DIGITAL CLOCK DISTRIBUTOR

LOCAL PRIMARY REFERENCE CE MARK COMPLIANT

MAINTENANCE

CONTENTS PAGE

1. GENERAL 1

2. TROUBLESHOOTING 3
A. Troubleshooting Considerations 3
B. Troubleshooting Procedures 3

3. ROUTINE/PREVENTIVE MAINTENANCE . . . 16

4. REPAIR AND RETURN PROCEDURES 16

5. REPLACEMENT PROCEDURES 16

6. CONTROLS AND INDICATORS 26

7. OPERATION 29
A. GTI/C Operation 29
B. GTI/C Displays 30

Charts

1. GTI/C Card Replacement 17
2. LOU/C Card Replacement 20
3. GTR Replacement 21
4. GTR Cold Weather Replacement 23

Figures

1. Fiber Termination Test 14
2. DCD-LPR/C Shelf 19
3. DCD-LPR/C Front Panel 26
4. LOU/C Card Front Panel 27
5. GTI/C Card Front Panel 28
6. GTI/C Card Status States 37
7. Display Screens – GTI/C -12 and -14 . . . 38
8. Display Screens – GTI/C -16 39
9. Display Screens – GTI/C -18 40

Tables

A. DCD-LPR/C Cards 2
B. GTI/C Alarm and Status Messages 5
C. GTI/C Fiber Optic System Troubleshooting 13
D. LOU/C Troubleshooting 15
E. GTI/C Operation 31

1. GENERAL

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

1.02 This section was reissued for the reasons listed below. Changes are marked by change bars:

- Added a GTI/C card, part number 090-44140-18.
- Added Table A, DCD-LPR/C Cards.
- Added Table C, GTI/C Fiber Optic System Troubleshooting, and Figure 1, Fiber Termination Test
- Updated sections 7A and 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:

DCD	Digital Clock Distributor
GPS	Global Positioning System
GTI/C	GPS Timing Interface card
GTR	GPS Timing Antenna/Receiver
LOU/C	LPR Oscillator Unit
LPR	Local Primary Reference
MIS/C	Maintenance Interface, System
pps	pulses per second
SSM	Synchronization Status Messaging
TNC/C	Transit Node Clock
TNC-E/C	Enhanced Transit Node Clock
TOD	Time-of-Day
UTC	Universal Coordinated Time

Note: Where information is common to the TNC-E/C and TNC/C cards, these cards are collectively referred to as clock cards.

1.05 The DCD-LPR/C conforms to the European Standards EN55022, EN50082-1, and EN60950, and carries the CE Mark certification.

1.06 Cards which may be included in the DCD-LPR/C are listed in Table A.

Table A. DCD-LPR/C Cards

CARD	NAME USED IN THIS SECTION	PART NUMBER	REVISION	FEATURES
GTI/C	GTI/C -12	090-44140-12	–	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
GTI/C	GTI/C -14	090-44140-14	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/C^{V5}	GTI/C -14	090-44140-14	E or later	
GTI/C^{V5}	GTI/C -16	090-44140-16	–	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/C^{V5}	GTI/C-18	090-44140-18	–	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) or 2.048 MHz (analog) Framing format: CCS/CAS with or without CCS4 Time-of-Day SSM capable
LOU/C	LOU-1/C	090-44145-01	–	Source: one oven-controlled crystal oscillator with two parallel outputs
LOU/C	LOU-2/C	090-44145-02	–	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/C cards, these cards are collectively referred to as GTI/C cards.
3. Where information is common to both LOU/C cards, these cards are collectively referred to as LOU/C cards.

2. TROUBLESHOOTING

A. Troubleshooting Considerations

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

2.02 The only true out-of-service condition is when ALL power is lost to a shelf, or long after ALL satellite signals fail. These conditions can easily be 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/C:

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

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

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/C 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.)

- +1 888 367 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/C System configuration (e.g., two GTI/C cards, one GTI/C card and one LOU/C card, external power supply, etc.)
- Card revision level
- Description of the problem including:
  - — Current status
  - — Error messages displayed
  - — Lamp settings

GTI/C LCD

2.07 If the LCD on the GTI/C 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, Repair and Return Procedures, and return the card to the factory.

RS-422–to–RS-232 Converter

2.08 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

2.09 Refer to the following tables for alarm messages or conditions, and the appropriate actions for troubleshooting the components of the DCD-LPR/C:

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

Table B. GTI/C 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 TNC-E/C and TNC/C clock combination in the DCD Shelf, ensure that the TNC-E/C is installed, and its ACTIVE lamp lit, prior to installing the TNC/C. Failure to allow the TNC-E/C to become active before installing the TNC/C may prevent the GTI/C from attaining GTI LOCK. Also, ensure that the TNCE/TNC switch is set to TNCE. 7. If upgrading an existing TNC/C and TNC/C DCD System, and installing a TNC-E/C and TNC/C combination, both TNC/C cards must be removed before installing the TNC-E/C card. During the TNC-E/C 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 TNC B clock. b. Remove the TNC A clock. c. Install the TNC-E/C in the TNC A slot. Wait for the ACTIVE lamp to light. d. Once the ACTIVE lamp has lit, install the TNC/C in the TNC B slot. 8. If using the GTI/C -16 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/C 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 (snow, new building construction, trees, something laying on the GTR, the GTR fell over, etc.). If an INSUF SATELLITES alarm does not exist, call Symmetricom's CTAC for assistance.
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/C 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.

Table B. GTI/C Alarm and Status Messages (Contd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
GTI FAIL:1	GTI/C output is not Stratum-1 quality.	1. Reseat the GTI/C card. If the alarm persists, continue to the next step. 2. Replace the GTI/C card. If the alarm persists, continue to the next step. 3. Check and/or replace the GTR.
GTI FAIL:2	GTI/C output is not Stratum-1 quality.	1. Reseat the GTI/C 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 greater than 500 E-12 for rubidium, or greater than 5000 E-12 for quartz, check, and/or replace, the TNC/C or TNC-E/C card in the DCD Shelf.
GTI FAIL:3	GTI/C output is not Stratum-1 quality.	Reseat the GTI/C card. If the alarm persists, replace the GTI/C card.
GTR FAIL:x	The GTR has failed (x is a failure code used by field service personnel).	Replace the GTR.
GTR PWR FAULT	There is a fault on the output of the GTR power supply (located on the GTI/C card).	The GTI/C -12 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/C -12 and -14 provide an immediate minor alarm upon a GTR PWR FAULT condition. The GTI/C -16 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.
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/C card in the shelf (if equipped). Or, check for OSC A and OSC B lamps lit red on the LOU/C 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/C 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 TNC-E/C cards are not used in the DCD Shelf, skip to the next step. If TNC-E/C cards are installed in the DCD Shelf, verify that the ACTIVE lamps are lit on the TNC-E/C cards. (If the TNC-E/C 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 TNC-E/Cs are warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamps are lit on the TNC-E/C cards, continue to next step. 4. Replace the cables between the DCD and DCD-LPR/C shelves; recheck the alarms.

Table B. GTI/C Alarm and Status Messages (Contd)

MESSAGE	EXPLANATION	ACTION
MAJOR (MJ) ALARMS (Contd)		
Note: The following alarm applies only to the GTI/C -16 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/C 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/C 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/C card.
MINOR (MN) ALARMS		
FUSE A	Fuse A on the DCD-LPR/C Shelf has failed, or battery A has failed.	1. Measure the voltage on TB2 at the DCD-LPR/C Shelf. The BATT A terminal measures –36 V dc to –56 V dc in relation to the RTN terminal. If the voltage is not within the specified range, troubleshoot office battery A. If the voltage is within the specified range, continue to next step. 2. Replace the –48VA fuse on the front panel of the DCD-LPR/C Shelf.
FUSE B	Fuse B on the DCD-LPR/C Shelf has failed, or battery B has failed.	1. Measure the voltage on TB1 at the DCD-LPR/C Shelf. The BATT B terminal measures –36 V dc to –56 V dc in relation to the RTN terminal. If the voltage is not within the specified range, troubleshoot office battery B. If the voltage is within the specified range, continue to next step. 2. Replace the –48VB fuse on the front panel of the DCD-LPR/C 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/C 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, etc.). If an INSUF SATELLITES alarm does not exist, call Symmetricom's CTAC for assistance.
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/C 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/C Alarm and Status Messages (Contd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
GTI OUT FAULT	One (or both) of the GTI/C outputs has a fault (the output is shorted externally, or the GTI/C card has failed).	1. Remove the snap screw-down connector from the appropriate terminal block (TB1 or TB2) for the card displaying the alarm. If the GTI OUT FAULT clears, replace the snap screw-down connector, and skip to Step 3. If the GTI OUT FAULT does not clear, continue to the next step. 2. Remove the snap screw-down connector from the other terminal block (TB1 or TB2). If the GTI OUT FAULT does not clear, replace the snap screw-down connector, and replace the GTI/C card, using the replacement procedure in this section. If the GTI OUT FAULT alarm clears, skip to Step 6. 3. Trace the cable from the terminal block (TB1 or TB2) 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 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 cable is connected to the appropriate terminal block for the card displaying the alarm to the input of the DCD Shelf. If not correct, correct the cabling. If the cabling is correct, replace the cable between the terminal block for the card displaying the alarm and the input of the DCD Shelf. 6. Trace the cable from the other terminal block (TB1 or TB2) 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 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 cable is connected to the appropriate terminal block for the card displaying the alarm to the input of the DCD Shelf. If not correct, correct the cabling. If the cabling is correct, replace the cable between the terminal block for the card displaying the alarm and the input of the DCD Shelf.
GTR COMM	There has been no status message from the GTR for more than 1 min.	Observe the lamp labeled DS1 or DS2 on the shelf backplane. If the lamp is lit green, replace the GTI/C card, using the replacement procedure in this section. If the lamp is off, see Table C. ***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.

Table B. GTI/C Alarm and Status Messages (Contd)

MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
Note: The following applies only to the GTI/C -12 and GTI/C -14 cards; the GTI/C -16 and GTI/C -18 cards provide an immediate major alarm, without immediately affecting the GTI/C card timing output, upon a GTR PWR FAULT. The GTI/C -12 and GTI/C -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/C 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/C card has not been removed. Remove the power supply board from the GTI/C 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/C card power supply daughter board, in case the GTI card has to be returned for servicing. 1. On the rear of the DCD-LPR/C 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. 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 33 V, replace the power cable on the terminal block (ensure colors are correct as previously noted), then replace the GTI/C card, using the replacement procedure in this section. If the voltage is between 29 V and 33 V, replace the power cable on the terminal block (ensure colors are correct as previously noted), and continue to the next step. 3. At the (inside) GTR lightning protector, remove one of the power leads from the GTR side of the protector, and measure the current in series with the removed lead. If the current is greater than 200 mA, replace the GTR antenna, using the replacement procedure in this section. If the current is less than 200 mA, replace the inside GTR lightning protector, and recheck the alarms. 4. At the (inside) GTR lightning protector, measure the voltage across the power leads on the GTR side of the protector. If the voltage is between 29 V and 33 V, skip to Step 6. 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/C Shelf side of the protector. If the voltage is not between 29 V and 33 V, replace the cable between the DCD-LPR/C Shelf and the (inside, if configured with two lightning protectors) GTR lightning protector. If the voltage is between 29 V and 33 V, replace the (inside, if configured with two lightning protectors) GTR lightning protector, and recheck the alarms.

Table B. GTI/C Alarm and Status Messages (Contd)

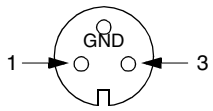
MESSAGE	EXPLANATION	ACTION
MINOR (MN) ALARMS (Contd)		
GTR PWR FAULT (Contd)	(See previous)	6. At the GTR antenna, remove the 4 nuts holding the GTR onto the mounting flange, raise the GTR enough to disconnect the power connector from the GTR, and measure the voltage between pins 1 and 3 in the connector on the end of the power cable (see sketch). If the voltage is between 29 V and 33 V, 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 33 V, 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/C 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 29 V 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 29 V 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.
OSC A LOS	No signal is being received on the OSC A input.	1. Check for OSC A LOS alarm on the other GTI/C card in the shelf (if equipped). Or, check if the OSC A lamp is lit red on the LOU/C 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/C card. If the alarm persists, or if the other card indicates loss of same oscillator input, continue to the next step. 2. If TNC-E/C cards are not used in the DCD Shelf, skip to the next step. If TNC-E/C cards are installed in the DCD Shelf, verify that the ACTIVE lamp is lit on the TNC-E/C card in the TNC A slot. (If the TNC-E/C 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 TNC-E/C is warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamp is lit on the TNC-E/C in the TNC A slot, continue to next step. 3. Replace the cable between the DCD Shelf and the DCD-LPR/C Shelf OSC A input. Recheck the alarms.
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/C Alarm and Status Messages (Contd)

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/C card in the shelf (if equipped). Or, check if the OSC B lamp is lit red on the LOU/C 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/C card. If the alarm persists, or if the other card indicates loss of same oscillator input, continue to the next step. 2. If TNC-E/C cards are not used in the DCD Shelf, skip to the next step. If TNC-E/C cards are installed in the DCD Shelf, verify that the ACTIVE lamp is lit on the TNC-E/C card in the TNC A slot. (If the TNC-E/C 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 TNC-E/C is warmed up, or troubleshoot the DCD Shelf, using the manual for that shelf. If the ACTIVE lamp is lit on the TNC-E/C in the TNC A slot, continue to next step. 3. Replace the cable between the DCD Shelf and the DCD-LPR/C Shelf OSC B input. Recheck the alarms.
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.
Note: The following alarm applies only to the GTI/C -16 and -18 cards; this alarm escalates to a TOD FAIL condition when the alarm delay time set on the GTI/C card is exceeded.		
TOD INVALID	The GTI/C 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.

Table B. GTI/C Alarm and Status Messages (Contd)

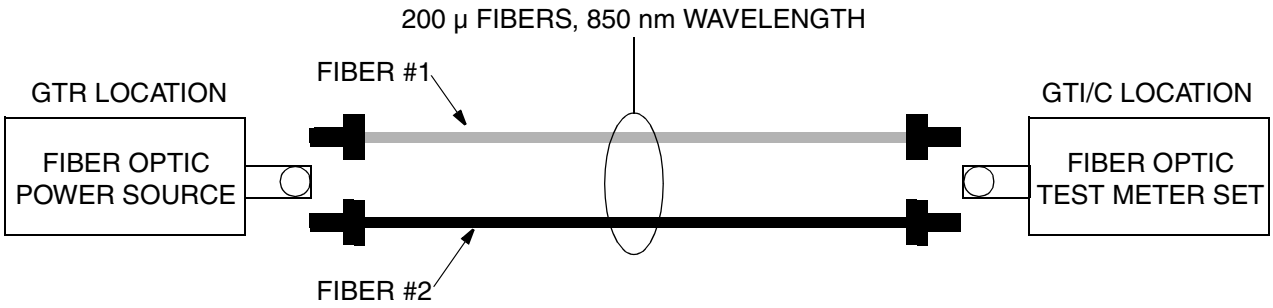
MESSAGE	EXPLANATION	ACTION
STATUS MESSAGES		
GPS FREQ TOL	Timing from the GTR is out of tolerance compared to the OSC A and OSC B signals.	None required if this message occurs alone. If a GPS INVALID alarm exists under the MAJOR or MINOR alarms above, troubleshoot that alarm.
GPS INVALID	Timing information 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 CONVERG-ING	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/C Operation, and Section 7B, GTI/C Displays. SSM status messages apply only to the GTI/C -18 card. These messages require no action; they indicate SSM configuration and software version information only.		

Table C. GTI/C Fiber Optic System Troubleshooting

STEP	PROCEDURE
Use this procedure to troubleshoot when the DS1 or DS2 lamp is off on the LPR/C Shelf backplane.	
1	Swap the two fiber cables (XMT A [J16] and XMT B [J20]) on the backplane (remove, and reconnect to the opposite connector [RCV A [J15] and RCV B [J19]] to check for crossed cables). If the DS1 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, connect the fiber cables to the original connectors, and continue to the next step.
2	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 shelf backplane 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 3 (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 shelf backplane, 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 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) 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 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, continue to step d. d. Repeat Steps a through c on the other fiber cable. If the DS1 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, contact CTAC.
3	With both fiber cables connected at the GTR, and the GTI/C card plugged in, lift the RCVR (RCVR A for DS1, RCVR B for DS2) fiber from the shelf backplane, 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 4. 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 (or DS2) lamp is off, continue to Step b. b. Replace the ST type connectors. If the DS1 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, continue to Step c. c. Replace the GTR. If the DS1 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, continue to Step d. d. Replace the fiber cable. If the DS1 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, contact CTAC.
4	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.
5	Subtract the source level from the received level to determine the fiber loss (see Figure 1 for examples).

Table C. GTI/C Fiber Optic System Troubleshooting (Contd)

STEP	PROCEDURE
6	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 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, contact CTAC. If the fiber loss exceeds 7 dB, replace the ST type connectors, then repeat Steps 4 and 5. If the fiber loss still exceeds 7 dB, replace the fiber cable. If the DS1 (or DS2) lamp is lit green, the trouble has been eliminated. If the DS1 (or DS2) lamp is off, contact CTAC.



Typical losses for 200 µ cable lengths:

- 30.3 m . . . . 2.0 dB
- 151.7 m . . . 2.7 dB
- 304.8 m . . . 3.6 dB
- 457.2 m . . . 4.5 dB
- 609.6 m . . . 5.4 dB

Typical examples for 152 m 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 D. LOU/C Troubleshooting

CONDITION	EXPLANATION	ACTION
The procedures contained in this table are for the LOU-1/C and the LOU-2/C cards. Follow the appropriate replacement procedures in this section when replacing a card.		
LOU-1/C		
OSC A lamp lights red	The oscillator in the LOU-1/C card has failed.	Return the card to the factory for repair of the oscillator.
LOU-2/C		
OSC A lamp lights red	Oscillator A in the LOU-2/C 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/C 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/C System is an annual or semi-annual check of the GTR and weather-resistant conduit to ensure that each is sound and intact. During snowstorms, 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 +44 1483 510300, and obtain a Return Material Authorization (RMA) number.

   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 Charts 1 through 4 are replacement procedures for DCD-LPR/C System cards, and the antenna.

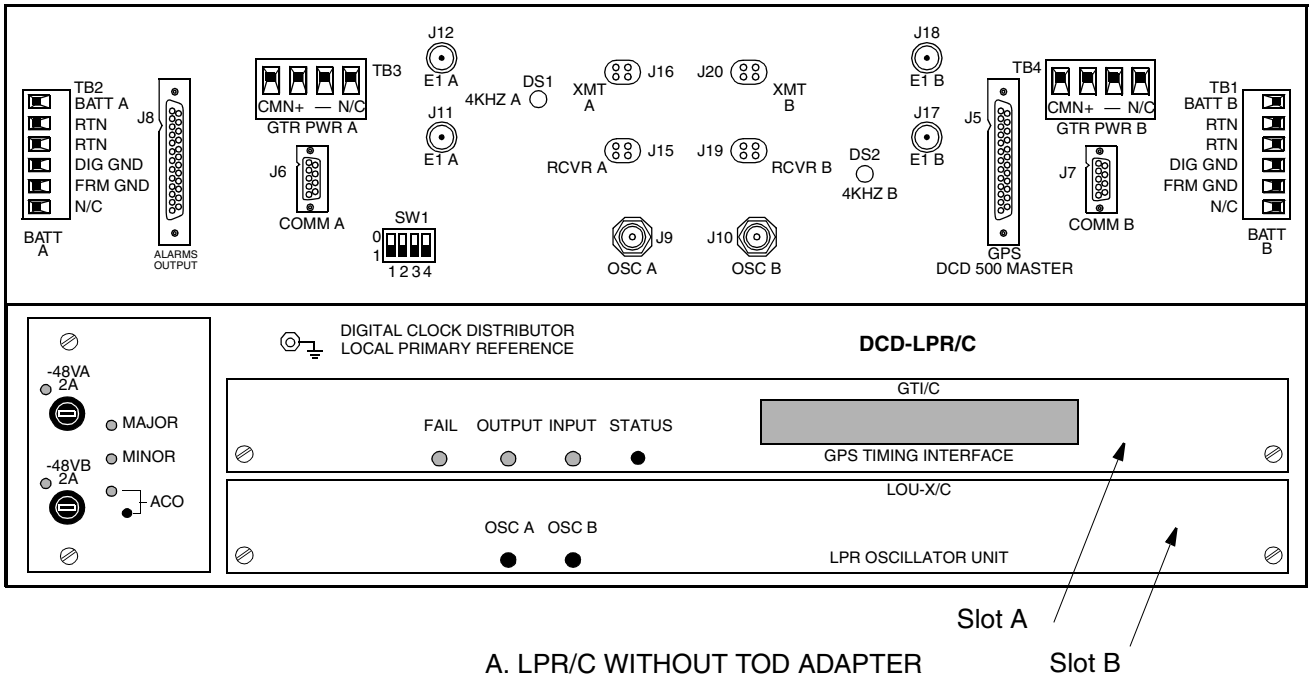
Note: If using a DCD-500 series shelf with a 090-44018-05 or 090-44018-15 MIS/C card, use the Maintenance section of the DCD Shelf Manual to replace the card, instead of Charts 1 through 2 in this section.

Chart 1. GTI/C Card Replacement

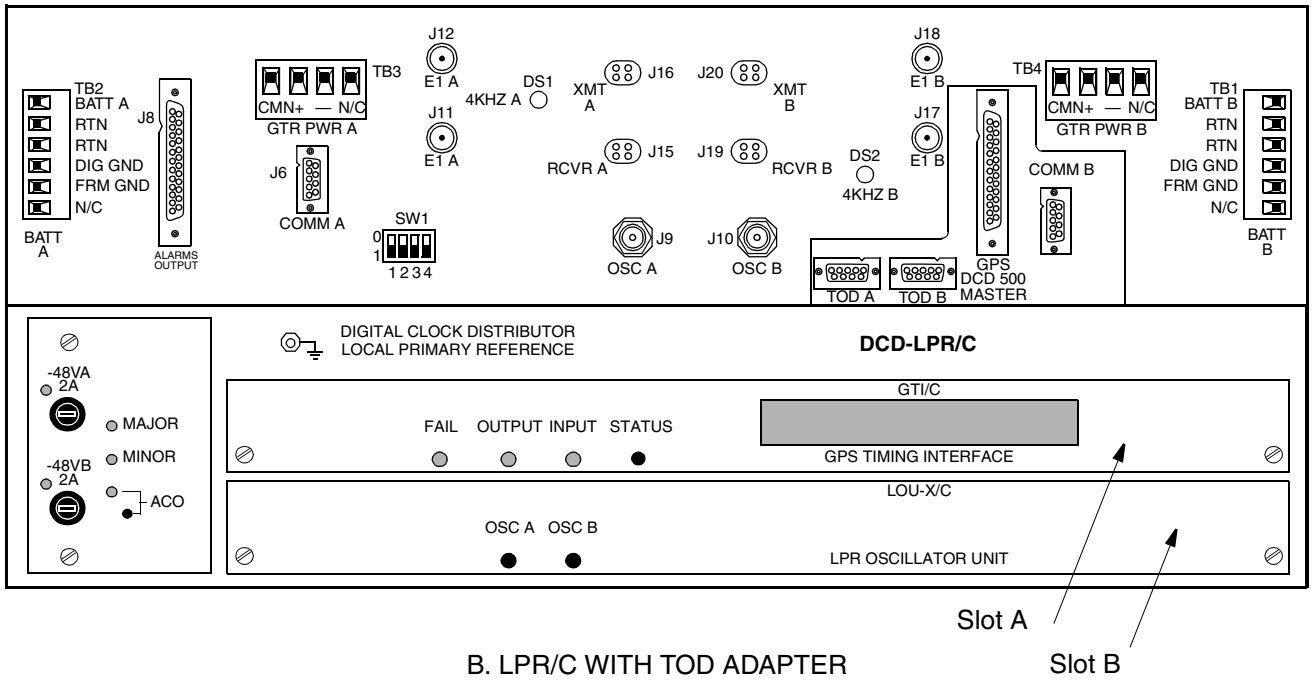
STEP	PROCEDURE
Use this procedure to replace a GTI/C card (p/n 090-44140-12, -14, -16, or -18). ***Notes:*** 1. Each slot in the DCD-LPR/C is independent of the other slot. For this reason, when one card is removed, its removal does not affect the other card or the DCD-LPR/C Shelf. The reaction occurs at the DCD Shelf, if the DCD-LPR/C is connected to a DCD Shelf. If either one or two GTI/C cards are installed, when the failed card is removed, the clock input card in the DCD Shelf issues an LOS alarm, and switches its reference to the next reference signal in priority order. 2. If using the GTI/C -16 or -18, the Home Display is the UTC time; the GTI/C -16 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/C card. ***Requirement:*** The appropriate reference input lamp(s) light red on the clock input card in the DCD Shelf.
2	On the replacement card, set switches on SW2 (and SW1 if replacing a GTI/C -16 or -18 card) the same as the failed card.
3	Insert the replacement GTI/C card into the appropriate slot in the DCD-LPR/C 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/C card. ***Requirement:*** The GTI/C performs a lamp test, and display various status messages, followed by: SEARCHING 0H where 0H = zero hours
5	Observe the GTI/C card lamps. ***Requirement for GTI/C -12:*** The FAIL and OUTPUT lamps are OFF, and the INPUT lamp is lit red. ***Requirement for GTI/C -14, -16, and -18:*** The FAIL, OUTPUT, and INPUT lamps are all OFF.
6	While in SEARCHING 0H, check the DS1 or DS2 lamp (as appropriate) on the DCD-LPR/C Shelf backplane. ***Requirement:*** The DS1 lamp should be lit green. The lamp in this condition indicates that a 4 kHz signal is being received at the GTI/C from the GTR.
7	Measure the voltage between PWR+ and PWR–. The DCD-LPR/C Shelf backplane provides power to the GTR antenna unit via the GTI/C card. The GTI/C card in Slots A and B provides power at terminals TB3 (Slot A) and TB4 (Slot B) on the DCD-LPR/C Shelf (see Figure 2). ***Requirement:*** The voltage reads +31.0 V ±2.0 V.
8	Other messages may appear. After 15 min to 30 min (longer in sites with poor satellite views), observe the display, and confirm that the following appears: ***Requirement:*** ACQUIRED 0H where 0H = zero hours

Chart 1. GTI/C Card Replacement (Contd)

STEP	PROCEDURE
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 of GTR LOCK, observe the display to verify the system has entered GTI LOCK. ***Requirement:*** GTI LOCK 0H where 0H = zero hours ***Note:*** For at least 100 h, the display will blank the hours.
15	Observe the lamps. ***Requirement:*** The FAIL lamp is OFF, and the INPUT and OUTPUT lamps are lit green.
16	If the DCD-LPR/C is not equipped with TOD, skip to Step 20. 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.
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.



A. LPR/C WITHOUT TOD ADAPTER



B. LPR/C WITH TOD ADAPTER

Figure 2. DCD-LPR/C Shelf

Chart 2. LOU/C Card Replacement

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

Chart 3. GTR Replacement

STEP	PROCEDURE
Use this procedure to replace a GTR in outside temperatures above –20 °C. If replacing the GTR in temperatures below –20 °C, refer to Chart 4. To make the installation flow smoother, it is recommended that two installers be present, one at the DCD-LPR/C site, and the other at the GTR site; each should be equipped with a walkie-talkie or some type of communications device.	
1	At the DCD-LPR/C, remove the GTI/C 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 0.61 m 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 at least 100 h in any of the following status states, the display will blank the hours.	
12	Reinsert the GTI/C card into the DCD-LPR/C Shelf; secure in place.
13	Observe the GTI/C card. ***Requirement for all GTI/Cs:*** Upon power-up, the GTI/C performs a lamp test, and display various status messages, followed by: SEARCHING 0H where 0H = zero hours ***Requirement for GTI/C -12:*** The FAIL and OUTPUT lamps are OFF, and the INPUT lamp is lit red. ***Requirement for GTI/C -14, -16, and -18:*** The FAIL, OUTPUT, and INPUT lamps are all OFF.
14	While in SEARCHING 0H, check the DS1 or DS2 lamp (as appropriate) on the DCD-LPR/C backplane. ***Requirement:*** The lamp is lit green. The lamp in this condition indicates that a 4 kHz signal is being received at the GTI/C from the GTR.
15	Measure the voltage between PWR+ and PWR–. The DCD-LPR/C Shelf backplane provides power to the GTR antenna unit via the GTI/C card. The GTI/C card in Slots A and B provides power at terminals TB3 (Slot A) and TB4 (Slot B) on the DCD-LPR/C Shelf (see Figure 2). ***Requirement:*** The voltage reads +31.0 V ±2.0 V.

Chart 3. GTR Replacement (Contd)

STEP	PROCEDURE
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
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 at least 100 h in GTI LOCK, the display will blank the hours.
23	Observe the lamps. ***Requirement:*** The FAIL lamp is OFF, and the INPUT and OUTPUT lamps are lit green.
24	If the DCD-LPR/C 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 4. GTR Cold Weather Replacement

STEP	PROCEDURE
Use this procedure to replace the GTR in cold weather conditions (below –20 °C). ***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/C site, and the other at the GTR site; each should be equipped with a walkie-talkie or some 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/C, remove the GTI/C 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 0.61 m 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 at least 100 h in any of the following status states, the display will blank the hours.
12	Reinsert the GTI/C card into the DCD-LPR/C Shelf; secure in place.
13	Observe the GTI/C card. ***Requirement for all GTI/Cs:*** The GTI/C performs a lamp test, and displays various status messages, followed by: SEARCHING 0H where 0H= hours ***Requirement for GTI/C -12:*** The FAIL and OUTPUT lamps are OFF, and the INPUT lamp is lit red. ***Requirement for GTI/C -14, -16, and -18:*** The FAIL, OUTPUT, and INPUT lamps are all OFF.

Chart 4. GTR Cold Weather Replacement (Contd)

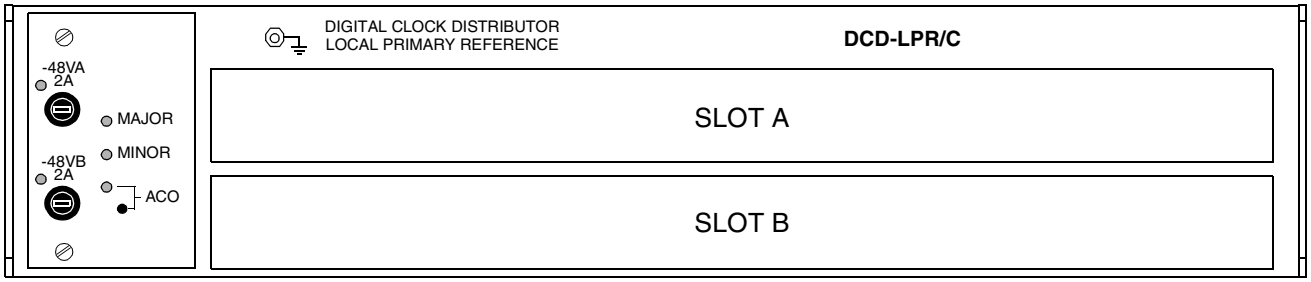
STEP	PROCEDURE
14	While in SEARCHING 0H, check the DS1 or DS2 lamp (as appropriate) on the DCD-LPR/C backplane. ***Requirement:*** The lamp is lit green. The lamp in this condition indicates that a 4 kHz signal is being received at the GTI/C from the GTR.
15	Measure the voltage between PWR+ and PWR–. The DCD-LPR/C Shelf backplane provides power to the GTR antenna unit via the GTI/C card. The GTI/C card in Slots A and B provides power at terminals TB3 (Slot A) and TB4 (Slot B) on the DCD-LPR/C 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 satellite views), 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
21	Observe the lamps. ***Requirement:*** The lamp status does not change.
22	After 2 h or 3 h of GTR LOCK, observe the display, to verify the system has entered GTI LOCK. ***Requirement:*** GTI LOCK 0H where 0H = zero hours ***Note:*** For at least 100 h, the display will blank the hours.
23	Observe the lamps. ***Requirement:*** The FAIL lamp is OFF, and the INPUT and OUTPUT lamps are lit green.

Chart 4. GTR Cold Weather Replacement (Contd)

STEP	PROCEDURE
24	If the DCD-LPR/C 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.

6. CONTROLS AND INDICATORS

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



MAJOR: Lamp that lights red when a major alarm is declared. During a major alarm, the GTI/C 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/C Front Panel

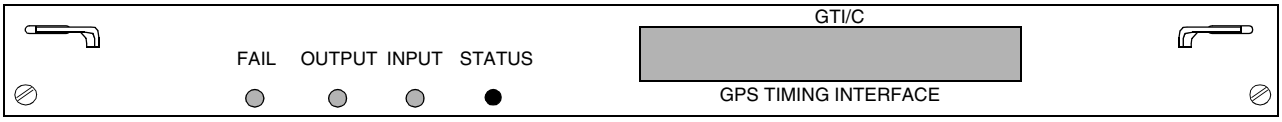
A. LOU-1/C

B. LOU-2/C

LOU-1/C 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/C 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/C Card Front Panel



FAIL: Lamp that lights red when the GTI/C card fails.

OUTPUT: Lamp that lights green to indicate the GTI/C output is active, or lights red to indicate the GTI/C output is disabled. (Initially, the lamp is off until GTI LOCK, to indicate that the GTI/C output is not guaranteed to meet specification, and is in AIS or squelch.)

INPUT: p/n 090-44140-12. 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 090-44140-14. 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 090-44140-16 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/C status displays.

Display: 16-character LCD which shows the GTI/C status and/or alarm conditions.

Figure 5. GTI/C Card Front Panel

7. OPERATION

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

A. GTI/C Operation

GTI/C -12 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 displays 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 (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/C -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/C -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/C Displays

GTI/C -12 or -14 Card

7.11 The GTI/C 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/C displays several screens:

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

7.12 Table E lists the various GTI/C 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/C -16 Card

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

7.14 Table E lists the various GTI/C -16 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/C -18 Card

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

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

7.16 Table E 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 E. GTI/C Operation

DISPLAY	DESCRIPTION
Home Display (GTI/C -12 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) ***Note:*** For at least 100 h in any of the states listed, the display will blank the hours. 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/C -16 and -18)	The UTC time is displayed in the following format: yyyymmdd hhmmss where: yyyymmdd = equals year month day hhmmss = hours (24 hour 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/C -12 and -14)	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 hour clock) minutes seconds
GTI STATUS (GTI/C -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)

Table E. GTI/C Operation (Contd)

DISPLAY	DESCRIPTION
GTI STATUS (GTI/C -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 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
SOFTWARE VERSION AND SWITCH SETTINGS (GTI/C -12, -14, and -16 only)	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 = xxxxyxxx where: y = one of the numbers listed below, indicating the following framing formats: 2 = CCS4 3 = CAS4 4 = CCS 5 = CAS This display is the configuration code and is for factory use only. (See “Software Version and Switch Settings – GTI/C -12, -14, and -16” on page 41, for additional information.)

Table E. GTI/C Operation (Contd)

DISPLAY	DESCRIPTION
SOFTWARE VERSION AND SWITCH SETTINGS (GTI/C -18 only)	From the Perf Metric screen, press the STATUS pushbutton to display the Software Version and Switch Settings screen. The Software Version and Switch Settings settings are displayed in the following format: GTI SW#.##.## CONFIG = xxxxyxxx where: y = one of the numbers listed below, indicating the following formats: 2 = CCS4 3 = CAS4 4 = CCS 5 = CAS 6 = analog This display is the configuration code and is for factory use only. (See "Software Version and Switch Settings – GTI/C -18" on page 42, for additional information.)
CURRENT STATUS	From the Software Version and Switch Setting 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 button 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/C -16 and -18 only)	From the Current Status screen, press the STATUS pushbutton to display the Event History screen. 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 s, the log will be cleared; once cleared, a confirmation display appears. ***Note:*** Upon power up, UTC time is not available. Initial event timestamps are based on the internal oscillator; they are denoted with a 921010 date.

Table E. GTI/C Operation (Contd)

DISPLAY	DESCRIPTION
ALARM EVENTS	If an alarm has occurred, the Alarm Events screen appears after a 5 s button entry timeout while in the Home Display screen. 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 button 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/C -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/C -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 Sa bit configuration.
SSM STATUS (GTI/C -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/C. If SSM is disabled, only the title bar (“SSM Status”) will be displayed; the SSM status itself will not.

Home Display – GTI/C -12 and -14

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

state hhH xx

where:

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

hh = the total hours in that state

Note: For at least 100 hours in any of the states listed above, the display will blank the hours.

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

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

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, and averaged it over a 2 hour period (within 15 meters).

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/C 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/C is being steered by the UTC traceable GPS signals. If the 4 kHz signal becomes unstable, the GTI/C will return to GTR UNLOCK.

7.19 Refer to Figure 6 and Figure 7 for illustrations of the various status and display states.

Home Display – GTI/C -16 and -18

7.20 The Home Display for the GTI/C -16 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 6 and Figure 8 for the GTI/C -16 card, and Figure 6 and Figure 9 for the GTI/C -18 card.

UTC Display – GTI/C -12 and -14

Note: This display is the Home Display for the GTI/C -16 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

GTI Status – GTI/C -16

7.23 The GTI Status display consists of the following information:

state hhH xx

where:

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

hh = the total hours in that state

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

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

7.24 Refer to Figure 6 and Figure 8 for an illustration of the various status and display states.

GTI Status – GTI/C -18

7.25 The GTI Status display consists of the following information:

state hhH xx

where:

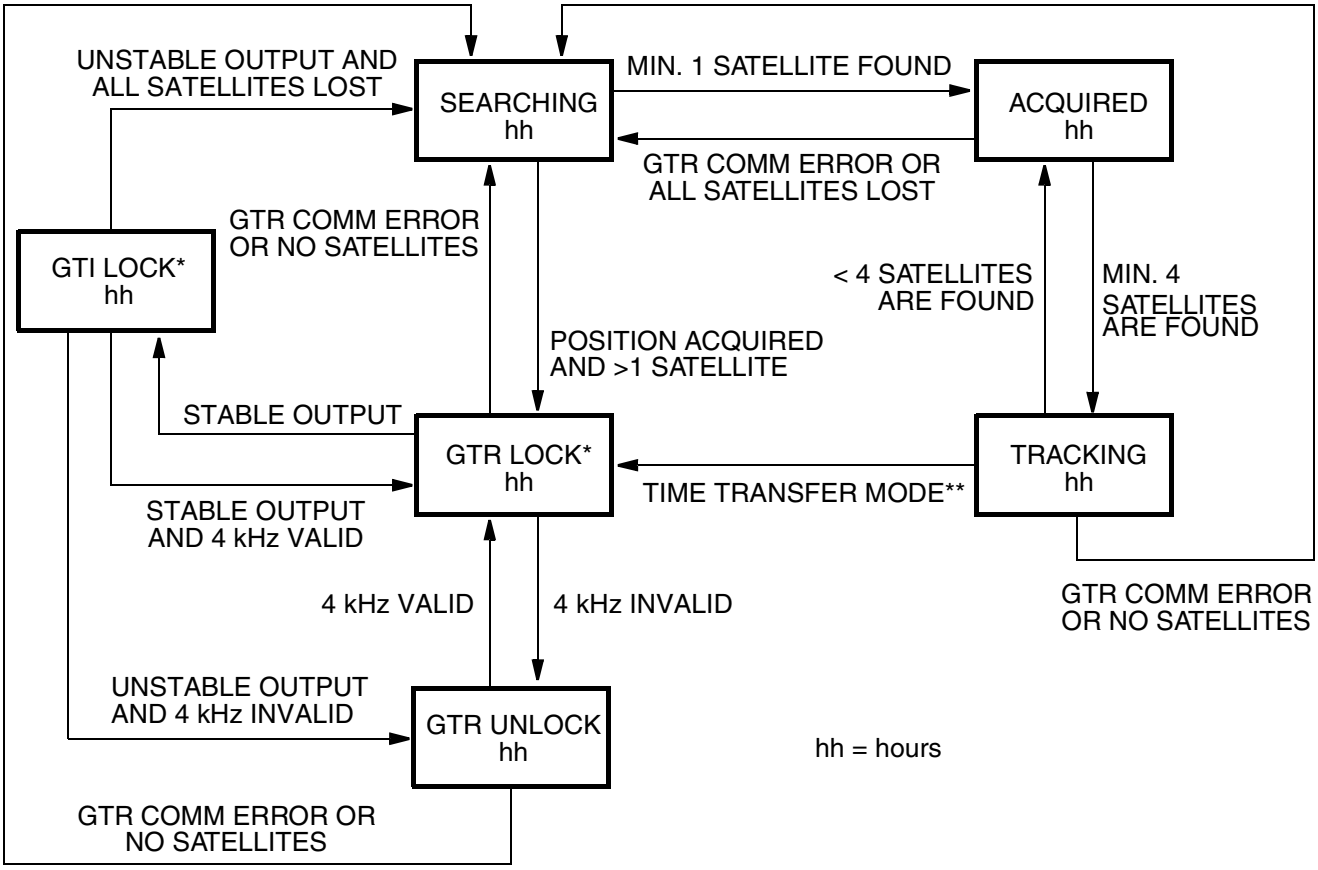
state = SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTR UNLOCK, or GTI LOCK

hh = the total hours in that state

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

Note: For at least 100 hours in SEARCHING, ACQUIRED, TRACKING, GTR LOCK, GTI LOCK, or GPS INVALID, the display will blank the hours.

7.26 Refer to Figure 6 and Figure 9 for an illustration of the various status and display states.



* GTR LOCK and GTI LOCK are normal mode displays.

** Time Transfer mode is reached when the GTR has established position after 2 consecutive h of averaging with <25 m 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 6. GTI/C Card Status States

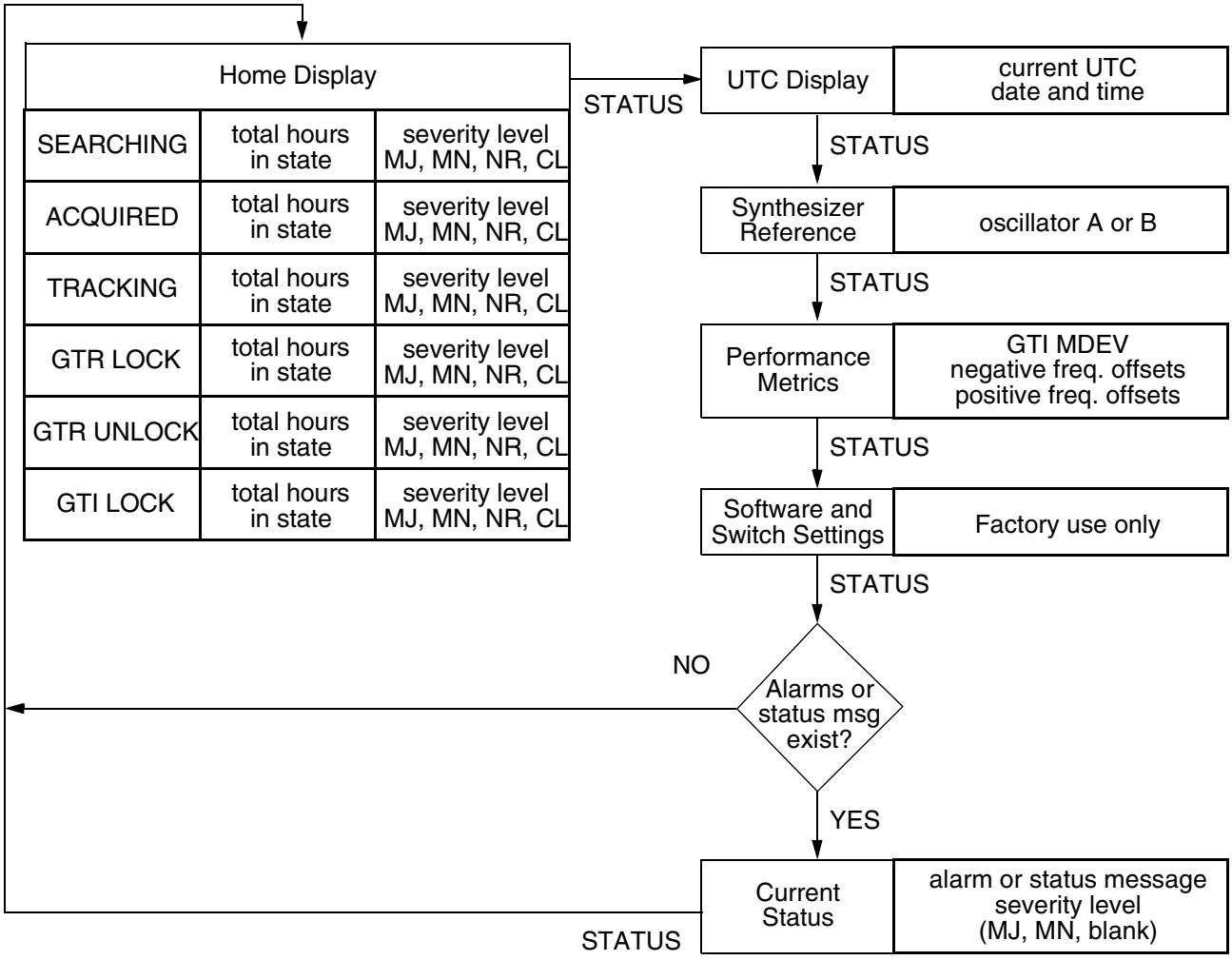


Figure 7. Display Screens – GTI/C -12 and -14

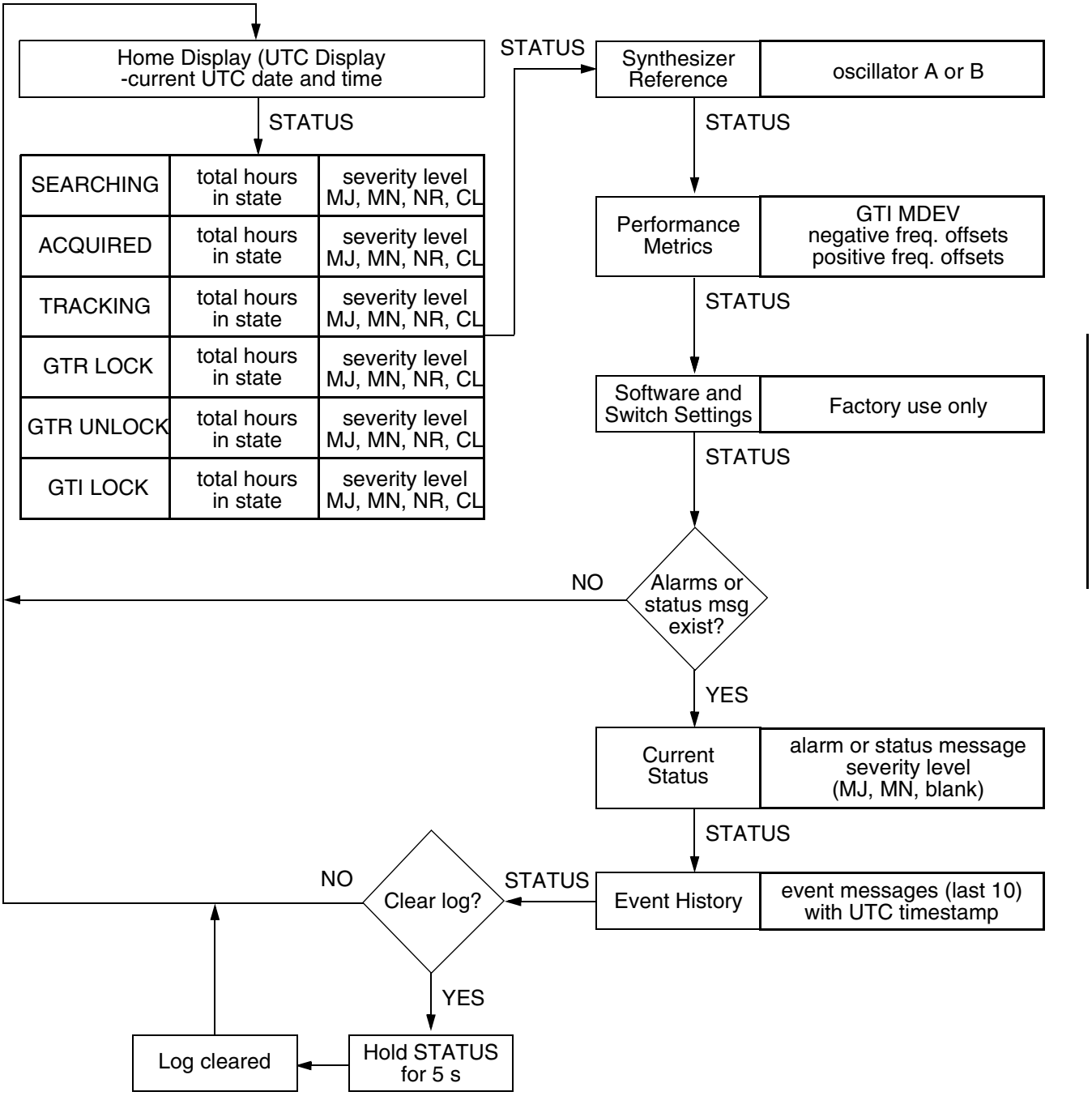


Figure 8. Display Screens – GTI/C -16

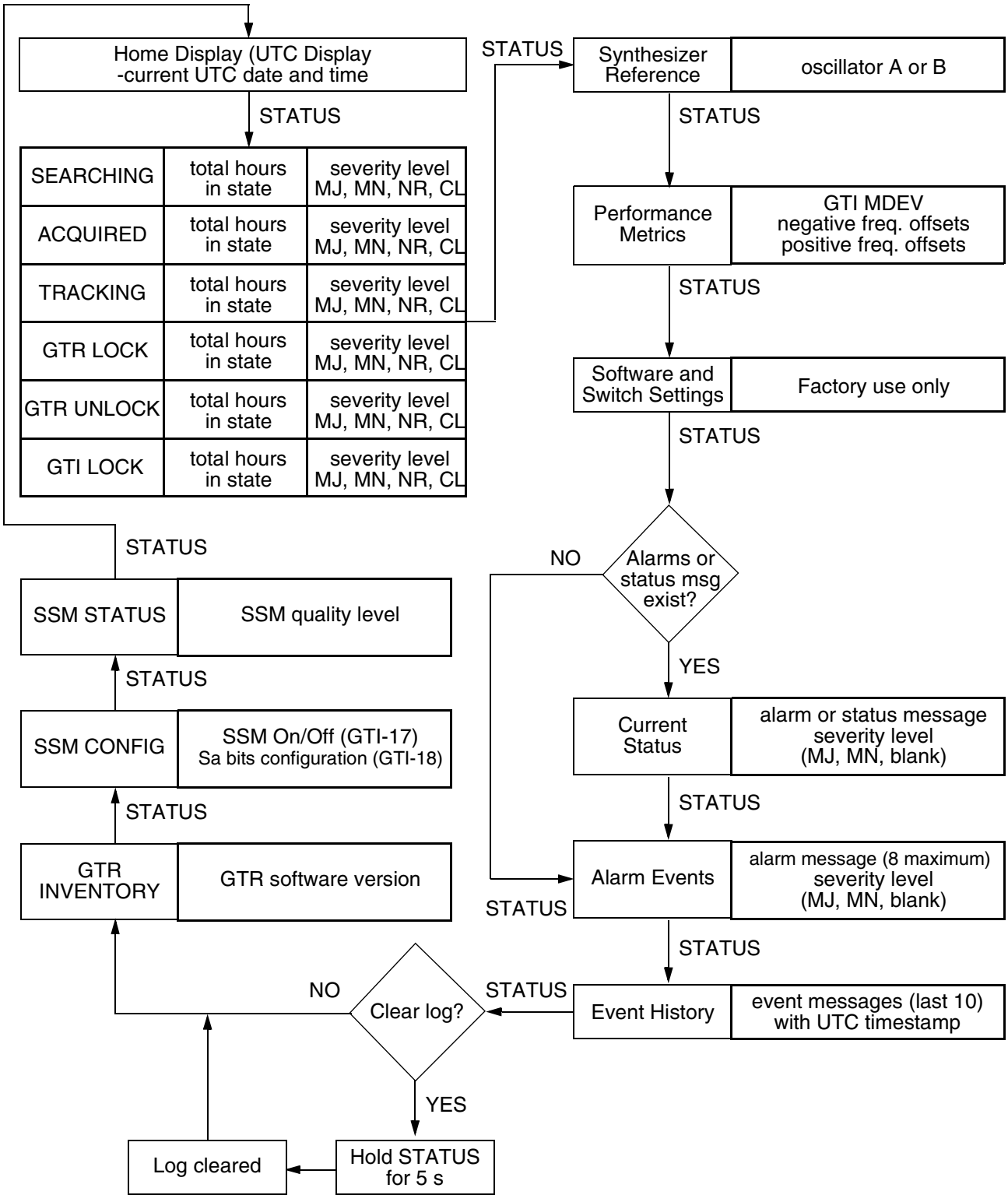


Figure 9. Display Screens – GTI/C -18

Synthesizer Reference

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

OSCILLATOR x

where: x = A or B

Performance Metrics

7.28 Performance Metrics screens display values only after GTI lock has been achieved for over 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/C.

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

7.30 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 at least 1 x 10^{-11} persists for over 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/C alarms.

7.31 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 at least 5 x 10^{-10} persists for over 2 hours, the local oscillator is operating marginally or poorly, and may be the cause of current GTI/C alarms.

7.32 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).

7.33 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/C -12, -14, and -16

7.34 The Software Version and Switch Settings display is for factory use only. The displays are in the following format:

GTI SW #.##.##

CONFIG = xxxxyxxx (8 characters)

where:

y = one of the numbers listed below, indicating the following framing formats:

2 = CCS4

3 = CAS4

4 = CCS

5 = CAS

Software Version and Switch Settings – GTI/C -18

7.35 The Software Version and Switch Settings display is for factory use only. The displays are in the following format:

GTI SW #.##.##

CONFIG = xxxxyxxx (8 characters)

where:

y = one of the numbers listed below, indicating the following formats:

2 = CCS4

3 = CAS4

4 = CCS

5 = CAS

6 = analog

Event History – GTI/C -16 and -18

7.36 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/C -18

7.37 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/C -18

7.38 The SSM Config screen displays the current SSM 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/C -18

7.39 The SSM Status screen displays the current SSM quality level being output from the GTI/C; 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 panel lamps.

7.44 A major alarm indicates a failure of the GTI/C system, such that the output primary reference quality is no longer certain. If a major alarm occurs, a switch setting on the GTI/C card determines whether the GTI/C 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 an external clock source to the GTI/C card has failed, however, the output of the DCD-LPR/C via the GTI/C is still of primary reference quality. Immediate action is not required, but operator action within at least 24 hours is required to resolve the displayed problem.

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