DIGITAL CLOCK DISTRIBUTOR

LOCAL PRIMARY REFERENCE

MAINTENANCE

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Tables

1. GENERAL

1.01 This section provides maintenance and operation procedures for the Symmetricom Digital Clock Distributor - Local Primary Reference (DCD-LPR) System.

1.02 This section is reissued for the following reasons. Changes and additions are marked with change bars.

- Updated section 2B.
- Removed references to analog capability for the GTI-18 card.
- Updated Table B, GTI Card Alarm and Status Messages.
- Updated Table G, GTI Card Operation.
- Updated section 7B.

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:

ALM	alarm
DCD	Digital Clock Distributor
FR	framing
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
OSC	oscillator
pps	pulses per second
SSM	Synchronization Status Messaging
ST2	Stratum-2 Clock
ST2E	Enhanced Stratum-2 Clock
ST3E	Enhanced Stratum-3 Clock
TI	timing interface card or slot
TC	trouble code
TNC	Transit Node Clock
TOD	Time-of-Day
UTC	Universal Coordinated Time

1.05 Cards which may be included in the DCD-LPR System are listed in Table A.

Table A. DCD-LPR Cards

CARD	NAME USED IN THIS SECTION	PART NUMBER	REVISION	FEATURES
ANSI-STANDARD CARDS				
GTI^{V5}	GTI-17	090-42140-17	–	Input: 5 MHz or 10 MHz, quartz, rubidium, or better quality clocks, any combination of two quartz, rubidium, or better quality clocks, or LOU card Output: 1.544 Mb/s (T1) Framing format: ESF or D4 Time-of-Day SSM capable
GTI	GTI-15	090-42140-15	A	Input: 5 MHz or 10 MHz, quartz, rubidium, or better quality clocks, any combination of two quartz, rubidium, or better quality clocks, or LOU card Output: 1.544 Mb/s (T1) Framing format: ESF or D4 Time-of-Day
GTI^{V5}	GTI-15	090-42140-15	B or later	
GTI	GTI-13 (Note 4)	090-42140-13	D or earlier	Input: 5 MHz or 10 MHz, quartz, rubidium, or better quality clocks, any combination of two quartz, rubidium, or better quality clocks, or LOU card Output: 1.544 Mb/s (T1) Framing format: ESF or D4
GTI^{V5}	GTI-13 (Note 4)	090-42140-13	E or later	
GTI	GTI-11 (Note 4)	090-42140-11	–	Input: 5 MHz or 10 MHz, rubidium or better quality clocks, ST2E or ST2 cards only Output: 1.544 Mb/s (T1) Framing format: ESF or D4
LTI	LTI	090-41140-01	–	Input: 5 MHz from ST2E or ST2 cards only Output: 1.544 Mb/s (T1) Framing format: ESF or D4

Table A. DCD-LPR Cards (Cont'd)

CARD	NAME USED IN THIS SECTION	PART NUMBER	REVISION	FEATURES
ITU-STANDARD CARDS				
GTI^{V5}	GTI-18	090-42140-18	–	Input: 5 MHz or 10 MHz, quartz, rubidium, or better quality clocks, any combination of two quartz, rubidium, or better quality clocks, or LOU card Output: 2.048 Mb/s (E1) Framing format: CCS/CAS with or without CCS4 Time-of-Day SSM capable
GTI^{V5}	GTI-16	090-42140-16	–	Input: 5 MHz or 10 MHz, quartz, rubidium, or better quality clocks, any combination of two quartz, rubidium, or better quality clocks, or LOU card Output: 2.048 Mb/s (E1) Framing format: CCS/CAS with or without CCS4 Time-of-Day
GTI	GTI-14 (Note 4)	090-42140-14	D or earlier	Input: 5 MHz or 10 MHz, quartz, rubidium, or better quality clocks, any combination of two quartz, rubidium, or better quality clocks, or LOU card Output: 2.048 Mb/s (E1) Framing format: CCS/CAS with or without CCS4
GTI^{V5}	GTI-14 (Note 4)	090-42140-14	E or later	
GTI	GTI-12 (Note 4)	090-42140-12	–	Input: 5 MHz or 10 MHz, rubidium or better quality clocks, TNC-E cards only Output: 2.048 Mb/s (E1) Framing format: CCS/CAS with or without CCS4
ANSI-STANDARD AND ITU-STANDARD CARDS				
LOU	LOU-1	090-42145-01	–	Source: one oven-controlled crystal oscillator with two parallel outputs
LOU	LOU-2	090-42145-02	–	Source: two independent oven-controlled crystal oscillators, each with one output

Notes:
1. The ^{V5} indicates that this is a Version 5 card.
2. Where information is common to all GTI cards, these cards are collectively referred to as GTI cards.
3. Where information is common to both LOU cards, these cards are collectively referred to as LOU cards.
4. Manufacture discontinued.

Notes:

1. Where information is common to the TNC-E, ST2, and ST2E cards, these cards are collectively referred to as rubidium clock cards.
2. Where information is common to the TNC and ST3E cards, these cards are collectively referred to as quartz clock cards.

2. TROUBLESHOOTING

A. Troubleshooting Considerations

2.01 Most alarm conditions in the DCD-LPR are not out-of service or service-affecting conditions. The system is designed with redundant power and timing interface cards.

2.02 The only true out-of-service condition is when ALL power is lost to a shelf, or ALL reference inputs fail. In most cases, these conditions are caused by operating errors from hasty attempts at troubleshooting alarm conditions in the system before proper alarms analysis is performed.

2.03 Before taking any action on the system, such as removing cards, consider the following guidelines for troubleshooting the DCD-LPR:

1. **DON'T** touch the shelf until you have analyzed the condition and know the possible result of any planned corrective action.

2. **DON'T PANIC!** Both major and minor alarms in the shelf require immediate attention. But, very few alarms in the DCD-LPR are service affecting; IMPROPER corrective actions could be service affecting.

3. **DON'T** touch the shelf until you have been properly grounded.

4. **DO** write down any alarm and normal lamp conditions in the shelf. These will help you to determine where to look for the cause of the condition.

5. **DO** use the DCD-LPR manual and available job aids to assist you.

6. **DO** determine if any network elements (NE) being timed from the DCD-LPR are in alarm, or reporting slips.

7. **DO** take your time. An operating error can affect ALL network elements in the office.

8. **DO** contact your supervisor, technical support, and/or Symmetricom if you are not sure what to do.

2.04 Always follow proper electrostatic discharge (ESD) precautions when handling DCD-LPR cards. This includes, but is not limited to:

- Wearing a properly grounded and tested wrist strap when handling cards

- Storing DCD cards only in antistatic packaging provided by the factory

B. Troubleshooting Procedures

2.05 If problems are encountered while troubleshooting the system, contact Symmetricom's Customer Technical Assistance Center (CTAC) at one of the following numbers:

- +44 1483 510300 (U.K.)

- +1 408 428 7907(U.S.A.)

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

2.06 When calling CTAC, ensure that the following information is readily available:

- Shelf part number, serial number and issue/revision level

- DCD-LPR System configuration (e.g., one GTI and one LTI, two GTIs, one GTI and one LOU, external power supply, etc.)

- Card revision level

- Description of the problem including:

  — Current status

  — Error messages displayed

  — Lamp settings

GTI or LTI LCD

2.07 If the LCD on the GTI or LTI card fails to appear, check the connector (which plugs into the backplane); if the connector is good, the card is defective. If this is the case, perform the procedures in Part 4, and return the card to the factory.

System Test Fail Messages for GTI Cards

2.08 The following conditions will lead to GTI cards sending a SYSTEM TEST FAIL message.

1. When the WatchDog timer expires, the LCD display shows:

   SYSTEM TEST FAIL
   x:yyyy:WD

where

x = current bank number
yyyy = return address of function where the failure occurs

When this occurs, reseat the GTI card.

2. The software detects a failure (i.e., unrecognizable GTI state, status, alarm, etc.). The LCD display shows:

   SYSTEM TEST FAIL
   x:yyyy:SW

where

x = current bank number
yyyy = return address of function where the failure occurs

When this occurs, replace the GTI card.

RS-422–to–RS-232 Converter

2.09 If the equipment using the TOD signal is not functioning properly, and an RS-422–to–RS-232 converter is used, check the converter as follows:

1. At the equipment (DTE) end, disconnect the RS-232 cable (which comes from the converter).

2. Connect the cable to a PC communication port.

3. Run terminal emulation software on the PC, and observe the format of the TOD signal: it should be as shown in the Data Format part of the Time-of-Day section of the DCD-LPR System Specifications Table (in the Functional Description section).

DCD-LPR Cards

2.10 Refer to the following tables for alarm messages or conditions, and the appropriate actions for troubleshooting DCD-LPR cards:

- Table B for a list of alarm messages, and appropriate actions to be taken for troubleshooting the GTI card, and Table D for troubleshooting the GTI fiber optic system

- Table E for a list of alarm messages, and appropriate actions to be taken for troubleshooting the LTI card

- Table F for a list of conditions, and appropriate actions to be taken for troubleshooting the LOU card.

Table B. GTI Card Alarm and Status Messages

MESSAGE	EXPLANATION	ACTION
Notes: 1. If multiple alarms exist, troubleshoot alarms in the order in which they appear in this table. 2. The same message may appear in this table as more than one type of alarm (i.e., MJ and MN). The alarm severity for some events is determined by the amount of time the condition has persisted. 3. Major and minor alarms are cleared when the message repeats with CL, instead of MN or MJ. 4. The TIME CONVERGING condition has cleared when CONVRGED ON TIME is displayed, the INSUF SATELLITES condition has cleared when SUFF. SATELLITES is displayed, and the GPS FREQ TOL condition has cleared when GPS FREQ TOL CL is displayed. 5. Follow the appropriate replacement procedure in this section when replacing a card or antenna. 6. If using a rubidium and quartz clock combination in the DCD Shelf, ensure that the rubidium clock card is installed, and its ACTIVE lamp lit, prior to installing the quartz clock card. Failure to allow the rubidium clock card to become active before installing the quartz clock card may prevent the GTI from attaining GTI LOCK. Also, ensure that the ST2/ST3 switch on the DCD Shelf backplane is set to ST2. 7. If upgrading an existing quartz/quartz clock DCD System, and installing a rubidium and quartz clock combination, both quartz clock cards must be removed before installing the rubidium clock card. During the rubidium clock card's stabilization period (approximately 1 h), the shelf will be in-service, but will not have holdover clock capabilities; timing will be provided by the active clock input card. To upgrade the system, follow the procedures listed below: a. Remove the STB clock. b. Remove the STA clock. c. Install the rubidium clock card in the STA slot. Wait for the ACTIVE lamp to light. d. Once the ACTIVE lamp has lit, install the quartz clock card in the STB slot. 8. If using the GTI-15, -16, -17, or -18, the STATUS button must be pressed to display the alarm screens. Test Equipment: Digital Multimeter (Fluke 77 or equivalent)		
MAJOR (MJ) ALARMS		
Note: The GPS LOS MINOR alarm condition escalates to a GPS INVALID condition when the alarm delay time is exceeded.		
GPS INVALID	Timing information from the GTR is invalid. (This condition has existed longer than the time set for a major alarm on the GTI card.)	1. If a GPS FREQ TOL alarm exists, replace the GTR, using the replacement procedure in this section. If a GPS FREQ TOL alarm does not exist, continue to the next step. 2. If an INSUF SATELLITES alarm exists, visually check the GTR for obstructions which may be blocking or partially blocking the GTR's view of the sky (e.g., snow, new building construction, trees, something laying on the GTR, the GTR fell over). If an INSUF SATELLITES alarm does not exist, call Symmetricom's CTAC.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
GPS LOS	No signal is being received from the GTR. (This condition has existed longer than the time set for a major alarm on the GTI card.)	1. If a GTR PWR FAULT alarm exists, fix that problem first (see GTR PWR FAULT under MINOR ALARMS in this table), then recheck the alarms. If a GTR PWR FAULT alarm does not exist, continue to the next step. 2. Fix the optical problem (see GTR COMM under MINOR ALARMS in this table). ***Note:*** If this and the GTR COMM message are displayed, and the system is configured with an external power supply, check the external power supply; if bad, remove and replace the external power supply. See also GTR COMM.
GTI FAIL:1	GTI output is not Stratum-1 quality.	1. Reseat the GTI card. If the alarm persists, continue to the next step. 2. Replace the GTI card. If the alarm persists, continue to the next step. 3. Check and/or replace the GTR.
GTI FAIL:2	GTI output is not Stratum-1 quality.	1. Reseat the GTI card. If the alarm persists, continue to the next step. 2. Use the screen display to check performance metrics for FREQ A or B frequency offset readings: if more than 500 E-12 for rubidium, or more than 5000 E-12 for quartz, check and/or replace the rubidium or quartz card in the DCD Shelf.
GTI FAIL:3	GTI output is not Stratum-1 quality.	Reseat the GTI card. If the alarm persists, replace the GTI card.
GTR FAIL:1	Preamp current out of range.	Reseat the GTI card. If the condition still exists, replace the GTR.
GTR FAIL:2	PLL out of lock.	Reseat the GTI card. If the condition still exists, replace the GTR.
GTR FAIL:3	System not locked to GPS time (4 KHz not valid)	Reseat the GTI card. If the condition still exists, replace the GTR.
GTR FAIL:4	Flash EPROM checksum failure	Reseat the GTI card. If the condition still exists, replace the GTR.
GTR FAIL:5	RAM EPROM checksum failure	Wait. If the condition does not clear, reseat the GTI card. If the condition still exists, replace the GTR.
GTR PWR FAULT	There is a fault on the output of the GTR power supply (located on the GTI card).	The GTI-11, -12, -13, and -14 provide a GTR PWR FAULT major alarm after a user-configuration alarm delay time by setting sections 1 and 2 on SW2. The GTI-11, -12, -13, and -14 provide an immediate minor alarm upon a GTR PWR FAULT condition. The GTI-15, -16, -17, and -18 provide an immediate alarm upon a GTR PWR FAULT condition. For the appropriate actions, refer to the GTR PWR FAULT MINOR ALARM section of this table.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
NO INPUTS	No signal is being received from the GTR, OSC A, and OSC B inputs.	1. Check for OSC A LOS and OSC B LOS alarms on the other GTI card in the shelf (if equipped); or check for OSC BOTH alarm on the LTI card in shelf (if equipped); or check for OSC A and OSC B lamps lit red on the LOU card in shelf (if equipped). If the other card does not indicate loss of oscillator inputs or if there is no other card in the shelf, replace the GTI card. If the alarm persists, or if the other card indicates loss of oscillator inputs, continue to the next step. 2. Verify that there is power to the DCD Shelf. If not, apply power. If there is power to the DCD Shelf, continue to the next step. 3. If 5 MHz isolation modules are not used between the DCD Shelf and the DCD-LPR Shelf, skip to the next step. If 5 MHz isolation modules are used, check that the isolation modules are correctly installed (from the appropriate connector on the DCD Shelf backplane to the "TO DCD SHELF" end of one isolation module, and from the appropriate connector on the DCD-LPR Shelf to the "TO LPR" end of the isolation module); refer to Table C for isolation module connections. If reversed, install correctly, and recheck the alarms. If not reversed, continue to the next step. 4. If rubidium clock cards are not used in the DCD Shelf, skip to the next step. If rubidium clock cards are installed in the DCD Shelf, verify that the ACTIVE lamps are lit on the rubidium clock cards. (If the rubidium clock cards have recently been powered, up to 1 h may be required before the ACTIVE lamps light green.) If the ACTIVE lamps are not lit, wait until the rubidium clocks are warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamps are lit on the rubidium clock cards, continue to the next step. 5. Replace the cables between the DCD and LPR Shelves. Recheck the alarms.
Note: The following alarm applies only to the GTI-15, -16, -17, and -18 cards; the TOD INVALID minor alarm condition escalates to a TOD FAIL condition when the alarm delay is exceeded.		
TOD FAIL	The GTI card detects a discrepancy between the synthesized 1 pps signal it is creating and the 1 pps reference signal from the GTR. (This condition has existed longer than the time set for a minor alarm by switches on the GTI card.)	1. If other alarms exist (GPS LOS, GPS INVALID, NO INPUTS, GTR FAIL, or INSUF SATELLITES), troubleshoot these alarms before addressing the TOD FAIL alarm. 2. If TOD FAIL is not accompanied by other alarms, replace the GTI card.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS		
FUSE A	Fuse A on the DCD-LPR Shelf has failed, or battery A has failed.	1. Measure the voltage on TB1, at the rear of the DCD-LPR Shelf. The BATT A terminal should measure –40 V dc to –56 V dc in relation to the RTN terminal. If the voltage is not within the specified range, trouble-shoot office battery A. If the voltage is within the specified range, continue to the next step. 2. Replace the –48V A fuse on the front panel of the DCD-LPR Shelf.
FUSE B	Fuse B on the DCD-LPR Shelf has failed, or battery B has failed.	1. Measure the voltage on TB5, at the rear of the DCD-LPR Shelf. The BATT B terminal should measure –40 V dc to –56 V dc in relation to the RTN terminal. If the voltage is not within the specified range, trouble-shoot office battery B. If the voltage is within the specified range, continue to the next step. 2. Replace the –48V B fuse on the front panel of the DCD-LPR Shelf.
GPS INVALID	Timing information from the GTR is invalid. (This condition has existed longer than the time set for a minor alarm by switches on the GTI card.)	1. If a GPS FREQ TOL alarm exists, replace the GTR. If a GPS FREQ TOL alarm does not exist, continue to the next step. 2. If an INSUF SATELLITES alarm exists, visually check the GTR for obstructions which may be blocking or partially blocking the GTR's view of the sky (snow, new building construction, trees, something laying on the GTR, the GTR fell over). If an INSUF SATELLITES alarm does not exist, call Symmetricom's CTAC.
GPS LOS	No signal is being received from the GTR. (This condition has existed longer than the time set for a minor alarm by switches on the GTI card.)	1. If a GTR PWR FAULT alarm exists, fix that problem first (see GTR PWR FAULT under MINOR ALARMS in this table), then recheck the alarms. If a GTR PWR FAULT alarm does not exist, continue to the next step. 2. Fix the optical problem (see GTR COMM under MINOR ALARMS in this table).

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
GTI OUT FAULT	One (or both) of the GTI outputs has a fault (the output is shorted externally, or the GTI card has failed).	1. Unwrap the ring (R) lead from the upper (TB1) set of pins on the GTI Module for the card displaying the alarm.If the GTI OUT FAULT alarm clears, rewrap the R lead on TB1, and skip to Step 3. If the GTI OUT FAULT alarm does not clear, continue to the next step. 2. Unwrap the R lead on the lower (TB2) set of pins on the GTI Module. If the GTI OUT FAULT alarm does not clear, rewrap the R lead on TB1 and TB2, then replace the GTI card, using the replacement procedure in this section. If the GTI OUT FAULT alarm clears, rewrap the R lead on TB1 and TB2, then skip to Step 6. 3. Trace the cable from the upper set of pins (TB1) on the GTI Module for the card displaying the alarm to one of the inputs on the DCD Shelf. 4. Pull the appropriate clock input card out of the shelf (traced in the previous step). If the GTI OUT FAULT alarm clears, replace the clock input card, using the procedures in the Maintenance section of the DCD Shelf manual. If the GTI OUT FAULT alarm does not clear, continue to the next step. 5. Verify that the wiring from the upper set of pins (TB1) on the GTI Module for the card displaying the alarm to the input of the DCD Shelf is correct (ensure that tip [T] is connected to tip, ring [R] to ring, and shield [S] to shield). If the wiring is not correct, correct the wiring. If the wiring is correct, replace the cable between the upper set of pins (TB1) on the GTI Module for the card displaying the alarm and the input of the DCD Shelf. 6. Trace the cable from the lower set of pins (TB2) on the GTI Module for the card displaying the alarm to one of the inputs on the DCD Shelf. 7. Pull the appropriate clock input card out of the shelf (traced in the previous step). If the GTI OUT FAULT alarm clears, replace the clock input card, using the procedures in the Maintenance section of the manual for the DCD Shelf. If the GTI OUT FAULT alarm does not clear, continue to the next step. 8. Verify that the wiring from the lower set of pins (TB2) on the GTI Module for the card displaying the alarm to the input of the DCD Shelf is correct (ensure that tip [T] is connected to tip, ring [R] to ring, and shield [S] to shield). If the wiring is not correct, correct the wiring. If the wiring is correct, replace the cable between the lower set of pins (TB2) on the GTI Module for the card displaying the alarm and the input of the DCD Shelf.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
GTR COMM	There has been no status message from the GTR for more than 1 min.	On the GTI Fiber Optic I/O Module (for Slot A or B, depending on the location of the card displaying the alarm) on the rear of the DCD-LPR Shelf, observe the lamp labeled DS1. If the lamp is lit green, replace the GTI card, using the replacement procedure in this section. If the lamp is off, see Table D. ***Note:*** If this and the GPS LOS message are displayed, and the system is configured with an external power supply, check the external power supply; if bad, remove, and replace, the external power supply. See also GPS LOS.
Note: The following message applies only to the GTI-11, GTI-12, GTI-13, and GTI-14 cards; the GTI-15, -16, -17, and -18 cards provide an immediate major alarm, without immediately affecting the GTI card timing output, upon a GTR PWR FAULT. The GTI-11, GTI-12, GTI-13, and GTI-14 cards require the user to configure for the major or minor alarm.		
GTR PWR FAULT	There is a fault on the output of the GTR power supply (located on the GTI card).	***Notes:*** a. If an external power supply is being used to power the GTR, this message indicates that the power supply board on the GTI card has not been removed. Remove the power supply board from the GTI card (as indicated in the Test and Acceptance section of this manual) if an external power supply is being used to power the GTR. b. Save the removed GTI card power supply daughter board, in case the GTI card has to be returned for servicing. 1. On the rear of the DCD-LPR Shelf, measure the voltage between the PWR– and PWR+ terminals on the GTR POWER A (TB3) or GTR POWER B (TB4) terminal block (depending on the location of the card displaying the alarm: Slot A or B). If the voltage is between 29 V and 33 V, skip to Step 4. If the voltage is not between 29 V and 33 V, continue to the next step. 2. On the rear of the DCD-LPR Shelf, disconnect the power cable from the terminal block (before disconnecting, note the color of the wires on each terminal), and remeasure the voltage. If the voltage is not between 29 V and 33V, replace the power cable on the terminal block (ensure colors are correct, as previously noted), then replace the GTI card, using the replacement procedure in this section. If the voltage is between 29 V and 33V, replace the power cable on the terminal block (ensure colors are correct as previously noted), and continue to the next step.

Table B. GTI Card Alarm and Status Messages (Cont'd)

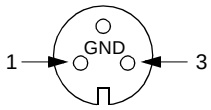
MESSAGE	EXPLANATION	ACTION
		MINOR (MN) ALARMS (Contd)
GTR PWR FAULT (Cont'd)	(See previous)	3. At the (inside, if configured with two lightning protectors) GTR lightning protector, remove one of the power leads from the GTR side of the protector, and measure the current in series with the disconnected lead and lightning protector terminal. If the current is more than 200 mA, replace the GTR antenna, using the replacement procedure in this section. If the current is less than 185 mA, replace the inside GTR lightning protector, and recheck the alarms. 4. At the (inside, if configured with two lightning protectors) GTR lightning protector, measure the voltage across the power leads on the GTR side of the protector. If the voltage is between 29V and33 V, skip to S tep6. If the voltage is not between 29 V and 33 V, continue to the next step. 5. At the (inside) GTR lightning protector, measure the voltage across the power leads on the DCD-LPR Shelf side of the protector. If the voltage is not between 29 V and 33 V, replace the cable between the DCD-LPR Shelf and the (inside, if configured with two lightning protectors) GTR lightning protector. If the voltage is between 29 V and 3 3V, replace the (inside, if configured with two lightning protectors) GTR lightning protector, and recheck the alarms. 6. At the GTR antenna, remove the 4 nuts holding the GTR onto the mounting flange, raise the GTR enough to disconnect the power connector from the GTR, and measure the voltage between pins 1 and 3 in the connector on the end of the power cable (see sketch below). If the voltage is between 29 V and 33V, replace the GTR antenna, using the replacement procedure in this section, then recheck the alarms. In single lightning protector installations, if the voltage is not between 29 V and 33V, contact Symmetricom's CTAC for assistance. If using two lightning protectors, reconnect the cable, secure the GTR to the mounting flange, and continue to the next step.  7. At the outside GTR lightning protector, measure the voltage across the power leads on the DCD-LPR Shelf side of the protector. If the voltage is not between 29 V and 33 V, replace the cable between the inside and outside GTR lightning protectors. If the voltage is between 29V and 33 V, continue to the next step. 8. At the outside GTR lightning protector, measure the voltage across the power leads on the GTR antenna side of the protector. If the voltage is between 2 9V and 33 V, replace the cable between the outside GTR lightning protector and the GTR antenna. If the voltage is not between 29 V and 33 V, replace the outside GTR lightning protector.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
OSC A LOS	No signal is being received on the OSC A input.	1. Check for the OSC A LOS alarm on the other GTI card in shelf (if equipped), or check for the OSC A alarm on the LTI card in the shelf (if equipped). Or, check if the OSC A lamp is lit red on the LOU card in the shelf (if equipped). If the other card does not indicate loss of oscillator input, or if there is no other card in the shelf, replace the GTI card. If the alarm persists, or if the other card indicates loss of same oscillator input, continue to the next step. 2. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC A input, skip to the next step. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC A input, check that the isolation module is correctly installed (from the appropriate connector on the DCD Shelf backplane to the "TO DCD SHELF" end of one isolation module, and from the appropriate connector on the DCD-LPR Shelf to the "TO LPR" end of the isolation module); refer to Table C for isolation module connections. If reversed, install correctly, and recheck the alarms. If not reversed, continue to the next step. 3. If rubidium clock cards are not used in the DCD Shelf, skip to the next step. If rubidium clock cards are installed in the DCD Shelf, verify that the ACTIVE lamp is lit on the rubidium clock card in the STA slot. (If the rubidium clock card has recently been powered, up to 1 h may be required before the ACTIVE lamp lights green.) If the ACTIVE lamp is not lit, wait until the rubidium clock card is warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamp is lit on the rubidium clock card in the STA slot, continue to the next step. 4. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC A input, replace the cable between the DCD Shelf and the DCD-LPR Shelf OSC A input. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC A input, bypass the isolation module by using single continuous cable from the output of the DCD Shelf to the OSC A input of the DCD-LPR Shelf. Recheck the alarms. If the OSC A alarm has cleared, reconnect the original cable through the isolation module, then replace the following, one at a time, until the alarm clears: a. The cable between the DCD Shelf and the isolation module b. The cable between the isolation module and the DCD-LPR Shelf OSC A input c. The isolation module
OSC A TOL	The OSC A signal is out of tolerance compared to the OSC B and GTR signals.	Troubleshoot the alarms on the DCD Shelf, using the Maintenance section of the manual for that shelf.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
OSC B LOS	No signal is being received on the OSC B input.	1. Check for the OSC B LOS alarm on the other GTI card in the shelf (if equipped); or, check for the OSC B alarm on the LTI card in the shelf (if equipped); or, check if the OSC B lamp is lit red on the LOU card in the shelf (if equipped). If the other card does not indicate loss of oscillator input, or if there is no other card in the shelf, replace the GTI card. If the alarm persists, or if the other card indicates loss of the same oscillator input, continue to the next step. 2. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC B input, skip to the next step. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC B input, check that the isolation module is correctly installed (from the appropriate connector on the DCD Shelf backplane to the "TO DCD SHELF" end of one isolation module, and from the appropriate connector on the DCD-LPR Shelf to the "TO LPR" end of the isolation module); refer to Table C for isolation module connections. If reversed, install correctly, and recheck the alarms. If not reversed, continue to the next step. 3. If rubidium clock cards are not used in the DCD Shelf, skip to the next step. If rubidium clock cards are installed in the DCD Shelf, verify that the ACTIVE lamp is lit on the rubidium clock card in the STA slot. (If the rubidium clock card has recently been powered, up to 1 h may be required before the ACTIVE lamp lights green.) If the ACTIVE lamp is not lit, wait until the rubidium clock card is warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamp is lit on the rubidium clock card in the STA slot, continue to the next step. 4. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC B input, replace the cable between the DCD Shelf and the DCD-LPR Shelf OSC B input. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC B input, bypass the isolation module by using single continuous cable from the output of the DCD Shelf to the OSC B input of the DCD-LPR Shelf. Recheck the alarms. If the OSC B alarm has cleared, reconnect the original cable through the isolation module, then replace the following, one at a time, until the alarm clears: a. The cable between the DCD Shelf and the isolation module b. The cable between the isolation module and the DCD-LPR Shelf OSC B input c. The isolation module
OSC B TOL	The OSC B signal is out of tolerance compared to the OSC A and GTR signals.	Troubleshoot the alarms on the DCD Shelf, using the Maintenance section of the manual for that shelf.

Table B. GTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
Note: The following alarm applies only to the GTI-15, -16, -17, and -18 cards; this alarm escalates to a TOD FAIL condition when the alarm delay time set on the GTI card is exceeded.		
TOD INVALID	The GTI card detects a discrepancy between the synthesized 1 pps signal it is creating and the 1 pps reference signal from the GTR.	1. If other alarms exist (GPS LOS, GPS INVALID, NO INPUTS, GTR FAIL, or INSUF SATELLITES), troubleshoot these alarms before addressing the TOD INVALID alarm. 2. If TOD INVALID is not accompanied by other alarms, wait to see if it escalates to a TOD FAIL alarm.
STATUS MESSAGES		
GPS FREQ TOL	Timing from the GTR is out of tolerance compared to the OSC A and OSC B signals.	None required if this message occurs alone. If a GPS INVALID alarm exists under the MAJOR or MINOR alarms above, troubleshoot that alarm.
GPS INVALID	Timing information from the GTR is invalid.	None required if this message occurs as a STATUS message.
INSUF SATELLITES	Not enough satellites can be located.	None required if this message occurs alone. If a GPS INVALID alarm exists under the MAJOR or MINOR alarms above, troubleshoot that alarm.
TIME CONVERGING	Timing from the GTR is not stable.	None required if this message occurs alone. If a GPS INVALID alarm exists under the MAJOR or MINOR alarms above, troubleshoot that alarm.
Note: For information on SSM status messages, refer to Section 7A, GTI Card Operation, and Section 7B, GTI Card Displays. SSM status messages apply only to GTI-17 and GTI-18 cards. These messages require no action; they indicate SSM configuration and software version information only.		

Table C. Isolation Module Connections

DCD SHELF			DCD-LPR SHELF	
SHELF TYPE	**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

Table D. GTI Fiber Optic System Troubleshooting

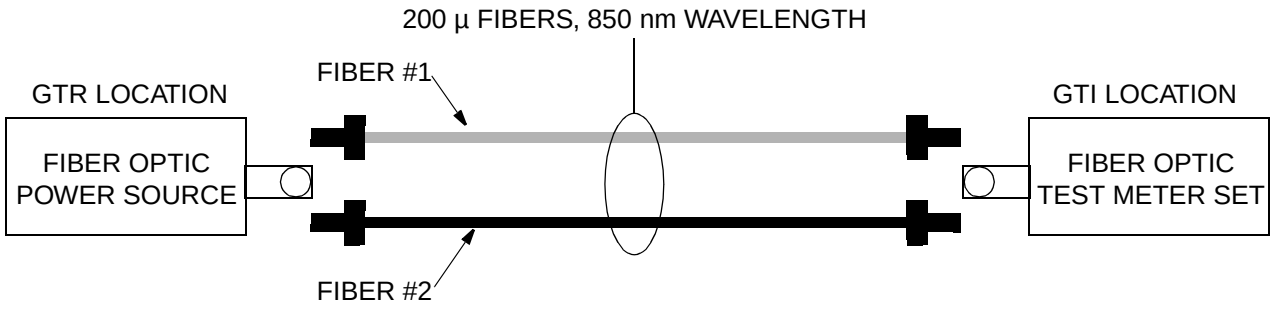
STEP	PROCEDURE
Use this procedure to troubleshoot when the DS1 lamp is off on the GTI Fiber Optic I/O Module.	
1	On the GTI Fiber Optic I/O Module (for Slot A or B, depending on the location of the card displaying the alarm) on the rear of the DCD-LPR Shelf, swap the two fiber cables on the connectors on the GTI Fiber Optic I/O Module (remove and reconnect to the opposite connector [XMT J3 and RCV J2] to check for crossed cables). If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, connect the fiber cables to the original connectors, and continue to the next step.
2	Remove the GTI I/O Module from the J9 or J10 connector on the LPR backplane, align the module pins with the connector sockets, and reseat the module (the J9 or J10 connector pins may have become off-set). If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to the next step.
3	Replace the GTI I/O Module. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to the next step.

Table D. GTI Fiber Optic System Troubleshooting (Cont'd)

STEP	PROCEDURE
4	Determine the quality of fiber cable connector terminations. The fiber cable specifications are: glass multimode 850 nm wavelength, 200 µ core, 230 µ cladding, 500 µ buffer, 2.5 mm (0.1 in.). The maximum fiber loss allowed between the GTI I/O Module and the GTR, including the connectors, is 7 dB. To test the connector terminations, do one of the following: • Obtain a Wilcom FS850 fiber optic power source (or equivalent) and a Wilcom FM850 fiber optic meter test set (or equivalent), and continue to Step 5 (recommended). • If a fiber optic power meter test set is unavailable, perform the following (not recommended): a. Lift a colored fiber cable off the GTR, and point the ST type connector toward bright sunlight, or shine a flashlight into the ST type connector. b. Lift the same color fiber cable off the GTI I/O Module, and point the ST type connector at a piece of white paper. c. If the light on the paper is bright, check the fiber cable strain relief at the GTR, and/or replace the GTR. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to step d. If the light is dim or missing, replace the ST type connectors, then repeat steps a and b. If the light is still dim or missing, replace the fiber cable. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to step d. d. Repeat Steps a through c on the other fiber cable. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, contact CTAC.
5	With both fiber cables connected at the GTR, and the GTI card plugged in, lift the RCV fiber from the GTI I/O Module, and plug it into the fiber power meter connector for multimode 62.5 µ, 850 nm wavelength. If no light is received, continue to Step 6. If the reading exceeds 30 dB, perform the following: a. Install a strain relief on the fiber cable at the GTR mounting flange. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to Step b. b. Replace the ST type connectors. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to Step c. c. Replace the GTR. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, continue to Step d. d. Replace the fiber cable. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, contact CTAC.
6	Measure each of the fibers end to end, using a source with a known output level at one end, and the test set at the other end; record the readings.
7	Subtract the source level from the received level to determine the fiber loss (see Figur e1 for examples).

Table D. GTI Fiber Optic System Troubleshooting (Cont'd)

STEP	PROCEDURE
8	If the fiber loss is less than 7 dB, check the fiber cable strain relief at the GTR, and/or replace the GTR. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, contact CTAC. If the fiber loss exceeds 7 dB, replace the ST type connectors, then repeat Steps 6 and 7. If the fiber loss still exceeds 7 dB, replace the fiber cable. If the DS1 lamp is lit green, the trouble has been eliminated. If the DS1 lamp is off, contact CTAC.



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 1. Fiber Termination Test

Table E. LTI Card Alarm and Status Messages

MESSAGE	EXPLANATION	ACTION
Notes: 1. If multiple alarms exist, troubleshoot alarms in the order in which they appear in this table. 2. The same message may appear in this table as more than one type of alarm (i.e., MJ and MN). The alarm severity for some events is determined by the amount of time the condition has existed. 3. Major and minor alarm messages are cleared when the message repeats with CL following the message, instead of MN or MJ. 4. Follow the appropriate replacement procedure in this section when replacing a card or an antenna. Test Equipment: Digital Multimeter (Fluke 77 or equivalent)		
MAJOR (MJ) ALARMS		
ANTENNA LOSS	The current supplied to the LORAN antenna is out of tolerance (the fault is in the line or antenna, or the LTI card has failed).	***Note:*** These tests will not affect the outputs of the DCD distribution shelf (DCD-ST2, DCD-519, or DCD-523). 1. Measure the voltage across the SIG+ and SIG– terminals on TB6 (Slot A) or TB7 (Slot B), as appropriate. Requirement: 12 V dc ±1 V dc for either load or no-load. 2. If less than 12 V ±1 V, lift either the SIG+ or SIG– lead from the TB and remeasure across the SIG+ and SIG– terminals on the TB. If still significantly less than 12 V, replace the LTI card. If 12 V ±1 V, set the meter to mA and connect the meter probes in series with the lifted lead and the vacant TB terminal. Requirement: more than 4 mA and less than 50 mA. If less than 4 mA, the power leads to the antenna are open, or the antenna is bad. If more than 50 mA, the power leads to the antenna are shorted, one of the lightning protectors is bad, or the antenna is bad. 3. Connect a 1000 Ω, 1/4 W resistor in series with one of the ampmeter probes; connect the other side of the resistor and the other meter probe across the SIG+ and SIG– terminals of the TB. Requirement: approximately 12 mA ±3 mA. If results are out of the mA range, replace the LTI card. If within the mA range, remove the resistor and ampmeter, and reconnect the lifted lead to the TB terminal. 4. Go to the INSIDE lightning protector (LP). Remove the twinax connector from the LPR side of the LP. Strip a 25.4 mm to 50.8 mm (1 in. to 2 in.) piece of 0.644 mm (22 AWG) wire. Insert the wire into the socket of the twinax connector on the cable from the DCD-LPR Shelf. Measure the voltage across the socket and pin of the connector. If less than 1 2V, either replace (or repair) the connector on the cable, or replace the cable between the INSIDE LP and the DCD-LPR Shelf. If it reads 12 V, reconnect the twinax connector to the LP (LPR side).

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
	MAJOR (MJ) ALARMS (Contd)	
ANTENNA LOSS (Cont'd)	(See previous)	5. Remove the twinax connector from the ANT side of the LP. Insert the stripped wire in the socket of the connector on the LP. Measure the voltage across the socket and pin of the connector. If less than 12 V, replace the LP. If it reads 12 V, reconnect the twinax connector to the LP (ANT side). 6. Go to the OUTSIDE lightning protector (LP). Remove the twinax connector from the LPR side of the LP. Strip a 25.4 mm to 50.8 mm (1 in. to 2 in.) piece of 0.644 mm (22 AWG) wire. Insert the wire into the socket of the twinax connector on the cable from the INSIDE LP (LPR side). Measure the voltage across the socket and pin of the connector. If less than 12V, either replace (or repair) the connector on the cable, or replace the cable between the INSIDE LP and the OUTSIDE LP. If it reads 12 V, reconnect the twinax connector to the LP (LPR side). 7. Remove the twinax connector from the ANT side of the LP. Insert the stripped wire in the socket of the connector on the LP. Measure the voltage across the socket and pin of the connector. If less than 12 V, replace the LP. If it reads 12 V, reconnect the twinax connector to the LP (ANT side). 8. Go to the antenna. Remove the cover on theT-box. Remove the twinax connector from the antenna. Strip a 25.4 mm to 50.8 mm (1 in . to 2in.) piece of 0.644 mm (22 AWG) wire. Insert the wire into the socket of the twinax connector on the cable from the OUTSIDE LP. Measure the voltage across the socket and pin of the connector. If less than12 V, either replace (or repair) the connector on the cable, or replace the cable between the OUTSIDE LP and the antenna. If it reads 12V, leave the wire in the socket of the twinax connector, and go to the next step. 9. Verify that the LTI is furnishing sufficient current to the antenna. Connect a 1000 Ω, 1/4 W resistor in series with one of the ampmeter probes; connect the other side of the resistor and the other meter probe across the socket and pin of the connector. Requirement: approximately 12 mA ±3 mA. If results are out of the mA range, repeat the above tests because something was missed, or replace the LTI card. If within the mA range, remove the wire from the socket, resistor, and ampmeter. The antenna is defective, and should be replaced.

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
DSP COM LOSS	The LTI card has failed.	Replace the LTI card.
DSP INPUT		
DSP SEARCH	The LTI has been searching for LORAN stations longer than the time set for the major alarm time-out.	1. Verify that the GRI is set correctly. If set correctly, continue to the next step. If incorrect, set correctly. 2. Verify that the antenna is vertical (not horizontal). If correct, continue to the next step. If incorrect, reset the antenna to the vertical position. 3. Ensure that all the guidelines in the Engineering Guidelines section of this manual have been followed. If followed, continue to the next step. If any guidelines were not followed, correct the installation. 4. Replace the LTI card, and recheck the alarms. If the alarm persists, continue to the next step. 5. Replace the LORAN antenna.
NO INPUTS	Both the OSC A and OSC B input signals, and the LTI card have failed.	Replace the LTI card.

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
OSC BOTH	Both the OSC A and OSC B input signals have failed.	1. Check for the OSC BOTH alarm on the other LTI card in the shelf (if equipped), or, check for the OSC A LOS and OSC B LOS alarms on the GTI card in the shelf (if equipped). If the other card does not indicate loss of oscillator inputs, or if there is no other card in the shelf, replace the LTI card. If the alarm persists, or if the other card indicates loss of oscillator inputs, continue to the next step. 2. If 5 MHz isolation modules are not used between the DCD Shelf and the DCD-LPR Shelf, skip to the next step. If 5 MHz isolation modules are used between the DCD Shelf and the DCD-LPR Shelf, check that the isolation modules are correctly installed (from the appropriate connector on the DCD Shelf backplane to the "TO DCD SHELF" end of one isolation module, and from the appropriate connector on the DCD-LPR Shelf to the "TO LPR" end of the isolation module); refer to Table C for isolation module connections. If reversed, install correctly, and recheck the alarms. If not reversed, continue to the next step. 3. Verify that there is power to the DCD Shelf. If not, apply power. If there is power to the DCD Shelf, continue to the next step. 4. If rubidium clock cards are not used in the DCD Shelf, skip to the next step. If rubidium clock cards are installed in the DCD Shelf, verify that the ACTIVE lamps are lit on the rubidium clock cards. (If the rubidium clock cards have recently been powered, up to 1 h may be required before the ACTIVE lamps light green.) If the ACTIVE lamps are not lit, wait until the rubidium clock cards are warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamps are lit on the rubidium clock cards, continue to the next step. 5. If 5 MHz isolation modules are not used between the DCD-LPR Shelf and the DCD Shelf, replace the cables between the DCD and LPR Shelves. If 5 MHz isolation modules are used, bypass the isolation modules by using single continuous cables from the outputs of the DCD Shelf to the inputs of the DCD-LPR Shelf for both OSC A and OSC B. Recheck the alarms. If the OSC BOTH alarm has cleared, reconnect the original cables through the isolation modules, then replace the following, one at a time, until the alarm clears: a. The cables between the DCD Shelf and the isolation modules b. The cables between the isolation modules and the DCD-LPR Shelf c. The isolation modules
PLL UNLOCKED PRR UNLOCKED SYN UNLOCKED	The LTI card has failed. (The LTI outputs a PRR AIS signal.)	Replace the LTI card.

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
PRR OUTPUT	One (or both) of the LTI outputs has a fault (the output is shorted externally, or the LTI card has failed).	1. At the rear of the DCD-LPR Shelf, loosen the 3 knurled screws holding the LTI Module for the card displaying the alarm. Carefully pull the LTI Module straight out from the shelf until the module disconnects from the shelf. If the PRR OUTPUT alarm clears, reinstall the LTI Module on the rear of the DCD-LPR Shelf, and continue to the next step. If the PRR OUTPUT alarm does not clear, reinstall the LTI Module on the rear of the shelf, then replace the LTI card. 2. Use a wire-unwrapping tool to unwrap the ring (R) lead from the upper set of pins (TB1) on the LTI Module for the card displaying the alarm. If the PRR OUTPUT alarm does not clear, rewrap the wire on the R pin, and skip to Step 6. If the PRR OUTPUT alarm clears, rewrap the wire on the R pin of the module, and continue to the next step. 3. Trace the cable from the upper set of pins (TB1) on the LTI Module for the card displaying the alarm to one of the inputs on the DCD Shelf. 4. Pull the clock input card, in the slot corresponding to the input to which the cable was traced in the previous step, out of the shelf. If the PRR OUTPUT alarm clears, replace the clock input card, using the procedures in the Maintenance section of the DCD Shelf manual. If the PRR OUTPUT alarm does not clear, continue to the next step. 5. Verify that the wiring from the upper set of pins (TB1) on the LTI Module for the card displaying the alarm to the input of the DCD Shelf is correct (ensure that tip [T] is connected to tip, ring [R] to ring; shield [S] is connected only at the DCD-LPR Shelf). If the wiring is not correct, correct the wiring. If the wiring is correct, replace the cable between the upper set of pins (TB1) on the LTI Module for the card displaying the alarm and the input of the DCD Shelf. 6. Trace the cable from the lower set of pins (TB2) on the LTI Module for the card displaying the alarm to one of the inputs on the DCD Shelf. 7. Pull the clock input card in the slot corresponding to the input to which the cable was traced in the previous step out of the shelf. If the PRR OUTPUT alarm clears, replace the clock input card, using the procedures in the Maintenance section of the manual for the DCD Shelf. If the PRR OUTPUT alarm does not clear, continue to the next step. 8. Verify that the wiring from the lower set of pins (TB2) on the LTI Module for the card displaying the alarm to the input of the DCD Shelf is correct (ensure that tip [T] is connected to tip, ring [R] to ring; shield [S] is connected only at the DCD-LPR Shelf). If the wiring is not correct, correct the wiring. If the wiring is correct, replace the cable between the lower set of pins (TB2) on the LTI Module for the card displaying the alarm and the input of the DCD Shelf.

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS		
DSP SEARCH	The LTI has been searching for LORAN stations for a period exceeding the time set for the minor alarm time-out.	1. If less than 2 h have passed since theLTI was powered, wait until the LTI has been powered for at least 2 h, then recheck the alarms. If minimum 2 h have passed since the LTI was powered, continue to the next step. 2. Verify that the GRI is set correctly. If correct, continue to the next step. If incorrect, set correctly. 3. Verify that the antenna is vertical (not horizontal). If correct, continue to the next step. If incorrect, reset the antenna to the vertical position. 4. Ensure that all the guidelines in the Engineering Guidelines section of this manual have been followed. If followed, continue to the next step. If any guidelines were not followed, correct the installation. 5. Replace the LTI card, and recheck the alarms. If the alarm persists, continue to the next step. 6. Replace the LORAN antenna, using the replacement procedure in this section.
FUSE A	Fuse A on the DCD-LPR Shelf has failed, or battery A has failed.	1. Measure the voltage on TB1, at the rear of the DCD-LPR Shelf. The BATT A terminal should measure –40 V dc to –56 V dc in relation to the RTN terminal. If the voltage is not within the specified range, trouble-shoot office battery A. If the voltage is within the specified range, continue to the next step. 2. Replace the –48 V A fuse on the front panel of the DCD-LPR Shelf.
FUSE B	Fuse B on the DCD-LPR Shelf has failed, or battery B has failed.	1. Measure the voltage on TB5, at the rear of the DCD-LPR Shelf. The BATT B terminal should measure –40 V dc to –56 V dc in relation to the RTN terminal. If the voltage is not within the specified range, trouble-shoot office battery B. If the voltage is within the specified range, continue to the next step. 2. Replace the –48 V B fuse on the front panel of the DCD-LPR Shelf.

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
OSC A	The OSC A input signal has failed. (If OSC A input was in use, the LTI switches to OSC B, and outputs a DS1 AIS signal until the OSC B input is qualified [approximately 15 min].)	1. Check for the OSC A alarm on the other LTI card in shelf (if equipped), or, check for the OSC A LOS alarm on the GTI card in the shelf (if equipped). If the other card does not indicate loss of oscillator input or if there is no other card in the shelf, replace the LTI card. If the alarm persists, or if the other card indicates loss of same oscillator input, continue to the next step. 2. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC A input, skip to the next step. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC A input, check that the isolation module is correctly installed (from the appropriate connector on the DCD Shelf backplane to the "TO DCD SHELF" end of one isolation module, and from the appropriate connector on the DCD-LPR Shelf to the "TO LPR" end of the isolation module); refer to Table C for isolation module connections. If reversed, install correctly, and recheck the alarms. If not reversed, continue to the next step. 3. If rubidium clock cards are not used in the DCD Shelf, skip to the next step. If rubidium clock cards are installed in the DCD Shelf, verify that the ACTIVE lamp is lit on the rubidium clock card in the STA slot. (If the rubidium clock card has recently been powered, up to 1 h may be required before the ACTIVE lamp lights green.) If the ACTIVE lamp is not lit, wait until the rubidium clock card is warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamp is lit on the rubidium clock card in the STA slot, continue to the next step. 4. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC A input, replace the cable between the DCD Shelf and the DCD-LPR Shelf OSC A input. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC A input, bypass the isolation module by using single continuous cable from the output of the DCD Shelf to the OSC A input of the DCD-LPR Shelf. Recheck the alarms. If the OSC A alarm has cleared, reconnect the original cable through the isolation module, then replace the following, one at a time, until the alarm clears: a. The cable between the DCD Shelf and the isolation module b. The cable between the isolation module and the DCD-LPR Shelf OSC A input c. The isolation module

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
OSC B	The OSC B input signal has failed. (If OSC B input was in use, the LTI switches to OSC A, and outputs a DS1 AIS signal until the OSC A input is qualified [approximately 15 min].)	1. Check for the OSC B alarm on the other LTI card in the shelf (if equipped), or, check for the OSC B LOS alarm on the GTI card in the shelf (if equipped). If the other card does not indicate loss of oscillator input, or if there is no other card in the shelf, replace the LTI card. If the alarm persists, or if the other card indicates loss of the same oscillator input, continue to the next step. 2. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC B input, skip to the next step. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC B input, check that the isolation module is correctly installed (from the appropriate connector on the DCD Shelf backplane to the "TO DCD SHELF" end of one isolation module, and from the appropriate connector on the DCD-LPR Shelf to the "TO LPR" end of the isolation module); refer to Table C for isolation module connections. If reversed, install correctly, and recheck the alarms. If not reversed, continue to the next step. 3. If rubidium clock cards are not used in the DCD Shelf, skip to the next step. If rubidium clock cards are installed in the DCD Shelf, verify that the ACTIVE lamp is lit on the rubidium clock card in the STA slot. (If the rubidium clock card has recently been powered, up to 1 h may be required before the ACTIVE lamp lights green.) If the ACTIVE lamp is not lit, wait until the rubidium clock card is warmed up or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamp is lit on the rubidium clock card in the STA slot, continue to the next step. 4. If a 5 MHz isolation module is not used between the DCD Shelf and the DCD-LPR Shelf OSC B input, replace the cable between the DCD Shelf and the DCD-LPR Shelf OSC B input. If a 5 MHz isolation module is used between the DCD Shelf and the DCD-LPR Shelf OSC B input, bypass the isolation module by using single continuous cable from the output of the DCD Shelf to the OSC B input of the DCD-LPR Shelf. Recheck the alarms. If the OSC B alarm has cleared, reconnect the original cable through the isolation module, then replace the following, one at a time, until the alarm clears: a. The cable between the DCD Shelf and the isolation module b. The cable between the isolation module and the DCD-LPR Shelf OSC B input c. The isolation module

Table E. LTI Card Alarm and Status Messages (Cont'd)

MESSAGE	EXPLANATION	ACTION
NONREPORTING (NR) ALARMS		
DSP COM LOSS	Power has recently been applied to the LTI.	None required (this is a temporary message that appears during initialization).
STATUS MESSAGES		
LTI HOLDOVER	After having been in LTI LOCK, all LORAN stations have been lost.	None required (this may be a temporary condition caused by local weather).

Table F. LOU Card Troubleshooting

CONDITION	EXPLANATION	ACTION
The procedures contained in this table are for the LOU-1 and the LOU-2 cards. Follow the appropriate replacement procedure in this section when replacing a card.		
LOU-1		
OSC A lamp lights red	The oscillator in the LOU-1 card has failed.	Return the card to the factory for repair of the oscillator.
LOU-2		
OSC A lamp lights red	Oscillator A in the LOU-2 card has failed.	Return the card to the factory for repair of the oscillator.
OSC B lamp lights red	Oscillator B in the LOU-2 card has failed.	Return the card to the factory for repair of the oscillator.

3. ROUTINE/PREVENTIVE MAINTENANCE

3.01 Basically a self-sustaining system, the only routine/preventive maintenance to the DCD-LPR System is an annual or semi-annual check of the GTR (and/or LORAN antenna) and weatherproof conduit to ensure that each is sound and intact. During snowstorms, for extremely high drifts, it is recommended that the GTR be checked to ensure that it is not covered in snow. If covered, the GTR cannot track properly.

4. REPAIR AND RETURN PROCEDURES

4.01 When returning defective equipment for factory repair, obtain the following information *prior* to calling your local Symmetricom distributor, or Symmetricom's Customer Service Department:

- A complete description of the trouble (alarms observed, equipment behavior, etc.), part number, serial number, issue/revision level, and warranty expiration date
- If the warranty has expired, a purchase order with "bill to" information
- A customer field contact, address, phone number, and FAX number
- Return shipping information

4.02 To return defective or damaged equipment:

1. Call your local Symmetricom distributor, or Symmetricom's Inside Sales at one of the following, and obtain a Return Material Authorization (RMA) number:
   - +44 1483 510300 (U.K.)
   - +1 408 428 7907 (U.S.A.)

   Notes:

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

   b. Retain the RMA number for future reference. The RMA number is used by Symmetricom for internal tracking of the unit. Reference the RMA number in all communications regarding the unit.

2. Pack the defective equipment, including a list containing all the information obtained above, in the original packing material. If the original packing material is not available, inform Symmetricom, and the appropriate shipping material will be provided.

   Note: Equipment *must be returned in the original packaging* for approved replacement packaging for the warranty to be honored.

3. Mark the RMA number and the equipment serial number on the outside of the shipping carton.

4. Ship the equipment prepaid and insured to one of the addresses below, as directed by the Customer Assistance Center:

   Symmetricom
   Attn: Customer Service
   2300 Orchard Parkway
   San Jose, CA 95131

   or

   Symmetricom
   Attn: Repair and Return
   Building 7
   Aguada West Industrial Site
   Aguada, Puerto Rico 00602

4.03 Repaired equipment is typically shipped within 30 days of receipt by Symmetricom, or per contract terms. Shipping costs to Symmetricom are paid by the customer; shipping costs back to the customer are paid by Symmetricom.

5. REPLACEMENT PROCEDURES

5.01 Chart 1 through Chart 6 are replacement procedures for DCD-LPR System cards and antennas.

Note: If using a DCD-519 or -523 Shelf with a 090-45018-05 or 090-45018-25 MIS card, use the Maintenance section of the DCD-519 or -523 Manual to replace the DCD-LPR cards, instead of Charts 1 through 3 in this section.

Chart 1. GTI Card Replacement

STEP	PROCEDURE
	Use this procedure to replace the GTI card (p/n 090-42140-11, -12, -13, -14, -15, -16, -17, or -18). ***Notes:*** 1. Each TI slot in the DCD-LPR is independent of the other TI slot. For this reason, when one card is removed, its removal does not affect the other card or the DCD-LPR Shelf. The reaction occurs at the DCD Shelf, if the DCD-LPR is connected to a DCD Shelf. If either one or two GTI cards are installed, when the failed card is removed, the clock input card in the DCD Shelf will issue an LOS alarm, and will switch reference to the next higher priority reference. 2. If using the GTI-15, -16, -17, or -18, the Home Display is the UTC time; the GTI-15, -16, -17, or -18 requires that you press the STATUS button (as appropriate) to display any of the alarm or status screens. For this reason, where instructions require you to confirm a display other than the UTC time, press the STATUS button (as appropriate) to display the alarm or status screen.
1	Remove the failed GTI card. ***Requirement:*** The appropriate reference input lamp(s) will light on the clock input card in the DCD Shelf.
2	On the replacement card, set switches on SW2 (and SW1 if replacing a GTI-15, -16, -17, or -18 card) the same as the failed card.
3	Insert the replacement GTI card into the appropriate slot in the DCD-LPR Shelf. Using the locking levers, carefully align the card with the connector on the shelf backplane, and lock the levers to set firmly in place.
4	Observe the GTI card. ***Requirement:*** The GTI performs a lamp test, and displays various status messages, followed by: SEARCHING 0H where 0H = zero hours
5	Observe the GTI card lamps. ***Requirement for GTI-11 and -12:*** The FAIL and OUTPUT lamps are OFF, and the INPUT lamp is lit red. ***Requirement for GTI-13, -14, -15, -16, -17 and -18:*** The FAIL, OUTPUT, and INPUT lamps are all OFF.
6	While in SEARCHING 0H, check the lamp on the GTI module I/O A and/or I/O B, at the back of the DCD-LPR. ***Requirement:*** The DS1 lamp is lit green. The lamp in this condition indicates that a 4 kHz signal is being received at the GTI from the GTR.
7	Measure the voltage between PWR+ and PWR–. The DCD-LPR Shelf backplane provides power to the GTR antenna unit via the GTI card. The GTI card in Slots A and B provides power at terminals TB3 (Slot A) and TB4 (Slot B) on the DCD-LPR Shelf (see Figure 2). ***Requirement:*** The voltage reads +31.0 V ±2.0 V.

Chart 1. GTI Card Replacement (Cont'd)

STEP	PROCEDURE
8	Other messages may appear. After 15 min to 30 min (longer in sites with poor coverage), observe the display, and confirm that the following appears: ***Requirement:*** ACQUIRED 0H where 0H = zero hours
9	Observe the lamps. ***Requirement:*** The lamp status does not change.
10	The ACQUIRED 0H display may only appear for 1 s or 2 s before it changes to the next display state. Observe the display, and confirm that the following appears: ***Requirement:*** TRACKING 0H where 0H = zero hours
11	Observe the lamps. ***Requirement:*** The INPUT lamp is lit green, and both the OUTPUT and FAIL lamps are off.
12	Typically, the tracking mode could last 6 h to 9 h, after which, observe the display, and confirm that the following is displayed: ***Requirement:*** GTR LOCK 0H where 0H = zero hours
13	Observe the lamps. ***Requirement:*** The lamp status does not change.
14	After 2 h or 3 h have passed, observe the display to verify the system has entered GTI LOCK. This is indicated by the following display: ***Requirement:*** GTI LOCK 0H where 0H = zero hours ***Note:*** For minimum 100 h in GTI LOCK, the display will blank the hours on the following: • GTI-11, Software Rev. 2.03 and above • GTI-12, Software Rev. 3.01.02 and above • All revisions of the GTI-13, -14, -15, -16, -17, and -18
15	Observe the lamps. ***Requirement:*** The FAIL lamp is OFF, and the INPUT and OUTPUT lamps are lit green.
16	If the DCD-LPR is not equipped with TOD, skip to Step20. If it is, observe the PWR lamp on the RS-422–to–RS-232 converter. ***Requirement:*** The lamp is lit green.
17	Connect a PC COM port to the DB25 RS-232 connector on the RS-422–to–RS-232 converter.

Chart 1. GTI Card Replacement (Cont'd)

STEP	PROCEDURE
18	Using a program such as Hyperterminal, set for 9600, 8, N, 1.
19	Observe the screen. ***Requirement:*** The time code is displayed once per second.
20	This procedure is completed.

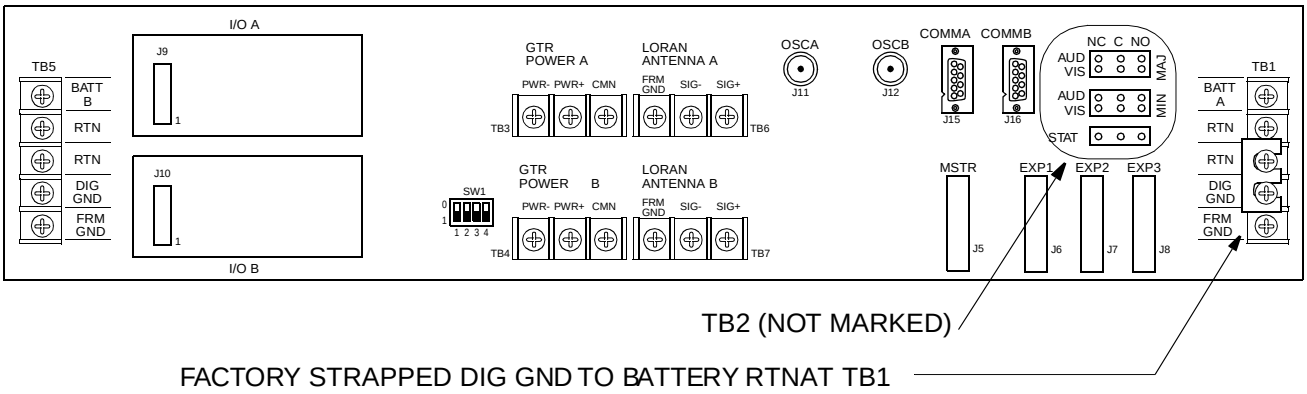


Figure 2. DCD-LPR Shelf—Rear View

Chart 2. LTI Card Replacement

STEP	PROCEDURE
Use this procedure to replace the LTI card (p/n 090-41140-01). ***Note:*** Each TI slot in the DCD-LPR is independent of the other TI slot. For this reason, when one card is removed, its removal does not affect the other card or the DCD-LPR Shelf. The reaction occurs at the DCD Shelf, if the DCD-LPR is connected to a DCD Shelf. If either one or two LTI cards are installed, when the failed card is removed, the clock input card in the DCD Shelf will issue an LOS alarm, and will switch reference to the next higher priority reference.	
1	Remove the failed LTI card. ***Requirement:*** The appropriate reference input lamp(s) lights on the clock input card in the DCD Shelf.
2	On the replacement card, set switches on SW1 and SW2 the same as the failed card. ***Note:*** SW2 section 8 must be set to the OFF (DOWN) position to enable MIS card communication.
3	Insert the replacement LTI card into the appropriate slot(s) in the DCD-LPR Shelf. Using the locking levers, carefully align the card with the connector on the shelf backplane and lock the levers to set firmly in place.
4	Upon power-up, observe the LTI card. ***Requirement:*** The INPUT and OUTPUT lamps flash green, then red, and then momentarily go off, and the LTI LCD display screen shows: GRI SEARCH 0H
5	Observe the INPUT and OUTPUT lamps. ***Requirement:*** Less than 1 min later, both the INPUT and OUTPUT lamps light red; the display does not change. Approximately 1 min after that, the INPUT lamp goes off, and then lights green; the OUTPUT lamp status and the display remains the same.
6	Measure the voltage between SIG+ and SIG– on TB6 and/or TB7 (depending on which slot the LTI is installed; if in Slot A, TB6, Slot B, TB7). ***Requirement:*** The voltage reads +12.0 V dc ±2.0 V.
7	Observe the display. ***Requirement:*** Within 3 h, in most cases, the screen may display various messages, and after the LTI has acquired lock to a LORAN-C transmitter, will display: LTI LOCK 0H

Chart 2. LTI Card Replacement (Cont'd)

STEP	PROCEDURE
8	Observe the lamps. ***Requirement:*** The INPUT and OUTPUT lamps are lit green.
9	This procedure is completed.

Chart 3. LOU Card Replacement

STEP	PROCEDURE
Use this procedure to replace the LOU-1 or LOU-2 card.	
1	Remove the failed LOU card.
2	Observe the GTI card. ***Requirement:*** The GTI LCD displays OSC A LOS MN and OSC B LOS MN, and then, GTR LOCK; the GTI continues to provide output for up to 24 h, depending on the alarm integration time set.
3	Insert the replacement LOU card into the appropriate slot in the DCD-LPR Shelf. Using the locking levers, carefully align the card with the connector on the shelf backplane, and lock the levers to set firmly in place.
4	Observe the LOU card lamps. ***Requirement for LOU-1:*** The OSC A lamp flashes green, then lights solid green after warm-up. ***Requirement for LOU-2:*** The OSC A and OSC B lamps flash green, then light solid green after warm-up.
5	Observe the GTI LCD display. ***Requirement:*** OSC A LOS CL, OSC B LOS CL, and GTR LOCK are displayed. GTR LOCK is displayed from minimum 45 min to maximum 2 h, then GTI LOCK is displayed.
6	This procedure is completed.

Chart 4. GTR Replacement

STEP	PROCEDURE
Use this procedure to replace a GTR in outside temperatures warmer than –20 °C (4 °F). If replacing a GTR in temperatures below –20 °C (4 °F), use Chart 5. To make the installation flow smoother, it is recommended that two installers be present, one at the DCD-LPR site, and the other at the GTR site; each should be equipped with a walkie-talkie or some other type of communications device.	
1	At the DCD-LPR, remove the GTI card corresponding to the GTR to be removed.
2	At the cable slack or junction box, open the box, and pull the cable, to allow for slack to manipulate the fiber and power cables.
3	At the GTR, remove, and save, the four screws holding the GTR to the flange.
4	Slowly pull up the failed GTR until there is approximately 0.6 m (2 ft) of cable slack.
5	Remove the fiber connectors, noting which color cable goes to which connector.
6	Remove the power connector.
7	Attach the fiber cables to the replacement GTR.
8	Attach the power connector to the GTR.
9	Position the GTR on the flange, being sure that the cables (fiber and power) are not pinched.
10	Secure the GTR to the flange with the four screws.
11	Replace the cable inside the cable slack or junction box, and replace the cover.
Note: For minimum 100 h in SEARCHING, ACQUIRED, TRACKING, GTR LOCK, the display will blank the hours if the GTI installed is one of the following: • GTI-11, Software Rev. 2.03 and above • GTI-12, Software Rev. 3.01.02 and above • All revisions of the GTI-13, -14, -15, -16, -17, and -18	
12	Reinsert the GTI card into the DCD-LPR Shelf; secure in place.

Chart 4. GTR Replacement (Cont'd)

STEP	PROCEDURE
13	Observe the GTI card. ***Requirement for all GTIs:*** Upon power-up, the GTI performs a lamp test, and display various status messages, followed by: SEARCHING 0H where 0H = zero hours ***Requirement for GTI-11 and -12:*** The FAIL and OUTPUT lamps are OFF, and the INPUT lamp is lit red. ***Requirement for GTI-13, -14, -15, -16, -17 and -18:*** The FAIL, OUTPUT, and INPUT lamps are all OFF.
14	While in SEARCHING 0H, check the DS1 lamp on the GTI module I/O A and/or I/O B, at the back of the DCD-LPR. ***Requirement:*** The DS1 lamp is lit green. The lamp in this condition indicates that a 4 kHz signal is being received at the GTI from the GTR.
15	Measure the voltage between PWR+ and PWR–. The DCD-LPR Shelf backplane provides power to the GTR antenna unit via the GTI card. The GTI card in Slots A and B provides power at terminals TB3 (Slot A) and TB4 (Slot B) on the DCD-LPR Shelf (see Figure 2). ***Requirement:*** The voltage reads +31.0 V ±2.0 V.
16	Other messages may appear. After 15 min to 30 min (longer in sites with poor coverage), observe the display, and confirm that the following appears: ***Requirement:*** ACQUIRED 0H where 0H = zero hours
17	Observe the lamps. ***Requirement:*** The lamp status does not change.
18	The ACQUIRED 0H display may only appear for 1 s or 2 s before it changes to the next display state. Observe the display, and confirm that the following appears: ***Requirement:*** TRACKING 0H where 0H = zero hours
19	Observe the lamps. ***Requirement:*** The INPUT lamp is lit green, and both the OUTPUT and FAIL lamps are off.

Chart 4. GTR Replacement (Cont'd)

STEP	PROCEDURE
20	Typically, the tracking mode could last 6 h to 9 h, after which, observe the display, and confirm that the following is displayed: ***Requirement:*** GTR LOCK 0H where 0H = zero hours
21	Observe the lamps. ***Requirement:*** The lamp status does not change.
22	After 2 h or 3 h have passed, observe the display to verify the system has entered GTI LOCK. This is indicated by the following display: ***Requirement:*** GTI LOCK 0H where 0H = zero hours ***Note:*** For minimum 100 h in GTI LOCK, the display will blank the hours on the following: • GTI-11, Software Rev. 2.03 and above • GTI-12, Software Rev. 3.01.02 and above • All revisions of the GTI-13, -14, -15, -16, -17, and -18
23	Observe the lamps. ***Requirement:*** The FAIL lamp is OFF, and the INPUT and OUTPUT lamps are lit green.
24	If the DCD-LPR is not equipped with TOD, skip to Step 28. If it is, observe the PWR lamp on the RS-422–to–RS-232 converter. ***Requirement:*** The lamp is lit green.
25	Connect a PC COM port to the DB25 RS-232 connector on the RS-422–to–RS-232 converter.
26	Using a program such as Hyperterminal, set for 9600, 8, N, 1.
27	Observe the screen. ***Requirement:*** The time code is displayed once per second.
28	This procedure is completed.

Chart 5. GTR Cold Weather Replacement

STEP	PROCEDURE
Use this procedure to replace the GTR in cold weather conditions (below –20 °C or 4 °F). ***Notes:*** 1. The replacement GTR must be stored in a room-temperature environment. The replacement GTR should be moved quickly from the storage location to the installation site, and the power connector installed first. If the GTR is located where it cannot be installed within several minutes, precautions should be taken to keep the GTR warm while transporting it to the installation site (e.g., place the GTR inside an insulated container). 2. To make the installation flow smoother, it is recommended that two installers be present, one at the DCD-LPR site, and the other at the GTR site; each should be equipped with a walkie-talkie or some other type of communications device. 3. Do not move the GTR from its storage site until instructed to do so in the procedures.	
1	At the DCD-LPR, remove the GTI card corresponding to the GTR to be removed.
2	At the cable slack or junction box, open the box, and pull the cable, to allow for slack to manipulate the fiber and power cables.
3	At the GTR, remove, and save, the four screws holding the GTR to the flange.
4	Slowly pull up the failed GTR until there is at least 0.6 m (2 ft) of cable slack.
5	Remove the power connector.
6	Remove the fiber connectors, noting which color cable goes to which connector.
7	Obtain the replacement GTR from the storage site.
8	Attach the power connector to the GTR.
9	Attach the fiber cables to the replacement GTR.
10	Secure the GTR to the flange with the four screws, being sure that the cables (fiber and power) are not pinched.
11	Replace the cable inside the cable slack or junction box, and replace the cover.
Note: For minimum 100 h in SEARCHING, ACQUIRED, TRACKING, GTR LOCK, the display will blank the hours if the GTI installed is one of the following: • GTI-11, Software Rev. 2.03 and above • GTI-12, Software Rev. 3.01.02 and above • All revisions of the GTI-13, -14, -15, -16, -17, and -18	
12	Reinsert the GTI card into the DCD-LPR Shelf; secure in place.

Chart 5. GTR Cold Weather Replacement (Cont'd)

STEP	PROCEDURE
13	Observe the GTI card. ***Requirement for all GTIs:*** Upon power-up, the GTI performs a lamp test, and display various status messages, followed by: SEARCHING 0H where 0H = zero hours ***Requirement for GTI-11 and -12:*** The FAIL and OUTPUT lamps are OFF, and the INPUT lamp is lit red. ***Requirement for GTI-13, -14, -15, -16, -17 and -18:*** The FAIL, OUTPUT, and INPUT lamps are all OFF.
14	While in SEARCHING 0H, check the DS1 lamp on the GTI module I/O A and/or I/O B, at the back of the DCD-LPR. ***Requirement:*** The DS1 lamp is lit green. The lamp in this condition indicates that a 4 kHz signal is being received at the GTI from the GTR.
15	Measure the voltage between PWR+ and PWR–. The DCD-LPR Shelf backplane provides power to the GTR antenna unit via the GTI card. The GTI card in Slots A and B provides power at terminals TB3 (Slot A) and TB4 (Slot B) on the DCD-LPR Shelf (see Figure 2). ***Requirement:*** The voltage reads +31.0 V ±2.0 V.
16	Other messages may appear. After 15 min to 30 min (longer in sites with poor coverage), observe the display, and confirm that the following appears: ***Requirement:*** ACQUIRED 0H where 0H = zero hours
17	Observe the lamps. ***Requirement:*** The lamp status does not change.
18	The ACQUIRED 0H display may only appear for 1 s or 2 s before it changes to the next display state. Observe the display, and confirm that the following appears: ***Requirement:*** TRACKING 0H where 0H = zero hours
19	Observe the lamps. ***Requirement:*** The INPUT lamp is lit green, and both the OUTPUT and FAIL lamps are off.
20	Typically, the tracking mode could last 6 h to 9 h, after which, observe the display, and confirm that the following is displayed: ***Requirement:*** GTR LOCK 0H where 0H = zero hours

Chart 5. GTR Cold Weather Replacement (Cont'd)

STEP	PROCEDURE
21	Observe the lamps. ***Requirement:*** The lamp status does not change.
22	After 2 h or 3 h have passed, observe the display to verify the system has entered GTI LOCK. This is indicated by the following display: ***Requirement:*** GTI LOCK 0H where 0H = zero hours ***Note:*** For maximum 100 h in GTI LOCK, the display will blank the hours on the following: • GTI-11, Software Rev. 2.03 and above • GTI-12, Software Rev. 3.01.02 and above • All revisions of the GTI-13, -14, -15, -16, -17, and -18
23	Observe the lamps. ***Requirement:*** The FAIL lamp is OFF, and the INPUT and OUTPUT lamps are lit green.
24	If the DCD-LPR is not equipped with TOD, skip to Step 28. If it is, observe the PWR lamp on the RS-422–to–RS-232 converter. ***Requirement:*** The lamp is lit green.
25	Connect a PC COM port to the DB25 RS-232 connector on the RS-422–to–RS-232 converter.
26	Using a program such as Hyperterminal, set for 9600, 8, N, 1.
27	Observe the screen. ***Requirement:*** The time code is displayed once per second.
28	This procedure is completed.

Chart 6. LORAN-C Antenna Replacement

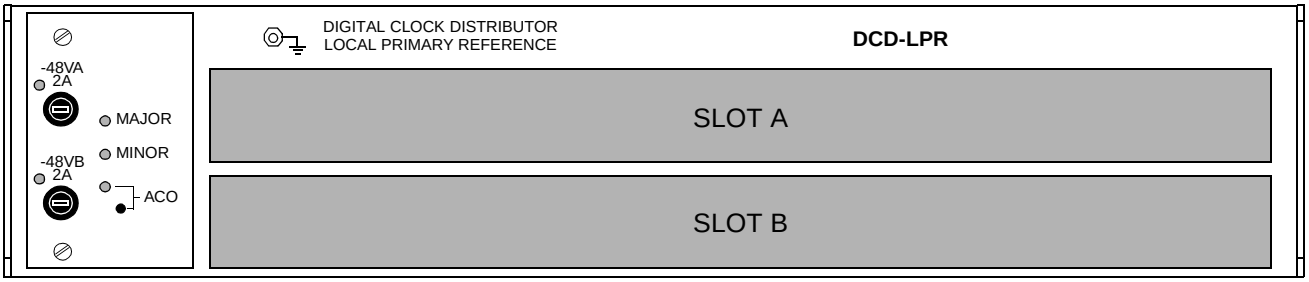
STEP	PROCEDURE
Use this chart to replace the LORAN-C antenna.	
1	At the DCD-LPR, remove the LTI card corresponding to the LORAN-C antenna to be removed.
2	At the cable slack or junction box (if applicable), open the box, and pull the cable, to allow for slack to manipulate the cable.
3	At the antenna, remove, and save, the two screws securing the conduit-T cover; remove the cover.
4	Slowly pull the power connector out of the side plate opening until it is clear of the conduit-T.
5	Disconnect the power connector, and remove the vinyl tubing. Do not discard the tubing.
6	Remove the green grounding wire (from the antenna) attached to the conduit-T.
7	Remove the grounding wire (with the two-hole lugs) connecting the conduit-T and the C-clamps.
8	Unscrew, and remove, the antenna.
9	Feed the twinax cable and grounding wire from the replacement antenna down through the threaded nipple, reducing bushing, and top of the conduit-T, then out the side plate opening. Make sure at least 0.3 m (1 ft) of twinax cable protrudes from the opening.
10	Screw the antenna onto the threaded nipple. Ensure that the twinax cable and grounding wire from the antenna are free to rotate as the antenna is screwed onto the nipple.
11	Reattach the green grounding wire to the conduit-T.
12	Reattach the grounding wire (with the two-hole lugs) connecting the conduit-T and C-clamps.
13	Replace the vinyl tubing on the cable (from the DCD-LPR), and reconnect the cables. Position the vinyl tubing to cover all metallic parts of the power connector.
14	Recoil the cable, and place it inside the conduit-T; replace the cover, and secure with screws.
15	Reinsert the LTI card, and secure in place.

Chart 6. LORAN-C Antenna Replacement (Cont'd)

STEP	PROCEDURE
16	Observe the LTI card. ***Requirement:*** Upon power-up, the INPUT and OUTPUT lamps flash green, then red, and then momentarily go off, and the LTI LCD screen shows: GRI SEARCH 0H
17	Observe the INPUT and OUTPUT lamps. ***Requirement:*** Less than 1 min later, both the INPUT and OUTPUT lamps light red; the display does not change. Approximately 1 min after that, the INPUT lamp goes off, and then lights green, and the OUTPUT lamp status and display remain the same.
18	Observe the display; within 3 h, in most cases, the screen may display various messages, and after the LTI has acquired lock to a LORAN-C transmitter, will read the following: LTI LOCK 0H ***Requirement:*** The INPUT and OUTPUT lamps are lit green.
19	This procedure is completed.

6. CONTROLS AND INDICATORS

6.01 Figure 3 shows the front of the shelf. Figure 4 shows the LOU-1 and LOU-2 card front panels; Figure 5 shows the GTI card front panel; Figure 6 shows the LTI card front panel.



MAJOR	Lamp that lights red when a major alarm is declared. During a major alarm, the LTI output is AIS; the GTI output is user-selectable as either a squelched or AIS signal.
MINOR	Lamp that lights yellow when a minor alarm is declared.
ACO	Lamp that lights green if the ACO pushbutton has been activated.
	Pushbutton that, when pressed, silences the audible alarm and lights the ACO lamp.

Figure 3. DCD-LPR Shelf

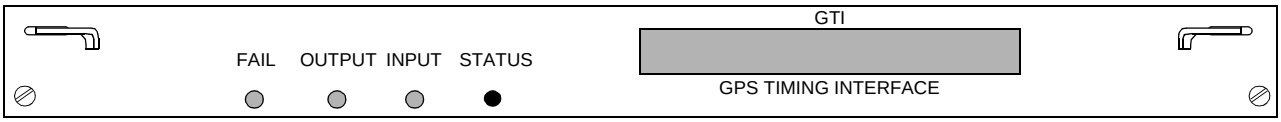
A. LOU-1

B. LOU-2

LOU-1 card: The OSC A lamp flashes green when warming up; lights solid green after warm-up, regardless of whether or not the signal is valid; lights solid red when the oscillator fails.

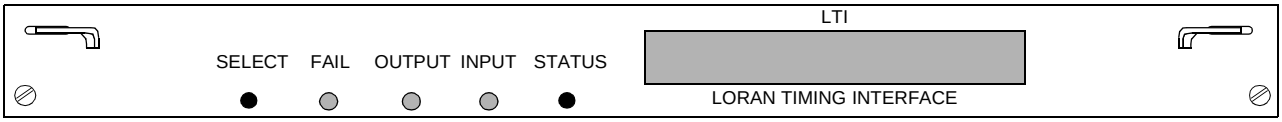
LOU-2 card: The OSC A and B lamps flash green when warming up; light solid green after warm-up, regardless of whether or not the signal is valid; light solid red when the corresponding oscillator fails.

Figure 4. LOU Card Front Panel



FAIL	Lamp that lights red when the GTI card fails.
OUTPUT	Lamp that lights green to indicate the GTI output is active, or lights red to indicate the GTI output is disabled. (Initially, the lamp is off until GTI LOCK, to indicate that the GTI output is not guaranteed to meet specification and is in AIS or squelch.)
INPUT	p/n 090-45100-11 or -12. Lamp that lights green to indicate that the GPS input is present and valid, or lights red at power-up, or to indicate the GPS input is invalid. p/n 090-45100-13 and -14. Lamp that lights green to indicate that the GPS input is present and valid, off to indicate that a GPS INVALID condition exists, or lights red to indicate GPS INVALID has escalated to a minor or major alarm. p/n 090-45100-15, -16, -17, and -18. Lamp that lights green to indicate that the GPS input is present and valid, off to indicate that a GPS INVALID minor alarm condition exists, or lights red to indicate GPS INVALID has escalated to a major alarm.
STATUS	Pushbutton used to cycle through the GTI status displays; used with the display.
Display	A 16-character LCD which shows the GTI status and/or alarm conditions.

Figure 5. GTI Card Front Panel



SELECT	Pushbutton used to select the LTI display selected with the STATUS pushbutton; used with the LCD screens.
FAIL	Lamp that lights red when the LTI card fails.
OUTPUT	Lamp that lights green to indicate the LTI output is active, or lights red to indicate the LTI output is AIS.
INPUT	Lamp that lights green to indicate that the LORAN-C input is present and valid, or lights red to indicate the LORAN-C input is invalid. During turn-up, the lamp lights green, red, off, then stays red until an input is validated.
STATUS	Pushbutton used to cycle through the LTI displays; used with the LCD screens.
Display	A 16-character LCD which shows the LTI menus and sub-menus, and alarm and status messages.

Figure 6. LTI Card Front Panel

7. OPERATION

7.01 A self-operating system, the DCD-LPR requires user-intervention only when access to the various LCD screens available to the GTI and LTI cards is required. This section provides descriptions of the various GTI and LTI screens and menus, and instructions on how to access them.

A. GTI Card Operation

GTI-11, -12, -13, or -14 Card

7.02 Each screen display can be accessed by pressing the STATUS button to step through the different screens. While in any screen, when the STATUS button is pressed and held, the next screen display will remain until the STATUS button is released. Five seconds after the STATUS button is released, the display returns to the Home Display (GTR LOCK or GTI State: GTI LOCK screen, etc.).

7.03 From the Home Display screen, each time the STATUS button is pressed, and then released, the screen will display one of the following screens, in the following order:

- Home Display (overall GTI State: GTI LOCK) (alarm/status messages are displayed as they occur)
- UTC Time (Universal Coordinated Time = Greenwich [England] Mean Time)
- Synthesizer Reference
- Performance Metrics (three displays)
- Software Version and Switch Settings (for factory use only)
- Current Status (if any exist)

7.04 The display changes to show an Alarm Event screen if an alarm or another event occurs.

GTI-15 or -16 Card

7.05 Each screen display can be accessed by pressing the STATUS button to step through the different screens. While in any screen, when the STATUS button is pressed and held, the next screen display will remain until the STATUS button is released. Five seconds after the STATUS button is released, the display returns to the Home Display (UTC Time = Universal Coordinated Time = Greenwich [England] Mean Time).

> ***Note:*** To display the status state or alarm/status messages, the STATUS button must be pressed, as appropriate, to access each screen.

7.06 From the UTC Time screen, each time the STATUS button is pressed, and then released, the screen will display one of the following screens, in the following order:

- Home Display is the UTC Time display
- GTI Status
- Synthesizer Reference
- Performance Metrics (three displays)
- Software Version and Switch Settings (for factory use only)
- Current Status (if any exist)
- Event History

7.07 The display changes to show an Alarm Event screen if an alarm or another event occurs.

GTI-17 or -18 Card

7.08 Each screen display can be accessed by pressing the STATUS button to step through the different screens. While in any screen, when the STATUS button is pressed and held, the next screen display will remain until the STATUS button is released. Five seconds after the STATUS button is released, the display returns to the Home Display (UTC Time = Universal Coordinated Time = Greenwich [England] Mean Time).

> ***Note:*** To display the status state or alarm/status messages, the STATUS button must be pressed, as appropriate, to access each screen.

7.09 From the UTC Time screen, each time the STATUS button is pressed, and then released, the screen will display one of the following screens, in the following order:

- Home Display is the UTC Time display
- GTI Status
- Synthesizer Reference
- Performance Metrics (three displays)
- Software Version and Switch Settings (for factory use only)
- Current Status (if any exist)
- Event History
- GTR Inventory
- SSM Config
- SSM Status

7.10 The display changes to show an Alarm Event screen if an alarm or another event occurs.

B. GTI Card Displays

GTI-11, -12, -13, or -14 Card

7.11 The GTI has a 16-character alphanumeric front panel display for status messages. Each press of the STATUS button on the front panel will cause the display of the next sequential status message; continuing to hold the STATUS button will keep the current message displayed. If the STATUS button is not pressed within 5 seconds, the display will revert to the Home Display (GTI State) screen. The DCD-LPR displays several screens:

- Home Display
- UTC Time
- Synthesizer Reference
- Performance Metrics
- Software Version and Switch Settings

7.12 Table G lists the various GTI screens in sequential order. Refer to Table B for a description of additional status messages, and all alarm messages.

> ***Note:*** After power-up, at least 4 hours are required to pass before the Performance Metrics will be displayed.

GTI-15 or -16 Card

7.13 The GTI-15 or -16 alphanumeric front panel display function and displays are similar to the GTI-11, -12, -13, and -14, except that the Home Display screen is the UTC Time display, and the GTI-15 or -16 has an additional screen: Event History.

7.14 Table G lists the various GTI screens in sequential order. Refer to Table B for a description of additional status messages, and all alarm messages.

> ***Note:*** After power-up, at least 4 hours are required to pass before the Performance Metrics will be displayed.

GTI-17 or -18 Card

7.15 The GTI-17 or -18 alphanumeric front panel display function and displays are similar to the GTI-15 and -16, except that the GTI-17 or GTI-18 has three additional screens:

- GTR Inventory (GTR software version)
- SSM Config (current SSM configuration)
- SSM Status

7.16 Table G lists the various GTI screens in sequential order. Refer to Table B for a description of additional status messages, and all alarm messages.

> ***Note:*** After power-up, at least 4 hours are required to pass before the Performance Metrics will be displayed.

Table G. GTI Card Operation

DISPLAY	DESCRIPTION
Home Display (GTI-11, -12, -13, and -14)	The Home Display is the GTI State screen, and appears at power-up. The Home Display screen displays the following information: state hh severity where: state = SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTR UNLOCK, or GTI LOCK hh = the total hours in that state (blank for hh minimum 100 h) severity = MJ (major), MN (minor), NR (non-reporting), CL (cleared) Once in the Home Display screen, after a 5 s button entry timeout, if an alarm occurs, the display will change to show the Alarm Events screen.
Home Display (GTI-15, -16, -17, and -18)	The UTC time is displayed in the following format: yyyymmdd hhmmss where: yyyymmdd = equals year month day hhmmss = hours (24 h clock) minutes seconds Once in the Home Display screen, after a 5 s button entry timeout, if an alarm occurs, the display will change to show the Alarm Events screen.
UTC TIME (GTI-13, -14, -15, -16, -17, and -18)	From the Home Display screen, press the STATUS pushbutton to display the UTC Time screen. The UTC time is displayed in the following format: yyyymmdd hhmmss where: yyyymmdd = equals year month day hhmmss = hours (24 h clock) minutes seconds
UTC TIME (GTI-11 and -12)	From the Home Display screen, press the STATUS pushbutton to display the UTC Time screen. The UTC time is displayed in the following format: yyyymmddhhmmss where: yyyymmdd = equals year month day, and hhmmss = hours (24 h clock) minutes seconds

Table G. GTI Card Operation (Cont'd)

DISPLAY	DESCRIPTION
GTI STATUS (GTI-15 and -16)	From the Home Display (UTC Time) screen, press the STATUS pushbutton to display the GTI Status screen. The GTI Status screen displays the following information: state hh severity where: state = SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTR UNLOCK, or GTI LOCK hh = the total hours in that state (blank for hh minimum 100 h) severity = MJ (major), MN (minor), NR (non-reporting), CL (cleared)
GTI STATUS (GTI-17 and -18)	From the Home Display (UTC Time) screen, press the STATUS pushbutton to display the GTI Status screen. The GTI Status screen displays the following information: state hh severity where: state = SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTR UNLOCK, GTI LOCK, or GPS INVALID hh = the total hours in that state (blank for hh minimum 100 h) severity = MJ (major), MN (minor), NR (non-reporting), CL (cleared)
SYNTH REF	From the UTC Time screen, press the STATUS pushbutton to display the Synth Ref screen. The Synth Ref screen is displayed in the following format: OSCILLATOR x where: x = A or B
PERF METRIC	From the Synth Ref screen, press the STATUS pushbutton to display the Perf Metric screen. The Perf Metric screen is displayed in the following format: PERF METRICS GTI MDEV xE-12 where: "x" is min. 0, max. 99 or FREQ y zE-12 where: "z" is min. 0, max. 9999 where: x = the MDEV Metric y = FREQ A or FREQ B z = Offset frequency

Table G. GTI Card Operation (Cont'd)

DISPLAY	DESCRIPTION
SOFTWARE VERSION AND SWITCH SETTINGS	From the Perf Metric screen, press the STATUS pushbutton to display the Software Version and Switch Settings screen. The Software Version and Switch Settings are displayed in the following format: GTI SW#.##.## CONFIG = xxxxxxxx This display is the configuration code and is for factory use only. (See "Software Version and Switch Settings – GTI-11, -13, -15, and -17" on page 57 for additional information for GTI-11, -13, -15, and -17. See "Software Version and Switch Settings – GTI-12, -14, -16, and -18" on page 58 for GTI-12, -14, -16 and -18.
CURRENT STATUS	From the Software Version and Switch Settings screen, press the STATUS pushbutton to display the Current Status screen. The current alarms are displayed in the following format: alarm severity where: alarm = the alarm message severity = MJ (major), MN (minor), or blank (non-alarmed status) Once in the Current Status screen, each time the STATUS pushbutton is pressed, the display will change to show another alarm. If another is not available, the display will return to the Home Display screen. ***Note:*** If status or alarms do not currently exist, this screen cannot be accessed.
EVENT HISTORY (GTI-15, -16, -17, and -18 only)	From the Current Status screen, press the STATUS pushbutton to display the Event History screen. The Event History screen displays the beginning of the event log, an event stack saving the last 10 events with a timestamp, and the end of the event log. The ending screen of the event log displays the following option: if the STATUS pushbutton is pressed and held for 5 s, the log will be cleared; once cleared, a confirmation display appears. ***Note:*** Upon power up, UTC time is not available.

Table G. GTI Card Operation (Cont'd)

DISPLAY	DESCRIPTION
ALARM EVENTS	If an alarm has occurred, the Alarm Events screen appears after a 5 s button entry timeout. The current alarms/events are displayed in the following format: alarm severity where: alarm = the alarm message severity = MJ (major), MN (minor), blank (non-alarmed status), CL (cleared) Once in the Alarm Events screen, each time the STATUS pushbutton is pressed, or after a 2 s timeout, the display will change to show another alarm; a maximum of 8 alarms can be displayed. If another is not available, the display will return to the Home Display screen. ***Note:*** The Alarm Events screen appears from any of the screens if an alarm occurs.
GTR INVENTORY (GTI-17 and -18 only)	From the Event History screen, press the STATUS pushbutton to display the GTR Inventory screen. The GTR Inventory screen displays the GTR software version, as reported by the GTR. ***Note:*** This information is not available until at least 30 s after power up.
SSM CONFIG (GTI-17 and -18 only)	From the GTR Inventory screen, press the STATUS pushbutton to display the SSM Config screen. The SSM Config screen displays the current SSM configuration. On the GTI-17, it displays ON or OFF. On the GTI-18, it displays the Sa bit configuration.
SSM STATUS (GTI-17 and -18 only)	From the SSM Config screen, press the STATUS pushbutton to display the SSM Status screen. The SSM Status screen displays the current SSM quality level being output from the GTI. If SSM is disabled, only the title bar ("SSM Status") will be displayed; the SSM status itself will not.

Home Display – GTI-11, -12, -13, and -14

7.17 The Home Display consists of the GTI State screen, used to display the following information:

state hh xx

where:

state = SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTR UNLOCK, or GTI LOCK

hh = the total hours in that state (0-99)

Note: For minimum 100 hours in SEARCHING, ACQUIRED, TRACKING, GTR LOCK, or GTI LOCK, the display will blank the hours if the GTI installed is one of the following:

- GTI-11, Software Rev. 2.03 and above
- GTI-12, Software Rev. 3.02.02 and above
- All revisions of the GTI-13 and -14

xx = alarm severity (MJ=major, MN=minor)

7.18 The states displayed on the Home Display screen are defined as follows:

a. SEARCHING = The GTR is searching for satellites.

b. ACQUIRED = The GTR has found at least one valid satellite and is getting GPS information. During this state, the GTR attempts to find,

and lock to, as many satellites as possible.

c. TRACKING = To attain TRACKING state, a minimum of four satellites must be found. While in this state, the GTR determines its position based on the geometry of the satellites being received.

d. GTR LOCK = This is displayed when the GTR goes into Time Transfer mode, and has received its position (within 15 meters [49 feet]), and averaged it over a 2 hour period.

e. GTR UNLOCK = This state indicates that the GTR was in GTR lock, but the GTR has lost partial satellite visibility, and the 4 kHz clock signal is unstable. While in this state, the GTI will attempt to revert to GTR LOCK.

f. GTI LOCK = This state indicates that the 4 kHz clock from the GTR is stable, and the output of the GTI is being steered by the UTC traceable GPS signals. If the 4 kHz signal becomes unstable, the GTI will return to GTR UNLOCK.

7.19 Refer to Figure 7 and Figure 8 for an illustration of the various status and display states.

Home Display – GTI-15, -16, -17, and -18

7.20 The Home Display for the GTI-15, -16, -17, and -18 is the UTC Time display and shows the current UTC (Universal Coordinated Time is Greenwich [England] Mean Time) date and time, as soon as one satellite is acquired. The UTC date and time is displayed in the following format:

yyyymmdd hhmmss

where

yyyymmdd = year month day

hhmmss = the time in the following format:
hours (24 hour clock) minutes seconds

7.21 For an illustration of the various status and display states, refer to Figure 7 and Figure 9 for the GTI-15 and GTI-16 cards, and Figure 7 and Figure 10 for the GTI-17 and GTI-18 cards.

UTC Display – GTI-13, -14, -15, -16, -17, and -18

Note: This display is the Home Display for the GTI-15, -16, -17, and -18.

7.22 The UTC Display shows the current UTC (Universal Coordinated Time is Greenwich [England] Mean Time) date and time as soon as one satellite is acquired. The UTC date and time is displayed in the following format:

yyyymmdd hhmmss

where

yyyymmdd = year month day

hhmmss = the time in the following format:
hours (24 hour clock) minutes seconds

UTC Display – GTI-11 and -12

7.23 The UTC date and time for the GTI-11 and GTI-12 cards is displayed in the following format:

yyyymmddhhmmss

where

yyyymmdd = year month day, and

hhmmss = the time in the following format:
hours (24 hour clock) minutes seconds

GTI Status – GTI-15 and -16

7.24 The GTI Status display consists of the following information:

state hh xx

where:

state = SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTR UNLOCK, or GTI LOCK

hh = the total hours in that state (0-99)

xx = alarm severity (MJ=major, MN=minor)

Note: For minimum 100 hours in SEARCHING, ACQUIRED, TRACKING, GTR LOCK, or GTI LOCK, the display will blank the hours.

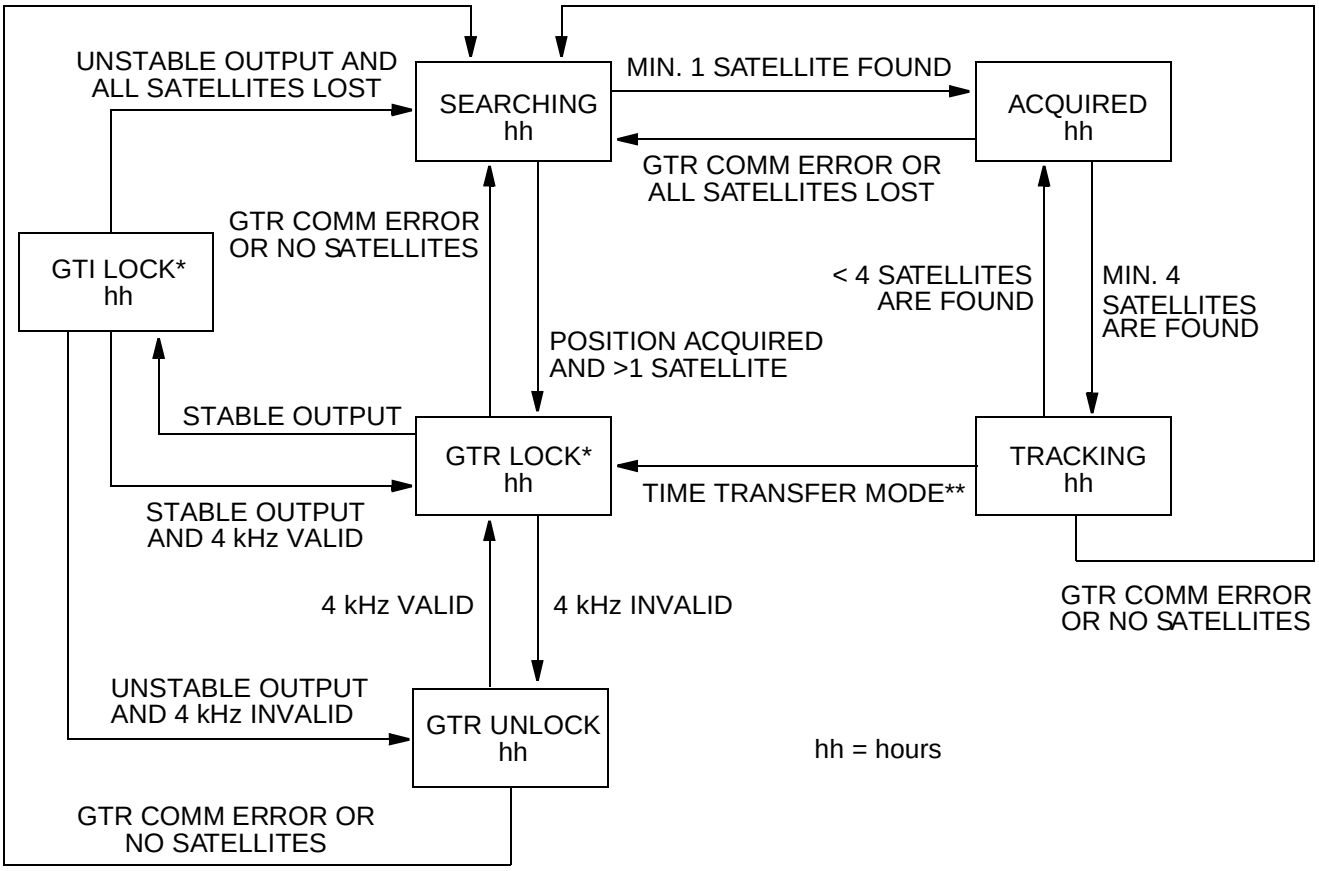
Synthesizer Reference

7.25 The Synthesizer Reference display shows the DCD oscillator driving the DCD-LPR output synthesizer stage. The Synthesizer Reference is shown in the following format:

OSCILLATOR x

where:

x = A or B



* GTR LOCK and GTI LOCK are normal mode displays.

** Time Transfer mode is reached when the GTR has established position after 2 consecutive hours of averaging with <25 m (82 ft) of difference. For initial power-up, or if the GTR has been disabled for >12 h, the time to reach Time Transfer mode could take over 4 h. The GTR retains information for approximately 12 h after being disabled. Therefore, if the GTR has been disabled for <12 h, the time to reach Time Transfer mode could be <5 min.

Figure 7. GTI Card Status States

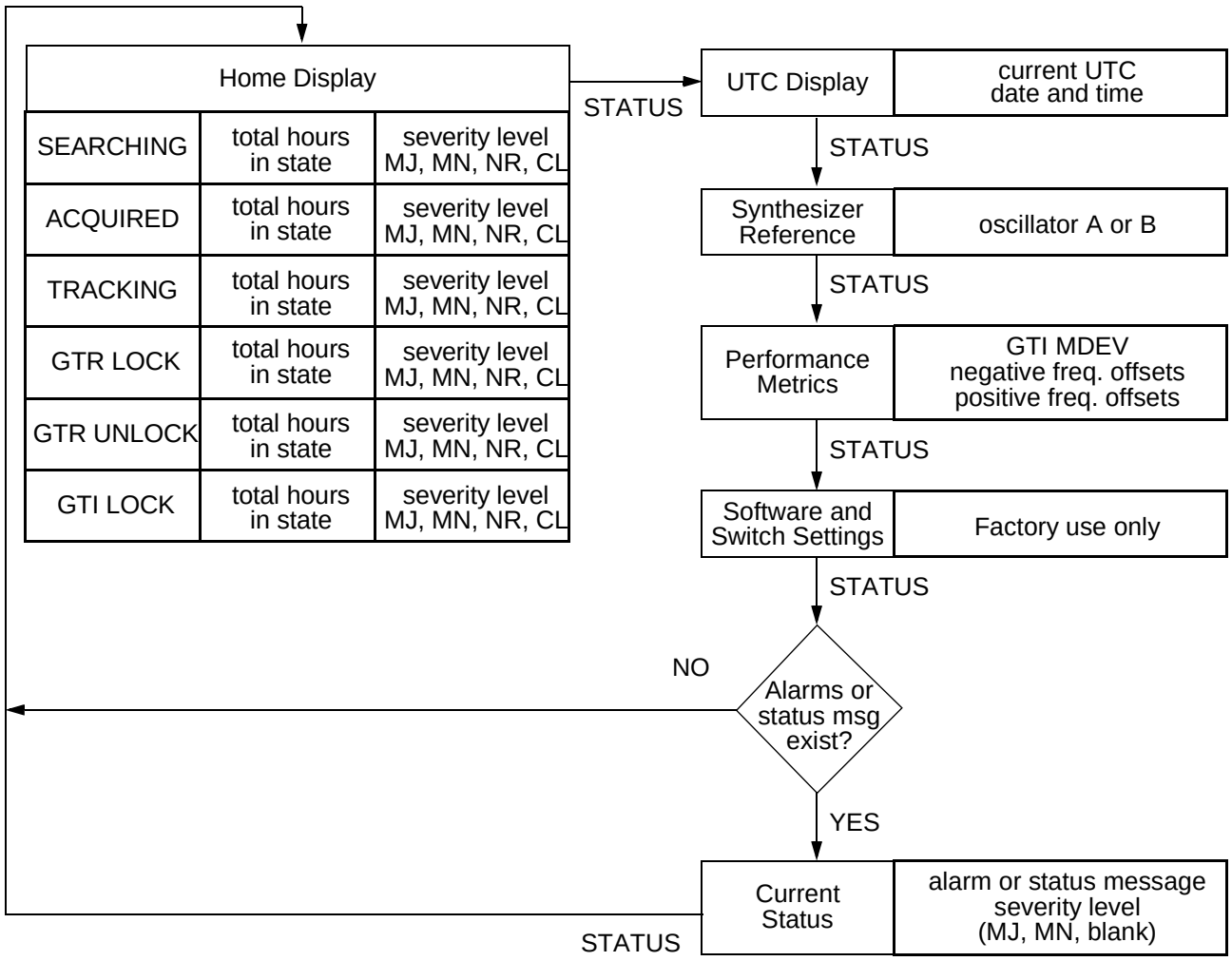


Figure 8. Display Screens – GTI-11 and -12

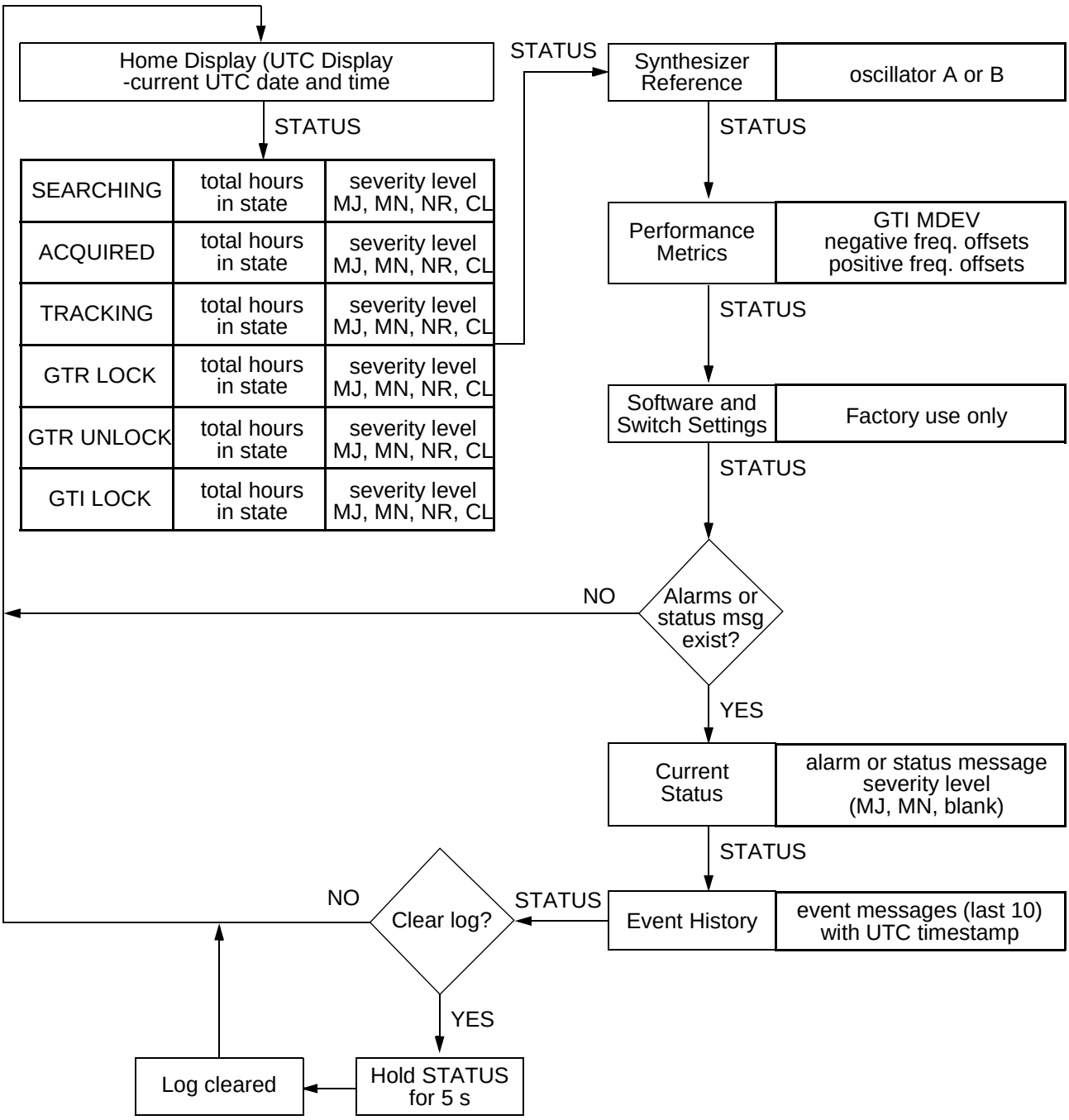


Figure 9. Display Screens – GTI-13, -14, -15 and -16

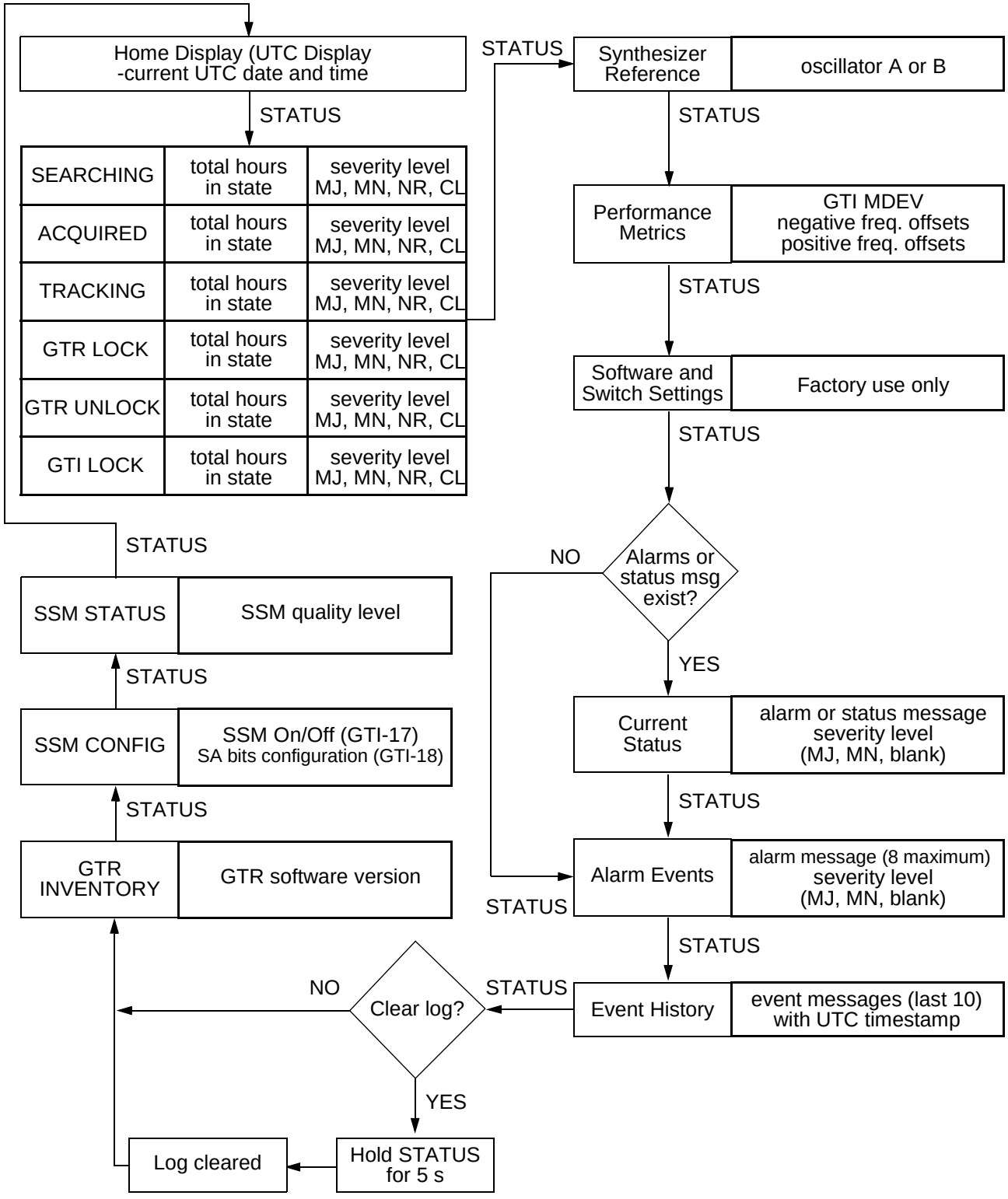


Figure 10. Display Screens – GTI-17 and -18

Performance Metrics

7.26 Performance Metrics screens display values only after GTI lock has been achieved maximum 4 hours. There are three Performance Metric screens; one screen displays information regarding the overall GTI MDEV, and two screens display oscillator frequency errors (negative and positive offsets). Modified Allan Standard Deviation (MDEV) is a standard measurement of frequency, and is used as a Figure of Merit for the overall timing performance of the GTI.

7.27 The frequency error displays the frequency offset of the individual local oscillators.

7.28 The GTI MDEV value is displayed in units of picoseconds per second (10^{-12} s/s). The MDEV value indicates the overall performance of the GPS and local oscillator ensemble. Typically, the display should be in a range between 1 and 5 x 10^{-12}. If a value of less than 1 x 10^{-11} persists for more than 10 hours, the local oscillator is operating marginally or poorly, or the GTR environment has changed dramatically. This may be the cause of current GTI alarms.

7.29 The frequency offset display is typically in a range between 1 and 5 x 10^{-10} if rubidium or cesium atomic oscillators are used. If a value of minimum 5 x 10^{-10} persists for more than 2 hours, the local oscillator is operating marginally, or poorly, and may be the cause of current GTI alarms.

7.30 For ovenized crystal oscillators, the frequency offset display is typically in a range between 10^{-7} to 5 x 10^{-10}.

> ***Note:*** Both negative and positive offsets are reported. If errors are not present, the screen displays NA (Not Available).

7.31 The Performance Metrics screens are displayed in the following format:

GTI MDEV xE-12	where: "x" is minimum 0, maximum 99

or

FREQ y zE-12	where: "z" is minimum 0, maximum 9999

where:

x = the MDEV Metric

y = FREQ A or FREQ B

z = Offset frequency

Software Version and Switch Settings – GTI-11, -13, -15, and -17

7.32 The Software Version and Switch Settings displays are in the following format:

GTI SW #.##.##

CONFIG = x x x x x x x x (8 characters)

		O	O	F	T		A
		S	S	R	C		L
		C	C				M
		2	1				

where:

ALM = one of the number sequences listed below, indicating the following formats:

00 = ALM 1

01 = ALM 2

10 = ALM 3

11 = ALM 4

TC = one of the number sequences listed below, indicating the following formats:

0 = AIS

1 = SQUELCH

FR = one of the number sequences listed below, indicating the following framing formats:

0 = D4

1 = ESF

OSC 1 = one of the number sequences listed below, indicating the following formats:

0 = Rubidium

1 = Quartz

OSC 2 = one of the number sequences listed below, indicating the following formats:

0 = Rubidium

1 = Quartz

Software Version and Switch Settings – GTI-12, -14, -16, and -18

7.33 The Software Version and Switch Settings displays are in the following format:

GTI SW #.##.##

CONFIG = x x x x x x x x (8 characters)

O O F T A
S S R C L
C C M
2 1

where:

ALM = one of the number sequences listed below, indicating the following formats:

00 = ALM 1

01 = ALM 2

10 = ALM 3

11 = ALM 4

TC = one of the number sequences listed below, indicating the following formats:

0 = AIS

1 = SQUELCH

FR = one of the number sequences listed below, indicating the following framing formats:

0 = D4

1 = ESF

2 = CRC4 (GTI-18 only)

3 = CAS4 (GTI-18 only)

4 = FAS (GTI-18 only)

5 = CAS (GTI-18 only)

OSC 1 = one of the number sequences listed below, indicating the following formats:

0 = Rubidium

1 = Quartz

OSC 2 = one of the number sequences listed below, indicating the following formats:

0 = Rubidium

1 = Quartz

Event History – GTI-13, -14, 15, -16, -17, and -18

7.34 The Event History log displays the beginning of the event log, an event stack saving the last 10 events with a timestamp, and the end of the event log. The ending screen of the event log displays the following option: if the STATUS button is pressed and held for 5 seconds, the log will be cleared; once cleared, a confirmation display appears.

Note: Upon power up, UTC time is not available.

GTR Inventory – GTI-17 and GTI-18

7.35 The GTR Inventory screen displays the GTR software version, as reported by the GTR. The display is in the following format:

GTR SW #.#

Note: This information is not available until at least 30 seconds after power up. During this time, the screen indicates “0.0” for the software version.

SSM Config – GTI-17 and GTI-18

7.36 The SSM Config screen displays the current SSM configuration.

7.37 On the GTI-17, the SSM configuration is displayed in the following format:

SSM CONFIG
SSMT

where: SSMT indicates SSM enabled

or

SSM CONFIG
SSM OFF

where: SSM OFF indicates SSM disabled

7.38 On the GTI-18, the SSM configuration displays the Sa bit configuration in the following format:

SSM CONFIG
SSMSA = xxxxx

where: x = Sa4 to Sa8; 1 indicates Sa enabled, and 0 indicates Sa disabled

For example, if the display indicates:

SSM CONFIG
SSMSA = 01110

Then, Sa8 and Sa4 are disabled, and Sa7, Sa6, and Sa5 are enabled.

SSM Status – GTI-17 and GTI-18

7.39 The SSM Status screen displays the current SSM quality level being output from the GTI; displayed in the following format:

SSM STATUS
QL-xxx

where: xxx indicates the current SSM quality level

7.40 For SSM quality level definitions, refer to the System Specifications table in the Functional Description section.

Status Messages

7.41 A status message is simply a text message, and has no alarm association. The purpose of a status message is to give debug information only when specific events are no longer occurring as expected.

Alarm Messages

7.42 The Alarm Events screen appears only if an alarm occurs. Each message is displayed for 5 seconds (in place of the current screen), and then disappears; once the message disappears, it cannot be redisplayed. If the number of alarm event messages exceeds the display capacity, pressing the STATUS button allows the operator to scroll through each message for each alarm event.

7.43 Alarms are displayed in the following format:

alarm severity

where:

alarm = the alarm or event message

severity = MJ (major), MN (minor), or CL (cleared)

Note: Major and minor severity levels are also indicated on the fuse and alarm (FA) panel lamps.

7.44 A major alarm indicates a failure of the GTI system, such that the output primary reference quality is no longer certain. If a major alarm occurs, a switch setting on the GTI card determines whether the GTI output will be squelched, or output an AIS signal. Immediate operator action is required to correct the problem.

7.45 A minor alarm indicates that a condition has occurred that causes GTI to go into bridging mode. Immediate action is not required, but operator action within a minimum of 24 hours is required to resolve the displayed problem (depending upon alarm integration settings).

7.46 CL (Clear) message indicates the condition is cleared and appears for only a brief time (approximately 2 seconds).

C. LTI Card Operation

7.47 The LTI has an alphanumeric front panel display for display of screens, menus, and sub-menus for individual tasks. The various screens and menus can only be accessed by proceeding through a menu tree, using the STATUS and SELECT buttons. See Figure 11 for an illustration of the LTI menu tree.

7.48 Each press of the STATUS button on the front panel will cause the display of the next menu. Pressing the SELECT button selects the displayed menu.

7.49 When neither the STATUS nor SELECT button has been pressed, the LCD screen will display one of the following messages:

- GRI SEARCH - the LTI is initially powered up, and is in the process of acquiring the first station.
- GRI FOUND - the LTI has determined that a station(s) is present, and is in the process of qualifying that station's ability to provide adequate timing information.

- GRI LOCK - the LTI has determined that at least one station's signal is of sufficient quality to provide an adequate time reference. The LTI then begins the process of disciplining its internal reference to agree with the received LORAN-C timing information.

- LTI LOCK - the LTI has adjusted its internal reference to the received LORAN-C station(s).

- LTI HOLDOVER - the LTI has lost all LORAN-C stations, and has reverted to the internal rubidium reference, disciplined by the most recently available LORAN-C timing corrections. When a LORAN-C station is re-acquired and locked, the LTI will revert to the LTI LOCK state.

7.50 A screen timeout occurs if the pushbuttons (STATUS, SELECT) have not been pressed for a period exceeding 30 seconds. At this time, the LTI will go one menu level up (from its current position), and continue to do so every 30 seconds, until it reaches the Main Menu, at which time the GRI SEARCH, GRI FOUND, GRI LOCK, LTI LOCK, or LTI HOLDOVER message is displayed. The message displayed depends upon the current status of the LTI. Pressing either pushbutton (STATUS, SELECT) on the LTI card will reset the display timeout back to 30 seconds.

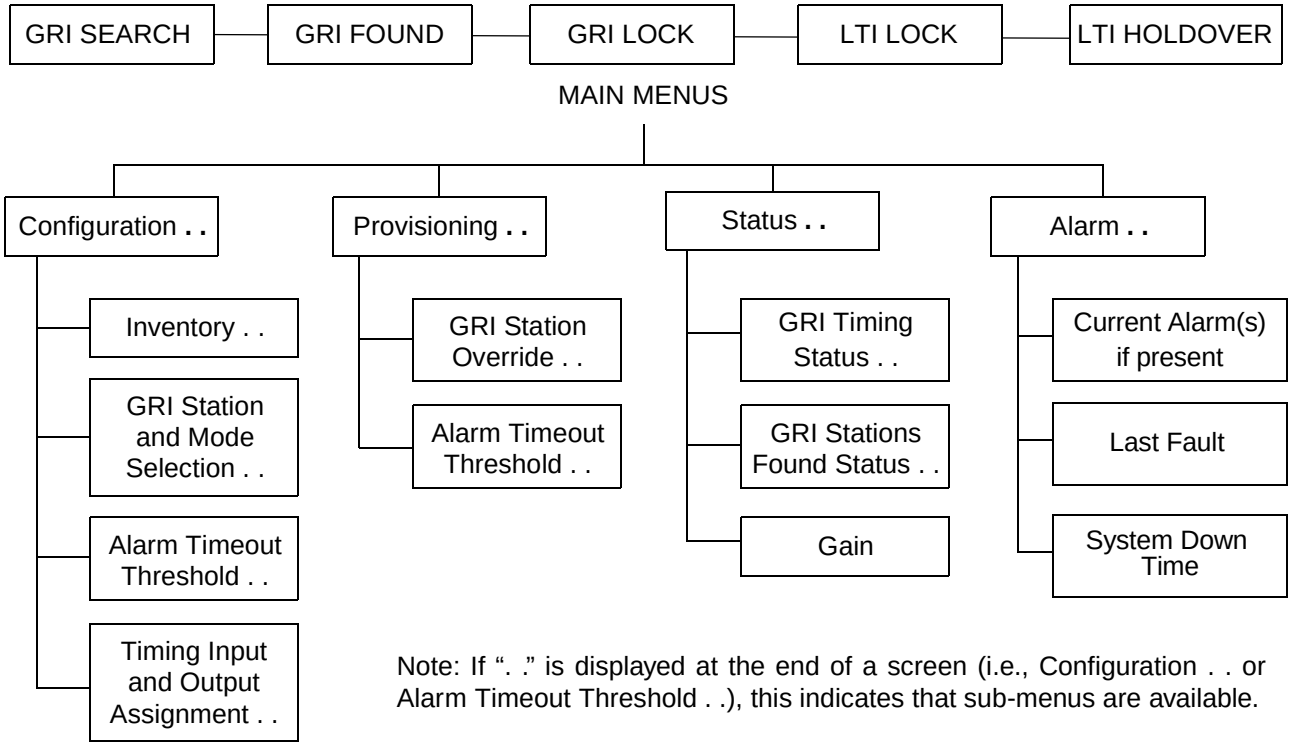


Figure 11. LTI Card Menu Tree

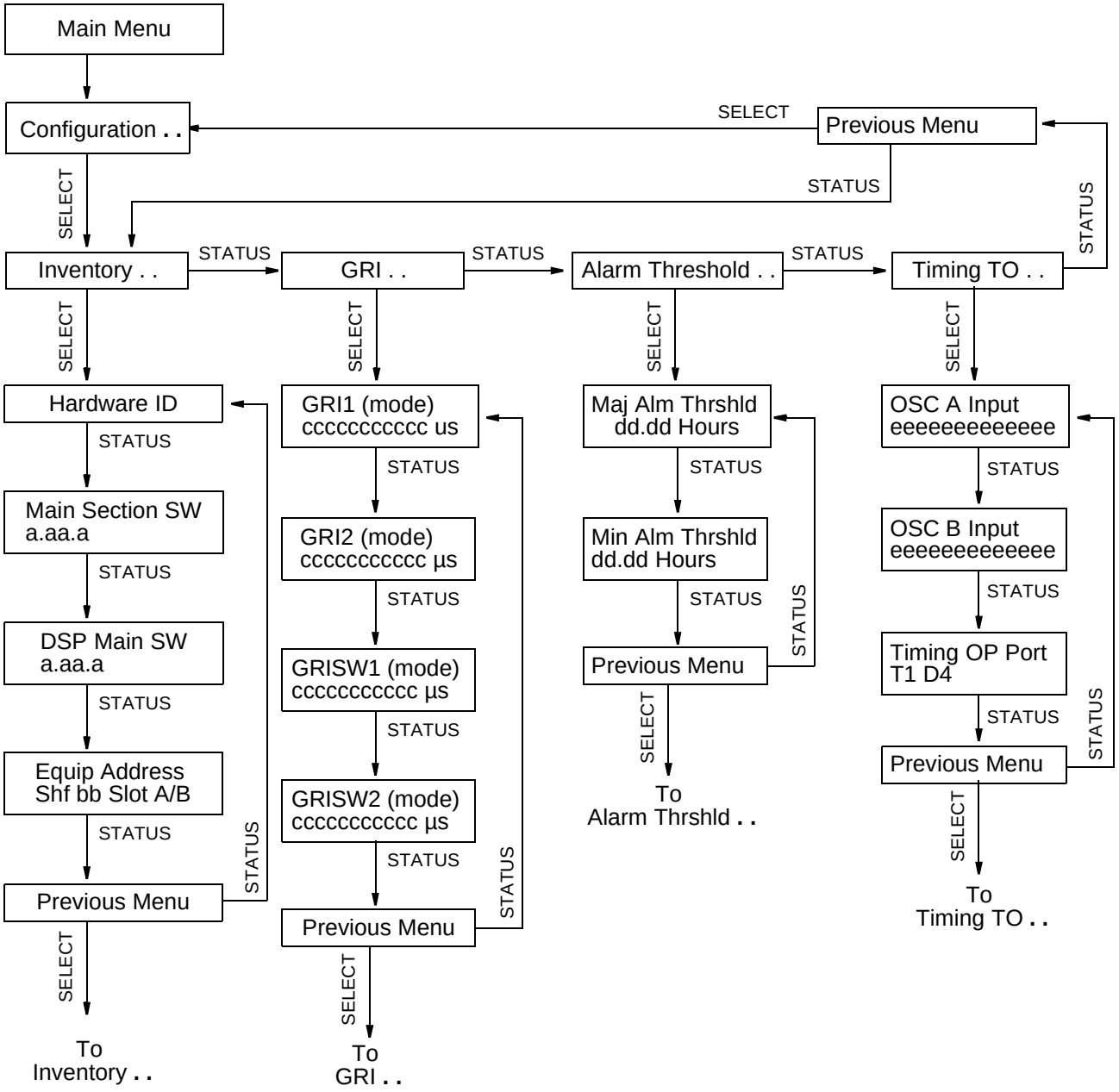
D. LTI Card Displays

7.51 Two types of screens are displayed:

- Modifiable = Screens which allow both modification to parameters and information display
- Non-modifiable = Screens which display information only

7.52 The Provisioning menus contain the modifiable screens. Confirmation screens appear for all modifiable screens: EXECUTE AND GO TO MAIN MENU or PREVIOUS MENU. Selecting EXECUTE executes the current choice, and returns to the Main Menu. PREVIOUS MENU aborts the current screen, and returns to the previous menu. For instructions on how to access and change modifiable screens, refer to the Test and Acceptance section of this manual.

7.53 The Configuration, Status, and Alarm screens contain the non-modifiable screens (Figure 12, Figure 13, and Figure 14; refer also to Table H for definitions for each screen shown).



a.aa.a = Software—Generic Point
bb = Shelf number (1 to 4)
ccccccccccc µs = LORAN-C station ID and µs GRI
dd.dd = Hours.quarter hours
eeeeeeeeeeeee = Oscillator Active or Standby or Not Present

Figure 12. LTI Card Configuration Screens

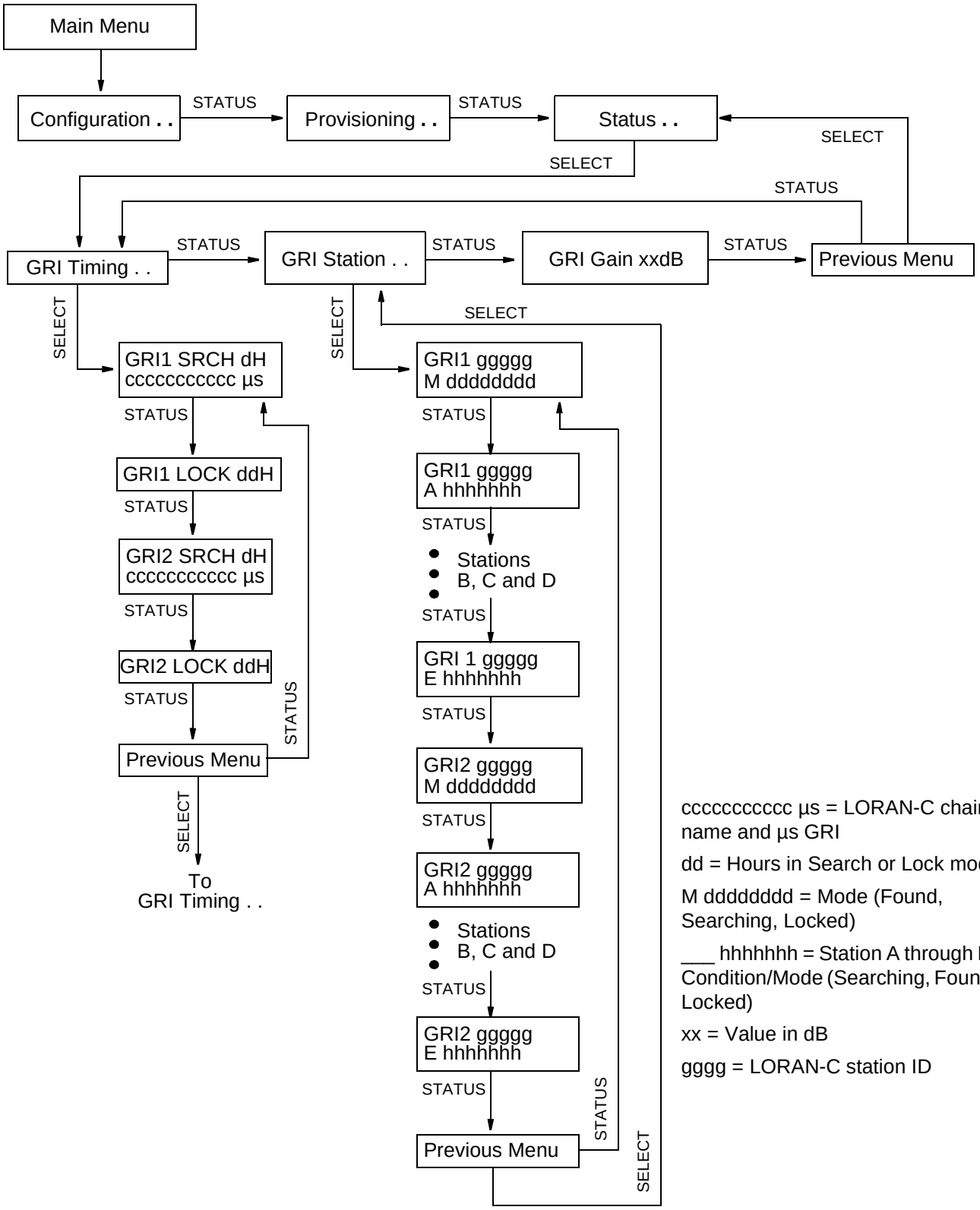
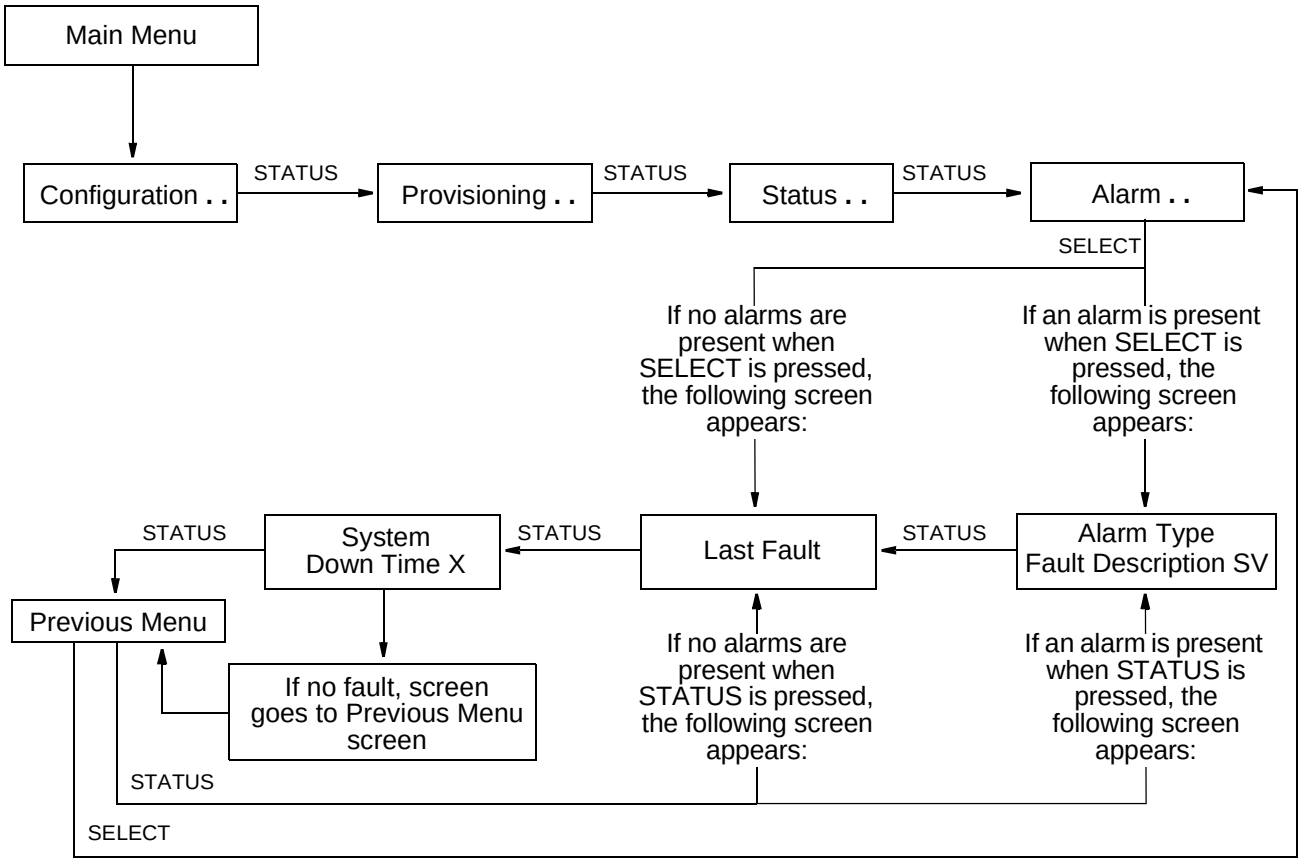


Figure 13. LTI Card Status Screens



Alarm Type = MAJOR, MINOR, or NR
Fault Description = Alarm currently active
SV = MN, MJ, CL

Figure 14. LTI Card Alarm Screens

Table H. LTI Card Menus and Screens

DISPLAY	DESCRIPTION
CONFIGURATION . .	
Inventory . .	Allows access to the following screens:
Hardware ID	Displays the hardware version
Main Section SW	Displays the active Maintenance Processor Software version number—information is embedded in the software
DSP Main SW	Displays the active DSP Software version number—information is embedded in the software
Equip. Address	Displays the shelf and slot identity (i.e., Slot ID = A or B, and Shelf ID = 1, 2, 3, or 4)
Previous Menu	Returns to the previous menu by pressing the SELECT button
GRI . .	Allows access to the following screens (refer to Table I for GRI information):
GRI1 (mode) chain name timing	Current GRI1 search mode (Auto or Designated), GRI chain name (i.e., SE USA = Southeast USA), and Group Repetition Interval (i.e., 79800 µs = GRI for SE USA chain)
GRI2 (mode) chain name timing	Current GRI2 search mode (Auto or Designated), GRI chain name (i.e., NC USA = North Central USA), and Group Repetition Interval (i.e., 82900 µs = GRI for NC USA chain)
GRISW1 (mode) chain name timing	Current power-on GRI 1 switch setting of the following: GRI1 search mode (Auto or Designated), GRI chain name (i.e., SE USA = Southeast USA), and Group Repetition Interval (i.e., 79800 µs = GRI for SE USA chain)
GRISW2 (mode) chain name timing	Current power-on GRI 2 switch setting of the following: GRI2 search mode (Auto or Designated), GRI chain name (i.e., NC USA = North Central USA), and Group Repetition Interval (i.e., 82900 µs = GRI for NC USA chain)
Previous Menu	Returns to the previous menu by pressing the SELECT button
Alarm Thrshld . .	Allows access to the following alarm threshold value screens, as follows:
Maj Alm Thrshold ___ . __ Hours	Displays the major alarm threshold in hours ranging from 0.25 h to 24.0 h in 0.25 h (15 min) increments
Min Alm Thrshold ___ . __ Hours	Displays the minor alarm threshold in hours ranging from 0.25 h to 24.0 h in 0.25 h (15 min) increments
Previous Menu	Returns to the previous menu by pressing the SELECT button
Timing TO . .	Allows access to the following timing input and output port screens:
OSC A Input Port Status	Displays the status (Active or SB [Standby] or Not Present) of timing input Port A
OSC B Input Port Status	Displays the status (Active or SB [Standby] or Not Present) of timing input Port B

Table H. LTI Card Menus and Screens (Cont'd)

DISPLAY	DESCRIPTION
CONFIGURATION . . (Cont'd)	
Timing OP Port Type Format	Displays the type (T1) and framing format (D4 or ESF)
Previous Menu	Returns to the previous menu by pressing the SELECT button
PROVISIONING . .	
GRI Override . .	Allows access to the following GRI station override menus. Refer to Table I for GRI information.
GRI1 (mode) Change Mode . .	Displays the current mode (Auto or Desgnatd), and allows access to the following GRI1 set mode screens:
GRIx (Current Mode) Mode=Auto	Displays the current mode (Auto or Desgnatd) of a particular GRI (x = 1 or 2), and sets the mode to auto
GRIx (Current Mode) Mode=Desgnatd . .	Allows access to the following screens to set mode of operation for a designated GRI:
GRIx Designated chain name chain interval	Displays a list of GRIx (x = 1 or 2) station selections in GRI chain name (i.e., SE USA = Southeast USA) and chain interval (i.e., 79800 µs = GRI for SE USA chain). A total of 28 screens are available; each screen displays information pertinent to a different GRI station. To select a particular station, select STATUS until the desired station is displayed, then select SELECT choose. There is also a "NONE" setting; this setting should be used when the operator knows that only one GRI can be received. If the unused GRI is set to None, the acquisition time of the designated GRI is reduced.
Previous Menu	Returns to the previous menu by pressing the SELECT button
Alarm Thrshold . .	Allows access to the following alarm threshold menus:
Maj Alm TT.TT H Change Thrshld . .	Allows access to the following major alarm threshold timeout assignment menus (H = TT.TT time value):
Major Alarm TO Threshold=tt.ttH	Selects a level of alarm threshold assignment, where tt.tt = the time value from 0.25 h to 24 h in 0.25 h increments. To select a value, select STATUS until the desired time value is displayed, then select SELECT choose. The time will increment 0.25 h each time the STATUS button is pressed to 24 h.
Min Alm TT.TTH Change Thrshld . .	Allows access to the following minor alarm threshold timeout assignment menus (TT.TT H = time value):
Minor Alarm TO Threshold=tt.ttH	Displays the current minor alarm threshold assignment, where tt.tt = the current time value from 0.25 h to 24 h
Minor Alarm TO Threshold=xx.xxH	Selects a level of alarm threshold assignment, where xx.xx = the time value from 0.25 h to 24 h in 0.25 h increments.To select a value, select STATUS until the desired time value is displayed, then select SELECT choose. The time will increment 0.25 h each time the STATUS button is pressed to 24 h.

Table H. LTI Card Menus and Screens (Cont'd)

DISPLAY	DESCRIPTION
PROVISIONING . . (Cont'd)	
Previous Menu	Returns to the previous menu by pressing the SELECT button
Previous Menu	Returns to the previous menu by pressing the SELECT button
STATUS . .	
GRI Timing . .	Allows access to the following GRI timing menu screens:
GRI# Srch ##H Search Mode	Displays the current search status for GRI1. # = 1 or 2, depending on whether GRI1 or GRI2 was selected. # # = number of hours the LTI has been searching for a LORAN-C signal, this number will increase to maximum 99 h; Search Mode = current status of the search (AUTO SEARCH = Auto mode and still searching for valid GRI; GRI name and Group Repetition Interval value = LTI has identified a GRI automatically or through designation)
GRI# Lock ##H GRI Name and Timing	Displays the lock status of GRI1. # = 1 or 2, depending on whether GRI1 or GRI2 was selected. # # = number of hours LTI has been locked and tracking a LORAN-C signal; this number will increase to maximum 99 h. GRI name and timing indicates the current GRI name and Group Repetition Interval value. This appears only when a GRI has been identified.
Previous Menu	Returns to the previous menu by pressing the SELECT button
GRI Station . .	Allows access to the following GRI stations found screens:
GRI1 GRI Name #Status	Displays the status of each particular station of GRI1. GRI Name is the abbreviated name of the selected GRI. # could be any of the possible LORAN-C secondary station designations (X, Y, Z, V, or W). These designations appear only if the master station has also been found. Otherwise, the stations are denoted by A, B, C, D, or E. Status is one of three possible states (Searching, Found, or Locked). Pressing the STATUS pushbutton will cycle through all of the possible stations of a particular chain.
GRI2 GRI Name #Status	Displays the status of each particular station of GRI2. GRI Name is the abbreviated name of the selected GRI. # could be any of the possible LORAN-C secondary station designations (X, Y, Z, V, or W). These designations appear only if the master station has also been found. Otherwise, the stations are denoted by A, B, C, D, or E. Status is one of three possible states (Searching, Found, or Locked). Pressing the STATUS pushbutton will cycle through all of the possible stations of a particular chain.
GRI Gain xxxdB	Displays the current gain value in xxx dB
Previous Menu	Returns to the previous menu by pressing the SELECT button

Table H. LTI Card Menus and Screens (Cont'd)

DISPLAY	DESCRIPTION
ALARMS . .	
Alarm . .	Allows access to the following alarm summary menus:
Alarm Type Fault Description SV	Displays the alarm type as Major, Minor, or Non-reporting; Fault Description displays the fault category (i.e., Signal Fault, Antenna Fault, etc.); SV displays the severity level as either MJ (major) or MN (minor)
Last Fault Fault Description SV	Displays the last fault category (i.e., Signal Fault, Antenna Fault, etc.); SV displays the severity level as either MJ (major) or MN (minor), or CL (cleared)
System Down Time	Displays the length of time the system has been down
Previous Menu	Returns to the Main Menu by pressing the SELECT button

Table I. LORAN-C Stations

GRI	CHAIN	LTI GRI CODE	STATION	LOCATION
59300 µs	Canadian East Coast	2	M X Y Z	Caribou, Maine USA Nantucket, Massachusetts, USA Cape Race, Newfoundland, Canada Fox Harbor, Labrador, Canada
59900 µs	Canadian West Coast	4	M X Y Z	Williams Lake, British Columbia, Canada Shoal Cove, Alaska, USA George, Washington, USA Port Hardy, British Columbia, Canada
79600 µs	Gulf of Alaska	7	M X Y Z	Tok, Alaska, USA Narrow Cape, Kodiak Island, Alaska, USA Shoal Cove, Alaska, USA Port Clarence, Alaska, USA
79700 µs	Norwegian Sea	8	M W X Y Z	Ejde, Faeroe Island, Denmark Bo, Norway Sylt, Germany Sandur, Iceland Jan Mayen, Norway
79800 µs	Southeast USA	9	M W X Y Z	Malone, Florida, USA Grangeville, Louisiana, USA Raymondville, Texas, USA Jupiter, Florida, USA Carolina Beach, North Carolina, USA
79900 µs	Mediterranean Sea	10	M X Y Z	Sellia Marina, Italy Lampedusa, Italy Kargabarun, Turkey Estartit, Spain
82900 µs	North Central USA	12	M W X Y	Havre, Montana, USA Baudette, Minnesota, USA Gillette, Wyoming, USA Williams Lake, British Columbia, Canada
89700 µs	Great Lakes	13	M W X Y Z	Dana, Indiana, USA Malone, Florida, USA Seneca, New York, USA Baudette, Minnesota, USA Boise City, Oklahoma, USA

Table I. LORAN-C Stations (Cont'd)

GRI	CHAIN	LTI GRI CODE	STATION	LOCATION
96100 µs	South Central USA	14	M	Boise City, Oklahoma, USA
			V	Gillette, Wyoming, USA
			W	Searchlight, Nevada, USA
			X	Las Crusas, New Mexico, USA
			Y	Raymondville, Texas, USA
			Z	Grangeville, Louisiana, USA
99400 µs	West Coast USA	15	M	Fallon, Nevada, USA
			W	George, Washington, USA
			X	Middletown, California, USA
			Y	Searchlight, Nevada, USA
99600 µs	Northeast USA	16	M	Seneca, New York, USA
			W	Caribou, Maine, USA
			X	Nantucket, Massachusetts, USA
			Y	Carolina Beach, North Carolina, USA
			Z	Dana, Indiana, USA
99700 µs	Northwest Pacific	17	M	Iwo Jima, Japan
			W	Marcus Island, Japan
			X	Hokkaido, Japan
			Y	Gesashi, Okinawa, Japan
			Z	Barrigada, Guam
99800 µs	Icelandic	18	M	Sandur, Iceland
			W	Angissoq, Greenland
			X	Ejde, Faeroe Island, Denmark
99900 µs	North Pacific	19	M	Saint Paul, Pribilof Island, Alaska, USA
			X	Attu, Alaska, USA
			Y	Point Clarence, Alaska, USA
			Z	Narrow Cape, Kodiak Island, Alaska, USA

7.54 The following procedure is an example of how to find out the current state of a specific station (refer also to Figure 13):

1. From the Configuration screen, press the STATUS button twice; once to display PROVISIONING, and a second time to display STATUS.

2. With STATUS displayed, press the SELECT button once. GRI Timing . . will be displayed.

3. With GRI Timing . . displayed, press the STATUS button once to display GRI Station. .

4. With GRI Station. . displayed, press the SELECT button once. GRI1 (station ID) and the state will be displayed.

5. With GRI1 (station ID) and the state displayed, press the STATUS button once. GRI1 (station ID) and the condition/state for another station will be displayed.

6. To reach the next station, press the STATUS button. Once all the available stations have been displayed, PREVIOUS MENU will be displayed.

7. With PREVIOUS MENU displayed, pressing the SELECT button returns to the GRI Station . . screen. Pressing the SELECT button returns to GRI1 (station ID) and the state.

Note: To return to the Main Menu from any screen, choose PREVIOUS MENU, STATUS, and SELECT, as appropriate, to go back through the entire menu tree.

Alarm Displays

7.55 Major alarms are displayed on the Main Menu (Table H) as they occur. If a major alarm has occurred, the MAJOR lamp will be lit, the MAJ alarm relay contacts will be in the Make condition (NO to C continuity), or in the Break condition (NC to C no-continuity), and the major alarm message will be displayed on the LCD screen for 2 seconds. The display will then revert to either LTI LOCK, LTI HOLDOVER, GRI LOCK, GRI FOUND, or GRI SEARCH.

7.56 Minor alarms are displayed on the Main Menu as they occur. If a major alarm has occurred, the MINOR lamp on the FA panel will be lit, the MIN alarm relay contacts will be in the Make condition (NO to C continuity), or in the Break condition (NC to C no-continuity), and the minor alarm message will be displayed on the LCD screen for 2 seconds; the display will revert to either LTI LOCK, LTI HOLDOVER, GRI LOCK, GRI FOUND, or GRI SEARCH.

7.57 Non-Reporting conditions are also displayed on the Main Menu as they occur. These conditions do not result in either a major or minor alarm; if however, this condition should persist for more than 10 minutes, a major alarm will occur.

7.58 Major and minor alarms can be retrieved by reaching the Alarm menu, and pressing the SELECT button to display the LTI alarm condition (Figure 14).

7.59 Cleared (CL) messages will be displayed for 2 seconds when the alarm condition that caused the alarm has cleared. CL messages cannot be retrieved.

8. INDEX