



\$35.00

USER'S GUIDE

**GROUND FAULT TESTER,
A80297 -01, -02, & -03)
(PART OF SEAR II ACCESSORY GROUP)**

March 2004 (Revised July 7, 2006)

**DOCUMENT NO. SIG-00-03-05-003
VERSION B.2**

Safetran Systems Corporation, California Division
10655 7th Street, Cucamonga, California 91730
1-800-793-SAFE

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SAFETRAN SYSTEMS CORPORATION
CALIFORNIA DIVISION
10655 7th STREET
CUCAMONGA, CALIFORNIA 91730
TELEPHONE: (909) 987-4673
CUSTOMER SERVICE: (800) 793-7233
TECHNICAL SUPPORT: (800) 793-7233
FAX: (909) 466-9516

CHANGE NOTICE

The following change(s) have been made to the User's Guide for the Ground Fault Tester dated March 2004, Document No. SIG-00-03-05-003.

- 1 March, 2005

Added photograph of the –03 configuration, changed section 1 and subsequent interconnection drawings to reflect the new configuration.

- 14 October 2005

Page 13, section 4:

Added power consumption specification information for the GFT.

- 7 July 2006

Page 1, section 1:

Added third paragraph regarding fail-safe design.
Reworded WARNING to address possible consequences of internal failure.

Page 2, section 2:

Reword sentence three of first paragraph to include ground fault threshold of 1.0 mA.

Page 2, Table 1:

Reword BAT 1 and BAT 2 FAIL Indication descriptions to include 1.0 mA threshold.

Page 13, section 4:

Added Alarm Threshold to specifications.

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NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are frequently used to direct the reader's attention to specific information. Use of the three terms is defined as follows:

NOTE

Generally used to highlight certain information relating to the topic under discussion.

CAUTION

REFERS TO PROPER PROCEDURES OR PRACTICES WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.

WARNING

INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.

If there are any questions, contact Safetran Application Engineering.

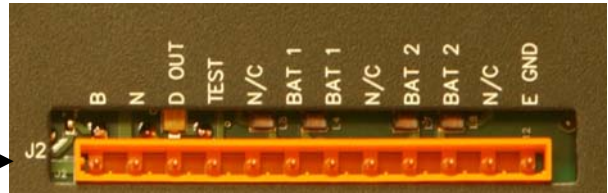
ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

Static electricity can damage electronic circuitry, particularly low voltage components such as the integrated circuits commonly used throughout the electronics industry. Therefore, procedures have been adopted industry-wide which make it possible to avoid the sometimes invisible damage caused by electrostatic discharge (ESD) during the handling, shipping, and storage of electronic modules and components. Safetran has instituted these practices at its manufacturing facility and encourages its customers to adopt them as well to lessen the likelihood of equipment damage in the field due to ESD. Some of the basic protective practices include the following:

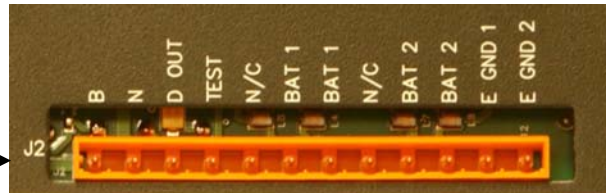
- Ground yourself before touching card cages, assemblies, modules, or components.
- Remove power from card cages and assemblies before removing or installing modules.
- Remove circuit boards (modules) from card cages by the ejector lever only. If an ejector lever is not provided, grasp the edge of the circuit board but avoid touching circuit traces or components.
- Handle circuit boards by the edges only.
- Never physically touch circuit board or connector contact fingers or allow these fingers to come in contact with an insulator (e.g., plastic, rubber, etc.).
- When not in use, place circuit boards in approved static-shielding bags, contact fingers first. Remove circuit boards from static-shielding bags by grasping the ejector lever or the edge of the board only. Each bag should include a caution label on the outside indicating static-sensitive contents.
- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.
- Use integrated circuit extractor/insertion tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Insertion (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

For information concerning ESD material applications, please contact the Safetran California Division Technical Support Staff in Rancho Cucamonga, California. ESD Awareness Classes and additional ESD product information are also available through the Technical Support Staff.

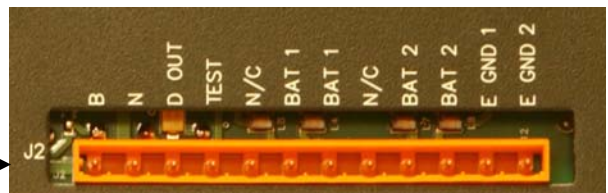
SEAR II ACCESSORY GROUP – GROUND FAULT TESTER (GFT)



A80297-01



A80297-02



A80297-03

Ground Fault Tester (Front Views)

1. GROUND FAULT TESTER (GFT) - INTRODUCTION

The 80297 Ground Fault Tester (GFT) can operate in two modes. In normal mode, the GFT constantly monitors up to two batteries for ground faults and indicates battery fault status to the SEAR II if connected. Information is provided to the SEAR II as a pulsed data signal via any unused SEAR II digital input. The unit can also be placed in test mode where a simulated ground fault is placed internally on an isolated battery input to verify that the unit is properly detecting faults. A separate internal circuit is used to verify the GFT's health, as indicated by the status of the GFT FAIL LED on the front panel. The GFT can be powered by a 9-30 VDC (12 VDC nominal) operating battery, or independently powered from a battery being monitored.

The GFT is available in three hardware configurations, A80297-01, A802297-02, and the A802297-03 (see facing page). The -01 configuration requires a single earth ground connection. The -02 and -03 configurations require two separate earth ground connections. The -01 and -02 configurations are used with 12 to 16 volt batteries. The -03 configuration is used with 24 volt batteries.

The GFT has been designed using fail-safe design principles to ensure that in the event of a failure, no more than a 0.5 mA ground can be placed on the battery being monitored.

WARNING

THE GROUND FAULT TESTER (GFT) SHOULD ONLY BE USED IN APPLICATIONS DESCRIBED IN THIS MANUAL.

AN INTERNAL FAILURE OF THE GFT MAY RESULT IN A GROUND OF UP TO 0.5 mA ON THE BATTERY BEING MONITORED. THEREFORE, THE GFT SHOULD NOT BE USED IN SAFETY CRITICAL APPLICATIONS THAT COULD BE ADVERSELY AFFECTED BY A GROUND OF UP TO 0.5 mA.

THE GFT CANNOT BE GUARANTEED TO CORRECTLY DETECT AND/OR REPORT GROUND FAULTS UNDER ALL FAILURE CONDITIONS.

2. HARDWARE DESCRIPTION

Connector J2 on the GFT front panel has two terminals labeled **BAT 1** and two terminals labeled **BAT 2** to provide non-polarized connection to the external batteries being monitored. The GFT will detect ground referenced leakage resistance from either or both battery terminals to earth ground. If this leakage **exceeds 1 mA**, the unit will set an active alarm as indicated by the **BAT 1** and **BAT 2** **FAULT** LEDs on the front panel (see table 1). Under normal monitoring conditions (no fault detected) the **BAT 1** and/or **BAT 2** **FAULT** LED will be lit steady. When an external ground fault is detected the corresponding **FAULT** LED on the GFT front panel will be set to a blinking condition. When the unit is in test mode both **FAULT** LEDs will blink continuously (see table 1).

The unit constantly monitors itself for internal failure via its onboard health check circuit. If the master oscillator circuit output level is too high or too low a GFT failure condition is set. The **GFT FAIL** LED on the front panel will change from a steady lit condition indicating normal operation, to blinking, indicating an active alarm state (see table 1).

The GFT can be used as a stand-alone device providing only visual indications of monitored battery status via its front panel LEDs, or connected to a SEAR II to receive and record any battery fault alarms. Data from the GFT is present on pin 3 (labeled D OUT) of connector J2.

Table 1. GFT Front Panel Indicators

LABEL	LED COLOR	INDICATION
PWR	Green	Illuminated constantly when internal 5V power is Present.
GFT FAIL	Red	Illuminated constantly when normal. Flashes when an internal master oscillator failure occurs.
BAT 1 FAULT	Red	Illuminated constantly when normal. Flashes when an external ground fault exceeding 1 mA is detected on monitored battery 1, or when in Test Mode.
BAT 2 FAULT	Red	Illuminated constantly when normal. Flashes when an external ground fault exceeding 1 mA is detected on monitored battery 2, or when in Test Mode.

Table 2. GFT Connector J2 Pin Assignments (A80297 -01, -02, & -03)

J2 TERMINAL	LABEL	I/O	SIGNAL DESCRIPTION
J2-1	B	IN	9-30 VDC, 12 VDC nominal input for the unit.
J2-2	N	IN	
J2-3	D OUT	OUT	Data output to SEAR II; referenced to the GFT N terminal.
J2-4	TEST	IN	Nominal +12V level activates internal Test Mode; +12V must be referenced to the GFT battery N terminal.
J2-5	N/C		
J2-6	BAT 1	IN	A resistance to earth ground from this terminal exceeding the calibrated set point will activate a BAT 1 FAULT .
J2-7	BAT 1	IN	A resistance to earth ground from this terminal exceeding the calibrated set point will activate a BAT 1 FAULT .
J2-8	N/C		
J2-9	BAT 2	IN	A resistance to earth ground from this terminal exceeding the calibrated set point will activate a BAT 2 FAULT .
J2-10	BAT 2	IN	A resistance to earth ground from this terminal exceeding the calibrated set point will activate a BAT 2 FAULT .

For A80297-01 only

J2-11	N/C		
J2-12	E GND	IN	An earth ground reference for detecting battery ground fault leakages.

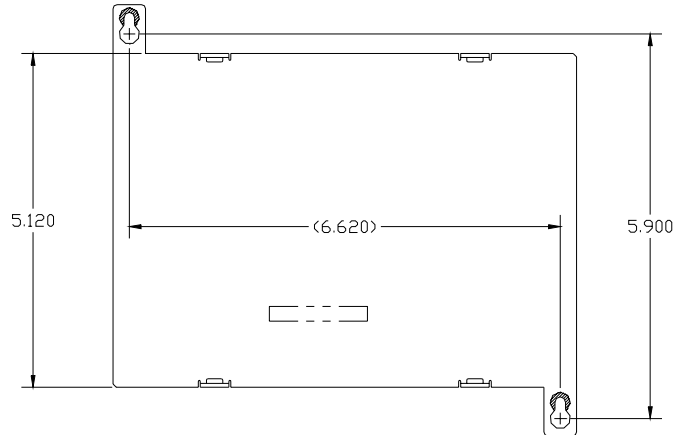
For A80297-02 & -03 only

J2-11	E GND 1	IN	Earth ground reference terminals required for detection of battery ground faults. Do not jumper these terminals to each other. Each must be connected to a different point on the chassis ground of the bungalow.
J2-12	E GND 2	IN	

3. INSTALLATION

Physical installation of the GFT involves mounting the unit on a wall, shelf, or rack (19-inch standard); making wiring connections; applying power and performing initial setup and checks before the system is put into operation.

3.1 Mounting Dimensions



3.2 Electrical Connections

A female mating connector is provided with the GFT for connector J2 on the unit's front panel. Make all wiring attachments to this connector before plugging it into J2. Pin assignments are marked on the GFT front panel immediately above J2. Refer to figure 2 and figure 3 and attach connector wires as follows:

Stand-alone connections: (Visual indications only)

- Connect operating battery power to GFT pins 1 and 2 (labeled B and N respectively).
- Connect GFT pins 6 and 7 (labeled BAT 1) to the terminals on monitored battery 1.
- Connect GFT pins 9 and 10 (labeled BAT 2) to the terminals on monitored battery 2.
- For A80297-01: Connect GFT pin 12 to an approved earth ground.
- For A80297-02 & -03: Connect GFT pins 11 and 12 to an approved earth ground. Do not jumper pins 11 and 12 together. Wire each pin to a separate earth ground point in the bungalow.

Additional SEAR II connections for monitoring/recording:

- Connect GFT pin 2 (labeled N) to (-) pin on SEAR II spare Digital Input channel.
- Connect GFT pin 3 (labeled D OUT) to (+) pin of same SEAR II Digital Input channel.

Additional SEAR II connections for remote test:

- Connect GFT pin 1 (labeled B) to one pin of a SEAR II Relay Output channel.
- Connect GFT pin 4 (labeled TEST) to other pin of the same SEAR II Relay Output channel.

3.3 GFT To SEAR II Interconnections

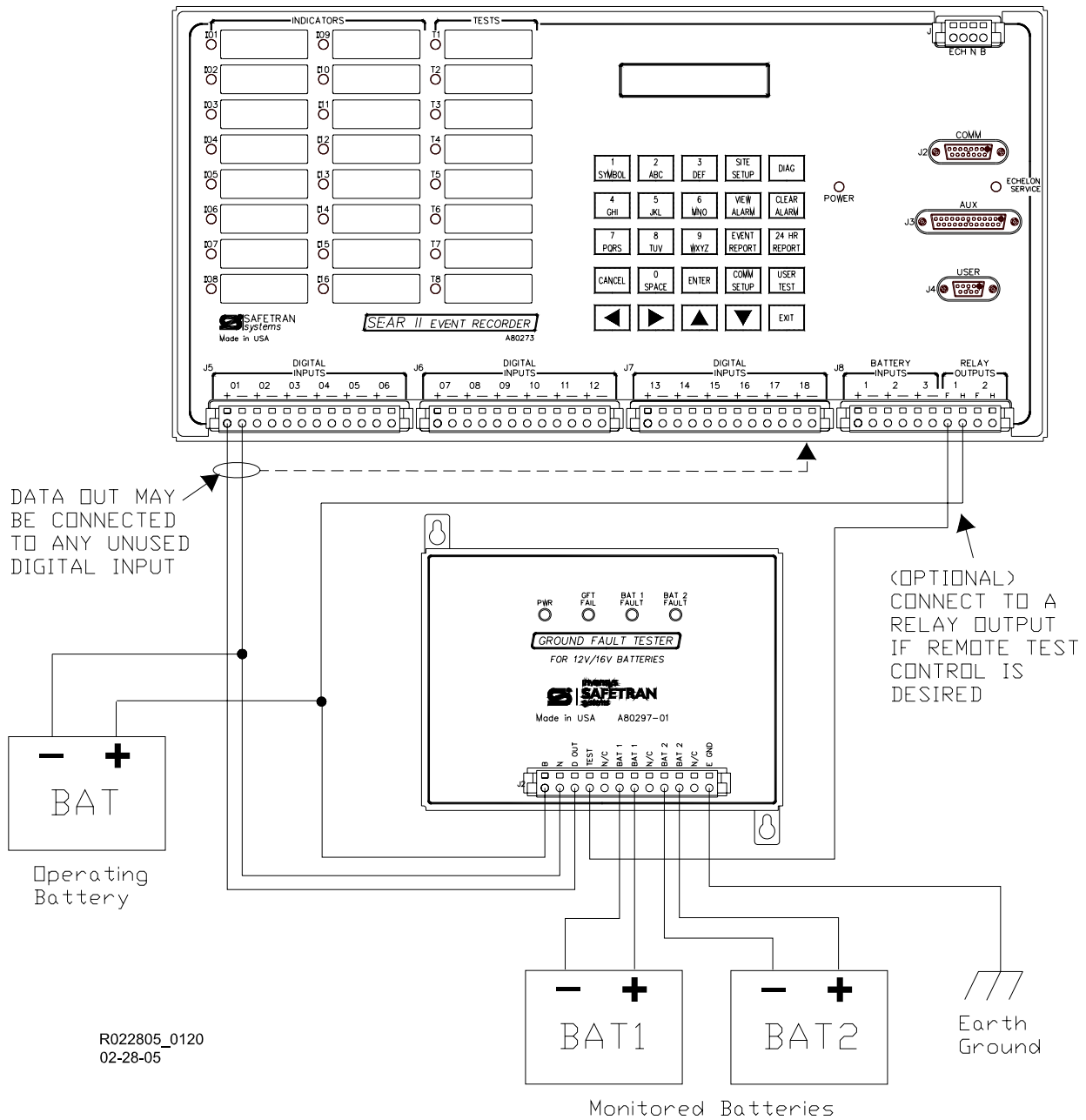
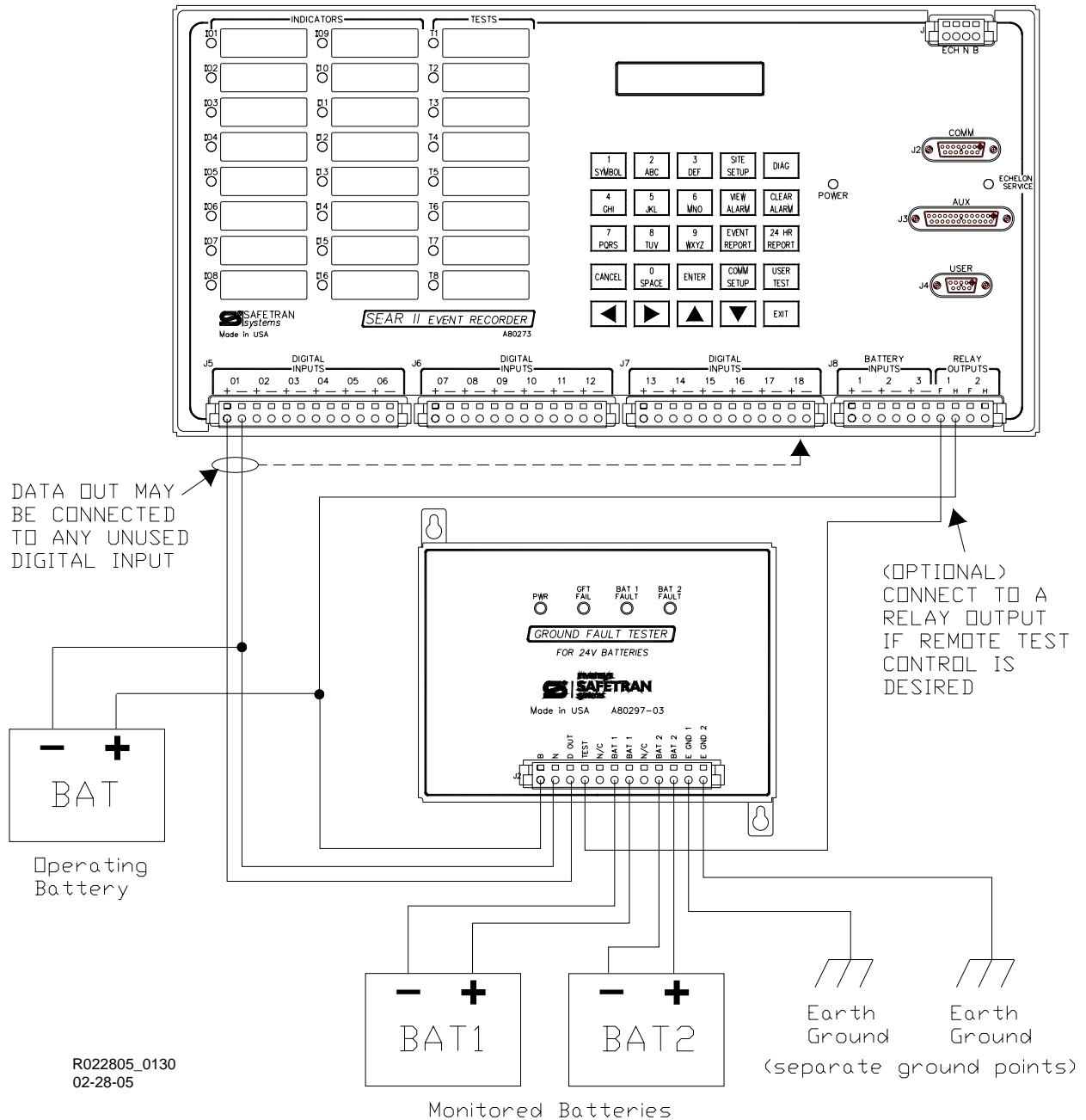


Figure 2. A80297-01 GFT to SEAR II Interconnection

NOTE

The negative (-) input terminal on the selected SEAR II Digital Input must be connected to the negative side of the battery that powers the GFT. (See figure 2)



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Figure 3. A80297-02 and A80297-03 GFT to SEAR II Interconnection

NOTE

The negative (-) input terminal on the selected SEAR II Digital Input must be connected to the negative side of the battery that powers the GFT. (See figure 3)

3.4 GFT/SEAR II Software Configuration Setup

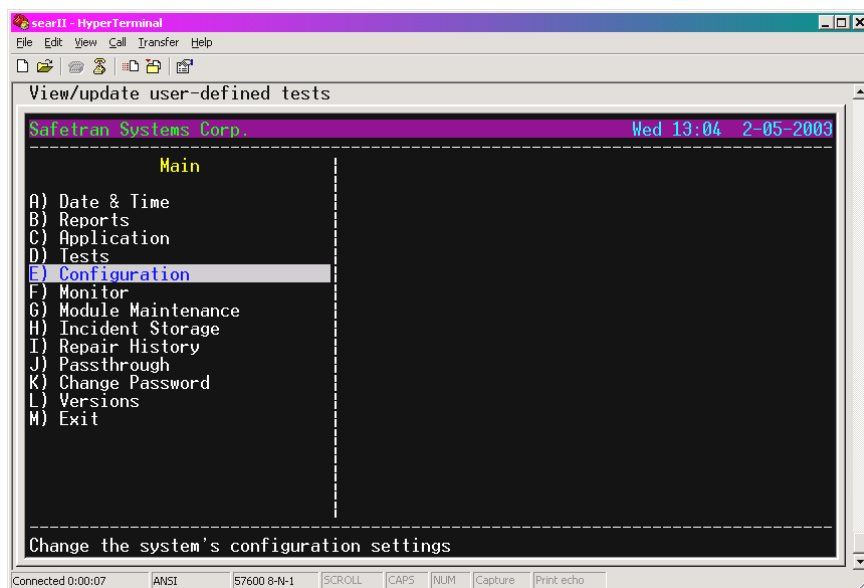
A spare Digital Input channel on the SEAR II is used to communicate with the GFT unit. To select and configure a Digital Input channel on the SEAR II, follow the steps below.

- Step 1.** Connect an RS232 serial cable between a Laptop computer or PC and the **USER** port (J4) on the SEAR II. Run **HyperTerminal** on the computer and adjust the port settings to communicate with the SEAR II as necessary. (The SEAR II is normally set for **19200-8-N-1** – baud rate, data bits, parity, and stop bits).

NOTE

The computer and SEAR II must be set to the same communication protocols in order to communicate. To verify the settings of the SEAR II USER port, use the SEAR II keypad and display. Press the **COMM SETUP** key on the keypad, then continue pressing the **ENTER** key to scroll through the various displayed settings until the settings for the USER port are shown. Press the **EXIT** key when done.

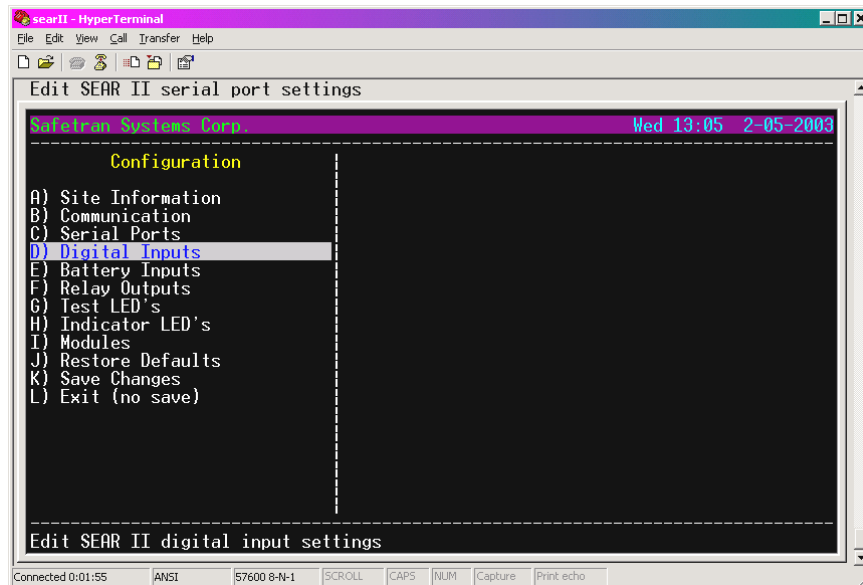
- Step 2.** After communication has been established with the SEAR II, press “[Ctrl]+[L]” on the computer keyboard to access the SEAR II **Main** menu.
- Step 3.** The **Main** menu should be displayed on the Laptop/PC. Using the keyboard **down arrow** (↓), scroll down the menu options and highlight **Configuration** as shown in the example screen below. Press the keyboard **Enter** key to proceed to the Configuration menu as shown in step 4.



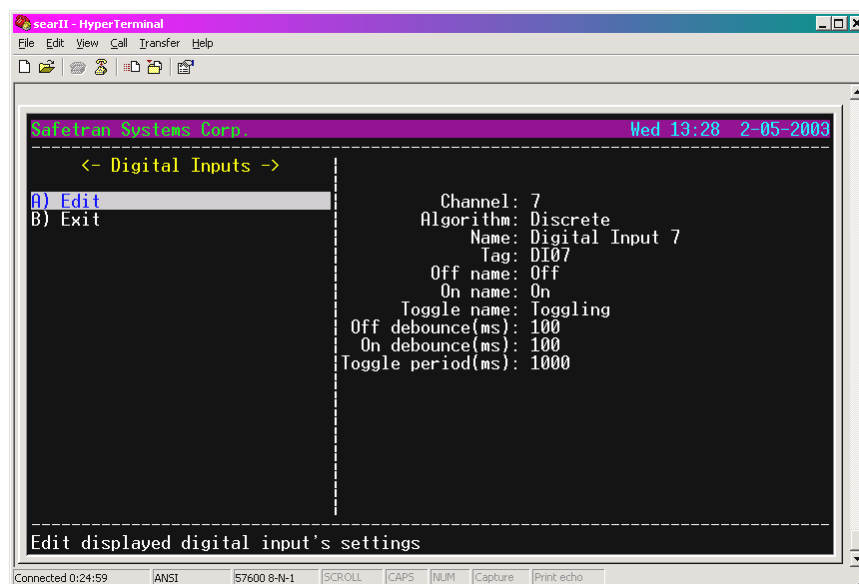
NOTE

The application screens shown on these pages are for example purposes only. Actual screens may vary depending on the SEAR II software version in use.

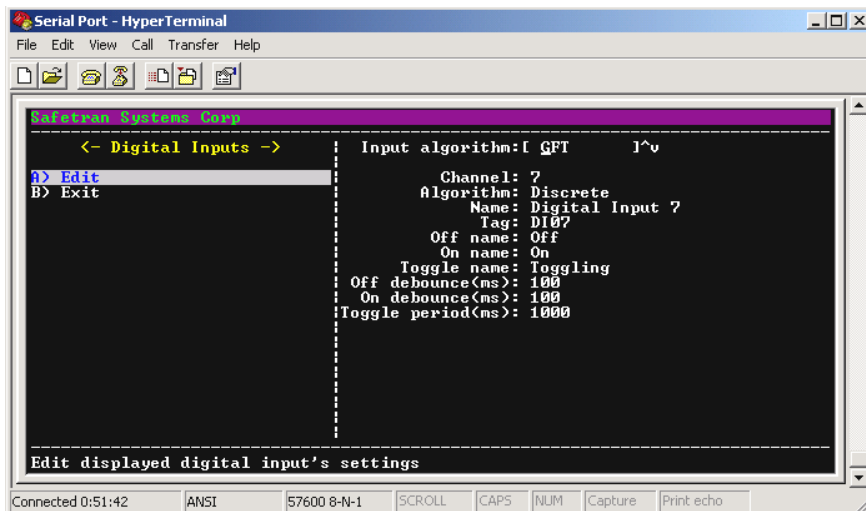
- Step 4. In the **Configuration** menu, scroll down and select **Digital Inputs**, as shown below. Press the **Enter** key to proceed to the <-Digital Inputs-> menu, shown in step 5.



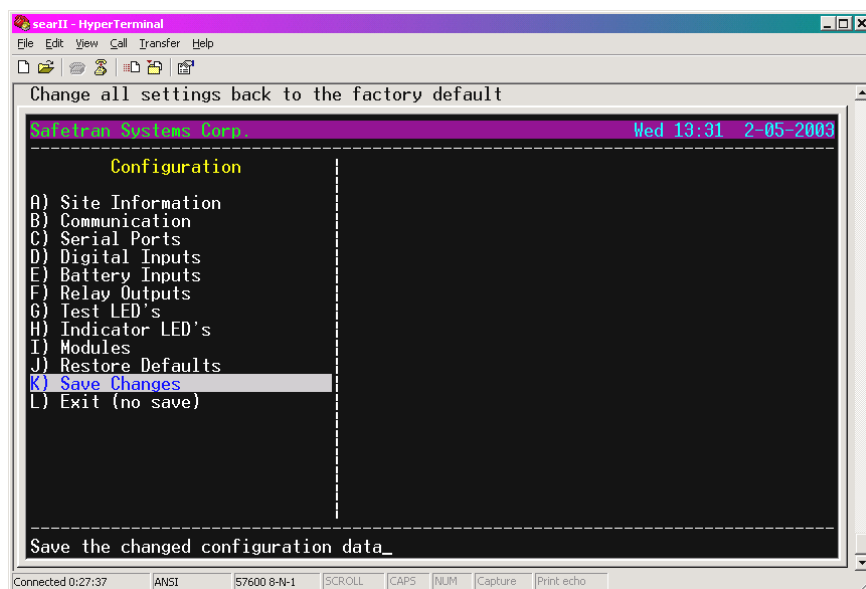
- Step 5. In the <-Digital Inputs-> menu, use the keyboard **right arrow** key (→) to select a spare input channel on the SEAR II. In the example below, Channel 7 is selected.



- Step 6. With the **Edit** option highlighted, press **Enter**. Use the keyboard **down arrow** and select **GFT**. A screen similar to the one below is displayed. The next prompt allows you to accept the default names for the GFT batteries, or you can manually change them by selecting **Manual Entry** and editing the displayed names. Verify the information, then scroll to **Exit** and press **Enter** to return to the Configuration menu.



- Step 7. In the **Configuration** menu, scroll down to selection **Save Changes** as shown below. Press the **Enter** key to save the current setup and exit to the Main menu.



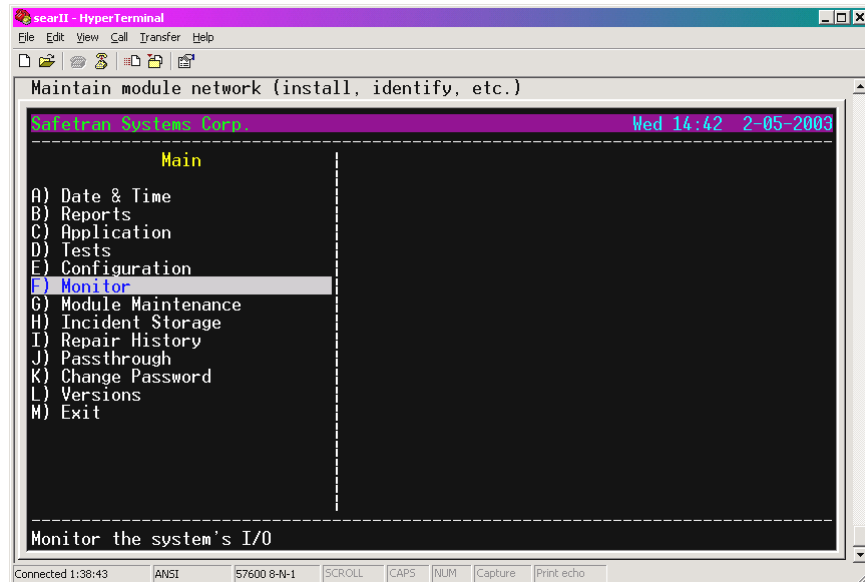
- Step 8. This concludes the GFT/SEAR II setup configuration.

NOTE

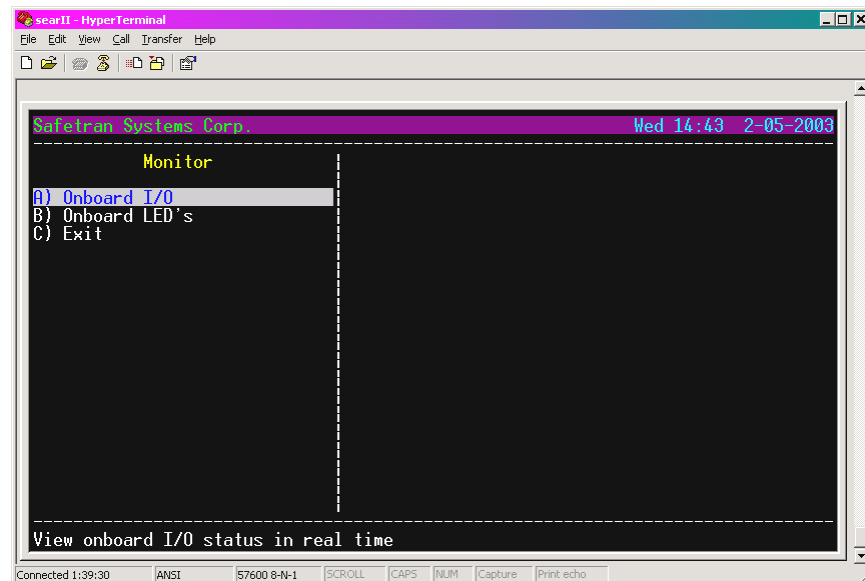
To monitor the inputs in real time, follow the steps outlined in paragraph 3.5.

3.5 Real Time Monitoring of GFT Inputs

Step 1. After configuring a Digital Input channel for the GFT on the SEAR II, go to the **Main** menu and scroll down to selection **Monitor**, as shown below. Press the **Enter** key.



Step 2. In the **Monitor** menu, scroll to selection **Onboard I/O** as shown. Press **Enter**.



Step 3. The channel selected in the configuration setup will be displayed similar to the screen shown below. Refer to Table 3 for descriptions of the abbreviations appearing on the channel display. If a problem occurs with the GFT input, “STUCK LOW” or “STUCK HIGH” may be shown on the display. Both errors indicate a problem with the wiring to the input.

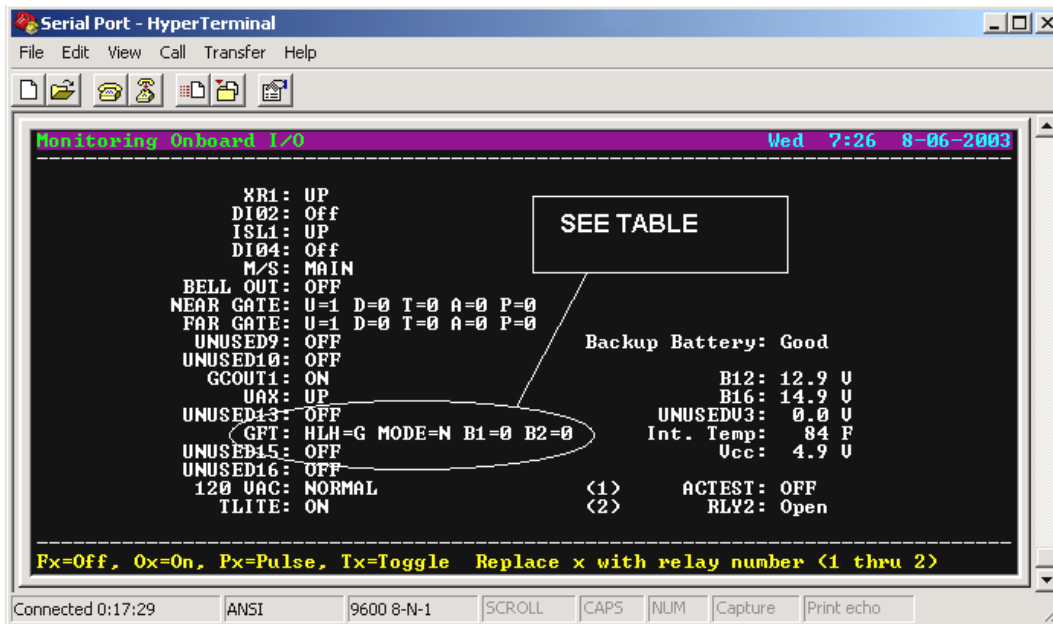


Table 3. Sensor Monitoring Legend

DESIGNATION	MONITORING	GFT SCREEN INDICATIONS
HLH	GFT Health	G = Good Health, B = Bad Health
MODE	GFT Mode	N = Normal, T = Test
B1	Battery 1 Fault	Ø = No fault, 1 = Fault
B2	Battery 2 Fault	Ø = No fault, 1 = Fault

Step 4. To return to the previous menu, press Escape on the PC keyboard.

NOTE

GFT indications are listed in the SEAR II History Log using the label as entered in the configuration.

3.6 Installation Verification

At completion of the GFT installation, a configuration verification should be performed to ensure the integrity of GFT/SEAR II operation. The following steps should be performed depending on the physical configuration you employ (see paragraph 3.2). Refer to paragraph 5.1 for additional details on using the GFT's Test Mode feature.

3.6.1 GFT Stand Alone Configuration

If the GFT is configured for “stand alone” mode (visual indication only), temporarily apply +12 VDC to the TEST pin on GFT connector J2 and ensure BAT 1 and BAT 2 FAULT LEDs on the GFT front panel begin blinking, and remain blinking as long as Test Mode is enabled.

NOTE

For simplified testing, a momentary-contact pushbutton switch may be installed between the test voltage source, and connector J2 pin 4 (TEST) on the GFT. With this additional hardware, a “quick test” can be performed by simply pressing the pushbutton switch, verifying the BAT FAULT LEDs are blinking, then releasing the switch.

3.6.2 SEAR II Monitoring/Recording Configuration – Manual Test

If the GFT is configured to allow a SEAR II to monitor and record GFT status, run HyperTerminal and enter GFT Real Time Monitor Mode as previously explained in paragraph 3.5. At this point all GFT indications should display as normal (HLH = G, MODE = N, B1 = Ø, B2 = Ø).

Initiate test mode MANUALLY by applying +12 VDC to pin 4 (TEST) of GFT connector J2. Ensure the GFT front panel BAT 1 and BAT 2 FAULT LEDs begin blinking and the SEAR II Monitor screen reflects the changes in GFT operating status (HLH = G, MODE = T, B1 = 1, B2 = 1). Be sure to remove the test voltage when done.

3.6.3 SEAR II Monitoring/Recording Configuration – Remote Test

If the GFT is configured to allow a SEAR II to monitor and record GFT status and execute remote testing via Relay Output 1 or 2, run HyperTerminal and enter GFT Real Time Monitor Mode as previously explained in paragraph 3.5. At this point all GFT indications should display as normal (HLH = G, MODE = N, B1 = Ø, B2 = Ø).

Initiate test mode REMOTELY by temporarily configuring the SEAR II to toggle RELAY OUTPUT 1 or 2, as applicable (refer to *SEAR II Installation & Operation Manual #SIG-00-02-07*). After the GFT is remotely set to Test Mode ensure the GFT front panel BAT 1 and BAT 2 FAULT LEDs begin blinking, then return to Real Time Monitor Mode and ensure the SEAR II Monitor screen reflects the changes in GFT operating status (HLH = G, MODE = T, B1 = 1, B2 = 1). Be sure to remove the test voltage by toggling the applicable SEAR II Relay Output when done.

4. SPECIFICATIONS

Alarm Threshold

1 mA

Power Supply

Input Range: 9-30 VDC
Isolation: 2000 Vrms, 60 Hz, 60 Sec

Power Consumption

0.3A @ 13.2V
0.5A @ 9.0V
0.3A @ 16.5V

Environmental

Temperature: -40 °F to +160 °F (-40 °C to +71 °C)
Humidity: 95%, non-condensing

Dimensions

Cover: 5.90 inches H x 7.120 inches W x 2.03 inches D
Base Plate: 5.120 inches H x 7.120 inches W

5. MAINTENANCE

5.1 Test Mode

No routine maintenance is required on the GFT.

Test Mode was designed to facilitate periodic verification of the GFT's continued ability to detect ground faults. Safetran recommends the use of this feature be incorporated in the regular site maintenance program.

The Test Mode feature allows you to test the internal circuitry of both battery monitor inputs for proper operation. Test Mode may be performed with or without batteries actually being monitored.

To activate Test Mode, temporarily apply +12 VDC to the TEST input pin on GFT connector J2, with negative reference to J2 pin N. This voltage places internal resistors between each monitor input and earth ground to internally test the monitoring circuits. The test voltage must be applied from the operating battery or other power source connected to GFT J2 pins B and N. For GFT **A80297-02** and **A80297-03**, the internal resistors will be properly referenced to earth ground only if both pins 11 and 12 are correctly wired to separate external earth grounds.

Test Mode effectively tests the unit for normal operation of all components, including those connected to the battery input terminals. When the GFT is in Test Mode and all internal circuits are functioning normally, both BAT FAULT LEDs will blink continuously. At the same time, battery fault data is transmitted to the SEAR II via the D OUT pin on GFT connector J2, if connected (see Figure 2 and Figure 3).

Test Mode may be remotely activated by connecting the GFT J2 TEST pin to a SEAR II Relay Output and configuring the SEAR II to toggle the corresponding relay. Refer to Figure 2 and Figure 3 for wiring, and the *SEAR II Installation & Operation Manual* #SIG-00-02-07 for information on configuring SEAR II Relay Outputs.

6. TROUBLESHOOTING

6.1 General

It is not possible to cover every combination of problems that may occur in the system. Therefore, the methods described in

Table 4 have been prepared to isolate the most probable system failures.

Table 4. Troubleshooting Chart

PROBLEM	POSSIBLE CAUSES	CHECK OR TRY
Green PWR LED not illuminated	No power to GFT or failed LED	Verify battery power is present at GFT connector J2, pins 1 (B+) and 2 (N-).
Red GFT FAIL LED not illuminated	No power to LED or failed LED	Verify that battery power is present. NOTE: <ul style="list-style-type: none"> LED should be lit steady when normal condition exists. LED should blink if an internal master oscillator failure occurs.
Red BAT 1 FAULT LED not illuminated	No power to LED or failed LED	Check that battery power is present. NOTE: <ul style="list-style-type: none"> LED should be lit steady when normal condition exists. LED should blink when an external ground fault is detected, or when set in Test Mode.
Red BAT 2 FAULT LED not illuminated	No power to LED or failed LED	Verify that battery power is present. NOTE: <ul style="list-style-type: none"> LED should be lit steady when normal condition exists. LED should blink when an external ground fault is detected, or when set in Test Mode.
BAT FAULT LEDs not blinking during Self Test (A80297-02 and A80297-03 only)	Improper earth ground reference	For A80297-02 and A80297-03 verify both earth ground reference terminals (E GND 1 and E GND 2) are securely connected to separate earth ground connection points.

NOTES



SAFETRAN
systems

Safetran Systems Corporation

2400 Nelson Miller Parkway
Louisville, Kentucky 40223
(502) 244-7400

Safetran Systems Corporation

California Division
10655 7th Street
Rancho Cucamonga, California 91730
(909) 987-4673