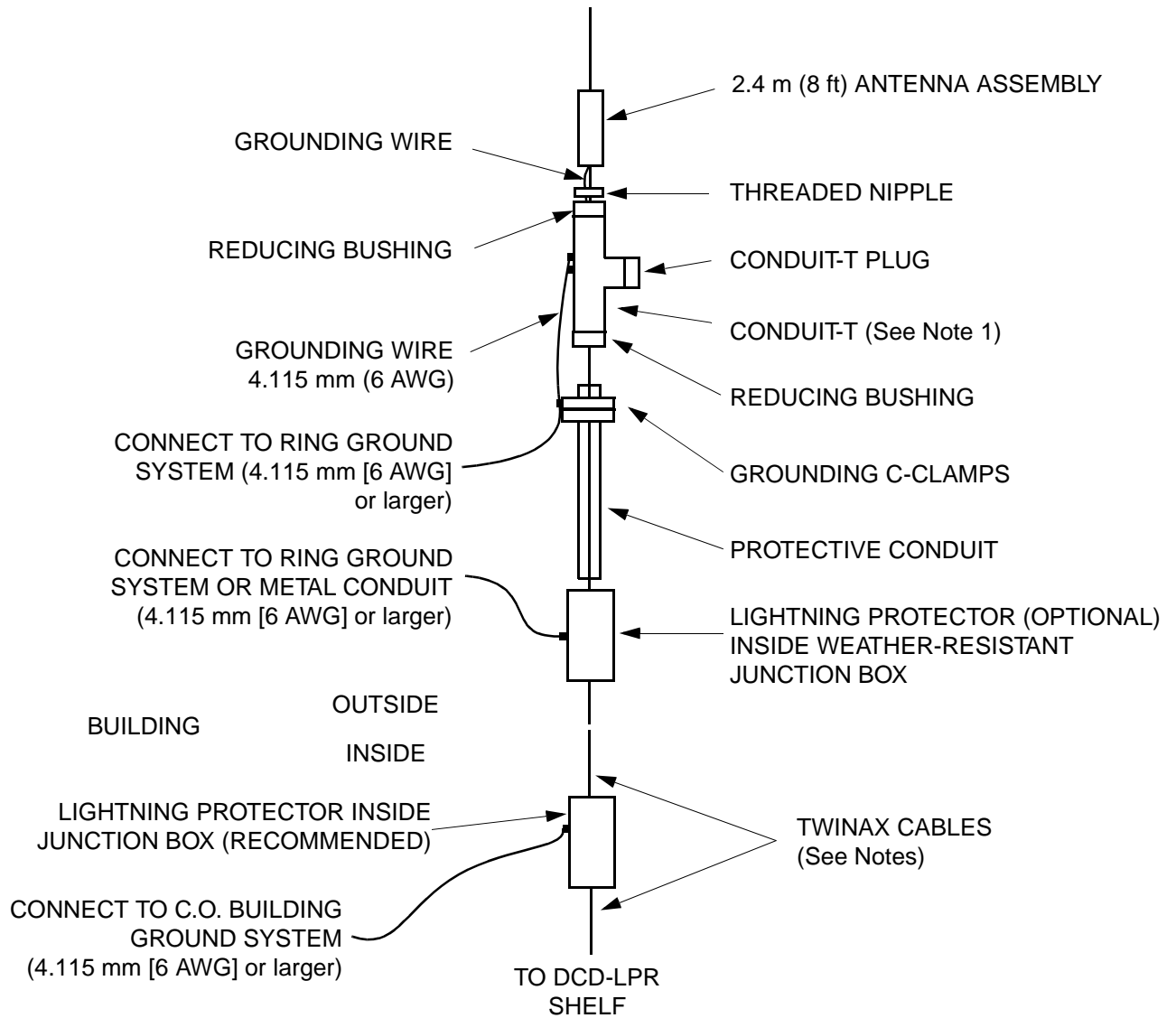
Warning: *Ensure that the lightning protectors are placed away from electrical devices or cabling that may induce arcing.*

Note: For single lightning protector installations, this procedure pertains to sites where the lightning protector is located within 15 meters (50 feet) of where the twinax cable enters the building. The shielded cable must not be run more than 15 meters (50 feet) inside the building without being grounded to a C.O. ground bar that is bonded to the OPGP. If the lightning protector is located at a cable distance more than 15 meters (50 feet) from the cable entrance, either relocate it to within 15 meters (50 feet) of the entrance, or contact Symmetricom CTAC for an alternate method.

1. Optional: mount a junction box for the inside lightning protector. The inside lightning protector should be mounted as near to the cable entrance point as possible. If using the single lightning protector scheme, it must be installed no more than 15 cable meters (50 cable feet) from the cable entrance point.
2. If installing dual lightning protectors, mount the weather-resistant junction box for the outside lightning protector, according to the company Installation Job Specification. It should be mounted as near to the cable entrance point as possible that permits the ground terminal of the lightning protector to be bonded as direct and short as possible to the ring ground system.

Warning: *Ensure that the lightning protectors are placed away from electrical devices or cabling that may induce arcing.*

3. If installing additional junction box(es) for cable slack and/or strain relief, mount at this time.



Notes:

1. Twinax cables may be routed through the supporting conduit section, or (optionally) through the side hole of the conduit-T.
2. Not all cables are supplied with the DCD-LPR System.

Figure 18. LORAN Antenna System Parts

4. If installing dual lightning protectors, mount the weather-resistant junction box for the outside lightning protector according to company Installation Job Specification.

Warning: *Ensure that the lightning protectors are placed away from electrical devices or cabling that may induce arcing.*

5. If installing additional junction box(es) for cable slack and/or strain relief, mount at this time.
6. Drill a hole, approximately 12.7 mm (0.5 inch) in diameter, centered in the lowest side of the junction box(es); the hole will be used to drain excess moisture that may accumulate in the box (Figure 1).
7. Glue a piece of fine mesh window screen over the hole on the inside of the junction box, to keep insects, etc., out of the box.
8. Install the mounting hardware for the mast.
9. Lay out the weather-resistant conduit, sleeves, elbows, etc., from the building entrance to the weather-resistant junction box (if a lightning protector is installed outside the building) to the mast. Do not cement the sections together at this time.

Note: The conduit route should be as direct as possible. *Avoid hard (tight) corner small radius turns and any unnecessary turns. The minimum bending radius is eight inches. All bends must be 90 degrees or greater.*

10. Attach and cement the conduit sections to both sides of the weather-resistant junction box (if applicable) and at the building entrance. Seal and waterproof the conduit section where it enters the building.
11. Insert pulling wires or cords in all conduit sections. Ensure the pulling wire or cord is routed through all conduit elbows, tees, sleeves, plugs, Ys, etc., that are not yet cemented to the conduit.
12. Pull or run the twinax cable and pulling wire or cord (if applicable) from the DCD-LPR Shelf to the lightning protector or junction box (for the lightning protector installed inside the building).
13. Detach the cables from the pulling wire or cord.

14. At the inside lightning protector or junction box, route the twinax cable (if provided) to its inside lightning protector junction box, and secure it.
15. At the inside lightning protector or junction box, cut the twinax cable (if provided) and pulling wire or cord. Allow sufficient slack in the pulling wire or cord, to secure it for future use. Allow sufficient slack in the twinax cable, to secure it and permit future replacement of lug connectors.
16. Attach the twinax cable (if provided) and pulling wire or cord to the pulling wire or cord in the conduit to the junction box for the outside lightning protector.
17. Pull the cable to the outside lightning protector junction box.
18. Detach the cable from the pulling wire or cord.
19. Cut the twinax cable and pulling wire or cord, allowing sufficient slack for securing and connecting cable, and for future lug connector replacement.
20. Attach the twinax cable and pulling wire or cord to the pulling wire or cord in the conduit to the mast.
21. Pull the cables through the conduit, uncemented conduit elbows, tees, sleeves, plugs, Ys, etc., and through the top of the mast. Allow sufficient slack for securing, connection to the antenna, and future lug connector replacement. Temporarily secure at the top of the mast.
22. Cement all conduit ends to conduit elbows, tees, sleeves, plugs, Ys, etc., on the rooftop conduit run.
23. Ensure the LTI is not in the DCD-LPR Shelf.
24. Wrap pipe thread tape (user-supplied) around the supplied pipe plug (factory-provided), and attach to the side hole of the conduit-T (Figure 19A).
25. Flexible or rigid weather-resistant conduit, following local electrical code requirements and company installation practices, may be connected to the side hole of the conduit-T connector. This provides an alternative method from that shown in Figure 19D, of running the antenna cable to the DCD-LPR.

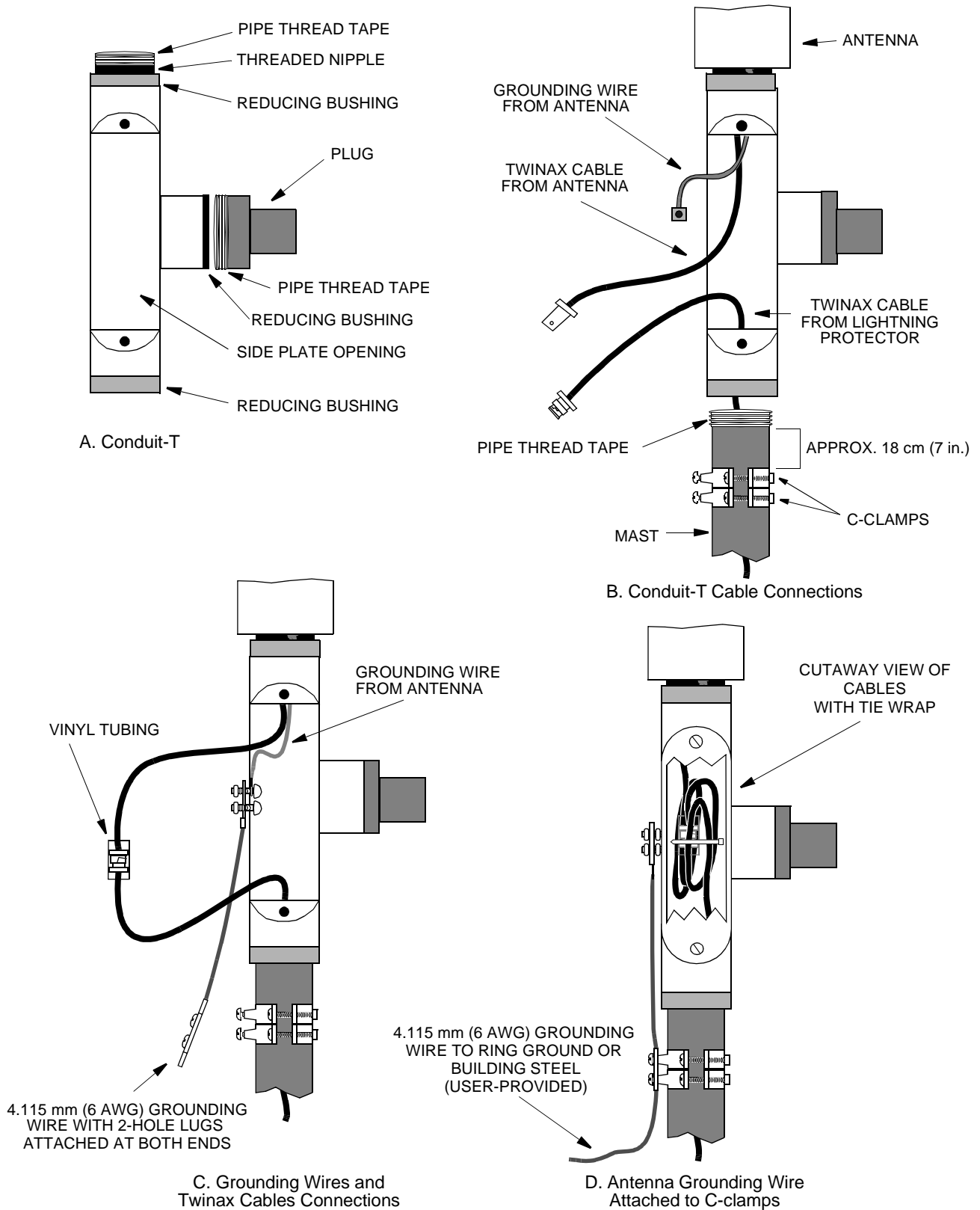


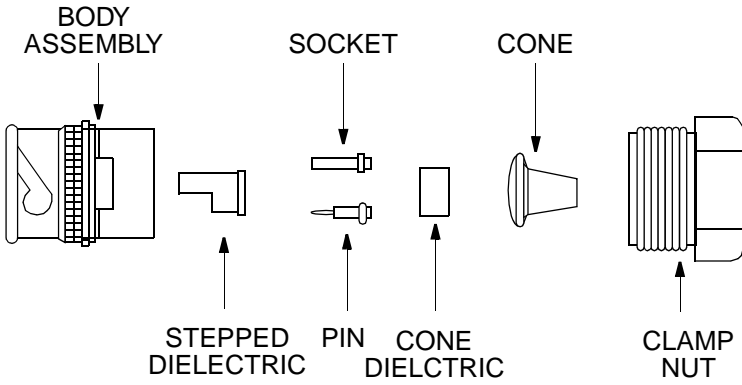
Figure 19. Conduit-T and Cable Connections

26. Wrap pipe thread tape (user-supplied) around the top and bottom of the 19 mm (0.75 inch) threaded nipple (factory-provided).
27. Screw the 19 mm (0.75 inch) end of one reducing bushing (factory-provided) into the threaded nipple.
28. Wrap pipe thread tape (user-supplied) around the 32 mm (1.25 inch) end of the reducing bushing mentioned previously. Screw the reducing bushing into the top of the conduit-T (Figure 19A).
29. On a second reducing bushing, wrap pipe threaded tape (user-supplied) around the 32 mm (1.25 inch) end. Screw the reducing bushing into the bottom of the conduit-T (Figure 19A).
30. Feed the twinax cable and grounding wire from the antenna down through the threaded nipple, reducing bushing, and the top of the conduit-T, then out the side plate opening. Make sure at least 0.3 meter (1 foot) of twinax cable protrudes from the opening (see Figure 19B).
31. Screw the antenna onto the threaded nipple (Figure 19B). Ensure that the twinax cable and grounding wire from the antenna are free to rotate as the antenna is screwed onto the nipple.
32. Wrap pipe thread tape (user-supplied) around one end of the provided 0.6 meter x 19 mm (2 foot x 0.75 inch) mast (factory-provided).
33. Mount the (two) grounding C-clamps (factory-provided) to the 0.6 meter (2 foot) mast within 177 mm (7 inches) of the threads on the wrapped end.
34. Feed the cable from the lightning protector through the weather-resistant conduit and the 0.6 meter (2 foot) mast, and out the side plate opening of the conduit-T. Ensure the cable connector emerges from the conduit end with the pipe thread tape, and at least 0.3 meter (1 foot) of twinax cable protrudes from the opening (Figure 19B).
35. Screw the 19 mm (0.75 inch) end of the second reducing bushing (on the bottom of the conduit-T) onto the 0.6 meter (2 foot) mast.
36. Attach the weather-resistant conduit to the mast, following company installation practices.
37. Adjust the position of the C-clamps to align with the screw holes in the side of the conduit-T (Figure 19C).
38. Slide the 76 mm (3 inch) piece of clear vinyl tubing (factory-provided) onto the cable from the outside lightning protector.
39. If using Type 2 lightning protectors, ignore this step. If using Type 1 lightning protectors, use Step a through Step m, to attach twinax BNC connectors to the cables used to make the following connections (Figure 20):
 - One end of the cable used to connect the (outside) lightning protector to the antenna cable
 - Both ends of the cable used to connect the outside and inside lightning protectors (dual lightning protector scheme)
 - One end of the cable used to connect to the (inside) lightning protector to the DCD-LPR
 - a. Place the clamp nut onto the cable (Figure 20B).
 - b. Remove the cable outer jacket (Figure 20B).
 - c. Fold the shield(s) back over the outer jacket (Figure 20C).
 - d. Cut and strip the conductors (Figure 20C), then lightly tin.
 - e. Install the cone under the shield. Continue to push the cone until the shield is flush with the edge of the cone.

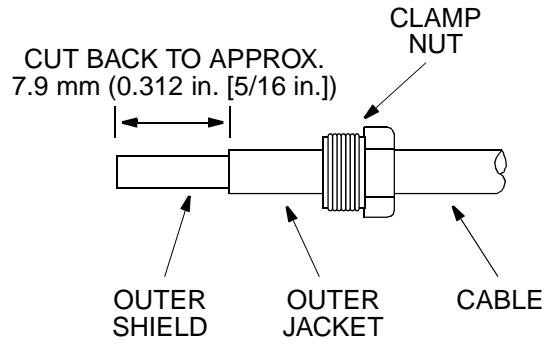
Note: Insert the cone as far as possible; in some cases, a gap will exist between the cone and the outer jacket.

 - f. Trim the shield to the base of the cone.
 - g. Insert the cone dielectric, hollow side toward the cone, over the conductors, and set into the counter-bore of the cone (Figure 20D).

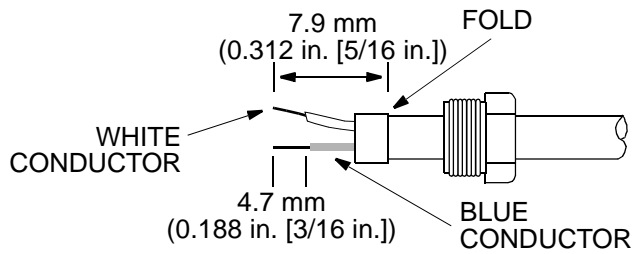
- h. Place the socket and pin over the conductors, into the holes of the cone dielectric, until seated against the cone dielectric (Figure 20E).
 - i. Solder the socket and pin in place.
 - j. Install the stepped dielectric over the socket and pin, with the pin exposed above the short step (Figure 20E).
 - k. Bring the clamp nut up onto the tapered portion of the cable.
 - l. Assemble the body assembly over the entire assembly, and engage with the clamp nut (Figure 20F).
 - m. Wrench tighten to 11 kg to 16 kg (25 pounds to 35 pounds) torque.
- Note:** If difficulty is encountered while installing the cone or engaging threads, assembly may be eased by warming the cable jacket with a heat gun or soldering iron.
- 40. Connect the antenna cable to the (outside) lightning protector cable.
 - 41. Slide the vinyl tubing over the connection (made in Step 40), so that no metal is exposed, and secure in place with the supplied tie wrap. It is necessary to maintain isolation between the cable connector body and the conduit-T (Figure 19C).
 - 42. Remove any paint from the area around the screw holes on the outside of the conduit-T.
- Note:** Do not ground through painted surfaces; all grounding connections should be between clean metal surfaces bonded tightly by two bolts. Use an anti-oxidation agent on the clean metal surfaces, and follow company installation procedures.
- 43. Insert a 8-32 x 15.8 mm (5/8 inch) bolt through a lock washer (factory-provided), then through the grounding lug on the antenna ground wire, and through one screw hole (from the inside to the outside) on the side of the conduit-T (see Figure 21 and Figure e22).
 - 44. Repeat Step 43 to the other screw hole, except there is no antenna ground wire for the second hole.
 - 45. Obtain the (factory-provided) 4.115 mm (6 AWG) grounding wire (with two-hole lugs attached at both ends; see Figure 22).
 - 46. On the outside of the conduit-T, thread a nut onto the 8-32 x 15.8 mm (5/8 inch) bolt, the two-hole lug without the crimp sleeve, then a second lock washer, and secure with the second nut (factory-provided) (see Figure e21).
 - 47. Connect the 4.115 mm (6 AWG) grounding wire to the C-clamps, as illustrated in Figure 21.



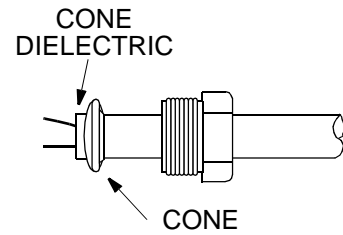
A. Connector Parts



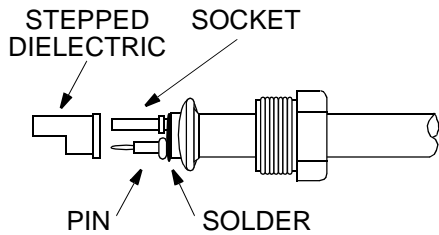
B. Remove outer jacket



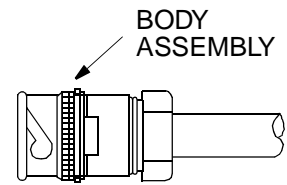
C. Cut and tin conductors



D. Cone and cone dielectric



E. Solder pin and socket



F. Attach body assembly

Figure 20. Twinax BNC Connector Assembly

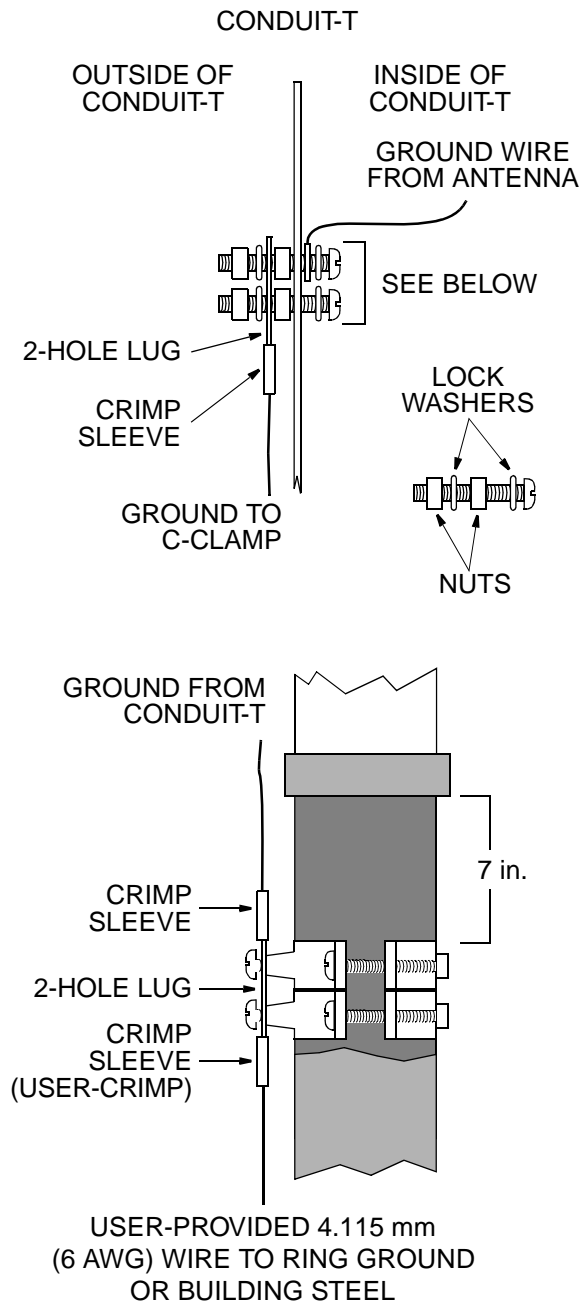


Figure 21. Grounding Wire Connections

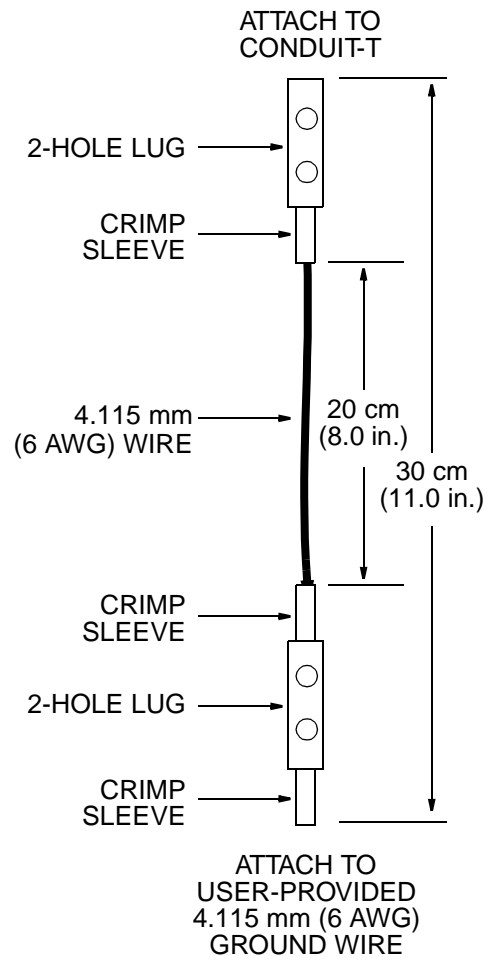


Figure 22. Grounding Wire with Two-Hole Lugs

48. Adjust the position of the C-clamps on the pipe so that the 4.115 mm (6 AWG) wire is straight between the conduit-T and the C-clamps.

Note: If any LTI grounding wires cross other principle grounding wires, it may be necessary to bond the two wires together (at the intersection), to prevent arcing, voltage induction, and fault voltage differences. Follow company installation and grounding procedures.

49. Loop all cables, and secure with a tie wrap; place the cables inside the conduit-T (see Figure 19D).
50. Place the conduit cover gasket on the inside of the conduit cover (factory-provided). Place the cover over the side plate opening; secure the cover to the conduit-T with the two provided screws (Figure 19D).
51. Crimp the user-provided 4.115 mm (6 AWG) (or larger) grounding wire to the crimp sleeve, as illustrated in Figure 22, to the ring ground on the roof of the building (Figure 19D).

Note: If grounding wires cross any other type of principle grounding wire, it may be necessary to bond the two wires together (at the intersection), to prevent arcing. Also, ensure that no unnecessary loops (no coiling) or hard turns on any ground wire occurs (to minimize inductance), following company installation procedures.

52. Double check all connections for tightness, to prevent arcing and intermittent operation.
53. Secure the mast/weather-resistant conduit to another conduit, a tower, or other fixture, using 19 mm (0.75 inch) U-bolts or other appropriate hardware, following company installation procedures.

F. Lightning Protector(s)

3.15 Symmetricom offers two types of LORAN lightning protectors: “Type 1” and “Type 2.” Type 1 lightning protectors have BNC connectors (Figure 23). Type 2 lightning protectors have screw-type connectors (Figure 24). When information applies to both types, reference will be made as “lightning protector(s).” Installation procedures for both lightning protector types are included in this section.

3.16 The various models of lightning protectors may be labeled slightly different. For this reason, when connections are made, reference will be made as “LPR” to indicate the connector on the lightning protector closest to the DCD-LPR Shelf, and “ANTENNA” as the connector on the lightning protector closest to the LORAN antenna.

Caution: *If installing more than one antenna (GTR or LORAN), under no circumstances are the two systems to be grounded together. Each system must have its own connection to ground.*

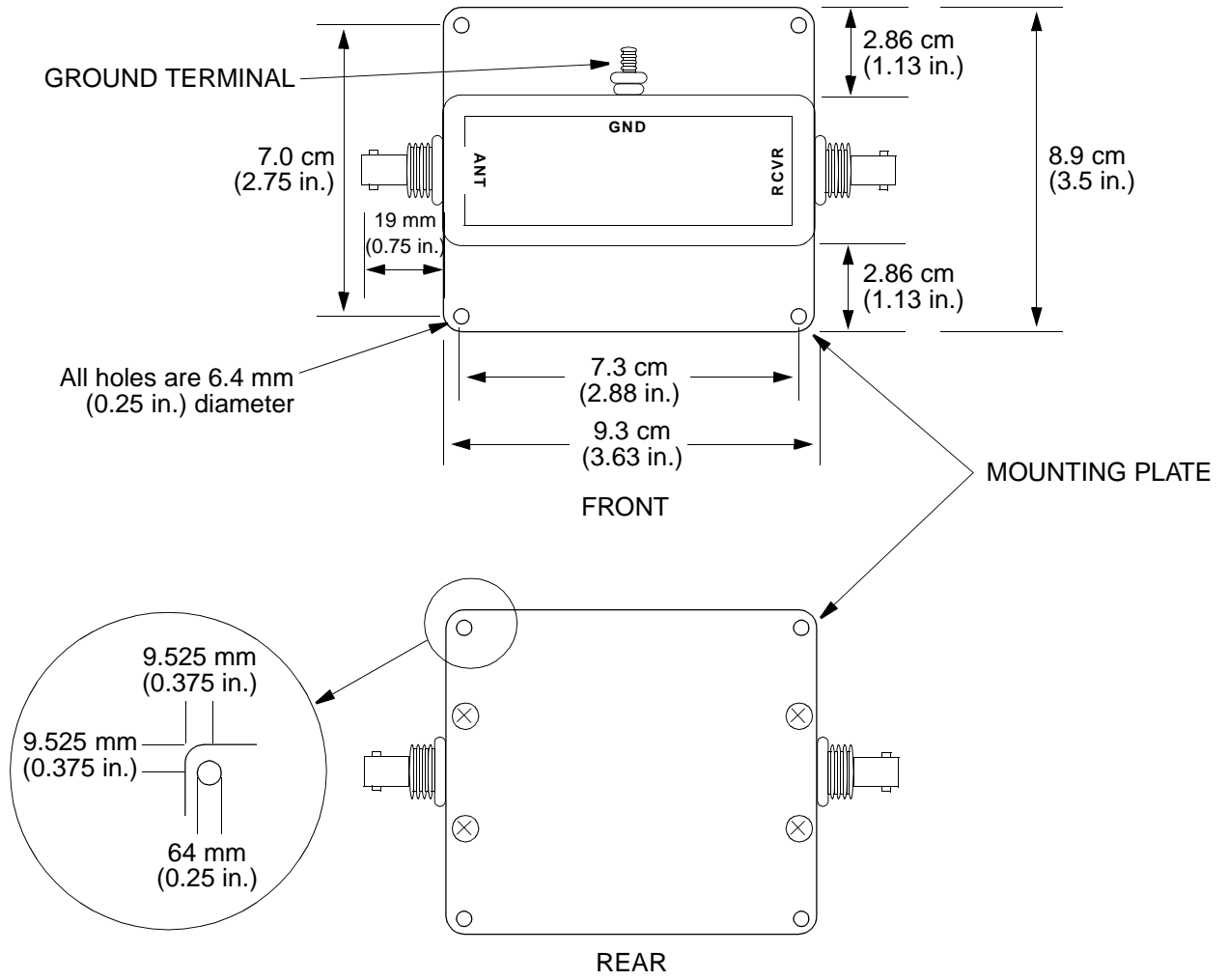


Figure 23. LORAN Type 1 Lightning Protector

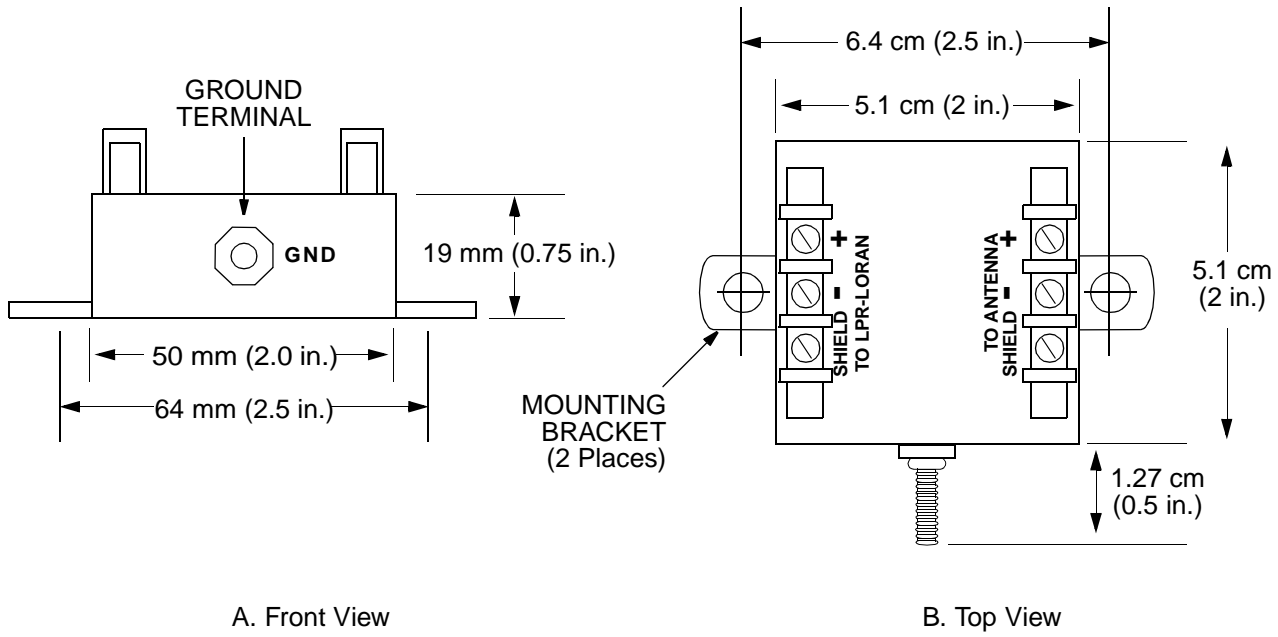


Figure 24. LORAN Type 2 Lightning Protector

Single Lightning Protector Installations

Note: The single lightning protector scheme is recommended for locations which do not have the inside and outside ground points connected to an OPGP.

3.17 This procedure pertains to initial installations at sites where the lightning protector is located within 3 meters (10 feet) of where the LORAN twinax cable enters the building. If the lightning protector is located at a distance more than 3 meters (10 feet) from the cable entrance, either relocate it to within 3 meters (10 feet) of the entrance, or if this is an upgrade to an existing site, contact Symmetricom CTAC for information.

3.18 The screw connections for Type 2 lightning protector connections are designed to accommodate spade lug connectors. The spade lugs should be the type to accommodate a 1.02 mm to 0.644 mm (18 AWG to 22 AWG) stranded wire, with a #6 stud size, and no more than 6.4 mm (0.25 inch) wide.

3.19 Inside the building, within 3 meters (10 feet) from the cable entry point, following company installation and grounding procedures, perform the following:

Note: The lightning protector should be mounted such that the ANTENNA end is pointed towards the entrance of the LORAN cable into the building, and the LPR end is pointed in-line with the LORAN cable from the DCD-LPR Shelf.

1. Install the lightning protector in the junction box (if provided), securing it inside, following company installation practices.
2. If using twinax cables other than ones purchased from Symmetricom, write down the color of each lead connected to the + and – terminals for making connection to the lightning protector and the antenna.

Note: Ensure that wiring continuity is maintained when making twinax cable connections.

3. Connect a 4.115 mm (6 AWG) (or larger for longer cable runs) wire from the ground terminal on the side of the lightning protector to the primary protection ground in the building.

Notes:

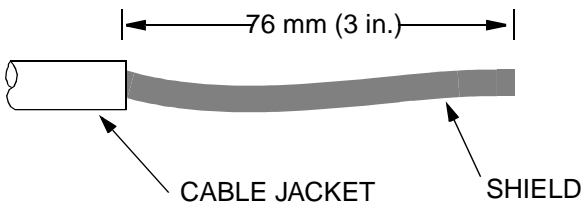
a. Ensure that the grounding wire is run as short and straight as possible. Do not run grounding wire through cable ducts. If grounding wires to the protector connect to any other type of grounding wire, i.e., to ring or building ground, it is necessary that the connection be bonded (following company installation practices), to prevent arcing. Also, ensure that no unnecessary loops (no coiling) or hard turns on any ground wire occur.

b. The other end of the C.O. ground cable must be connected to a C.O. ground plate that is bonded to the Office Principal Ground Point (OPGP). If such a ground is not available, an acceptable alternative would be to bond the end of the C.O. ground cable from the lightning protector to the nearest commercial AC green wire ground. The OPGP C.O. ground is the preferred ground, even if it is further away than the AC ground.

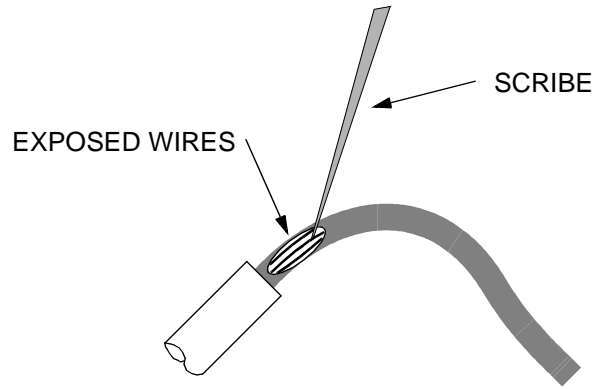
4. Use Step a through Step k below, to attach spade lug connectors to the cable used to make the following connections:

Note: Allow sufficient pigtail length of the + and – leads, and the shield, for ease of connection to the lightning protector and ground terminal. Consider future maintenance when determining the pigtail length (no wire or cable should have a complete loop in it).

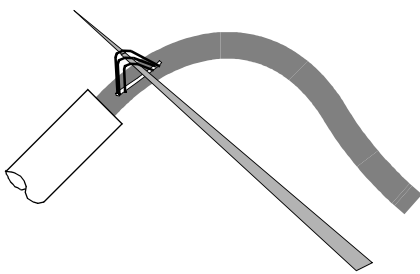
- Type 1 lightning protector to the DCD-LPR. Attach spade lug connectors to the end of the cable used to connect the lightning protector to the DCD-LPR, but do not attach a lug to the shield; instead, cut off the shield and tape back (per company practice).
 - Type 2 lightning protector to the antenna. Attach spade lug connectors to the end which connects to the lightning protector.
 - Type 2 lightning protector to the DCD-LPR. Attach spade lug connectors to both ends, but at one end, do not attach a lug to the shield; instead, cut off the shield and tape back (per company practice).
- a. Strip 76 mm (3 inches) off the cable jacket (Figure 25A).



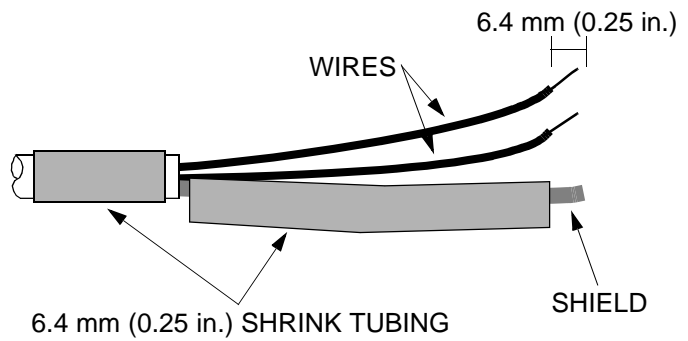
A. Cable Preparation



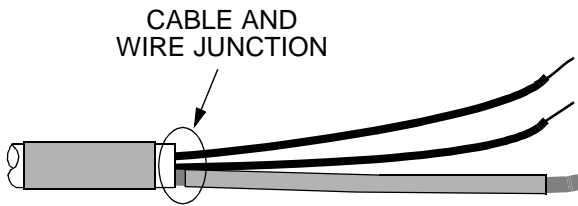
B. Exposing Wire



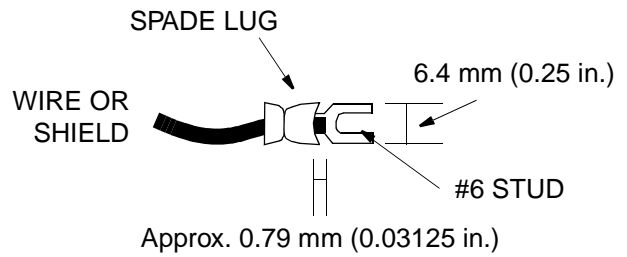
C. Separating Wires From Shield



D. Shrink Tubing



E. Cable and Wire Junction



F. Terminal Lug Connector

Figure 25. LORAN Antenna Power Cable Connector Preparation

- b. Using a scribe, carefully move the shield aside, to expose the wires (Figure e25B).
- c. Once the wires are exposed, use the scribe to pull the wires out of the shield (Figure 25C).
- d. Clip off the filler wires. On the remaining wires, strip 6.4 mm (0.25 inch) of plastic covering off each wire (Figure 25D). Trim the shield to the same length as the wires.
- e. Slide a 25.4 mm (1 inch) length of 6.4 mm (0.25 inch) shrink tubing over the wires (and shield), and onto the cable jacket (Figure 25D).
- f. Slide a 70 mm (2.75 inch) length of 6.4 mm (0.25 inch) shrink tubing over the shield, leaving approximately 6.4 mm (0.25 inch) of the shield exposed (Figure 25D) at the end.
- g. Using company practice, shrink tubing over the shield.
- h. Slide the 25.4 mm (1 inch) length of 6.4 mm (0.25 inch) shrink tubing over the cable jacket and wire junction (to cover any exposed shield) (Figure 25E).
- i. Using company practice, shrink tubing over the junction.
- j. Attach a blue lug (for 1.63 mm to 1.29 mm [14 AWG to 16 AWG] wire), to fit a #6 stud, onto the shield.
- k. Attach a red lug (for 1.02 mm to 0.644 mm [18 AWG to 22 AWG] wire), to fit a #6 stud, onto each of the wires.

Notes:

- 1) When attaching the shield/wire to the lug, 0.79 mm (0.03125 inch) should protrude above the lug barrel (Figure 25F).
- 2) The two twinax cable wires are to be connected to the + and – connectors of the lightning protector (Figure 24); either wire can be connected to either connector, but *this wiring must be continued for all lightning protector connections.*

5. Connect the twinax cable from the antenna to the ANTENNA side of the lightning protector:

Type 1: Connect the cable to the lightning protector (Figure 26).

Type 2: Connect the + and – leads, and shield, to the lightning protector, ensuring that the + lead connects to the “+” terminal, and the – lead connects to the “–” terminal (Figure 10).

Caution: DC polarity must be maintained. If not, the DCD-LPR and antenna will not function.

6. Connect the twinax cable from the DCD-LPR to the LPR side of the lightning protector:

Type 1: Connect the cable to the lightning protector (Figure 26).

Type 2: Connect the + and – leads, and shield, of the twinax cable from the DCD-LPR to the lightning protector, ensuring that the + lead connects to the “+” terminal, and the – lead connects to the “–” terminal (Figure e10).

7. Use antioxidant on all connections.
8. Check all connections for tightness, to prevent arcing and intermittent operation.
9. Secure and seal the cover on the junction box (if used).
10. After the antenna installation is completed, weatherproof all openings around the conduit-T, side plate opening, side hole plug, 0.6 meter (2 foot) mast/metal conduit connection, junction box surrounding the lightning protector, and where the conduit enters the building, following company installation procedures, using an appropriate waterproofing material, e.g., silicone glue and sealer.
11. Spray all exposed connectors with an electrically conductive anti-corrosion compound (e.g., Kopr-Shield).

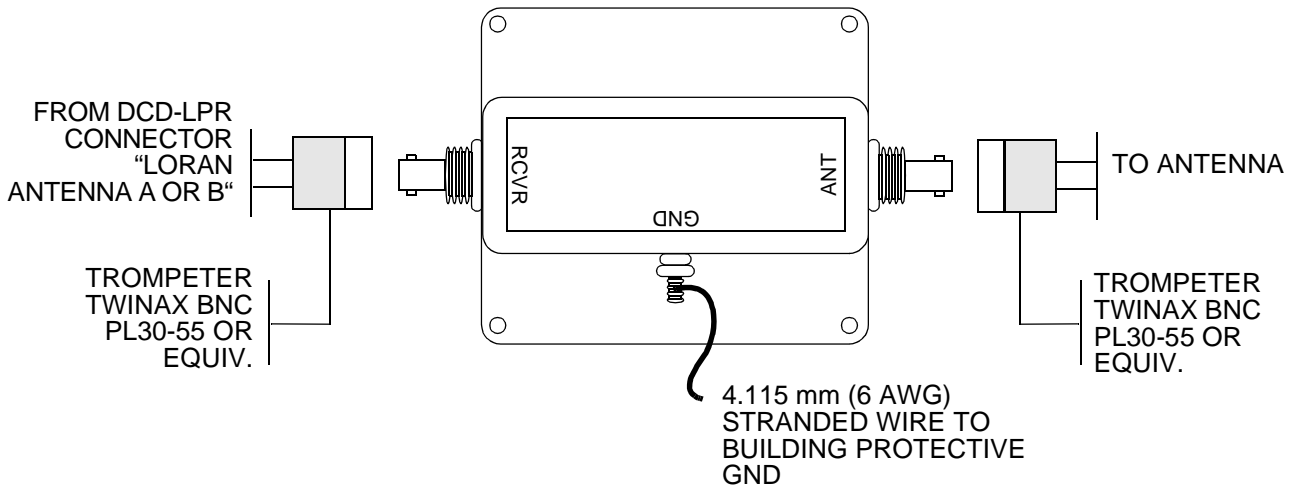
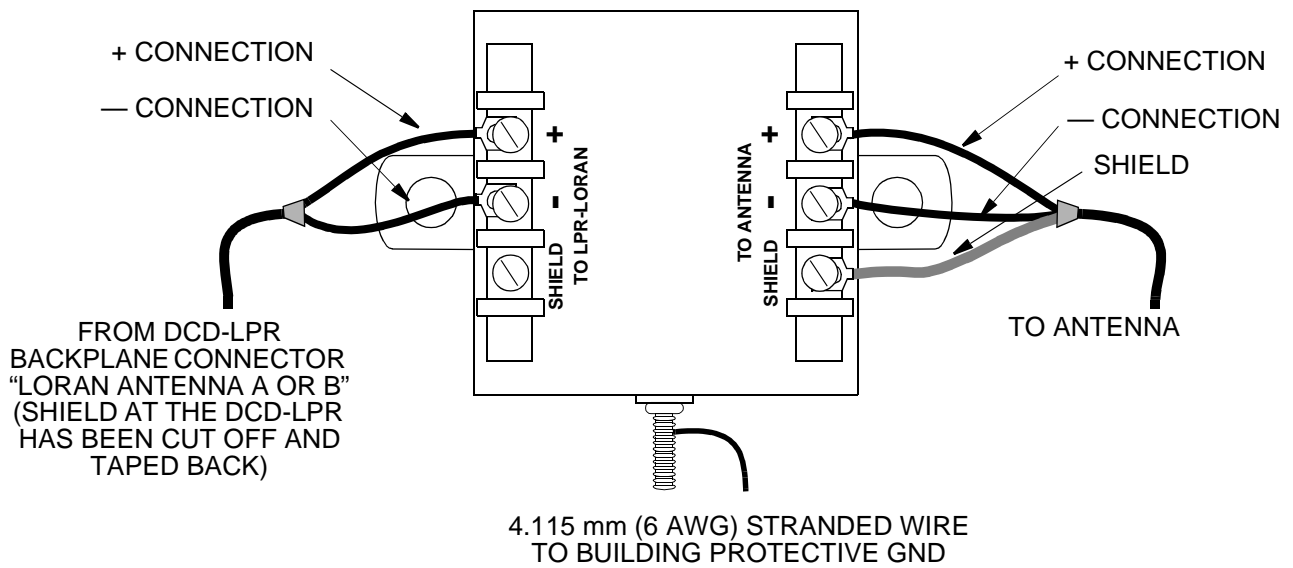


Figure 26. LORAN Type 1 Lightning Protector Connections (Single Lightning Protector)



Note: Maintain wire lead polarity, to ensure proper operation.

Figure 27. LORAN Type 2 Lightning Protector Connections (Single Lightning Protector)

Dual Lightning Protector Installations

Caution: *If installing more than one antenna (GTR or LORAN), under no circumstances are the two systems to be grounded together with one common wire. Each system must have separate ground points.*

Caution: *Do not ground both protectors together with one common wire; the outside and inside protectors must have separate ground points.*

Note: The dual lightning protector scheme can be used in locations that have the inside and outside ground points connected to an OPGP.

3.20 In dual lightning protector installations, the antenna is provided with two lightning protectors, one specifically designated for use outside the building, and the other for inside the building. Ensure that the outside protector is only installed outside the building, and the inside protector is only installed inside the building.

Inside Installation

3.21 Just inside the building, the inside lightning protector will be installed and connected to the cable from the outside lightning protector. At this point, the lightning protector ground connection is attached to building ground. A twinax cable will be connected from the LPR end of the inside lightning protector to the DCD-LPR. Follow company installation procedures for mounting, installing, and grounding lightning protectors.

Note: To maintain antenna-to-DCD-LPR integrity, do not attempt to use lightning protectors other than the ones supplied with the LTI System.

Warning: *Make sure that the lightning protectors are mounted away from devices or cabling that may induce arcing.*

3.22 Install the inside lightning protector as follows:

Note: The lightning protector is a cable in-line device. Follow company installation procedures when mounting the protector.

1. Install the lightning protector in the junction

box (if provided), securing it inside, following company installation practices.

2. If using twinax cables other than ones purchased from Symmetricom, write down the color of each lead connected to the + and – terminals for making connection to the lightning protector (and antenna, if using the Type 2 lightning protector).

Note: Ensure that wiring continuity is maintained when making twinax cable connections.

3. Connect a 4.115 mm (6 AWG) (or larger for longer cable runs) wire from the ground terminal on the side of the lightning protector to the primary protection ground in the building.

Notes:

a. Ensure that the grounding wire is run as short and straight as possible. Do not run grounding wire through cable ducts. If grounding wires to the protector connect to any other type of grounding wire, i.e., to ring or building ground, it is necessary that the connection be bonded (following company installation practices), to prevent arcing. Also, ensure that no unnecessary loops (no coiling) or hard turns on any ground wire occur.

b. The other end of the C.O. ground cable must be connected to a C.O. ground plate that is bonded to the Office Principal Ground Point (OPGP). If such a ground is not available, an acceptable alternative would be to bond the end of the C.O. ground cable from the lightning protector to the nearest commercial AC green wire ground. The OPGP C.O. ground is the preferred ground, even if it is further away than the AC ground.

4. Use Step a through Step k below, to attach spade lug connectors to the cable used to make the following connections:

- Type 1: inside lightning protector to the DCD-LPR. Attach spade lug connectors to the end of the cable used to connect the inside lightning protector to the DCD-LPR, but do not attach a lug to the shield; instead, cut off the shield and tape back (per company practice).

- Type 2: outside lightning protector to the anten-

- na. Attach spade lug connectors to the end of the cable which connects to the outside lightning protector.
- Type 2: outside lightning protector to the inside lightning protector. Attach spade lug connectors to both ends. It is recommended to make a shield connection at the inside lightning protector; if not, at one end, do not attach a lug to the shield, but cut off the shield, and tape back (per company practice).
 - Type 2: inside lightning protector to the DCD-LPR. Attach spade lug connectors to both ends, but at one end, do not attach a lug to the shield; instead, cut off the shield, and tape back (per company practice).
- a. Strip 76 mm (3 inches) off the cable jacket (Figure 25A).
 - b. Using a scribe, carefully move the shield aside, to expose the wires (Figure e25B).
 - c. Once the wires are exposed, use the scribe to pull the wires out of the shield (Figure 25C).
 - d. Clip off the filler wires. On the remaining wires, strip 6.4 mm (0.25 inch) of plastic covering off each wire (Figure 25D). Trim the shield to the same length as the wires.
 - e. Slide a 25.4 mm (1 inch) length of 6.4 mm (0.25 inch) shrink tubing over the wires (and shield), and onto the cable jacket (Figure 25D).
 - f. Slide a 70 mm (2.75 inch) length of 6.4 mm (0.25 inch) shrink tubing over the shield, leaving approximately 6.4 mm (0.25 inch) of the shield exposed (Figure 25D) at the end.
 - g. Using company practice, shrink tubing over the shield.
 - h. Slide the 25.4 mm (1 inch) length of 6.4 mm (0.25 inch) shrink tubing over the cable jacket and wire junction (to cover any exposed shield) (Figure 25E).
 - i. Using company practice, shrink tubing over the junction.
 - j. Attach a blue lug (for 1.63 mm to 1.29 mm [14 AWG to 16 AWG] wire), to fit a #6 stud, onto the shield.
 - k. Attach a red lug (for 1.02 mm to 0.644 mm [18 AWG to 22 AWG] wire), to fit a #6 stud, onto each of the wires.

Notes:

- 1) When attaching the shield/wire to the lug, 0.79 mm (0.03125 inch) should protrude above the lug barrel (Figure 25F).
- 2) The two twinax cable wires are to be connected to the + and – connectors of the lightning protector (Figure 24); either wire can be connected to either connector, but *this wiring must be continued for all lightning protector connections.*
5. Using the cable designated for the inside-to-outside lightning protector connection, connect the cable to the ANTENNA end of the inside lightning protector:

Type 1: Connect to the lightning protector (Figure 28).

Type 2: Connect the + and – leads to the lightning protector (Figure 29). It is recommended to connect the shield to the ANTENNA end of the inside lightning protector. If not, tape the shield back per company practice.

Caution: DC polarity must be maintained. If not, the DCD-LPR and antenna will not function.

Note: Inside the building, (per company practice) at the entrance point, provide a “drip loop” with a maximum 0.3 meter (1 foot) radius for cable slack and to provide a water drip point.

6. Using the cable designated for the inside-lightning-protector-to-DCD-LPR connection, connect the cable to the LPR end of the inside lightning protector:

Type 1: Connect the end of the cable with the BNC connector to the lightning protector (Figure 28).

Type 2: Connect the + and – leads, and shield, of the end of the cable with three spade lugs to the lightning protector (being sure to maintain wire lead polarity (Figure 29).

Note: Do not connect to the DCD-LPR Shelf at this time.

Caution: *Twinax and antenna ground runs must never loop or have hard right-angle turns. Avoid hard (tight) corner small radius turns and any unnecessary turns. The minimum bending radius is*

eight inches. All bends must be 90 degrees or greater.

7. Use antioxidant on all connections.
8. Check all connections for tightness, to prevent arcing and intermittent operation.
9. Proceed to the next section for instructions on installing the outside lightning protector.

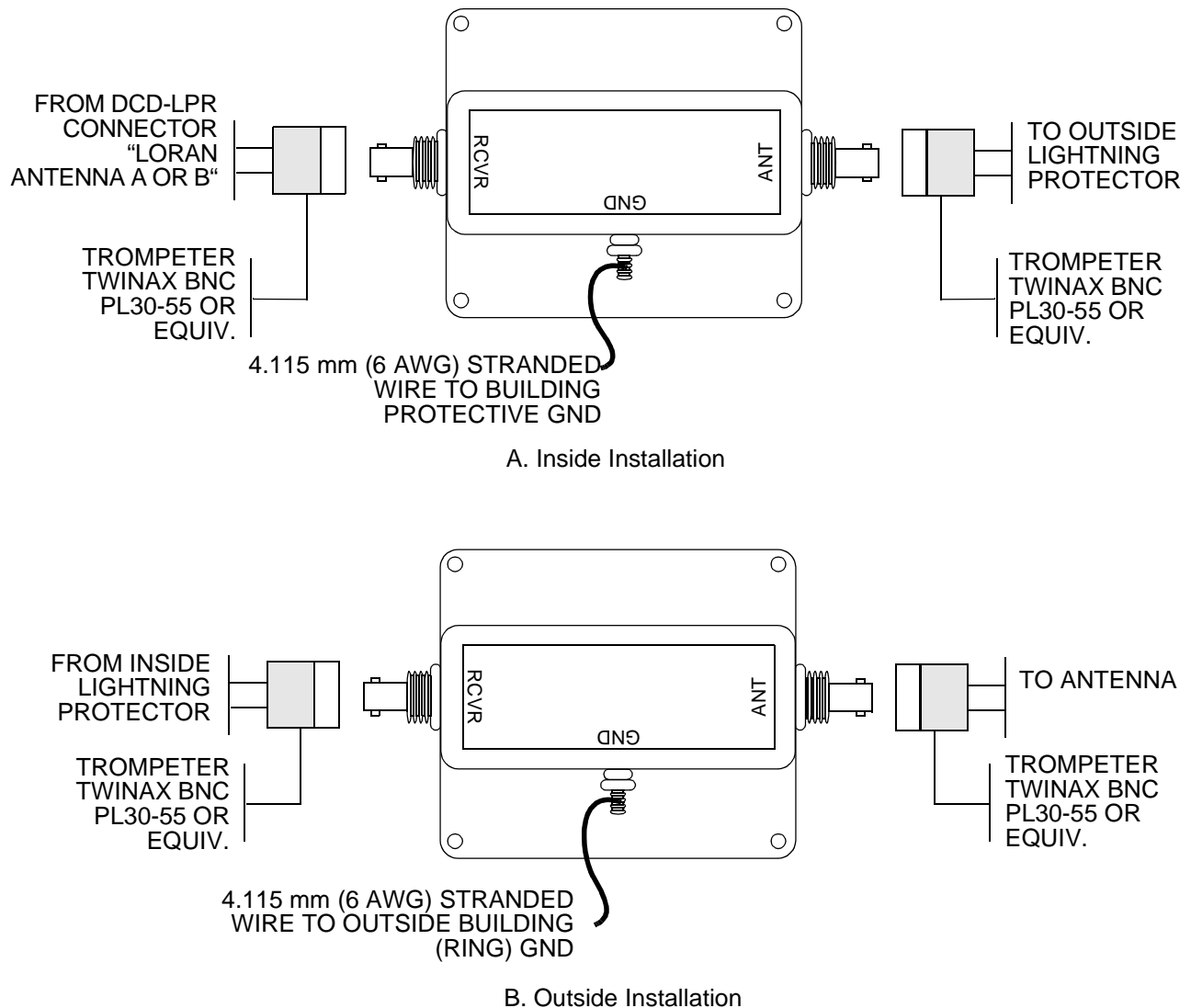
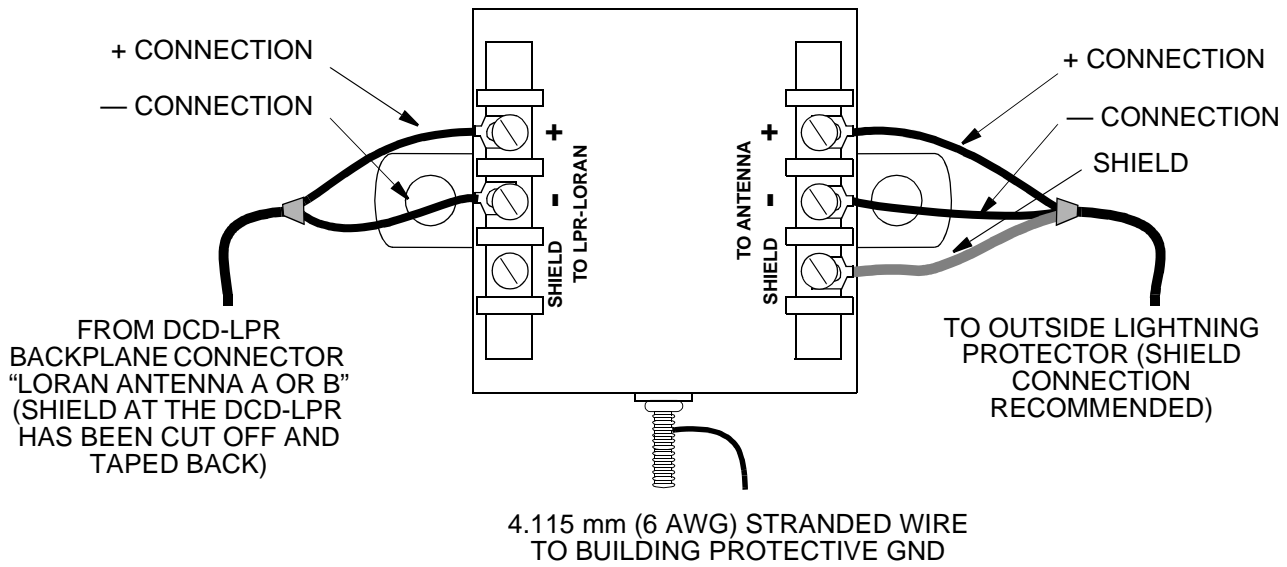
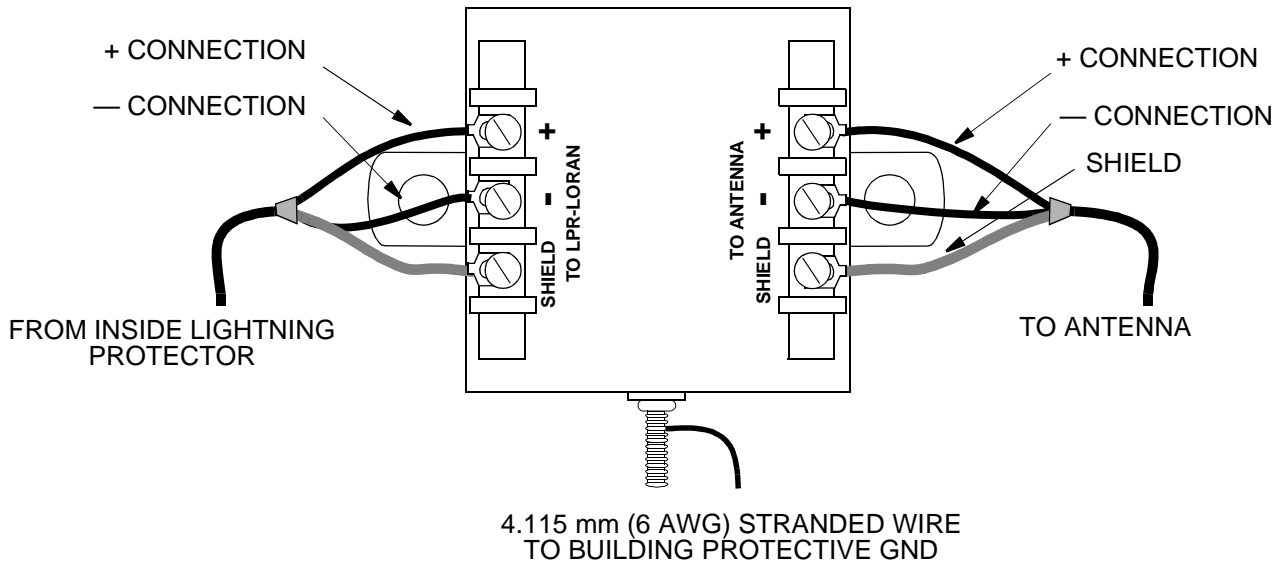


Figure 28. LORAN Type 1 Lightning Protector Connections (Dual Lightning Protectors)



Note: Maintain wire lead polarity, to ensure proper operation.

A. Inside Installation



Note: Maintain wire lead polarity, to ensure proper operation.

B. Outside Installation

Figure 29. LORAN Type 2 Lightning Protector Connections (Dual Lightning Protectors)

Outside Installation

3.23 The outside lightning protector must be contained in a weather-resistant junction box (i.e., a Carlon [Lamson and Sessions] 30 cm x 30 cm x 15 cm [12 inches x 12 inches x 6 inches] weather-resistant junction box, [refer to Table C for part number]). Proceed with the following instructions, to install the outside lightning protector.

1. Install a conduit fitting to each end of the junction box to connect to the conduit (a minimum 50.8 mm [2 inch] conduit is recommended).
2. Following company installation practices, attach the weather-resistant conduit to the junction box designated for the outside lightning protector, and connect to the building, following the Installation Job Specification. This conduit will be used to contain cable runs on the roof, if applicable.

Note: The junction box must be large enough to house the lightning protector, with enough space to allow for performing the various lightning protector connections.

3. Insert the outside lightning protector into the junction box; secure following company installation practices.
4. Connect the cable from the inside lightning protector to the LPR end of the outside lightning protector:

Type 1: Connect to the lightning protector (Figure 28).

Type 2: Connect the + and – leads, and shield to the lightning protector (Figure 29), being sure to maintain wire lead polarity established in the inside installation.

5. Connect the twinax cable from the antenna to the ANTENNA side of the outside lightning protector:

Type 1: Connect the cable to the lightning protector (Figure 28).

Type 2: Connect the + and – leads, and shield to the lightning protector, ensuring that the + lead connects to the “+” terminal, and the – lead connects to the “–” terminal (Figure 29).

6. Make the appropriate grounding connections, using Figures 19, 21, 28, and 29, and the following guidelines for reference:
 - a. The ground connection to the lightning protector should be made, following company installation procedures, and be connected to a metal conduit, or ring ground with a 4.115 mm (6 AWG) (or larger for longer cable runs) wire. A hole should be drilled through the outside of the junction box, and a conduit fitting installed, for the ground cable to be placed inside the junction box.
 - b. When attaching a ground wire to building ground, drill a hole in the ground casing, remove paint from the area of the screw hole, cover with an anti-oxidation agent, and secure the ground lug (following company installation practices).
 - c. If grounding wires cross any other type of principal grounding wire, it may be necessary to bond the two wires together (at the intersection) to prevent arcing (following company installation practices). Also, ensure that no unnecessary loops or hard turns on any ground wire occur (this will minimize inductance).
7. Check all connections for tightness, to prevent arcing and intermittent operation.
8. After the antenna installation is completed, weatherproof all openings around the conduit-T, side plate opening, side hole plug, 0.6 meter (2 foot) mast/metal conduit connection, junction box surrounding the outside lightning protector, and where the conduit enters the building, following company installation procedures, using an appropriate waterproofing material, e.g., silicone glue and sealer.
9. Spray all exposed connectors with an electrically conductive anti-corrosion compound (e.g., Kopr-Shield).

4. DCD-LPR INSTALLATION

A. Pre-installation Considerations

4.01 Prior to installation, verify the quality of ground within the building; consult with the office

grounding specialist as to the quality of ground, and grounding protection methods.

4.02 The following is optional: for communications with technical support, or other members of the installation team, ensure there is at least one phone line available within 3 meters (10 feet) of the DCD-LPR.

B. Cables Required

4.03 The cables required for installing the DCD-LPR Shelf and connecting to the DCD Shelf are:

- 0.644 mm (22 AWG), tinned, solid copper, shielded twisted pair cable
- 1.47 mm (16 AWG) stranded wire
- 4.115 mm (6 AWG) (or larger) copper grounding wire
- Two RG-59 75 ohm coax cables with appropriate connectors
- DB25-to-DB25 shielded standard RS-232 ribbon cable (factory-provided)

4.04 To make the DS1 connection from the DCD-LPR to the DCD Shelf, 0.644 mm (22 AWG), tinned, solid copper, shielded twisted pair cable may be needed. This cable must be provided by the user. To make the E1 connection from the DCD-LPR to the DCD Shelf, a cable with an SMB connector at the LPR end is required. Depending on the type of input connector at the DCD Shelf, a certain cable should be used (refer to Table D). This cable must be provided by the user.

4.05 To make the power connections to the DCD-LPR Shelf, 1.47 mm (16 AWG) stranded wire is needed. This cable must be provided by the user.

4.06 For grounding the relay rack containing the DCD-LPR Shelf, 4.115 mm (6 AWG) (or larger) copper grounding wire is recommended. This cable must be provided by the user.

4.07 To make the oscillator connections from the DCD-ST2, or any 500 series, shelf to the DCD-LPR Shelf, two RG-59 75 ohm coax cables with BNC connectors are needed. Two 1.8 meter (6 foot) RG-59 75 ohm coax cables with BNC connectors are provided with the DCD-LPR Shelf. If longer cables are re-

quired (not to exceed 15 meters [50 feet]), these must be provided by the user. (Not used for stand-alone configurations.)

4.08 If connecting to a DCD-419 Shelf (Rev. D or later), two RG-59 75 ohm coax cables, with BNC-to-SMB connectors are required (refer to Table D). This cable must be provided by the user.

Notes:

1. The DCD-LPR can only be used with Rev. D or later revisions of the DCD-419.
2. The revision letter of the DCD Shelf is located on the right rear outside sheet metal shelf, with the part number and serial number. This information may be stamped directly on the sheet metal, or on a large white label.

4.09 Alarm and status information to the DCD Shelf through the MIS card is carried via the factory-provided DB25-to-DB25 shielded cable; a 1.5 meter (5 foot) length of this cable is provided in the MIS modification kit.

Note: Alarm and status information to the DCD Shelf requires that an MIS card be installed in the master shelf.

4.10 To make the Time-of-Day (TOD) adapter to DCD-LPR Shelf connections (for TOD applications), a three-connector ribbon cable (factory-supplied) is required.

4.11 To make the TOD adapter to RS-422-to-RS-232 converter connection(s), one (or two) 0.511 mm (24 AWG) three twisted-pair shielded cable, with a DB9 (male) connector on one end and a DB9 (female) connector on the other end, is required. This cable must be provided by the user, and must not exceed 15 meters (50 feet), if using the 1 pps signal; if not using the 1 pps signal, the cable must not exceed 305 meters (1,000 feet).

4.12 To make the RS-422-to-RS-232 converter to Cisco Systems router connection(s), an RS-232 data communications cable, with a 25-pin male connector on one end and a 25-pin female connector on the other end, is required; not to exceed 15 meters (50 feet). For NTP Type 4 TOD applications, an RS-232 or RS-422 cable can be used.

C. Tools and Materials

4.13 Ensure that the user-provided tools and materials listed in Table D are on hand for the installation.

Table D. Customer Provided Tools and Materials (for DCD-LPR Shelf Installation)

ITEM	COMMENT
TOOLS	
Soldering iron and solder	—
Cable cutting tools	—
Volt-ohm meter	—
Multimeter	—
Wire-wrap tool	—
Small and medium screwdrivers	—
One 15.9 mm (0.625 in. [5/8 in.]) open-end wrench	For attaching connector plugs
MATERIALS	
0.644 mm (22 AWG), tinned, solid copper, shielded twisted pair cable	For DS1 connection from DCD-LPR to DCD Shelf (not used for stand-alone configurations.)
75 Ω cable with SMB connector on one end for DCD-LPR Shelf, and appropriate connector on other end for DCD Shelf	For E1 connection from DCD-LPR to DCD Shelf (not used for stand-alone configurations.) For DCD Shelf BNC input connector: p/n 060-00029-02 (0.6 m [2 ft]), 060-00029-01 (1.2 m [4 ft]), or 060-00029-06 (1.8 m [6 ft]) For DCD Shelf SMB input connector: p/n 060-00040-01 (1.2 m [4 ft]) For DCD Shelf Siemens 1.6/5.6 connector: p/n 060-00045-01 (1.2 m [4 ft])
1.47 mm (16 AWG) stranded wire	For power connections to DCD-LPR Shelf
4.115 mm (6 AWG) (or larger) copper grounding wire	For grounding relay rack containing DCD-LPR Shelf
Two RG-59 75 Ω coax cables with appropriate connectors	Two 1.8 m (6 ft) RG-59 75 Ω coax cables with BNC connectors are provided with DCD-LPR Shelf, to make oscillator connections from DCD-ST2, or any 500 series, shelf to DCD-LPR Shelf. If longer cables required, these must not exceed 1.5 m (50 ft). (Not used for stand-alone configurations.) If connecting to DCD-419 Shelf (Rev. D or later), two RG-59 75 Ω coax cables with BNC-to-SMB connectors required, and must be provided by user.

Table D. Customer Provided Tools and Materials (for DCD-LPR Shelf Installation) (Cont'd)

ITEM	COMMENT
TOOLS	
One or two 0.511 mm (24 AWG), 3 twisted-pair shielded cable (Belden 9680 or equivalent), with appropriate connectors	For TOD adapter connection(s) Cable length should not exceed 15 m (ft) if using 1pps signal, 305 m (1000 ft) if not If RS-422-to-RS-232 converter used, DB9 male and DB9 female connectors required; if converter not used, DB9 female connector(s) not required.
25-pin to 25-pin D (male to female) connectors RS-232 data communications cable	For RS-422-to-RS-232 converter to router connection(s) Not required if converter not used
Additional fuses (Bussman-type 3 A, 5 mm x 20 mm or 0.25 in. x 1.25 in. cartridge fuse, or equivalent)	For power distribution panel fuse replacement
Spade lug connectors to fit a 1.47 mm (16 AWG) wire, 63 mm (0.25 in.) wide, and fit to a #6 stud	—
Stand-alone power supply, p/n 990-40031-01, or equivalent (optional)	For external power source

D. Unpacking

Note: Save packing material. *All equipment returned must be packed in the original packing material.* Contact Symmetricom’s Customer Service Department if additional packaging is needed, or if any damage has occurred.

1. Unpack equipment carefully.
2. Inspect equipment for shipping damage, including bent or loose hardware, and broken connectors.

Inspect pins on the backplane to ensure that none are bent or broken. Notify Symmetricom and the carrier if equipment was damaged in transit.

3. Verify all items have been received. For a parts list, refer to Table M, at the end of this section.
4. Notify Symmetricom if any items are missing.

Note: If problems are encountered during installation, contact Symmetricom’s CTAC for assistance.

E. Assembly and Mounting

Rack Mounting

4.14 For mounting the DCD-LPR Shelf into a 48 cm (19 inch) or 58 cm (23 inch) rack, use the following instructions. The mounting ears can be positioned for flush mount or offset 12.7 cm (5 inches) for either rack.

1. Position the mounting ears for mounting the receiver in a 48 cm (19 inch) or 58 cm (23 inch) rack (Figure 30).

2. Install the DCD-LPR Shelf above a DCD Shelf. If the shelf must be mounted directly above equipment other than Symmetricom's equipment, leave one rack unit beneath the DCD-LPR Shelf for ventilation.

Note: If the DCD-LPR Shelf is not colocated with the DCD Shelf housing the clocks, the maximum oscillator cable length is 15.2 meters (50 feet).

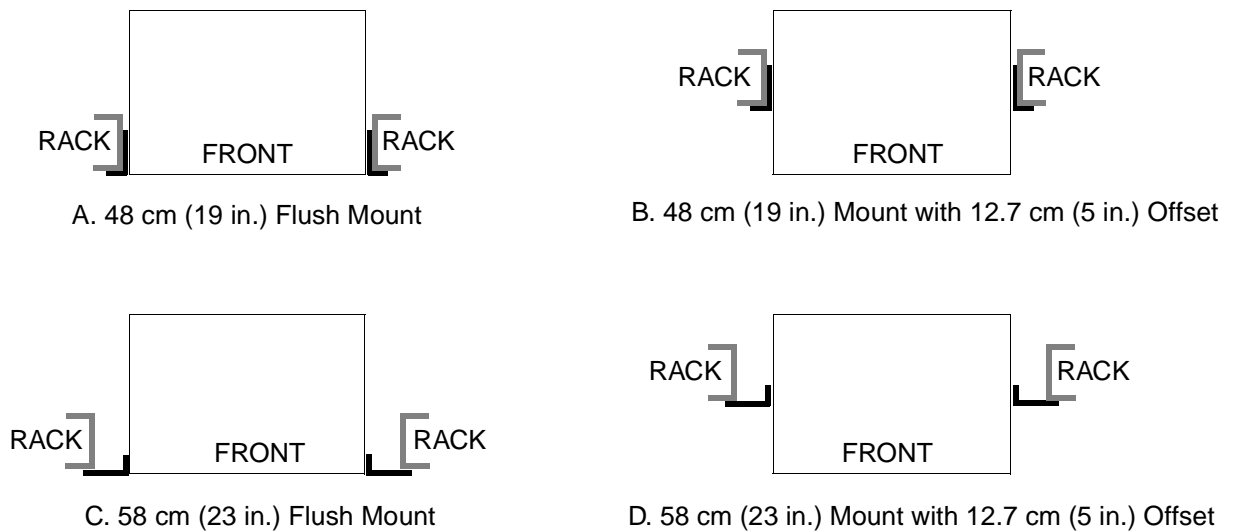


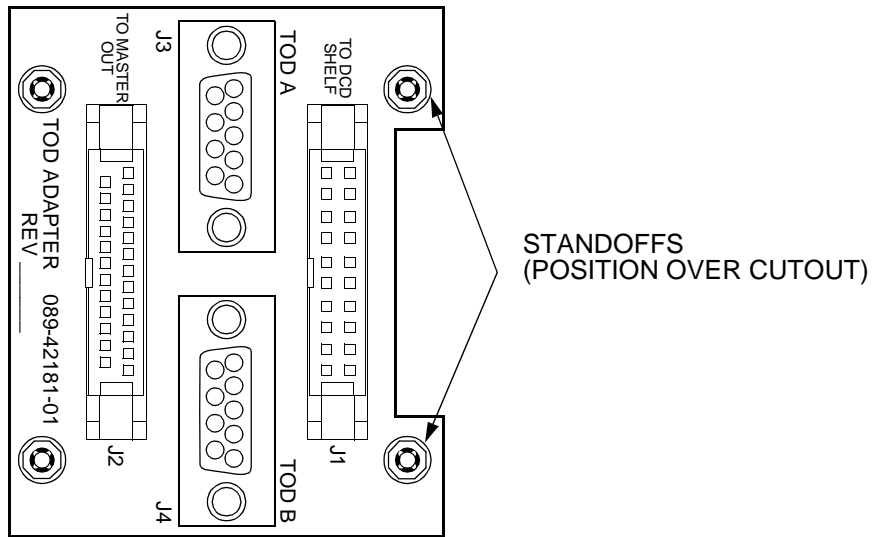
Figure 30. DCD-LPR Shelf Mounting Ears (Top View)

TOD Adapter**Notes:**

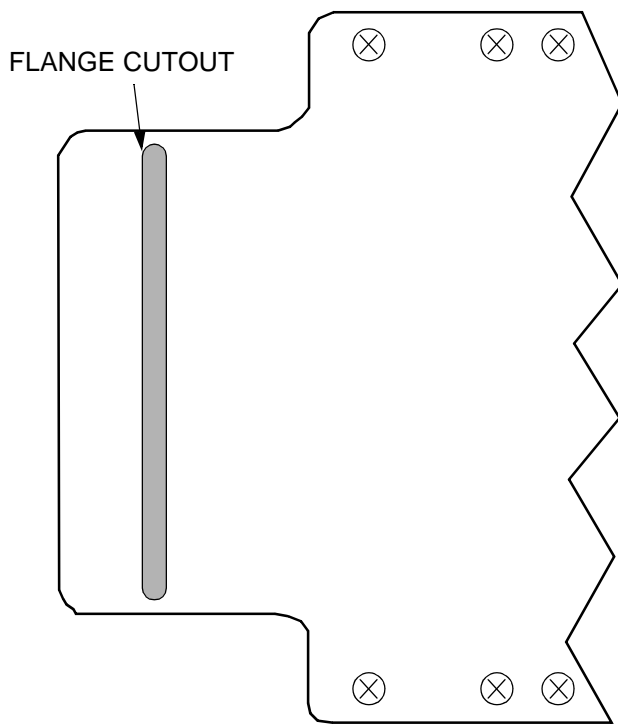
1. Prior to beginning the following procedures, ensure that the appropriate router has been installed, and power applied, per manufacturer's instructions.
2. For NTP Type 4 TOD applications, an RS-232 or RS-422 cable can be used; if an RS-422 cable is used, an RS-422-to-RS-232 converter is not required.

4.15 If configuring the DCD-LPR for TOD applications, once the DCD-LPR Shelf is mounted in the rack, install the TOD adapter and the RS-422-to-RS-232 converter, as follows:

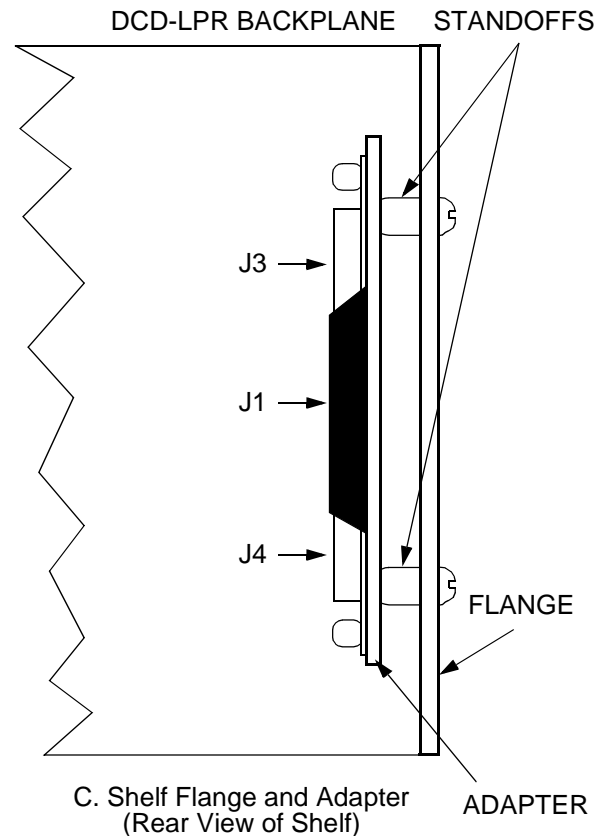
1. Remove the clear plastic backplane cover, and set aside.
2. Obtain the adapter from the kit. Position the adapter such that the standoffs located at the top of the adapter (over the J1 connector) are over the flange cutout (Figure 31 through Figure 33).
3. Using two provided 4-40 screws and split zinc washers, attach the adapter to the flange.
4. Obtain the RS-422-to-RS-232 converter (Figure 34), if used, from the kit, and position where desired (the distance between the adapter and the converter must not exceed 15 meters [50 feet], if using the 1 pps signal; if not using the 1 pps signal, the distance must not exceed 305 meters [1,000 feet]).



A. TOD Adapter

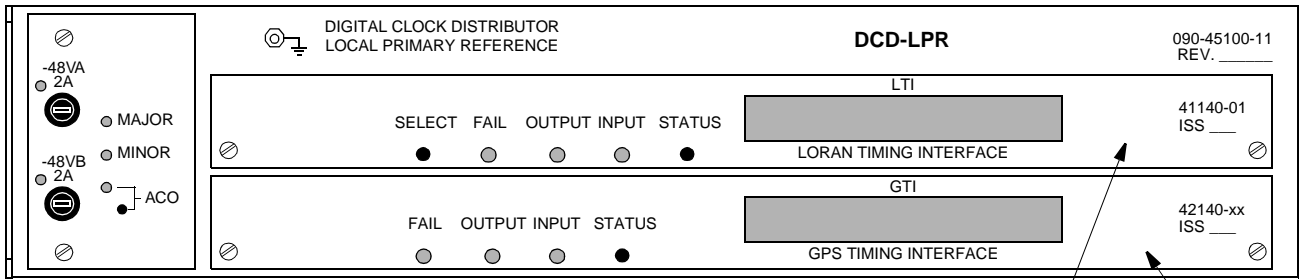


B. Shelf Flange (End View Right Side)



C. Shelf Flange and Adapter (Rear View of Shelf)

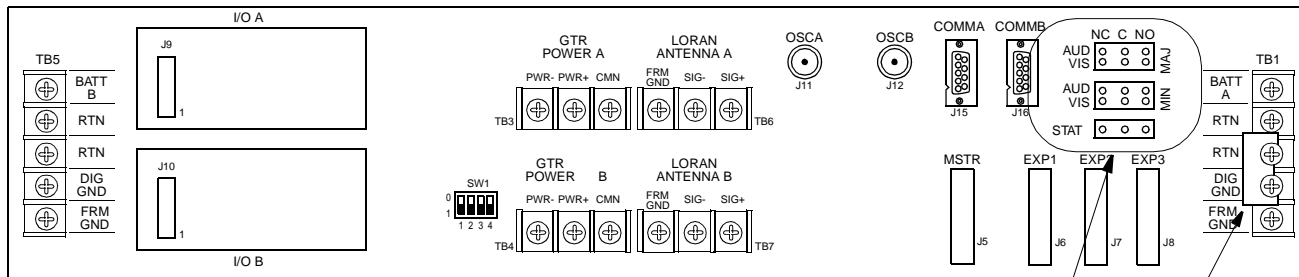
Figure 31. TOD Adapter and Shelf Flange



A. Front Panel

SLOT A (NOTE1)

SLOT B (NOTE1)



TB2 (NOT MARKED)

FACTORY STRAPPED DIG GND TO BATTERY RTN AT TB1

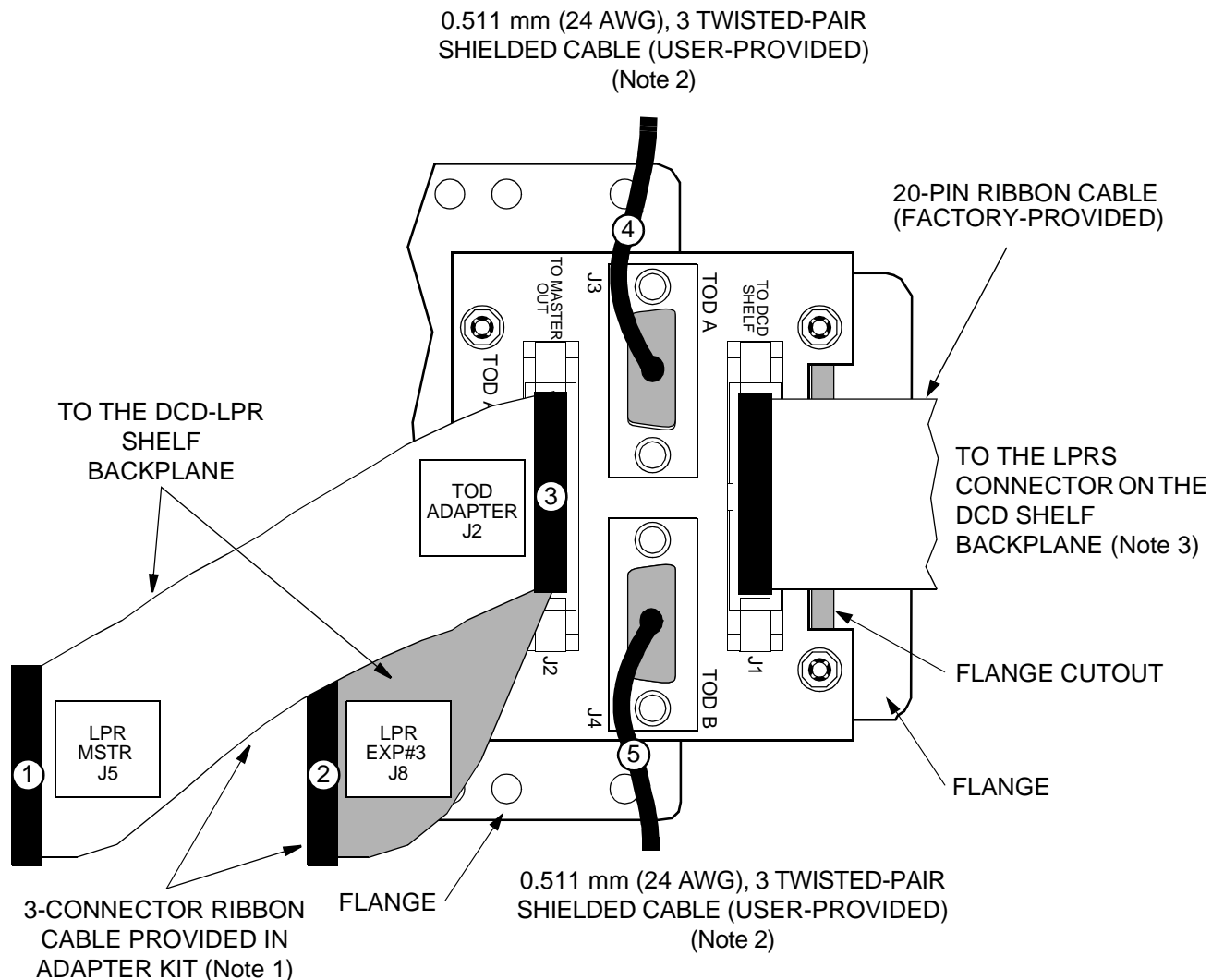
NOTE 2

B. Backplane

Notes:

1. The slot(s) which the LOU, LTI or GTI go into are independent; any card can go into either slot.
2. If configured for TOD, the TOD adapter would be mounted on the flange located on this side of the backplane.

Figure 32. DCD-LPR Shelf (Front and Rear Views)



- ① Connect to the MSTR connector (J5) on the DCD-LPR backplane.
- ② Connect to the EXP 3 connector (J8) on the DCD-LPR backplane
- ③ Connect to the TOD adapter connector (J2).
- ④ Connect to the RS-422 connector on the DTE; if an RS-232 connector is on the DTE, connect to the DB9 connector on the converter designated for GTI A.
- ⑤ Connect to the RS-422 connector on the DTE; if an RS-232 connector is on the DTE, connect to the DB9 connector on the converter designated for GTI B.

Notes:

1. Use care when making the three-connector ribbon cable connections; the applicable connectors are in close proximity of each other.
2. See Table D for connector type; see Table E for pin assignments.
3. For use with the MIS card.

Figure 33. Adapter Positioning and Connections

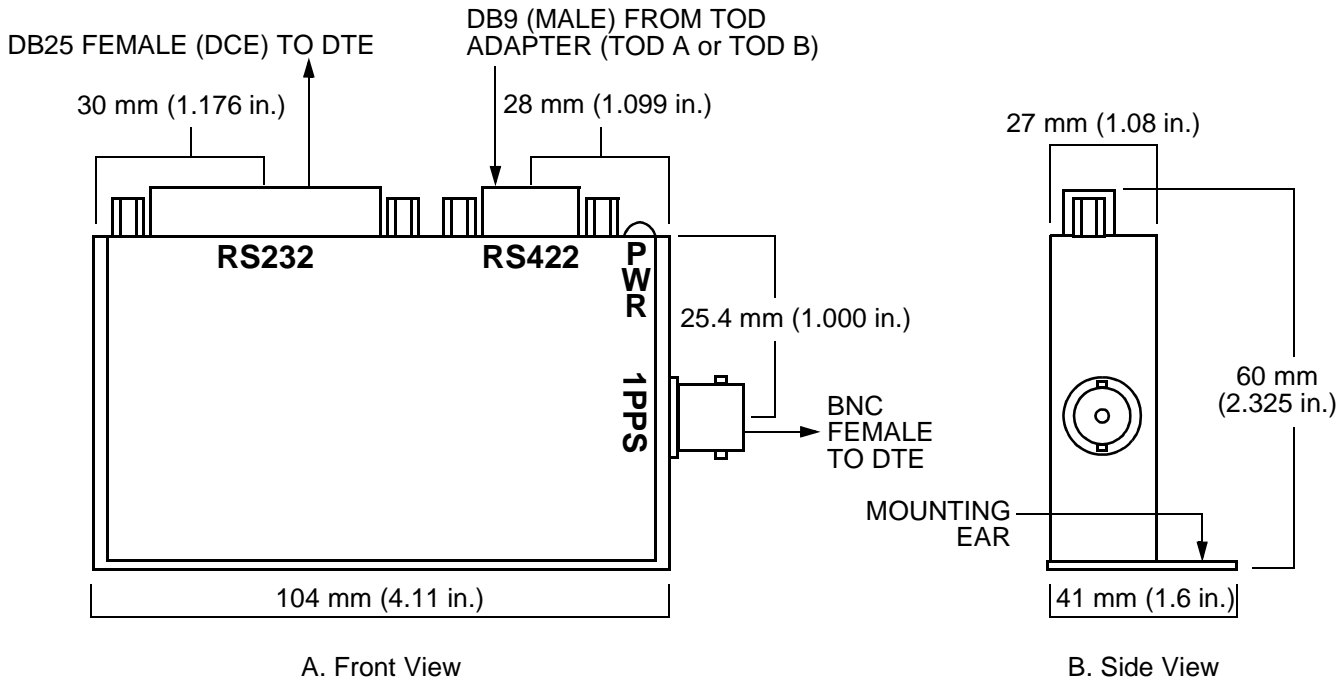


Figure 34. RS-422-to-RS-232 Converter and Connections

5. Use the provided 12-24 screws and flat stainless-steel washers, and the slot and/or cutout in the converter’s mounting ear (Figure 34B), to secure the converter to the desired surface.

6. Obtain the three-connector ribbon cable from the kit, and install the ribbon cable between the DCD-LPR Shelf backplane and the adapter (using Figure 32 and Figure 33 as reference), in the following order:

Note: Use care when making the three-connector ribbon cable connections; the applicable connectors are in close proximity of each other.

- a. Connector labeled “LPR MSTR J5”
- b. Connector labeled “LPR EXP #3 J8”
- c. Connector labeled “TOD ADAPTER J2” on the adapter

7. Obtain the 0.511 mm (24 AWG), three twisted-pair shielded cable(s) (user-provided, Belden 9680 or equivalent). Using company practice and Figure 33, attach a DB9 (male) connector on the

DCD-LPR Shelf end of the cable, and a DB9 (female) connector on the converter end of each cable; Table E contains the pin assignments for the DB9 connector. This is a straight cable (no null).

Table E. Adapter DB9 Connector (J3 and J4) Pin Assignments

PIN	FUNCTION
1	No connection
2	Data + Output (RS-422) (see Note)
3	Data – Output (RS-422) (see Note)
4	No connection
5	Ground (see Note)
6 and 7	No connection
8	1 pps Output (RS-232) (see Note)
9	+12V for RS-232 levels, Maximum 100 mA (see Note)

Note: Connect pins to 3 twisted-pairs: Pins 2 and 3 to one twisted pair, 5 and 8 to second pair; 9 to both wires of third pair.

8. Connect the connectorized cable(s) from TOD A (J3) and/or TOD B (J4) (TOD A is associated with GTI A, and TOD B is associated with GTI B, on the DCD-LPR Shelf) on the adapter to the appropriate DB9 converter connectors (Figure 34). Refer to Table F for DB9 cable pin assignments on the converter.

Table F. Converter DB9 Connector Pin Assignments

PIN	FUNCTION
1	No connection
2	Data + Input (RS-422)
3	Data – Input (RS-422)
4	No connection
5	Ground
6 and 7	No connection
8	1 pps Input (RS-232)
9	+12 V Input

9. Obtain the 25-pin standard data cable (should not exceed 15 meters [50 feet]), and plug one end

into the 25-pin connector on the converter, and the other end into the 25-pin AUX port on the router. (Refer to Table G for the DB25 cable pin assignments on the converter; for the router pin assignments, refer to the documentation supplied with the router.)

Table G. Converter DB25 Connector Pin Assignments

PIN	FUNCTION
1 and 2	No connection
3	Data Output (RS-232)
4	No connection
5	1 pps (RS-232)
6	No connection
7	Ground
8 through 25	No connection

10. Obtain the new clear plastic backplane cover (factory-provided) from the adapter kit, and attach the new clear plastic backplane cover to the backplane.

F. GTR to DCD-LPR Connections

Power Connections

4.16 There are two GTR power connections in single lightning protector schemes:

- One from the GTR to the inside lightning protector
- One from the inside lightning protector to the DCD-LPR Shelf

4.17 Three GTR power connections are required for dual lightning protector schemes:

- One from the GTR to the outside lightning protector
- One from the outside lightning protector to the inside lightning protector
- One from the inside lightning protector to the DCD-LPR Shelf

Note: If using power cables purchased from Symmetricom, the connector is provided with the cable, and the cable wire colors are as follows: + is red, – is black, and ground is white; a built-in drain wire is included. If using power cables purchased from another source, the colors may vary. If this is the case, ensure that wiring continuity is maintained when making power cable connections. If the shielded power cable is ordered from a source other than Symmetricom, contact Symmetricom Inside Sales Department for information regarding the availability of the connector. An unshielded power cable may be purchased from Symmetricom (refer to Table A). Also, the cable should

be 1.47 mm (16 AWG) for distances up to 305 meters (1,000 feet); for distances less than 305 meters (1,000 feet), consult the factory.

4.18 GTR power connections to the DCD-LPR Shelf are as follows: Secure the lug connectors to the PWR+, PWR–, and CMN terminals on the GTR POWER terminal block (TB3 or TB4 on the DCD-LPR backplane). Connect to TB3 if the GTI card is to be installed in “Slot A” of the DCD-LPR, or to TB4 if the GTI card is to be installed in “Slot B.”

4.19 If using an external power source (a linear power supply is preferred), follow the manufacturers’ instructions, and connect the power cable connectors. Ensure that the power source meets the following specifications:

- 1.16 amps in-rush maximum current
- Nominal 200 mA at 32 volts

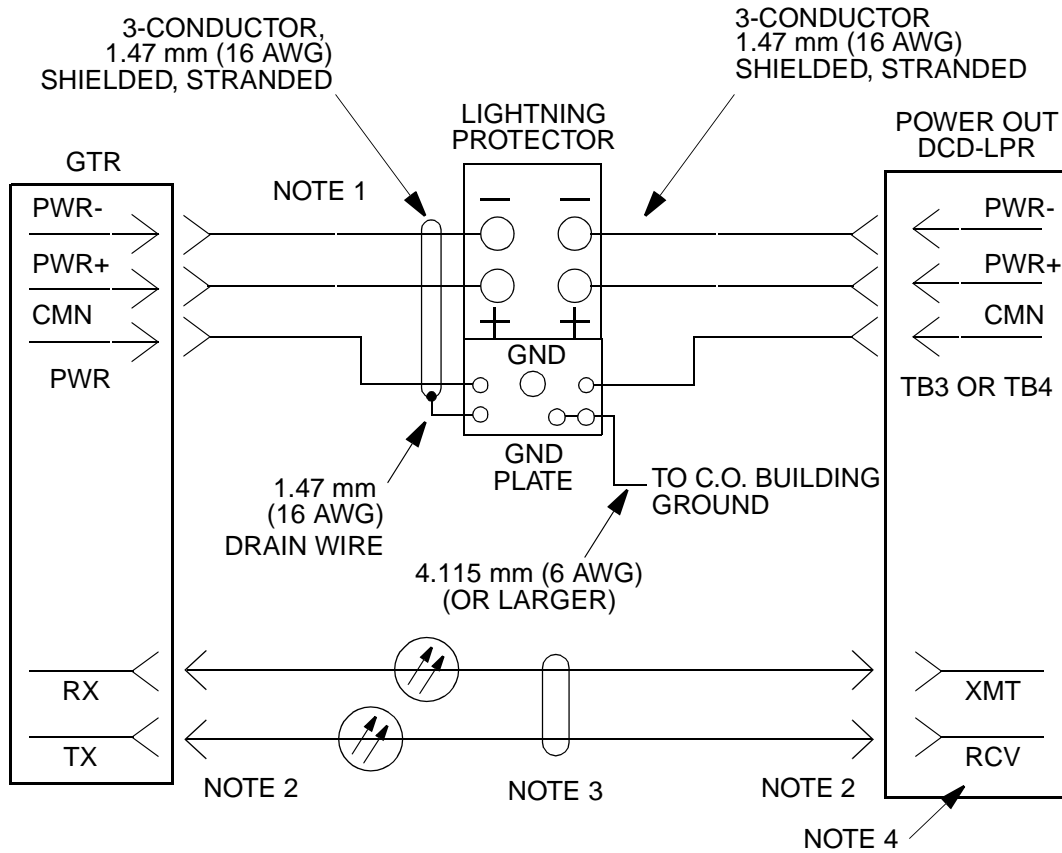
Notes:

1. Symmetricom recommends the Stand-alone Power Supply (refer to Table D) for use as an external power source.
2. Save the removed GTI card power supply daughter board in case the GTI card has to be returned for servicing.

4.20 Refer to Figure 32, and Figure 35 through Figure 37, and follow company installation practices, to cable the GTR to the DCD-LPR Shelf.

Note: The top GTI slot on the DCD-LPR Shelf is the “A” slot; “B” is the bottom slot (Figure 32A).

Caution: DC polarity must be maintained. If not, the DCD-LPR will not function.

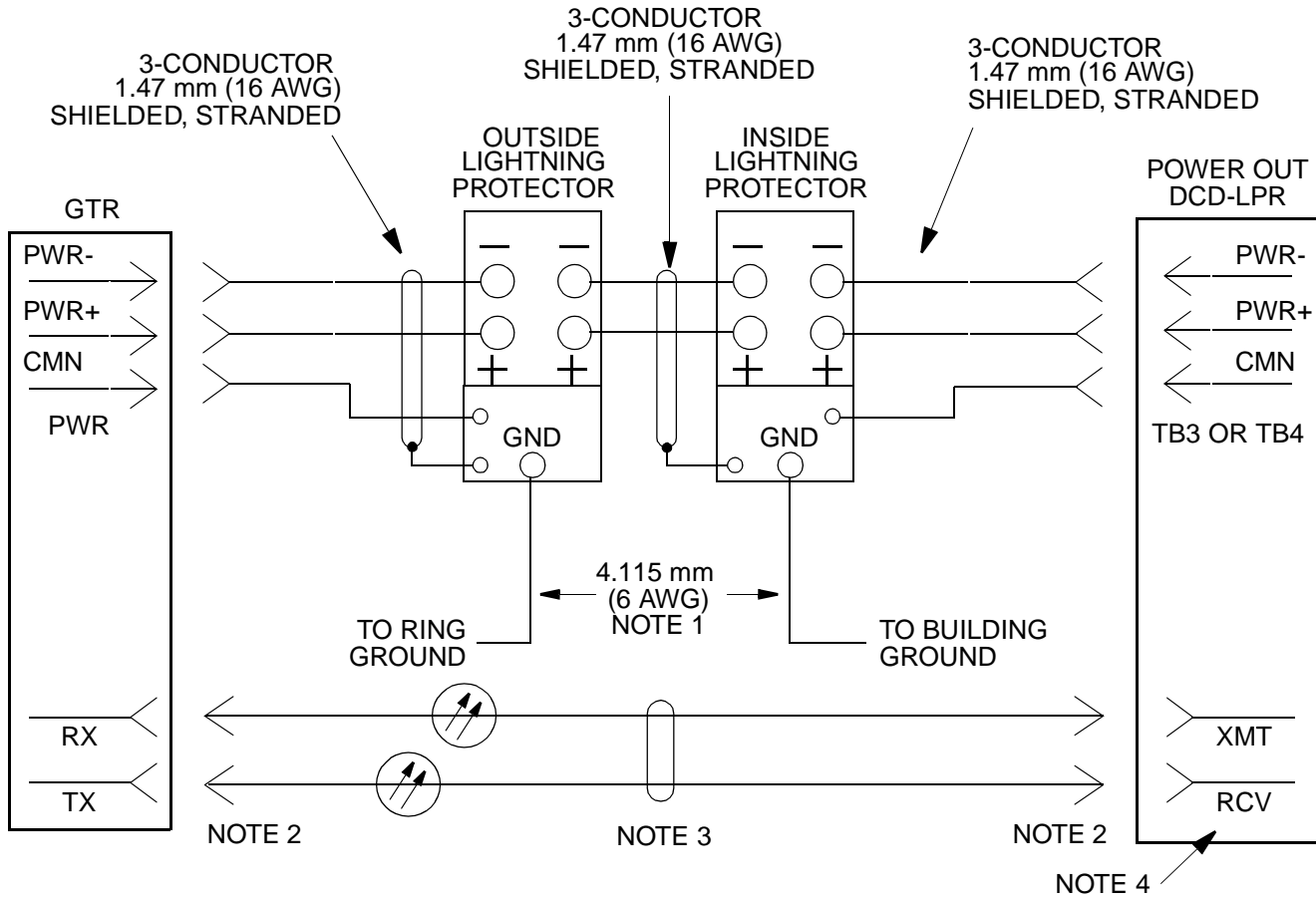


Notes:

1. The cable shield is open at the GTR. The drain wire is connected to the grounding plate of the lightning protector.
2. Fiber optic compound cleave ST style connector.
3. Riser-rated fiber optic 200 μ multimode cables.
4. Two-port Fiber I/O Module. Mounted and connected to J9 (I/O A) on the DCD-LPR for the GTR which has a corresponding GTI card installed in Slot A, and to J10 (I/O B) for a GTR which has a corresponding GTI card installed in Slot B. See also Figure 38.

Figure 35. GTR to DCD-LPR Connections (Single Lightning Protector)

Caution: DC polarity must be maintained. If not, the DCD-LPR will not function.



Notes:

1. Do not ground both protectors together with one common wire; the outside and inside protectors must have separate ground points. 4.115 mm (6 AWG) or larger copper grounding wire is recommended.
2. Fiber optic compound cleave ST style connector.
3. Riser-rated fiber optic 200 μ multimode cables.
4. Two-port Fiber I/O Module. Mounted and connected to J9 (I/O A) on the DCD-LPR for the GTR which has a corresponding GTI card installed in Slot A, and to J10 (I/O B) for a GTR which has a corresponding GTI card installed in Slot B. See also Figure 38.

Figure 36. GTR to DCD-LPR Connections (Dual Lightning Protectors)

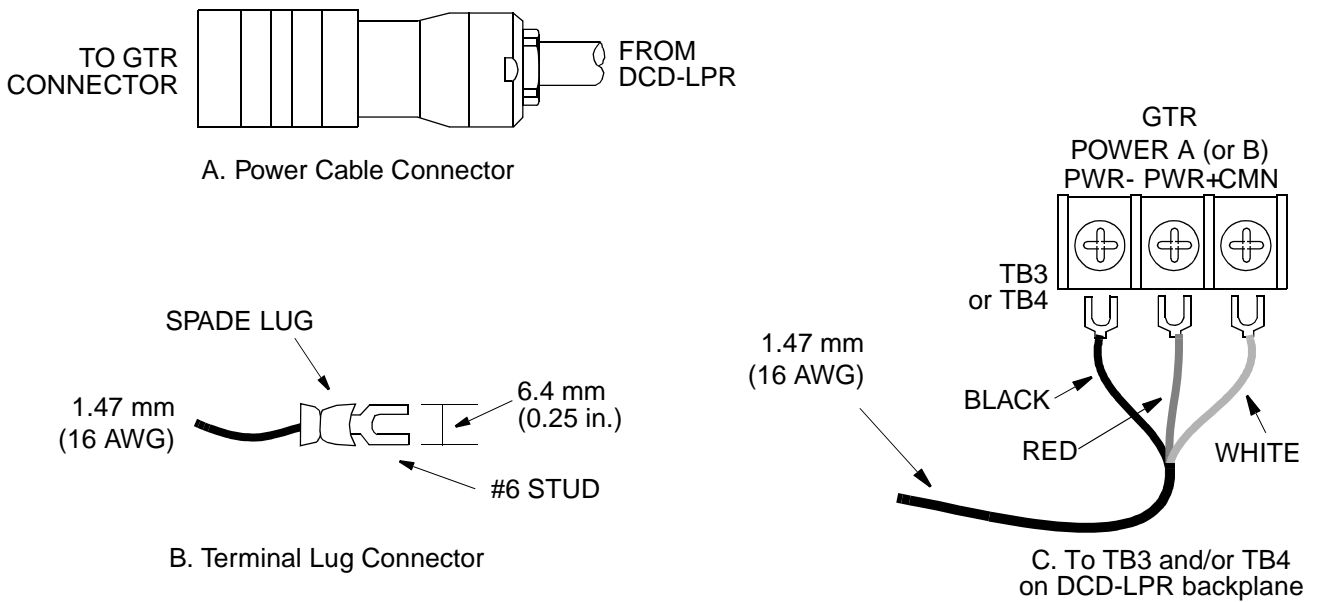


Figure 37. GTR to DCD-LPR Power Cable Connectors

Fiber Optic Cable Connections

4.21 There are two fiber optic cable connections (XMT and RCV) to the DCD-LPR via the GTI fiber I/O module(s) (Figure 38). GTI fiber I/O modules are installed on connectors labeled “I/O A” and “I/O B” (J9 and J10) on the DCD-LPR backplane (Figure 32B).

Note: Symmetricom offers a fiber optic cable with connectors already attached; connectors may also be ordered in a package of six (refer to Table A). To order Riser-rated fiber optic cables, refer to Table A.

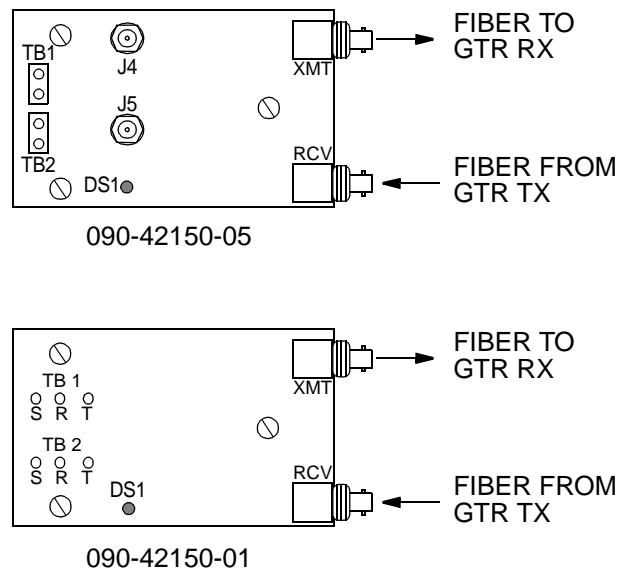


Figure 38. GTI Fiber I/O Module

4.22 To install the GTI fiber I/O modules, perform the following:

1. If using a 090-42150-01 GTI fiber I/O module, ignore this step.

If using a 090-42150-05 GTI fiber I/O module, the module will be connected to a DCD Shelf, and the Installation Job Specification requires connecting the shield of the J4 and J5 connectors to frame ground, strap the terminals of TB1 together, and strap the terminals of TB2 together. (Not recommended.)

2. If a GTI card will be installed in Slot A, mount a GTI fiber I/O module in I/O A, being sure to align the three screws (on the module) with the three standoffs (on the backplane); screw into position.
3. Connect the same color fiber optic cable that is connected to the TX connector on the GTR to the RCV connector on the GTI fiber I/O module.
4. Connect the other color fiber optic cable to the XMT connector on the GTI fiber I/O module.

Note: Fiber polarity must be maintained or the GTR will not operate correctly. If wiring polarity is incorrect, “GTR COMM” appears on the GTI LCD display, and the “DS1” lamp on the DCD-LPR I/O module is not lit.

5. To provide support and minimize cable clutter, route the cable to the right or left, and secure to the cable support bar, using tie wraps.

Note: The cable support bar, located at the back of the shelf, is connected to the sides of the shelf (flange), and runs the length of the backplane.

6. If a GTI card will be installed in Slot B, repeat Steps 2 through 5, but mount the GTI fiber I/O module in I/O B.

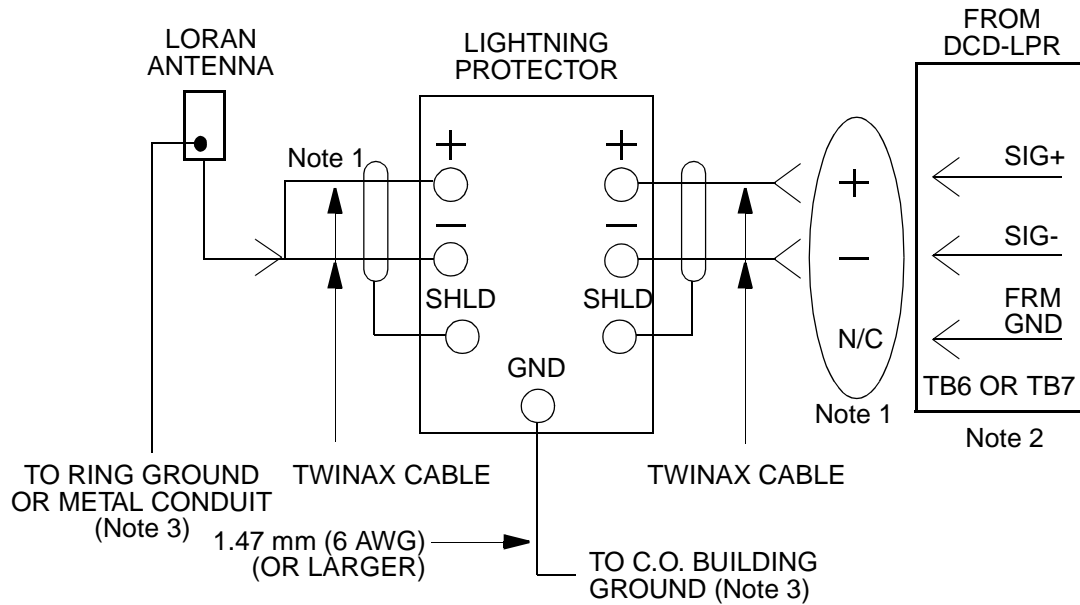
G. LORAN Antenna to DCD-LPR Connections

4.23 There is one connection from the LORAN antenna to the DCD-LPR Shelf, via the twinax cable from the lightning protector installed inside the building (applies to both single and dual lightning protector installations). The twinax cable contains two wires and two filler wires (which have been removed), surrounded by a shield. The two wires are cabled to the SIG+ and SIG– connectors on the DCD-LPR; be sure to maintain the wire lead polarity established in the procedures for installing the lightning protectors. The shield is cut off and taped back per company practice.

4.24 To make the connection, perform the following:

Note: Power polarity must be maintained, or the antenna will not operate correctly. If wiring polarity is incorrect, antenna fault messages appear on the LTI LCD display.

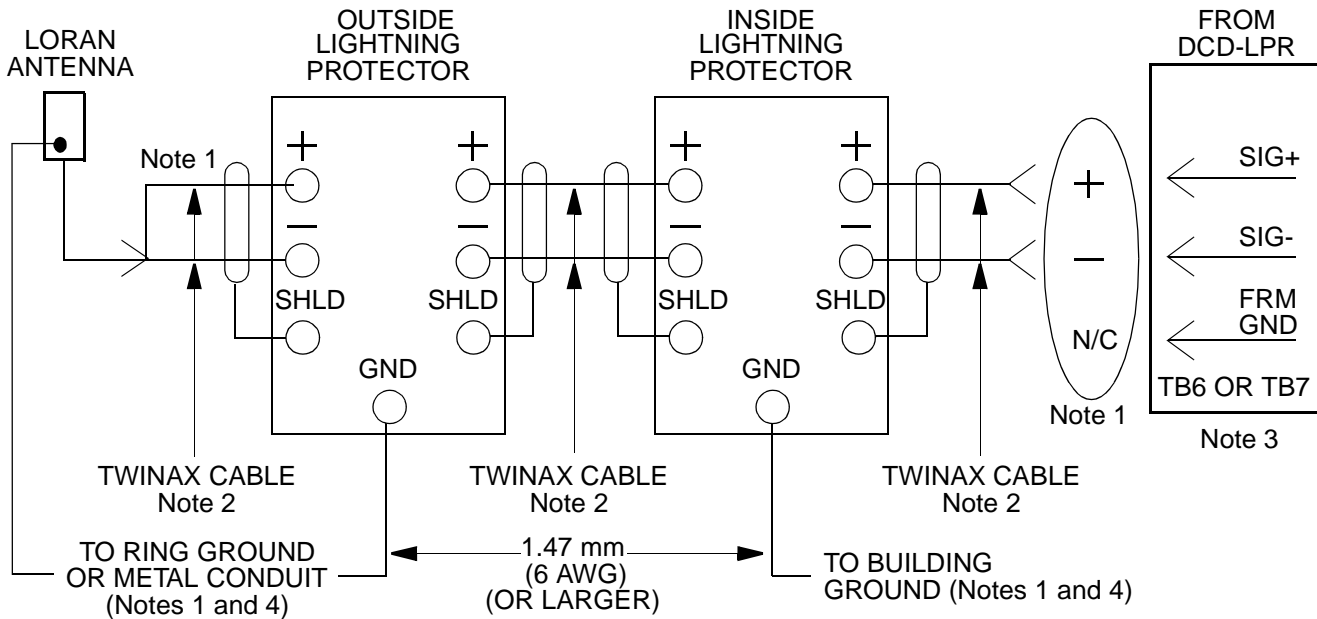
1. Connect the cable from the lightning protector (installed inside the building) to the three-terminal connectors labeled LORAN ANTENNA A (TB6) on the rear of the DCD-LPR Shelf, if the LTI will be inserted in Slot “A” (refer to Figure 32B, Figure 39 or Figure 40, and Figure 41). Ensure that the cable end contains two spade lugs; maintain wire lead polarity, and connect to the SIG+ and SIG– connectors only.
2. To provide support and minimize cable clutter, route the cable to the right or left, and secure to the cable support bar, using tie wraps.
3. When installing two LTI Systems, or if the LTI will be installed in Slot “B,” connect the cable from the corresponding inside lightning protector to the connector labeled LORAN ANTENNA B (TB7).
4. To provide support and minimize cable clutter, route the cable to the right or left, and secure to the cable support bar, using tie wraps.



Notes:

1. Cable (see Table A), with twinax BNC to the antenna, and the rest, spade lug connectors.
2. If connecting the DCD-LPR to one of the following DCD master shelves, an isolation module must be used: DCD-523 Rev. D or earlier, all revisions of DCD-519 and DCD-ST2, and DCD-419 Rev. D or later master shelves. The DCD-523 Rev. E or later shelves do not require an isolation module. Two types of modules are available; selection of the module is at factory discretion.
3. Keep the ground wire as short and straight as possible (minimum 1.47 mm [minimum 6 AWG] solid copper is recommended). Do not undersize this grounding wire; the grounding wire should not exceed 3 m (10 ft).

**Figure 39. LORAN Antenna to DCD-LPR Connections
(Single Lightning Protector, Type 2)**

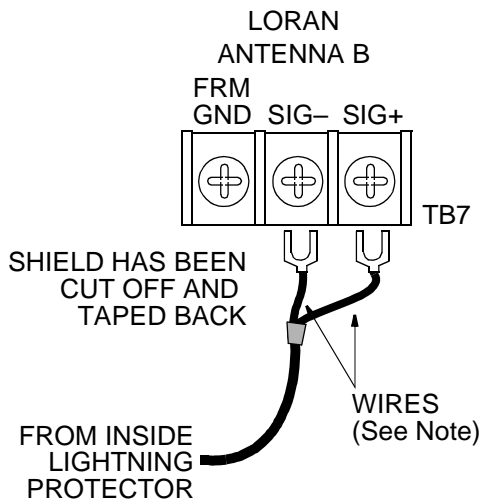
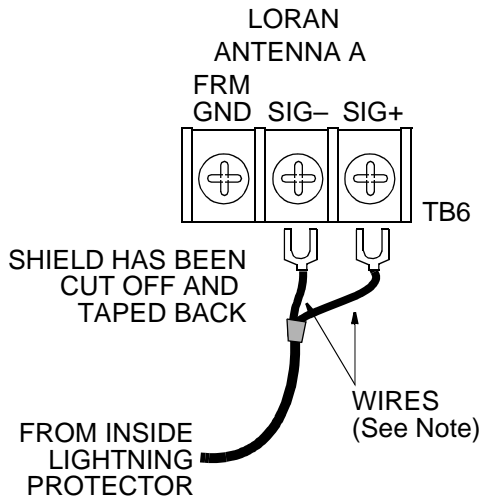


Caution: Lightning protectors must maintain wire lead polarity to ensure optimal antenna operation.

Notes:

1. Cable (see Table A), with twinax BNC to the antenna, and the rest, spade lug connectors.
2. Do not ground both protectors together with one common wire. The inside and outside lightning protectors must have separate ground points. If the shield is not connected at the inside lightning protector TO ANTENNA end, tape back per company practice.
3. If connecting the DCD-LPR to one of the following DCD master shelves, an isolation module must be used: DCD-523 Rev. D or earlier, all revisions of DCD-519 and DCD-ST2, and DCD-419 Rev. D or later master shelves. The DCD-523 Rev. E or later shelves do not require an isolation module. Two types of modules are available; selection of the module is at factory discretion.
4. Keep the ground wire as short and straight as possible (minimum 1.47 mm [minimum 6 AWG] solid copper is recommended). Do not undersize this grounding wire.; the grounding wire should not exceed 3 m (10 ft).

Figure 40. LORAN Antenna to DCD-LPR Connections (Dual Lightning Protectors, Type 2)



Note: Maintain wire lead polarity.

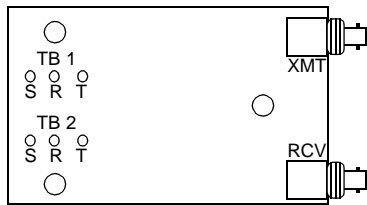
Figure 41. LORAN Antenna to DCD-LPR Power Connectors

H. DCD-LPR to DCD Shelf Connections

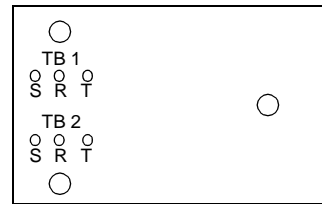
Timing Output Connections

4.25 If the DCD-LPR is a stand-alone configuration, skip this section, and proceed to Section I, Alarm and Status. If using a 090-42150-05 GTI fiber

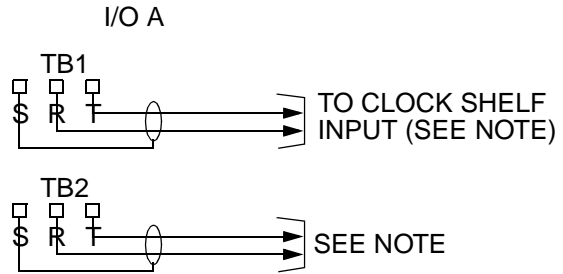
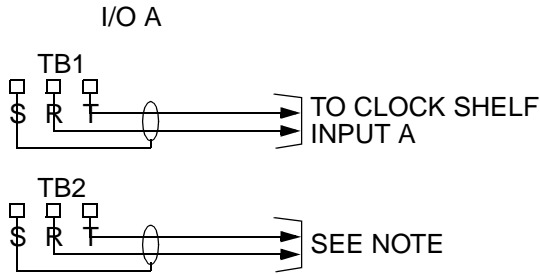
I/O module(s), refer to the Installation section of the DCD Shelf Manual to connect the Timing Interface modules to the DCD Shelf. Otherwise, connect the Timing Interface modules to the DCD Shelf, using Figure 42 and Table H as reference.



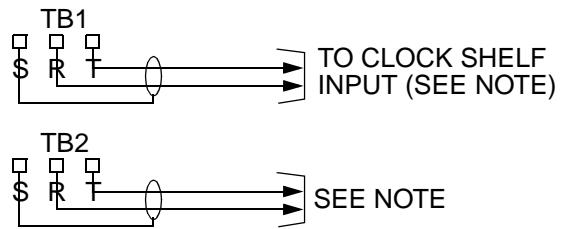
A. GTI Fiber I/O Module (I/O A and/or I/O B)



B. LTI Module (I/O A and/or I/O B)



C. TB1 and TB2 Connections for One Timing Interface Module (GTI or LTI)



I/O B

D. TB1 and TB2 Connections for Two Timing Interface Modules (GTI and/or LTI)

Note: The terminating connections for the E1 or DS1 signals are up to the network providers. It is recommended that at least one of the connections be the primary timing source (input clock card A) on the DCD Shelf housing the clocks.

Figure 42. Timing Interface Module Connections

Table H. GTI and LTI Module Timing Output Connections

DCD SHELF TYPE	FROM LPR SHELF GTI/LTI MODULE		TO DCD SHELF	
	CONNECTOR	LABEL	CONNECTOR	LABEL
DCD-ST2	TB1	T R S	CLOCK INPUT A DS1 IN TERM (TB7)	T R S
	TB2	T R S	CLOCK INPUT B DS1 IN TERM (TB10)	T R S
DCD-419	TB1	T R S	DS1-A TERM (TB7)	T R S
	TB2	T R S	DS1-B TERM (TB3)	T R S
DCD-523	TB1	T R S	TB 12 ROW #4	T R S
	TB2	T R S	TB 13 ROW #4	T R S
DCD-519	TB1	T R S	TB 12 ROW #4	T R S
	TB2	T R S	TB 13 ROW #4	T R S
Note: Make the connections listed for the clock shelf type being used.				

EXP# Connectors

4.26 The DCD-LPR backplane contains the following three connectors:

- EXP1 (J6) - future use
- EXP2 (J7) - future use
- EXP3 (J8) - TOD use

Right-angle Stratum Clock Connectors

Caution: If installing an LOU card, do not make the stratum clock connectors on the DCD clock shelf to DCD-LPR Shelf OSC A and OSC B connector connections.

4.27 Four right-angle BNC connectors (factory-provided) are included in the DCD-LPR hardware kit. These are to be connected to the appropriate stratum clock connectors on both the DCD clock shelf and the DCD-LPR. Without the right-angle connector, when connecting the DCD clock shelf to the DCD-LPR, the maximum allowable depth for the shelf is exceeded, and the clear plastic backplane cover cannot be installed.

4.28 To connect the 5 MHz inputs, refer to Table I, and make the connections listed for the clock shelf type being used.

Table I. Stratum Clock Connections

CLOCK SHELF CONNECTOR/LABEL		DCD-LPR CONNECTOR/LABEL
DCD-ST2	J24/5 MHZ OUTPUT A	J11/OSC A
	J25/5 MHZ OUTPUT B	J12/OSC B
DCD-419	J35/ NOT LABELED	J11/OSC A
	J36/ NOT LABELED	J12/OSC B
DCD-523	J61/OSC A OUT	J11/OSC A
	J62/OSC B OUT	J12/OSC B
DCD-519	J44/OSC A OUT	J11/OSC A
	J45/OSC B OUT	J12/OSC B
<i>Caution: Do not make these connections if an LOU card is installed in the DCD-LPR Shelf.</i>		

Isolation Module Connections

Caution: *If installing an LOU (LOU-1 or LOU-2) card, do not perform the following procedures; isolation modules are not required if a LOU card is installed.*

4.29 Depending on the version and revision of the DCD Shelf, an isolation module may be used. The isolation module is used to reduce potential noise coupling, and match impedances in the cables between the DCD master shelf and DCD-LPR. It also converts the 5 MHz output from a square wave to a sine wave. One module is required for each input.

4.30 If connecting the DCD-LPR to one of the following DCD master shelves, an isolation module must be used:

- DCD-523 Rev. D or earlier
- All DCD-519 Shelves
- All DCD-ST2 Shelves
- DCD-419 Rev. D or later

4.31 If connecting the DCD-LPR to an external source, an isolation module is not required. The external source must be a 5 MHz or 10 MHz sine wave with an amplitude of 1.25 volts ac to 1.50 volts ac.

4.32 If connecting the DCD-LPR to the DCD-523 Rev. E or later master shelf, the isolators are built into the shelf, and the uncorrected raw rubidium from the ST A and ST B sources is fed directly to the DCD-LPR via the OSC A (J11) and OSC B (J12) connectors on the DCD-LPR Shelf backplane. Thus, an isolation module is not required.

4.33 The isolation kit consists of the module (Figure 43), associated screws, and two 0.61 meter

(2 foot) long RG-59, 75 ohm coax cables. These cables will have BNC connectors at both ends if connecting to all shelves except for the DCD-419 (Rev. D or later) (Figure 43C and H), or SMB-to-BNC connectors if connecting to the DCD-419 (Figure 43D).

Note: There are two types of isolation modules available; both will be detailed in this section. The type of isolation module received with the DCD-LPR Shelf is at factory discretion.

4.34 When required, the isolation module is installed between the DCD-LPR Shelf and the DCD master shelf. To connect between the module and the DCD Shelf, two 0.61 meter (2 foot) long RG-59, 75 ohm coax cables are provided.

Note: Depending on the isolation module type, the 0.61 meter (2 foot) 75 ohm coax cable(s) may or may not be shipped already attached to the DCD side of the module.

4.35 For the connection between the DCD-LPR Shelf and the module, the two 1.2 meter (6 foot) lengths of 50 ohm coax cables (provided with the DCD-LPR Shelf) are used. If the DCD-LPR Shelf is not collocated with the DCD Shelf, and longer cables are required, these must not exceed 15.2 meters (50 feet), and are to be user-supplied.

Note: The isolation module(s) must be mounted on the rack, in close proximity to the DCD Shelf, whether or not the DCD-LPR is installed in a collocated or non-collocated location from the DCD Shelf. Attaching the isolation module (to the rack) grounds the module to rack frame ground. Grounding the module to rack frame ground is required if the DCD-LPR is located at a distance less than 1.8 meters (6 feet) from the DCD Shelf.

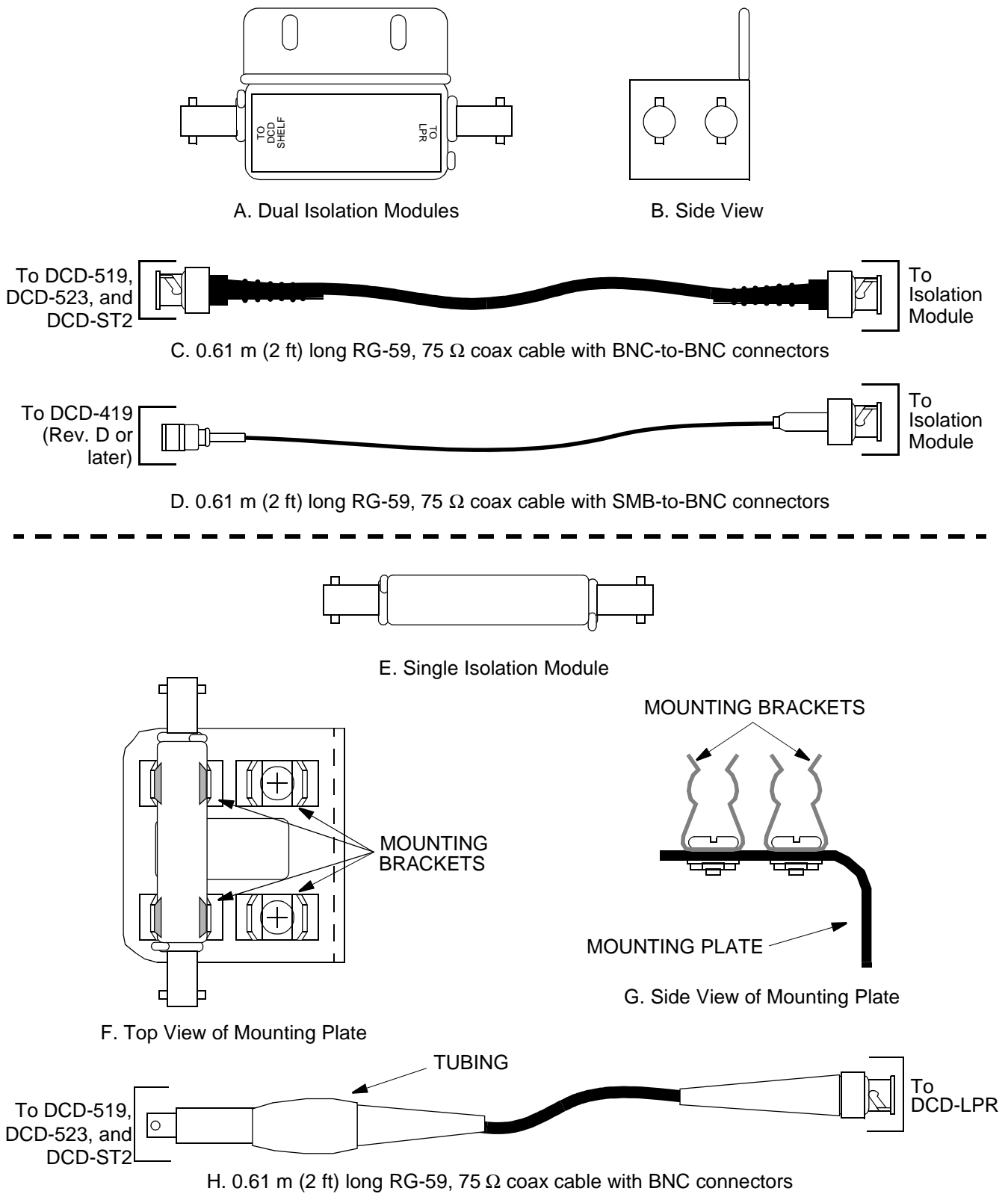


Figure 43. Isolation Modules and Cables

4.36 To install the isolation module(s), perform the following:

1. On the rear of the DCD rack, check either side of the DCD Shelf, directly above or below the shelf, for a location to mount the isolation module. Mount to the rack, using the two provided screws.

Note: Due to distance constraints, the module must be placed no more than 0.61 meter (2 feet) from the following connectors:

- OSC A/B OUT connectors on the rear of the DCD-519 and DCD-523 (Rev. D or earlier) master shelves
- 5 MHZ OUTPUT A/B connectors on the DCD-ST2 master shelf
- J35 and J36 connectors on the DCD-419 master shelf (Rev. D or later)

2. Use the provided 0.61 meter (2 foot) coax cable to connect from the appropriate “A” connector on the DCD Shelf backplane to the “TO DCD SHELF” end of one isolation module (refer to Table J, Figure 43, and Figure 44).

3. Use the 1.8 meter (6 foot) coax cable (from the DCD-LPR hardware kit), and connect from the OSC A connector on the DCD-LPR Shelf to the TO LPR-LORAN end of the isolation module (refer to Figure 43 and Figure 44).

Note: To provide support and minimize cable clutter, route cable to the right or left, and secure to the cable support bar, using tie wraps.

4. If applicable, repeat Steps 1 through 3 to a second isolation module, but connect to the appropriate “B” connector on the DCD Shelf backplane (refer to Figure 43 and Figure 44).

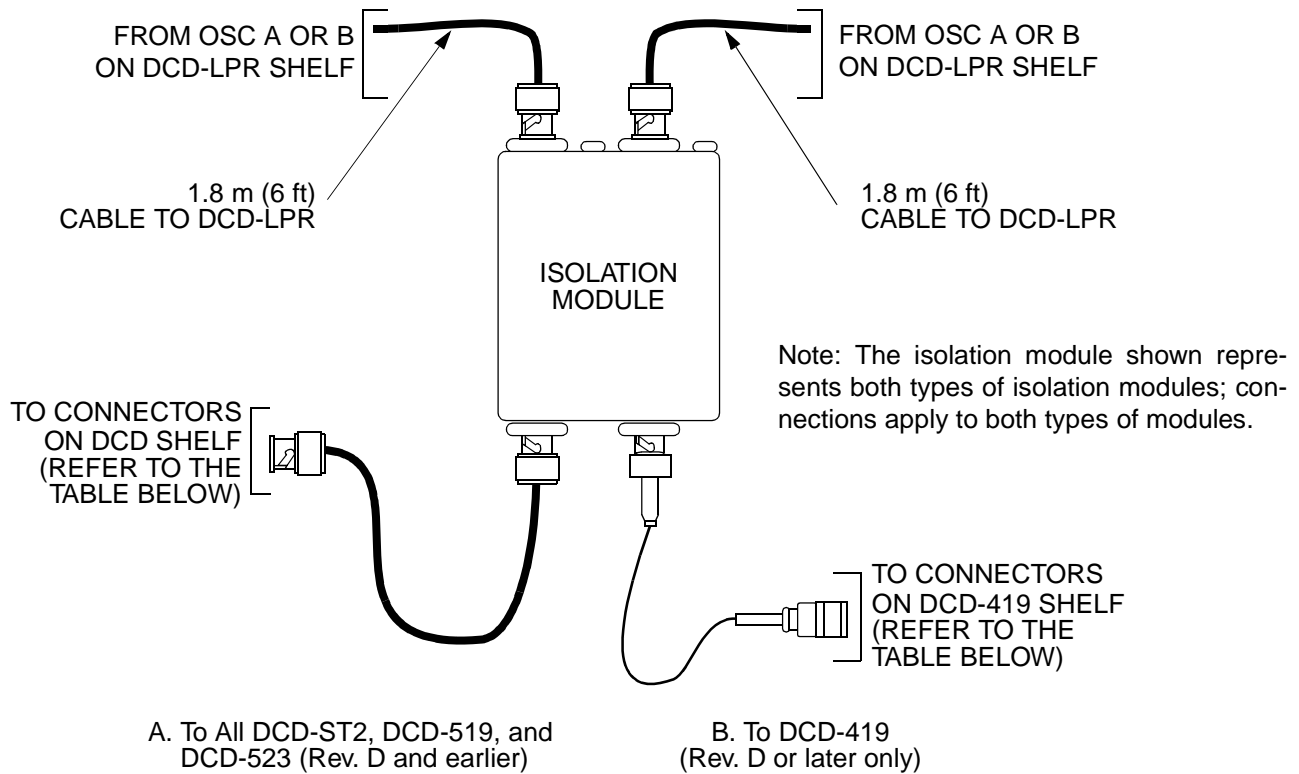
4.37 If an isolation module is not required, use the two 50 ohm coax cables (two 1.8 meter [6 foot] lengths of cable are provided with the DCD-LPR Shelf) to make the connections to the DCD Shelf. If longer cables are required, these must not exceed 15 meters (50 feet), and are to be user-supplied.

4.38 Refer to Table J and connect from the DCD Shelf to the OSC A and OSC B connectors on the DCD-LPR Shelf backplane.

Table J. Stratum Clock Connections to the DCD-LPR

CLOCK SHELF TYPE	FROM DCD SHELF		TO LPR SHELF	
	CONNECTOR	LABEL	CONNECTOR	LABEL
DCD-ST2	J24	5 MHZ OUTPUT A	J11	OSC A
	J25	5 MHZ OUTPUT B	J12	OSC B
DCD-419	J35	NOT LABELED	J11	OSC A
	J36	NOT LABELED	J12	OSC B
DCD-523	J61	OSC A OUT	J11	OSC A
	J62	OSC B OUT	J12	OSC B
DCD-519	J44	OSC A OUT	J11	OSC A
	J45	OSC B OUT	J12	OSC B

Note: Make the connections listed for the clock shelf type being used.



Isolation Module Connections

DCD SHELF	SHELF CONNECTOR	LABEL	DCD-LPR CONNECTOR	LABEL
DCD-ST2	J24	5 MHZ OUTPUT A	J11	OSC A
	J25	5 MHZ OUTPUT B	J12	OSC B
DCD-419	J35	NOT LABELED	J11	OSC A
	J36	NOT LABELED	J12	OSC B
DCD-523	J61	OSC A OUT	J11	OSC A
	J62	OSC B OUT	J12	OSC B
DCD-519	J44	OSC A OUT	J11	OSC A
	J45	OSC B OUT	J12	OSC B

Caution: Do not install an isolation module if a LOU card is installed in the DCD-LPR Shelf.

Figure 44. DCD Shelf to Isolation Module to DCD-LPR Shelf Connection

10 MHz Inputs

4.39 If configured to accept 10 MHz inputs (via re-strapped jumpers on the GTI card), connect the OSC A and OSC B connectors on the DCD-LPR Shelf backplane to an external source.

Notes:

1. Refer to the Test and Acceptance section of this manual for instructions on restrapping the GTI card for 10 MHz input.
2. If connecting to an external source, the external source must be a 5 MHz or 10 MHz sine wave, 1.25 volts ac to 1.50 volts ac.

4.40 These connections are made using two 50 ohm BNC-to-BNC coax cables (two 1.2 meter [6 foot] lengths of cable are provided with the DCD-LPR Shelf). If longer cables are required, these must not exceed 15.2 meters (50 feet), and are to be user-supplied.

Note: To provide support and minimize cable clutter, route cable to the right or left, and secure to the cable support bar, using tie wraps.

COMMA and COMMB Connectors

4.41 The DB9 connectors, COMMA and COMMB, are used in conjunction with switch SW1; refer to the Switch SW1 subsection.

I. Alarm and Status

4.42 On the DCD-LPR Shelf backplane there are three terminal blocks labeled MAJ, MIN, and STAT (Figure 32). Three wire-wrap post dry alarm contacts (NC, C, NO) are provided for each of the following alarm indicators: Major Audible, Major Visual, Minor Audible, and Minor Visual (Table K).

Note: The STAT terminal block is reserved for future use.

Table K. Alarm and Status Connections

ALARM	TYPE	PIN
MAJOR ALARM	AUD and VIS	NC, C, NO
MINOR ALARM	AUD and VIS	NC, C, NO

Note: The MAJ, MIN, and STAT terminal blocks make up TB2 of the DCD-LPR backplane. "TB2" is not silk-screened on the backplane (see Figure 32B).

4.43 Alarm contacts may be connected as NC (Normally Closed), NO (Normally Open), with a reference of C. Both NO audible and visual relay contacts close upon the occurrence of the corresponding alarm. Only the audible contacts are deactivated (opened) when the Alarm Cut Off (ACO) pushbutton on the Fuse and Alarm panel is pressed.

4.44 Both NC audible and visual relay contacts open upon the occurrence of the corresponding alarm. Only the audible contacts are deactivated (closed) when the Alarm Cut Off (ACO) pushbutton on the front panel of the Fuse and Alarm panel is pressed.

4.45 Connect the MAJ and MIN alarm outputs, using solid 0.644 mm or 0.511 mm (22 AWG or 24 AWG) from the audible and visual wiring posts to the local office alarm and distribution system.

Note: To provide support and minimize cable clutter, route cable to the right or left, and secure to the cable support bar, using tie wraps.

Cable Connection for MIS Card

4.46 Alarm and status information to the DCD Shelf through the MIS card is carried via a ribbon cable; a 1.5 meter (5 foot) length of this cable is provided in the MIS Modification kit.

4.47 Connect one end of the cable to connector to J48 (LPRS) on the DCD-519 Shelf or to J21 (LPRS) on the DCD-523 Shelf (Figure 45).

If equipped with a TOD adapter, connect to J1 (TO DCD SHELF) on the adapter board (Figure 46).

4.48 Connect the other end of the cable to one of the following locations on the DCD-LPR Shelf:

If not equipped with a TOD adapter, connect to J5 (MSTR) on the DCD-LPR Shelf backplane (Figure 47).

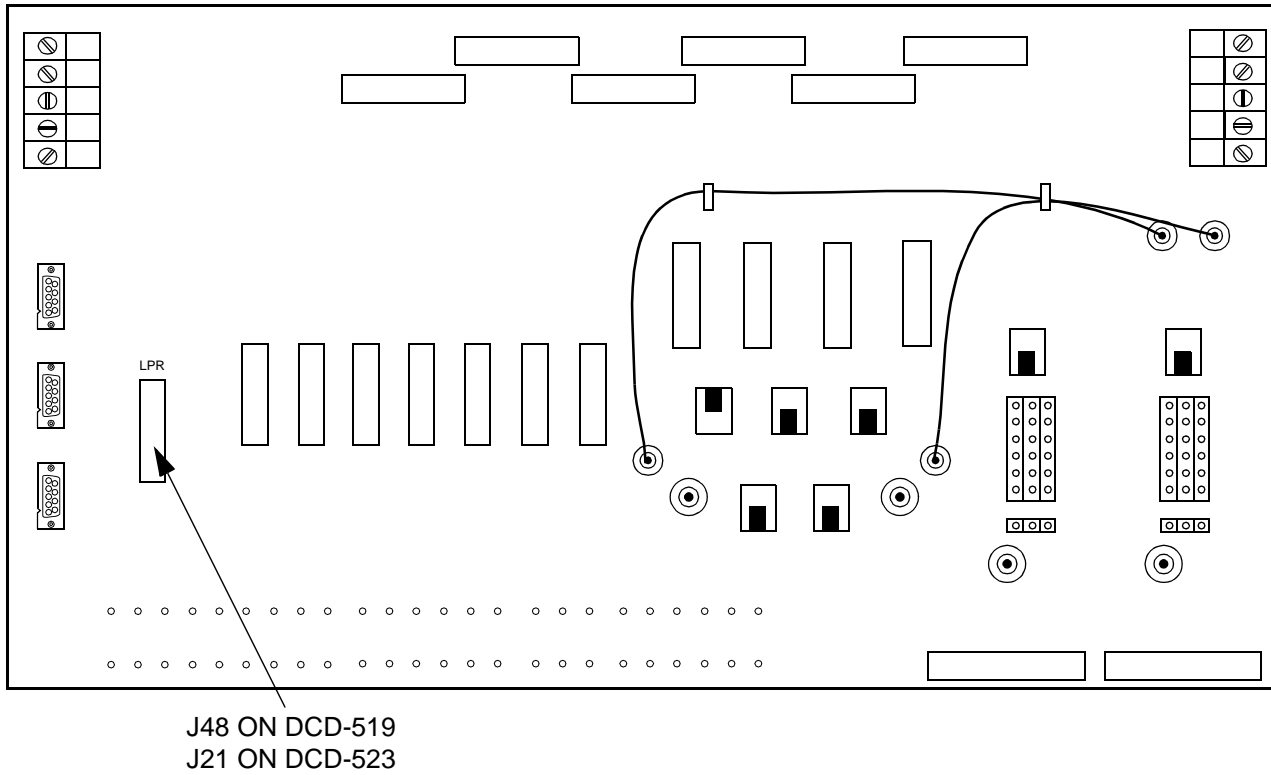


Figure 45. DCD-519 or DCD-523 Shelf Backplane

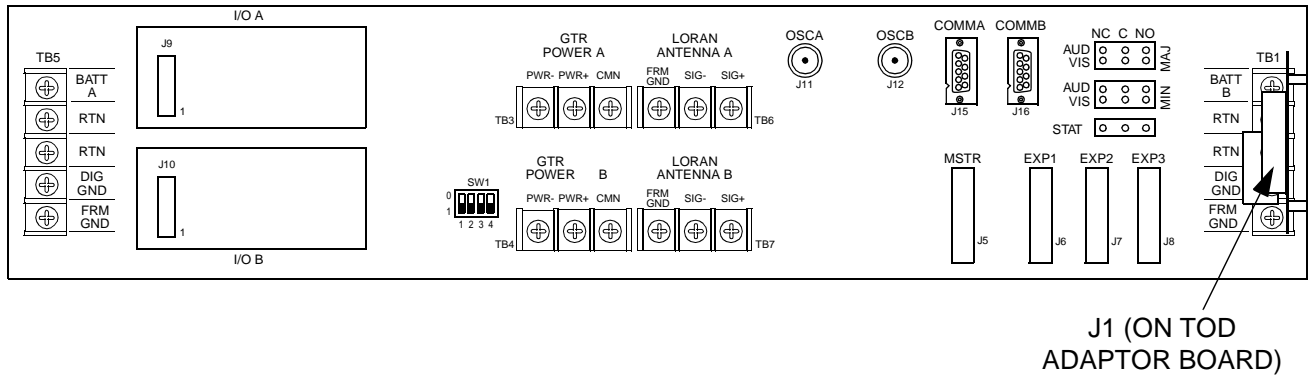


Figure 46. DCD-LPR Shelf Backplane with TOD Adaptor

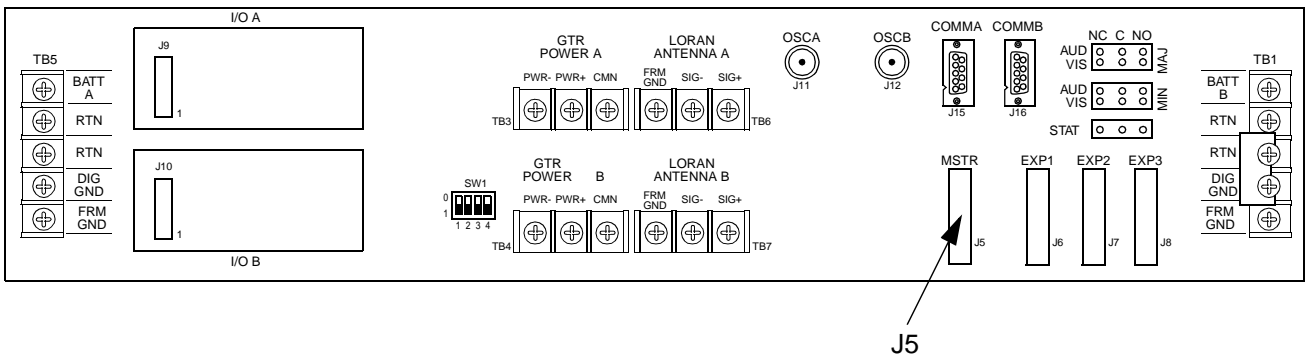


Figure 47. DCD-LPR Shelf Backplane without TOD Adaptor

Switch SW1

4.49 Switch SW1 on the DCD-LPR backplane (Figure 32) selects either: 1) communications via the COMMA and COMMB ports or 2) communications with the MIS card in the DCD500 Shelf via the MASTER (J5) connection. The switch is shipped from the factory with sections 3 and 4 in the Off (down) position, which enables the COMMA and COMMB ports for communication. To enable communications with the MIS card in the DCD500 Shelf via the MASTER (J5) connection, sections 3 and 4 of switch SW1 must be set to the On (up) position.

Note: Leave sections 1 and 2 in the Off (down) position.

J. Ground and Power Connections

4.50 Power and frame grounding connections are made at both the TB1 and TB5 FRM GND terminals on the DCD-LPR backplane. Both terminal blocks are spade lug office battery connections. Use spade lugs designed to accommodate 1.29 mm (16 AWG), 6.3 mm (0.25 inch) width and set with a #6 stud. Figure 48 illustrates the DCD-LPR power and ground connections.

4.51 1.29 mm (16 AWG) stranded wire (green insulation) is used for grounding connections; these wires are not provided, and must be supplied by the user.

4.52 Ensure the ground source is low noise, using company practices.

4.53 To provide support and minimize cable clutter, route cable to the right or left, and secure to the cable support bar, using tie wraps.

Ground Connections

4.54 Perform the following to correctly ground the DCD-LPR:

Note: DIG GND to battery RTN is factory-strapped at TB1 only.

1. Use 1.29 mm (16 AWG) green insulated wire to connect TB1 FRM GND terminal on the shelf backplane (see Figure 48) to rack frame ground. To do this, perform one of the following:

Note: Use a 25 watt soldering iron to ensure the #6 rod (frame ground connection) is heated sufficiently to prevent a cold solder connection.

- a. The connection should be soldered to the #6 frame ground rod run vertically on each side of the rack, if provided: two methods are acceptable:
 - Crimp a #16 spade lug to the 1.29 mm (16 AWG) wire, bend the lug around the #6 rod and solder.
 - Strip enough insulation from the 1.29 mm (16 AWG) wire to permit three complete turns around the #6 rod and solder.
 - b. If the #6 ground rods are not provided, crimp a #16 spade lug to the 1.29 mm (16 AWG) wire, and screw the lug to a screw hole on the rack. Remove the paint, and sand the area around the screw hole, to ensure proper conductivity. Apply a conductive anti-oxidant to the newly prepared surface.
 - c. Strip 4.7 mm (0.1875 inch) of insulation from the other end of the 1.29 mm (16 AWG) wire, and crimp a #16 spade or ring-terminal lug that fits around a #6 screw to the 1.29 mm (16 AWG) wire.
 - If a spade lug is used, loosen the TB1 FRM GND terminal #6 screw, insert the spade lug under the grip lock washer and around the screw, and tighten the #6 screw, with a small flat-blade screwdriver.
 - If a ring-terminal lug is used, remove the #6 screw from TB1 FRM GND terminal, put the #6 screw through the ring-terminal lug, and screw and tighten the #6 screw on TB1 FRM GND terminal.
2. Repeat Step 1, but on the TB5 FRM GND terminal, to connect to rack frame ground.

Note: Do not connect DIG GND to FRM GND on either TB1 and TB5; DIG GND is factory strapped with a U-link to battery RTN on TB1 only.

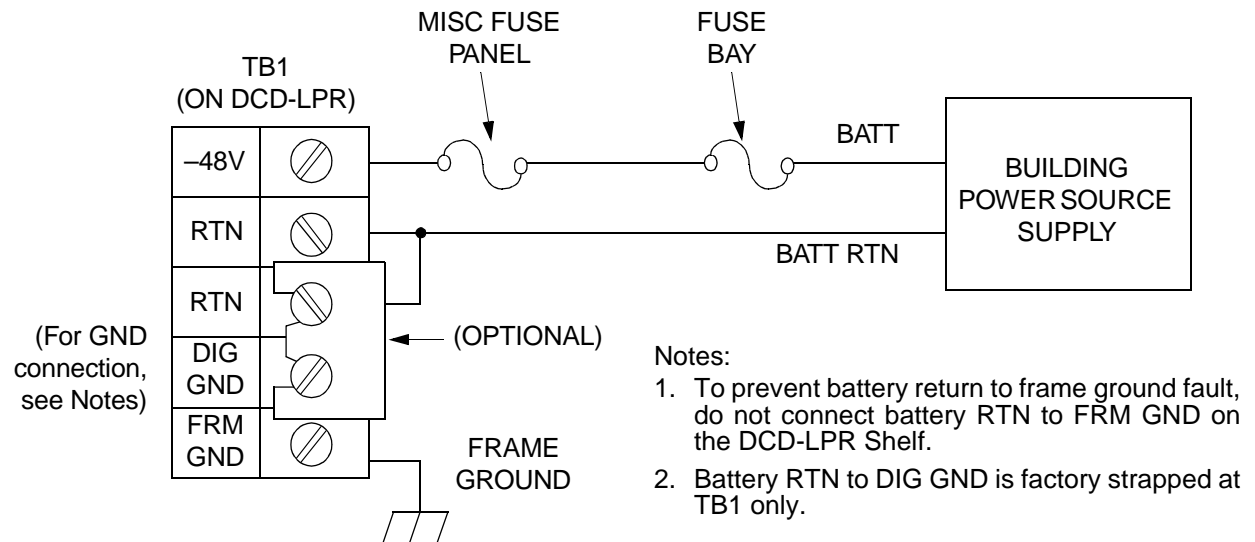


Figure 48. DCD-LPR Ground and Power Connections

Power Connections

4.55 Power connections are made on TB1 and TB5 (Figure 48). TB1 is for BATT A, and TB5 is for BATT B.

4.56 The DCD-LPR Shelf is fused for 2 amps. Fusing at the fuse bay should be 150 percent of the shelf rating, or the nearest larger size (minimum 3 amps).

Notes:

1. Ensure that the power load sources (A and B) are fully diverse, and cable runs are as di-

verse as possible. Do not install any type of redundant lead lying parallel and adjacent in the same cable rack. Leads A and B must be run down separate sides of each shelf. If the site only has one power source, run both A and B feeds from that single source.

2. Two 1.29 mm (16 AWG) stranded wires are used for power connections, one with red insulation (-48V), and the other with black insulation (RTN); these wires are to be user-supplied.

4.57 Use 1.29 mm (16 AWG) stranded wire to connect office battery supply leads from the power source to the terminals on the DCD-LPR backplane (Figure 32). The –48 volts dc A and –48 volts dc B input voltage supplies can be either filtered or unfiltered.

Note: A and B power inputs must come from two separate sources (leads). The power sources should be specified in the company Installation Job Specification. These may be from a battery distribution fuse board (BDFB), a miscellaneous fuse bay, or a miscellaneous fuse panel in the same rack as the DCD-LPR.

1. Remove shelf fuses from the front panel.
2. Remove battery source fuses from the rack fuse bay.
3. Run the power wires from the power source(s) to the DCD-LPR Shelf.
4. At the DCD-LPR Shelf, strip the ends of the three-conductor power cable, and crimp 1.29 mm (16 AWG) spade or ring-terminal lugs (user-provided) on each lead.
5. Connect the A power source lugs to –48V (red wire) and RTN (black wire) on the appropriate terminal block (TB1 or TB5, depending on the backplane revision).
6. Connect the B power source lugs to –48V (red wire) and RTN (black wire) on the appropriate terminal block (TB1 or TB5, depending on the backplane revision).
7. Verify with a volt-ohmmeter that there are no foreign battery, grounds, or shorts at the power source end of the wires.
8. Connect the leads to the power source terminals with the appropriate type of connectors or lugs,

as specified in the company Installation Job Specification.

Note: If power sources are direct from the BDFB, a separate, detailed Method of Procedure to cut leads into the BDFB should be developed and leads cut during non-busy hours.

9. Reinstall battery source fuses in the rack fuse bay.
10. Using a multimeter, verify that the input voltage level across –48V and RTN terminals of TB1 and TB5 is between –42 volts dc and –56 volts dc.
11. Reinstall shelf fuses in the front panel.

K. ST3E Thermal Insulators

4.58 In DCD Systems equipped with ST3E or LNC cards, and if one of the following GTI cards is installed in the DCD-LPR, a thermal insulator must be installed on the ST3E or LNC card's oscillator to keep the oscillator temperature constant:

- 090-42140-13
- 090-42140-14
- 090-42140-15
- 090-42140-18

4.59 If the thermal insulator is not installed on the ST3E card's oscillator, use the provided Thermal Insulator Kit to install the insulator.

5. TEST AND ACCEPTANCE

5.01 At this point, refer to the Test and Acceptance section of this manual for instructions on installing the GTI, LTI, and/or LOU cards, and performing a systems test and acceptance.

Table L. Parts List

ITEM	PART NUMBER
KITS	
Note: See Table M for kit details.	
T1 DCD-LPR Timing Kit	990-42100-11
GTI Card	090-42140-11
GPS Timing Antenna/Receiver	090-42110-01
Interface Wire-wrap Module	090-42150-01
GTR Hardware Kit	093-42100-11
E1 DCD-LPR Timing Kit	990-42100-12
GTI Card	090-42140-12
GPS Timing Antenna/Receiver	090-42110-01
Interface SMB Module	090-42150-05
GTR Hardware Kit	093-42100-11
T1 DCD-LPR Timing Kit	990-42100-13
GTI Card	090-42140-13
GPS Timing Antenna/Receiver	090-42110-01
Interface Wire-wrap Module	090-42150-01
GTR Hardware Kit	093-42100-11
Thermal Insulator Kit	093-40019-01
E1 DCD-LPR Timing Kit	990-42100-14
GTI Card	090-42140-14
GPS Timing Antenna/Receiver	090-42110-01
Interface SMB Module	090-42150-05
GTR Hardware Kit	093-42100-11
Thermal Insulator Kit	093-40019-01
T1 DCD-LPR Timing Kit	990-42100-15
GTI Card	090-42140-15
GPS Timing Antenna/Receiver	090-42110-01
Interface Wire-wrap Module	090-42150-01
GTR Hardware Kit	093-42100-11
Thermal Insulator Kit	093-40019-01

Table L. Parts List (Cont'd)

ITEM	PART NUMBER
E1 DCD-LPR Timing Kit	990-42100-16
GTI Card	090-42140-16
GPS Timing Antenna/Receiver	090-42110-01
Interface SMB Module	090-42150-05
GTR Hardware Kit	093-42100-11
Thermal Insulator Kit	093-40019-01
T1 DCD-LPR Timing Kit	990-42100-17
GTI Card	090-42140-17
GPS Timing Antenna/Receiver	090-42110-01
Interface Wire-wrap Module	090-42150-01
GTR Hardware Kit	093-42100-11
E1 DCD-LPR Timing Kit	990-42100-18
GTI Card	090-42140-18
GPS Timing Antenna/Receiver	090-42110-01
Interface SMB Module	090-42150-05
GTR Hardware Kit	093-42100-11
Thermal Insulator Kit	093-40019-01
LORAN Timing Kit	990-41100-01
Antenna Assembly	090-41000-22
LORAN Hardware Kit	093-41100-01
LTI Card	090-41140-01
LTI Wire-wrap Module	090-41150-01
DCD-LPR Shelf Kit	990-45100-11
LPR Shelf Assembly	090-45100-11
DCD-LPR Manual	997-45100-11
DCD-LPR Shelf Hardware Kit	093-45100-11

Table L. Parts List (Cont'd)

ITEM	PART NUMBER
DCD 5 MHz Isolation Kit (for DCD-519, DCD-ST2, or DCD-523, Rev. D or earlier)	093-45110-04
Dual 5 MHz Isolation Module	090-40002-52
0.6 m (2 ft) 75 Ω Coax Cable	160-00201-02
12-24 x 12.7 mm (0.5 in.) Screws	125-22441-08
DCD 5 MHz Isolation Kit (for DCD-419, Rev D or later)	093-45110-05
Dual 5 MHz Isolation Module	090-40002-52
1.2 m (4 ft) BNC-to-SMB Cable Adapter	060-00029-01
12-24 x 12.7 mm (0.5 in.) Screws	125-22441-08
TOD Adapter Kit (optional)	990-42181-01
TOD Adapter	090-42181-01
RS-422-to-RS-232 Converter	090-42182-01
TOD Hardware Kit	093-42181-01
ADDITIONAL PARTS	
Twinax Cable - plenum rated (optional)	060-45130-xx
LOU Card (optional)	090-42145-01
LOU Card (optional)	090-42145-02

Table M. Kit Details

QTY	ITEM	PART NUMBER
1	GTR Hardware Kit	093-42100-11
1	10 cm (4 in.) plastic pipe fitting flange	032-00006-02
1	Outdoor Lightning Protector Kit	093-42100-41
1	Lightning protector grounding plate	070-00300-01
1	Copper terminal	121-00055-01
8	22/16 spring-spade stud lug	121-00083-01
4	6-32 stainless steel nuts	125-00121-06
2	10-32 stainless steel hex nuts	125-00121-11
4	#6 stainless steel washer	125-00522-06
2	#10 stainless steel washer	125-00523-10
1	Outside lightning protector	143-00011-01
1	Indoor Lightning Protector Kit	093-42100-42
1	Lightning protector grounding plate	070-00300-01
1	Copper terminal	121-00055-01
8	22/16 spring-spade stud lug	121-00083-01
4	6-32 stainless steel nuts	125-00121-06
2	10-32 stainless steel hex nuts	125-00121-11
4	#6 stainless steel washer	125-00522-06
2	#10 stainless steel washer	125-00523-10
1	Inside lightning protector	143-00006-01
1	Lubricant	116-00025-01
1	Thermal Insulator Kit	093-40019-01
1	Thermal Insulator Installation instructions	097-40019-01
2	Thermal insulators	031-00007-01
2	Adhesive strips	031-00008-01
2	Thermal Insulator Installed labels	022-00188-01
2	Blank panels	970-00014-02
2	Issue E labels	022-00146-05
2	CLEI labels (for ST3E cards)	122-40019-10

Table M. Kit Details (Cont'd)

QTY	ITEM	PART NUMBER
1	LORAN Hardware Kit	093-41100-01
2	Lightning protector	090-41000-13
2	8-32 x 15.9 mm (5/8 in.) bolt	125-83241-10
4	Hex nuts	125-00110-08
4	Lock washers	125-00512-08
3	Reducing bushings	132-00009-06
1	Clear vinyl, 15.9 mm (0.625 in.) diameter, 76 mm (3 in.) long insulator	131-00012-01
2	1 mm x 2.5 mm (4.0 in. x 0.1 in.) tie wraps	128-00500-05
2	170 mm x 4.8 mm (6.7 in. x 0.19 in.) tie wraps	128-00500-04
1	Conduit-T body	032-00004-01
1	Conduit-T plug	132-00006-01
1	Gasket for conduit-T cover	131-00011-01
1	Conduit-T cover with two screws	132-00008-01
1	25.4 mm x 19 mm (1.0 in. x 0.75 in.) threaded nipple	132-00002-01
1	279 mm (11 in.) length of 4.115 mm (6 AWG) grounding wire with 2-hole lugs attached to both ends	060-00016-01
2	Grounding C-clamps	132-00004-01
5	Solder-connected BNC-type twinax connectors	121-00509-02
1	0.6 m x 19 mm (2 ft x 0.75 in.) conduit section	132-00005-01
2	BNC connector wrenches	154-00002-01
1	DCD-LPR Shelf Hardware Kit	093-45100-11
6	12-24 x 0.5 in. screws	125-22431-08
2	2 A, 5 x 20 mm fuses	143-00004-19
2	1.8 m (6 ft) coaxial cables (RG-59 75 Ω)	160-00201-06
4	90° right-angle connectors	121-00530-01
1	RS-422-to-RS-232 Converter	090-42182-01
1	RS-422-to-RS-232 converter module	190-00078-01
2	12-24 x 1/2 screws	125-22441-08

Table M. Kit Details (Cont'd)

QTY	ITEM	PART NUMBER
1	TOD Hardware Kit	093-42181-01
1	3-connector ribbon cable	060-42181-01
2	4-40 x 1/4 screws	125-44042-04
2	#4 split zinc washer	125-00511-04
2	#4 flat stainless steel washer	125-00520-04
1	Clear plastic backplane cover	072-00015-02

6. INDEX

Numerics

090-42150-01 GTI fiber I/O module 70
 090-42150-05 GTI fiber I/O module 70
 -13 and above GTI cards 3
 4.115 mm copper grounding wire 4
 50 ohm BNC-to-BNC coax cables 81

A

ACTIVE lamp 3
 Adapter, TOD 60
 Alarm Cut Off (ACO) pushbutton 81
 Antenna Assembly 36
 Antenna Mounting Kit 36
 Antenna, LORAN 33, 36, 44, 70
 Antenna, LORAN-C 36
 Antenna-to-DCD-LPR integrity 51
 Applications, NTP Type 4 TOD 56, 60
 Assembly, Antenna 36
 Assembly, connector 6

B

Backplane, DCD Shelf 79
 Backplane, DCD-LPR 76, 81, 84, 86
 Backplane, DCD-LPR Shelf 64, 79, 81, 82
 BNC connectors 44, 77
 BNC-to-BNC coax cables, 50 ohm 81
 Box(es), junction 10, 16, 36, 38
 Box, junction 7, 8, 10, 15, 16, 17, 21, 22, 25, 34, 35,
 36, 38, 47, 49, 51, 55
 box, junction 8
 Building ground 25, 26

C

C.O. ground bar 5, 10, 21, 36
 C.O. ground cable 19, 21, 47, 51
 C.O. ground plate 47, 51
 Cable wires, twinax 49, 52
 Cable, fiber optic 4, 30
 Cable, GTR 17
 Cable, LORAN 47
 Cable, outside lightning protector 41
 Cable, twinax 33, 36, 38, 40, 49, 51, 55, 70
 Cables, twinax 47, 51
 Card, GTI 66, 70, 81
 Card, gTI 9
 Card, LNC 86
 Card, LOU 77
 Card, LOU-1 77
 Card, LOU-2 77
 Card, LTI 36
 Card, MIS 56, 81, 84
 Card, ST2 3

Card, ST2E 3
 Card, ST3E 3, 86
 Card, TNC 3
 Card, TNC-E 3
 Cards, clock 3
 Cards, GTI 3, 9, 86
 Cards, LOU 3, 86
 Cards, LTI 36, 86
 Clock card, quartz 3
 Clock cards 3
 Clock cards, quartz 3
 Clock cards, rubidium 3
 Clock combination, rubidium and quartz 3
 Clock shelf, DCD 76
 Clock, rubidium 3
 Clocks, ST3E 3
 Clocks, TNC 3
 Connection(s), RS-422-to-RS-232 converter to
 router 58
 Connection(s), TOD adapter 58
 Connection, inside-lightning-protector-to-DCD-
 LPR 52
 Connection, lightning protector-to-DCD Shelf 5
 Connections, fiber optic cable 69
 Connections, lightning protector 52, 55
 Connections, RS-422-to-RS-232 converter to Cisco
 Systems router 56
 Connections, three-connector ribbon cable 64
 Connections, Time-of-Day (TOD) adapter to DCD-
 LPR Shelf 56
 Connections, TOD adapter to RS-422-to-RS-232
 converter 56
 Connections, Type 2 lightning protector 47
 Connector assembly 6
 Connector, DCD Shelf BNC input 57
 Connector, DCD Shelf Siemens 1.6/5.6 57
 Connector, DCD Shelf SMB input 57
 Connector, power cable 30
 Connectors, BNC 44, 77
 Connectors, power cable 66
 Connectors, screw-type 44
 Connectors, SMB-to-BNC 77
 Converter, RS-422-to-RS-232 60
 Copper grounding wire, 4.115 mm 4

D

Daughter board, GTI card power supply 66
 DCD clock shelf 76
 DCD master shelf 3, 77
 DCD master shelves 77
 DCD rack 79
 DCD Shelf 3, 56, 57, 59, 70, 74, 77, 79, 81
 DCD Shelf backplane 79
 DCD Shelf BNC input connector 57

DCD Shelf Manual 74
 DCD Shelf revision letter 56
 DCD Shelf Siemens 1.6/5.6 connector 57
 DCD Shelf SMB input connector 57
 DCD500 Shelf 84
 DCD-519 Shelf 82
 DCD-523 Rev. E or later master shelf 77
 DCD-523 Shelf 82
 DCD-LPR backplane 76, 81, 84, 86
 DCD-LPR hardware kit 76
 DCD-LPR I/O module 70
 DCD-LPR I/O module DS1 lamp 31
 DCD-LPR Shelf 8, 15, 17, 22, 33, 38, 44, 47, 53, 56, 57, 59, 60, 64, 65, 66, 70, 77, 79, 81, 82, 85, 86
 DCD-LPR Shelf backplane 64, 79, 81, 82
 DCD-LPR Shelf relay rack 33
 DCD-LPR Shelf, GTR power connections to 66
 DCD-LPR to DCD Shelf, DS1 connection from 57
 DCD-LPR to DCD Shelf, E1 connection from 57
 DCD-LPR to the DCD Shelf, DS1 connection from 56
 DCD-LPR to the DCD Shelf, E1 connection from 56
 Display, GTI LCD 28, 31
 DS1 connection from DCD-LPR to DCD Shelf 57
 DS1 connection from the DCD-LPR to the DCD Shelf 56
 DS1 lamp, DCD-LPR I/O module 31
 Dual lightning protector configurations 7
 Dual lightning protector installation 5
 Dual lightning protector installations 21, 33, 51
 Dual lightning protector scheme 21, 40, 51
 Dual lightning protector schemes 66
 Dual lightning protectors 10, 36, 38

E

E1 connection from DCD-LPR to DCD Shelf 57
 E1 connection from the DCD-LPR to the DCD Shelf 56
 External power source 58, 66

F

Fiber optic cable 4, 30
 Fiber optic cable connections 69
 Frame ground, rack 77
 Fuse and Alarm panel 81
 Fuse replacement, power distribution panel 58

G

GND stud 17, 22, 26
 GND terminals 26
 GPS System 31
 Ground bar, C.O. 5, 10, 21, 36
 Ground cable, C.O. 19, 21, 47, 51
 Ground connection, lightning protector 26

Ground connections, lightning protector 51
 Ground plate, C.O. 47, 51
 Ground terminal 17, 25
 Ground terminal, lightning protector 36
 Ground, building 25, 26
 Ground, ring or building 25
 Grounding plate 6, 19, 25
 Grounding plate connections, lightning protector 17
 Grounding plate, inside lightning protector 22
 Grounding plate, lightning protector 17
 Grounding plate, outside lightning protector 26
 Grounding wires, LTI 44
 GTI card 9, 66, 70, 81
 GTI card power supply daughter board 66
 GTI cards 3, 9, 86
 GTI cards, -13 and above 3
 GTI fiber I/O module 70
 GTI fiber I/O module(s) 69
 GTI fiber I/O module, 090-42150-01 70
 GTI fiber I/O module, 090-42150-05 70
 GTI fiber I/O modules 69, 70
 GTI LCD display 28, 31, 70
 GTR cable 17
 GTR power cable 6, 7, 8, 10, 17, 28
 GTR power cable wire colors 17, 22
 GTR power connections 66
 GTR power connections to the DCD-LPR Shelf 66

H

Hardware kit, DCD-LPR 76

I

I/O module, DCD-LPR 70
 I/O module, GTI fiber 70
 I/O modules, GTI fiber 69, 70
 Inside and outside lightning protectors 5
 Inside lightning protector 5, 7, 8, 10, 17, 21, 22, 25, 26, 33, 36, 38, 40, 51, 52, 55, 66, 70
 Inside lightning protector grounding plate 22
 Inside lightning protector junction box 38
 Inside lightning protector, single 3, 33
 Inside protector 26, 51
 Inside-lightning-protector-to-DCD-LPR connection 52
 Inside-to-outside lightning protector connection 52
 Installation method, single lightning protector 35
 Integrity, antenna-to-DCD-LPR 51
 Isolation kit 77
 Isolation module 77, 79
 Isolation module type 77
 Isolation module(s) 77, 79
 Isolation modules 77

J

Junction box 7, 8, 10, 15, 16, 17, 21, 22, 25, 34, 35, 36, 38, 47, 49, 51, 55
 Junction box(es) 10, 16, 36, 38
 Junction box(es), weather-resistant 7
 Junction box, inside lightning protector 38
 Junction box, lightning protector 15
 Junction box, outside lightning protector 15, 38
 Junction box, weather-resistant 7, 10, 15, 25, 26, 35, 36, 38, 55
 Junction boxes, weather-resistant 31

K

Kit, isolation 77
 Kit, MIS Modification 81

L

Lamp, ACTIVE 3
 LCD display, GTI 70
 lightning 49
 Lightning protection methods 3
 Lightning protector 5, 6, 7, 8, 10, 15, 17, 19, 21, 22, 25, 26, 33, 35, 36, 38, 40, 44, 47, 49, 51, 52, 53, 55, 70
 Lightning protector configurations, dual 7
 Lightning protector connection, inside-to-outside 52
 Lightning protector connections 52, 55
 Lightning protector ground connection 26, 51
 Lightning protector ground terminal 36
 Lightning protector grounding plate 17
 Lightning protector grounding plate connections 17
 Lightning protector installation, dual 5
 Lightning protector installation, single 5, 8
 Lightning protector installations, dual 21, 33, 51
 Lightning protector installations, single 10, 33, 36
 Lightning protector installations, single and dual 70
 Lightning protector junction box 15
 Lightning protector method, single 3
 Lightning protector scheme, dual 21, 40, 51
 Lightning protector scheme, single 5, 10, 17, 36, 47
 Lightning protector schemes, dual 66
 Lightning protector schemes, single 66
 Lightning protector types 44
 Lightning protector(s) 5, 6, 8, 34, 44
 Lightning protector, inside 5, 7, 8, 10, 17, 21, 22, 25, 26, 33, 36, 38, 40, 51, 52, 55, 66, 70
 Lightning protector, outside 5, 7, 8, 10, 15, 21, 25, 26, 33, 36, 38, 40, 51, 52, 53, 55, 66
 Lightning protector, Type 1 47
 Lightning protector, Type 2 47, 51
 Lightning protectors 10, 21, 22, 33, 34, 35, 36, 38, 44, 51, 70
 Lightning protectors, dual 10, 36, 38

Lightning protectors, inside and outside 5
 Lightning protectors, LORAN 44
 Lightning protectors, mounting, installing, and grounding 51
 Lightning protectors, outside and inside 40
 Lightning protectors, solid-state 26
 Lightning protectors, two 3
 Lightning protectors, Type 1 40
 Lightning protectors, Type 2 40, 44
 Lightning protector-to-DCD Shelf connection 5
 Lightning strike 10, 15, 16, 25
 Lightning protectors, Type 1 44
 LNC card 86
 LORAN antenna 33, 36, 44, 70
 LORAN cable 47
 LORAN lightning protectors 44
 LORAN twinax cable 47
 LORAN-C antenna 36
 LORAN-C System 31
 LOU card 77
 LOU cards 3, 86
 LOU-1 card 77
 LOU-2 card 77
 LPR Shelf 36
 LTI card 36
 LTI cards 36, 86
 LTI grounding wires 44

M

MAJ terminal block 81
 Manual, DCD Shelf 74
 Master shelf, DCD 3, 77
 Master shelf, DCD-523 Rev. E or later 77
 Master shelves, DCD 77
 Method, single lightning protector 33
 Methods, lightning protection 3
 MIN terminal block 81
 MIS card 56, 81, 84
 MIS Modification kit 81
 MIS modification kit 56
 Modification kit, MIS 56
 Module type, isolation 77
 Module(s), isolation 77, 79
 Module, isolation 77, 79
 Modules, isolation 77
 Modules, Timing Interface 74
 Mounting Kit, Antenna 36
 Mounting, installing, and grounding lightning protectors 51

N

NTP Type 4 TOD applications 56, 60

O

Office grounding specialist 55
 Outside and inside lightning protectors 40
 Outside and inside protectors 25, 26
 Outside lightning protector 5, 7, 8, 10, 15, 21, 25, 26, 33, 36, 38, 40, 51, 52, 53, 55, 66
 Outside lightning protector cable 41
 Outside lightning protector grounding plate 26
 Outside lightning protector junction box 15, 38
 Outside protector 26, 51

P

Panel, Fuse and Alarm 81
 Plate, grounding 6, 19, 25
 Plug, power connector 6
 Power cable connector 30
 Power cable connectors 66
 Power cable, GTR 6, 7, 8, 10, 17, 28
 Power cable, three-conductor 4, 5, 15, 22, 26
 Power connections, GTR 66
 Power connector plug 6
 Power distribution panel fuse replacement 58
 Power source, external 58, 66
 Protector(s), lightning 5, 6, 8, 34, 44
 Protector, inside 26, 51
 Protector, lightning 5, 6, 7, 8, 10, 15, 17, 19, 21, 22, 25, 26, 33, 35, 36, 38, 40, 44, 47, 49, 51, 52, 53, 55, 70
 Protector, outside 26, 51
 Protectors, lightning 10, 21, 22, 33, 34, 35, 36, 38, 44, 51, 70
 Protectors, outside and inside 25, 26
 Pushbutton, Alarm Cut Off (ACO) 81

Q

Quartz clock card 3
 Quartz clock cards 3

R

Rack frame ground 77
 Rack, DCD 79
 Relay rack, DCD-LPR Shelf 33
 Revision letter, DCD Shelf 56
 Ribbon cable, three-connector 56, 64
 Ring ground system 10
 Ring or building ground 25
 RS-422-to-RS-232 converter 60
 RS-422-to-RS-232 converter to Cisco Systems router connection(s) 56
 RS-422-to-RS-232 converter to router connection(s) 58
 Rubidium and quartz clock combination 3
 Rubidium clock 3
 Rubidium clock cards 3

S

Screw-type connectors 44
 Shelf, DCD 3, 56, 57, 59, 70, 74, 77, 79, 81
 Shelf, DCD500 84
 Shelf, DCD-519 82
 Shelf, DCD-523 82
 Shelf, DCD-LPR 8, 15, 17, 22, 33, 38, 44, 47, 53, 56, 57, 59, 60, 64, 65, 66, 70, 77, 79, 81, 82, 85, 86
 Shelf, LPR 36
 Single and dual lightning protector installations 70
 Single inside lightning protector 3, 33
 Single lightning protector installation 5, 8
 Single lightning protector installation method 35
 Single lightning protector installations 10, 33, 36
 Single lightning protector method 3, 33
 Single lightning protector scheme 5, 10, 17, 36, 47
 Single lightning protector schemes 66
 Site survey 3
 SMB-to-BNC connectors 77
 Solid-state lightning protectors 26
 Specialist, office grounding 55
 ST2 card 3
 ST2E card 3
 ST3E card 3, 86
 ST3E clocks 3
 STAT terminal block 81
 Strike, lightning 10, 15, 16, 25
 Stud, GND 17, 22, 26
 Survey, site 3
 System, GPS 31
 System, LORAN-C 31
 System, ring ground 10

T

Terminal block, MAJ 81
 Terminal block, MIN 81
 Terminal block, STAT 81
 Terminal, ground 17, 25
 Terminals, GND 26
 Three-conductor power cable 4, 5, 15, 22, 26
 Three-connector ribbon cable 64
 three-connector ribbon cable 56
 Three-connector ribbon cable connections 64
 Time-of-Day (TOD) adapter to DCD-LPR Shelf connections 56
 Timing Interface modules 74
 TNC card 3
 TNC clocks 3
 TNC-E card 3
 TOD adapter 60
 TOD adapter connection(s) 58
 TOD adapter to RS-422-to-RS-232 converter connection(s) 56
 Twinax cable 33, 36, 38, 40, 49, 51, 55, 70

Twinax cable wires 49, 52
Twinax cable, LORAN 47
Twinax cables 47, 51
Two lightning protectors 3
Type 1 lightning protector 47
Type 1 lightning protectors 40, 44
Type 2 lightning protector 47, 51
Type 2 lightning protector connections 47
Type 2 lightning protectors 40, 44
Types, lightning protector 44

W

Weather-resistant junction box 7, 10, 15, 25, 26, 35, 36, 38, 55
Weather-resistant junction box(es) 7
Weather-resistant junction boxes 31
Wire colors, GTR power cable 17, 22