

17. MAINTENANCE AND TROUBLE-SHOOTING

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17.1 BOARD FUNCTIONS AND DIAGNOSTICS

The diagnostics routine is a powerful tool for testing and identifying problems on both the Analog Boards, and Calibrate and Timing Board. The diagnostics software allows the operator to manipulate all board functions that are controlled by the computer.

To effectively use these routines, an oscilloscope and signal generator may be useful, but often much can be learned about the system by observing the display results on the LCD.

In order to use the diagnostic routines, it is essential that the block diagrams and the signal flow path be understood.

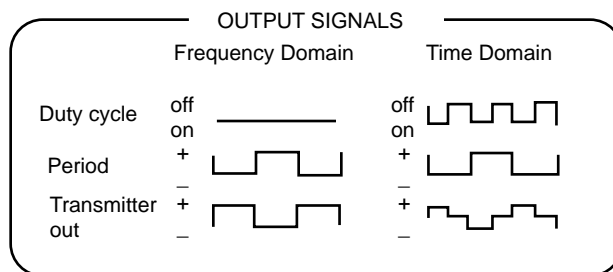


Figure 17.1 - Period and duty cycle control waveform

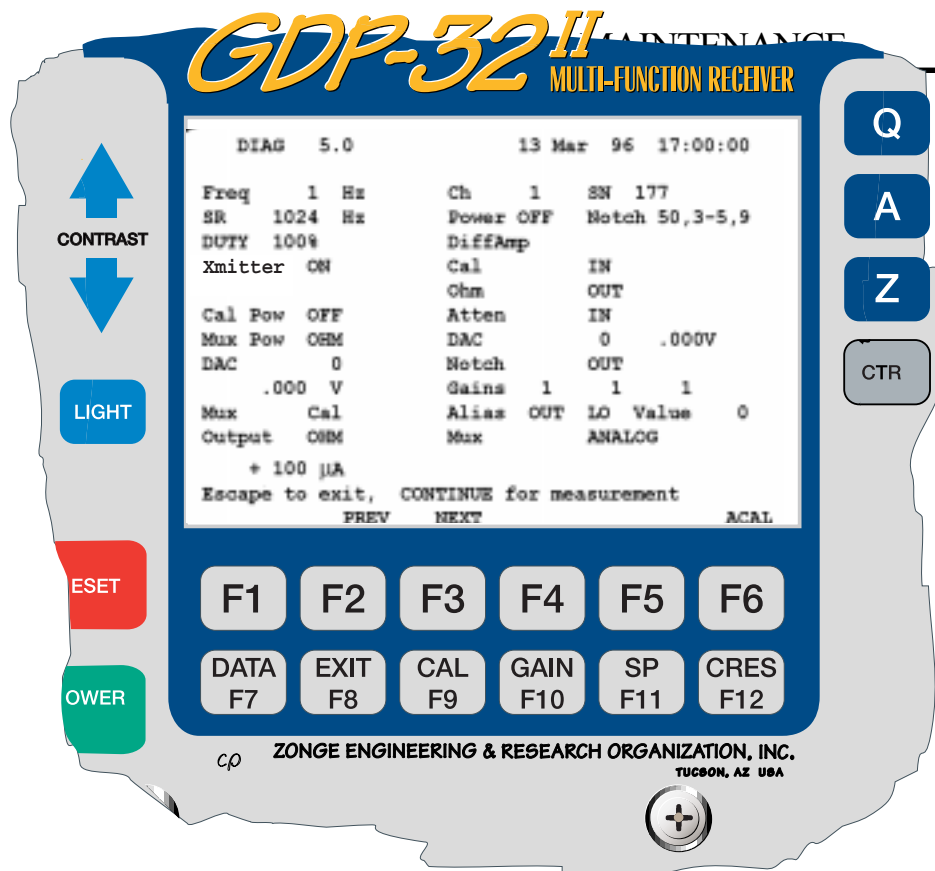
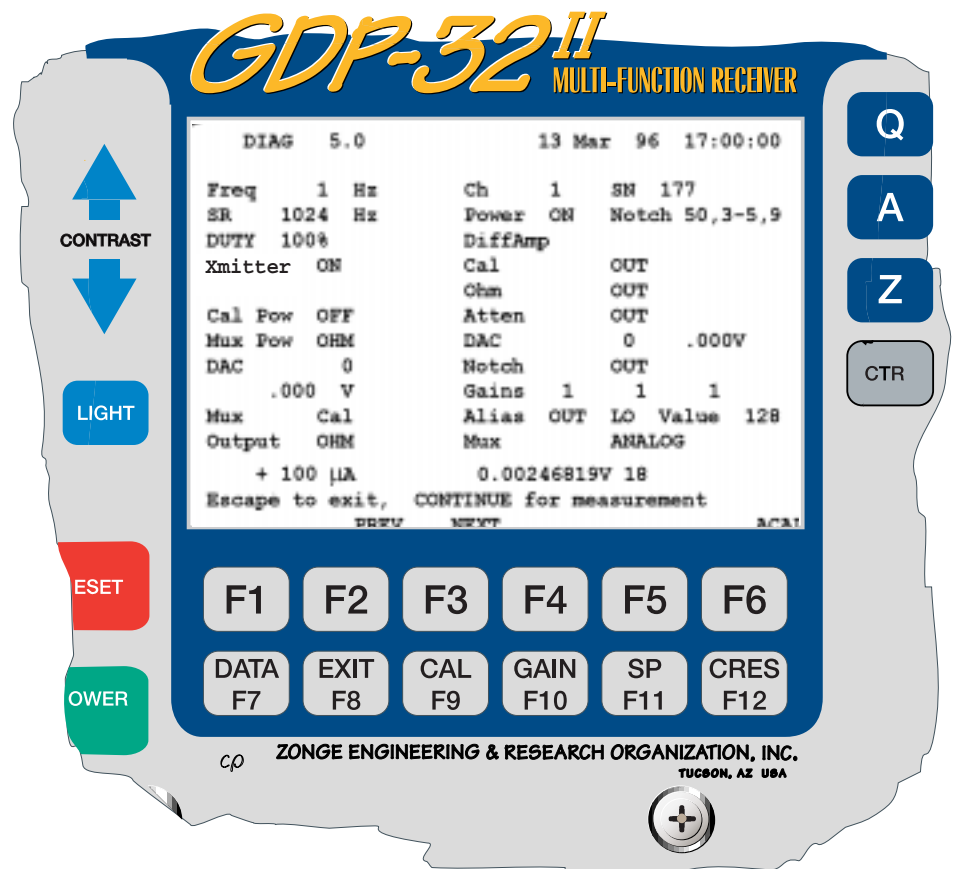


Figure 17.2 (a) - Diagnostic Screen displaying default values on cold startup.

Figure 17.2 (b) - Diagnostic after turning on channel 1. The A/D Output Line is blank until an analog channel is turned on.



THE DIAGNOSTICS PROGRAM

Running Diagnostics:

1. From the Main Menu press **2**, Utilities.
2. Press **2**, Diagnostics. If the receiver has just been turned on and no Survey Programs have been started, the screen appears as shown above in Figure 17.2 (a).

*NOTE: To leave diagnostic mode and return to the Main Program Menu, press **ESCAPE** ..*

There are three areas of the Diagnostic Screen:

- a) Timing (top left)
 - b) Calibrate (bottom left)
 - c) Analog Boards (right)
3. To move between screen menu sections use the two activated Special Function Keys:
 - b) The NEXT key (**F3**) circulates in a counter-clockwise motion from Timing to Calibrate to Analog Board menu sections of the screen.
 - c) The PREV (**F2**) key rotates between the three menu sections in the opposite direction (Analog to Calibrate to Timing).
 4. Use the Cursor Control keys to move through the screen sections and change parameters.

Timing Diagnostic Fields

The four Timing diagnostic fields are:

- Frequency (Freq)
- Sample Rate (SR)
- Duty Cycle (Duty)
- Automatic Transmitter Control (Auto Tx)- used for TEM, NanoTEM, and ZETA.

▪ **Frequency**

The frequency (period) is changed in binary steps from 0.00097656 Hz (.001 Hz on the display) to 8192 Hz.

External Monitoring - The period waveform (shown schematically in Figure 17.1) corresponding to the selected frequency can be observed by monitoring connector J3 pin 6 (PERIOD -on the timing card). Connector J3 connects the calibrate and timing card to the TRANSMITTER I/O connector located on the left hand side of the GDP-32 case, and this signal can be observed on pin D. The signal is also available on the 64-pin DIN bus connector J1 pin A7.

▪ **Sample Rate**

The ADC sample rate can be set to a selected value from 1 Hz to 32,768 Hz.

External Monitoring - The ADC convert command (sample rate) can be monitored on bus connector J1 pin A30, and EOC (end of convert) on pin A31.

▪ **Duty Cycle**

Changing this parameter allows the operator to select a duty cycle of 100% to generate a frequency-domain waveform, or a duty cycle of 50% to generate a time-domain waveform.

External Monitoring - The Duty Cycle can be observed on connector J3 pin 10 on the timing card, connector J1 (DIN bus connector) pin 8, and on pin K of the transmitter I/O connector.

NOTE: The low or ground level voltage state produced by the frequency domain duty cycle places the transmitter in a continual “on” state. The time-domain duty cycle rate is exactly twice that of the period waveform and produces a transmitter output waveform as shown in Figure 17.1.

▪ **Automatic Transmitter Control**

The TEM program provides for the control of battery powered transmitters to extend battery life. To turn the transmitter off, the Duty Cycle line

is set high (OFF).

It may be necessary to change Timing Board parameters while controlling an external lab or field transmitter in addition to doing GDP board level tests. See Figure 16.6 (a) for timing board parameters.

Analog Board Diagnostic Fields

Analog Board fields are shown on the right-hand side of the display in Figure 17.2 (a). In the following discussion, the default field parameters are used. Refer to Figure 17.2 (a) for details of the analog board.

- **Ch 1 SN 177**

The channel number and serial number displayed indicates the selected channel. The parameters for this channel are then displayed on the screen. If a new channel is selected using the Cursor Control Keys or entering the number from the keypad, the screen is updated and the new parameters are displayed.

- **Power OFF Notch 50,3-5,9**

OFF indicates the position of the individual channel power supply relay which provides power to the board. OFF can be toggled between ON and OFF. Notch 50,3-5,9 indicates the type of powerline notch filter installed. In this case it is a 50/150/250/450 Hz powerline notch filter. Other standard options are 60/180/300/-540 Hz and 50/150/60/180 Hz.

- **Cal IN**

Indicates that the calibrate relay is IN, which connects the analog input to the calibrate card and disconnects it from external inputs. See Figure 16.6 (a). The other option is OUT, which connects the analog card inputs to the external inputs.

- **Ohm OUT**

Sets the Ohm (contact resistance) relay to IN or OUT. See Figure 16.5(a).

- **Atten IN**

Sets the Attenuator to IN or OUT.

▪ **DAC 0 .000V**

The SP or Offset DAC voltages in counts and volts respectively. Enter either value and the other is automatically updated. Count values range from -32768 to 32767. Voltage values range from -2.500 to 2.500 volts.

▪ **Notch OUT**

Sets the Notch Filter to IN or OUT. Standard filter options are:

filter Setting	50 Hz powerline filters	60 Hz powerline filters
OUT	OUT	OUT
50	50, 150 Hz	
60		60, 180 Hz
50, 5	50/150/250/450 Hz	
60, 5		60/180/300/540 Hz
50/60	50/150/60/180 Hz	50/150/60/180 Hz

▪ **Gains 1 1 1**

Placed the cursor at the first “1” to modify to gain stage 0 (G0), at the second “1” to modify G1, and at the third “1” to modify G2. G1 and G2 have binary selection ranges from 1 to 128. G0 can be adjusted to 1, 4, or 16.

▪ **Alias OUT LO Value 0**

The **OUT** position indicates that the antialias filter is bypassed and that the channel has the maximum bandpass. When the field is toggled ON, the filter is inserted into the circuit.

LO - indicates that the low group of filters has been selected (i.e.: 1 to 255 Hz) while **HI** indicates that the HI group of filters has been selected (100 to 25,500 Hz). A value of 128 would indicate that the 128 Hz filter (or 12.8 kHz filter in the HI position) has been selected.

Value 0 - is the default value for the alias filter corner frequency. The signal path is incomplete and the channel will be inoperative when Value is set to 0. ~~This~~ The default value is used when the card is turned off in order to minimize current leakage and power loss. Valid values are from 1 to 255 in single increments, or 100 to 25,500 in increments of 100.

- **Mux ANALOG**

The multiplexer has been set to the ANALOG amplifier path. Other options are REFERENCE, GROUND, and BATTERY.

The line below the Mux control is used for the output of the ADC and has the following format:

y.yyyyyyyyV zzzzz for ANALOG, GROUND, REFERENCE

yy.yyyyyyyV zzzzz for BATTERY

yy.yyyyyyyC zzzzz for TEMPERATURE

The “y” value is a decimal representation of the most recent voltage conversion, taking into account all appropriate gains and attenuators. The “z” value represents the actual ADC count. The analog card must be turned on to receive values on this line. To have the ADC take a reading, press **CONTINUE**.

Note: The REFERENCE voltage should be 4.5 volts.

Calibrate Diagnostic Fields

The Calibrate diagnostics function in a manner similar to the Analog diagnostics. They are found in the lower left part of the screen in Figure 17.2.

- **Cal Pow OFF**

Turns the calibrator power supply OFF or ON.

- **DAC 0**

The calibrator DAC count. Count levels range from -32768 to 32767. Set either the DAC or the next setting for Output Voltage.

- **.000 V**

Output Voltage. Voltage levels range from -8.35 to 8.35. This voltage is then available to the multiplexer. Set either the Output Voltage or the previous setting for DAC. The default voltage is 1.000 V when Cal Pow is turned ON.

▪ **Mux Cal**

The default calibrator multiplexer setting is to read the Calibrate signal which is the bipolar switched DAC output. The options are:

- **Cal** (default - monitor the Calibrate signal – Bipolar switched DAC output)
- **DAC** (monitor the constant voltage output of the DAC directly)
- **Temp** (monitor temperature)
- **Batt** (monitor the 12 volt battery)

▪ **Output OHM**

The default setup sets the output relay to the OHM (ohmmeter) position. Toggling the field places the output into the MUX (multiplexer) position for measuring parameters determined by the Mux selection above.

+ 100 μ a - When OHM is selected, a constant current source is switched into the CAL output lines that are routed to each analog board. The polarity of this 100 μ a current may be toggled from '+' to '-'. This current source is switched into electrode pairs to measure contact resistance by the OHM relay on an analog board.

The last line on the screen is reserved for prompts for the soft function (F) keys:

ACAL

The ADC goes through an internal calibration each time the system is turned on or before each measurement. This is normally done automatically during data acquisition. To implement ADC calibration manually press **F6**.

DIAGNOSTIC EXAMPLES

Example using one analog channel

Procedure to determine the temperature inside the case:

1. From the Main Program Menu press **2**, Utilities.
2. Press **2**, Diagnostics. The cursor is in the **Channel** field; currently set to Channel 1.

3. Press **NEXT FIELD** to move the cursor to the *Power* field.
4. Press **SELECT DOWN** to turn on Channel *I*.
5. Press **NEXT FIELD** again to move to the *CAL* relay. Press **SELECT DOWN** to switch it to *IN*. Channel 1 is now connected to the internal calibration inputs.
6. Press **F2**, **PREV** to move to the calibration section of the Diagnostics screen.
7. With the cursor on the **Cal Pow OFF** field, press **SELECT DOWN** to turn the calibrate board *ON*.
8. Press **NEXT FIELD** to move to the **Mux Pow** field, press **SELECT DOWN** to display *CAL*
9. Press **NEXT FIELD** three times to move to the **Mux CAL** field. Press **SELECT DOWN** twice to display *Temp*. The temperature is now displayed on the ADC output line on the bottom portion of the right-hand side of the screen. The display will be similar to:

31.650765C 2685

which is read “31.7 degrees Celsius, 2685 counts.” The receiver operates at temperatures between -40° and +60°C.

Move back to the Mux field and press **SELECT UP** once to display Mux CAL. Put the channel selector switch on your lid panel to Channel 1. The needle will swing back and forth at a 1 Hz rate. This was the default frequency selected during turn-on, and you can read it since channel 1 is turned on and the “Cal” relay is IN.

To access the timing card fields, press **F2**, **PREV** once and the cursor will be on the “Freq” line. Press **SELECT UP** or **SELECT DOWN** and notice the change of frequency in the needle movement following the frequency selected on this menu.

Example using three boards

Suppose you are running a time-domain IP survey at 0.125 Hz with three channels turned on, and the data for channel 3 looks strange. You want to check to make sure the receiver is working properly, so get into the diagnos-

tics program to check out channel 3.

10. From the Main Program Menu press **4**, TDIP to enter the TDIP Survey Program
11. Use the default values in the first menu: dipole-dipole survey, synchronous mode, noisy gains, and quiet environment.
12. Press **CONTINUE** twice to get to the Channel Menu and turn on channels 1, 2, and 3.
13. Press **CONTINUE** again to get to the Data Acquisition Menu. Set the frequency to **0.125 Hz**, and put the notch filter **IN**, (for example 60 to turn on the 60 and 180 Hz powerline notch filters).
14. Press **CONTINUE** to gather one cycle of data. This will just be noise, but it sets the gains and SP buckout and give us some numbers to look at in the Diagnostics program. After the GDP gathers the data, press **CONTINUE** to save the data.

Press **EXIT** to leave the TDIP program and return to the Main Program Menu.

Press **2**, Utilities and then press **2**, Diagnostics.

The screen should now be similar to Figure 17.2(c).

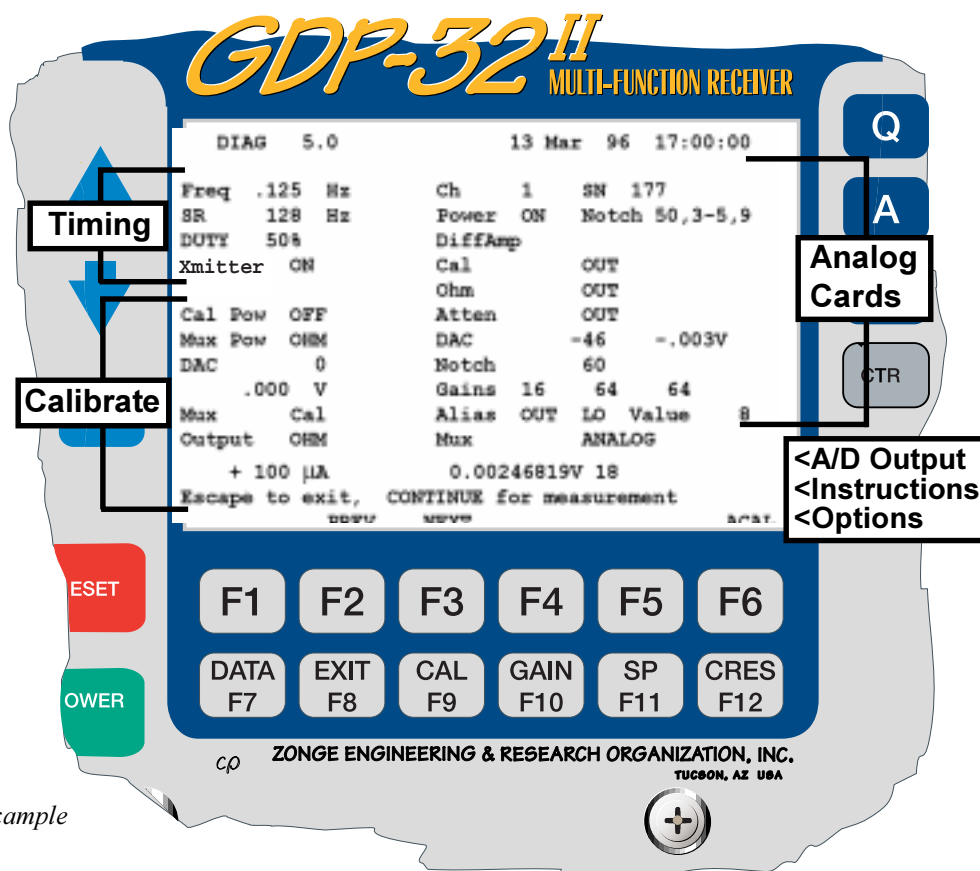


Figure 17.2 (c) Three channel TDIP example

Press **SELECT UP** twice to display Channel 3.

Press **NEXT FIELD** twice to get to the CAL OUT field. Press **SELECT DOWN** once to turn the calibrate input IN.

Now press **F2**, PREV to get to the **Cal Pow** OFF field. Press **SELECT DOWN** to turn the calibrator ON.

Press **NEXT FIELD** to get to **Mux Pow** and press **SELECT DOWN** to set **Mux Pow** to CAL.

Turn the meter select switch on the lid panel to Channel 3. Observe the needle swinging hard to the right and left. This is due to the high gains set from the TDIP routine with no signal on the inputs.

Press **F3** , NEXT to return to the analog card menu.

Press **NEXT FIELD** eight times to move to the ***Gain Stage*** line. Use **SELECT UP** or **SELECT DOWN** to change the gains on the first stage to 1.

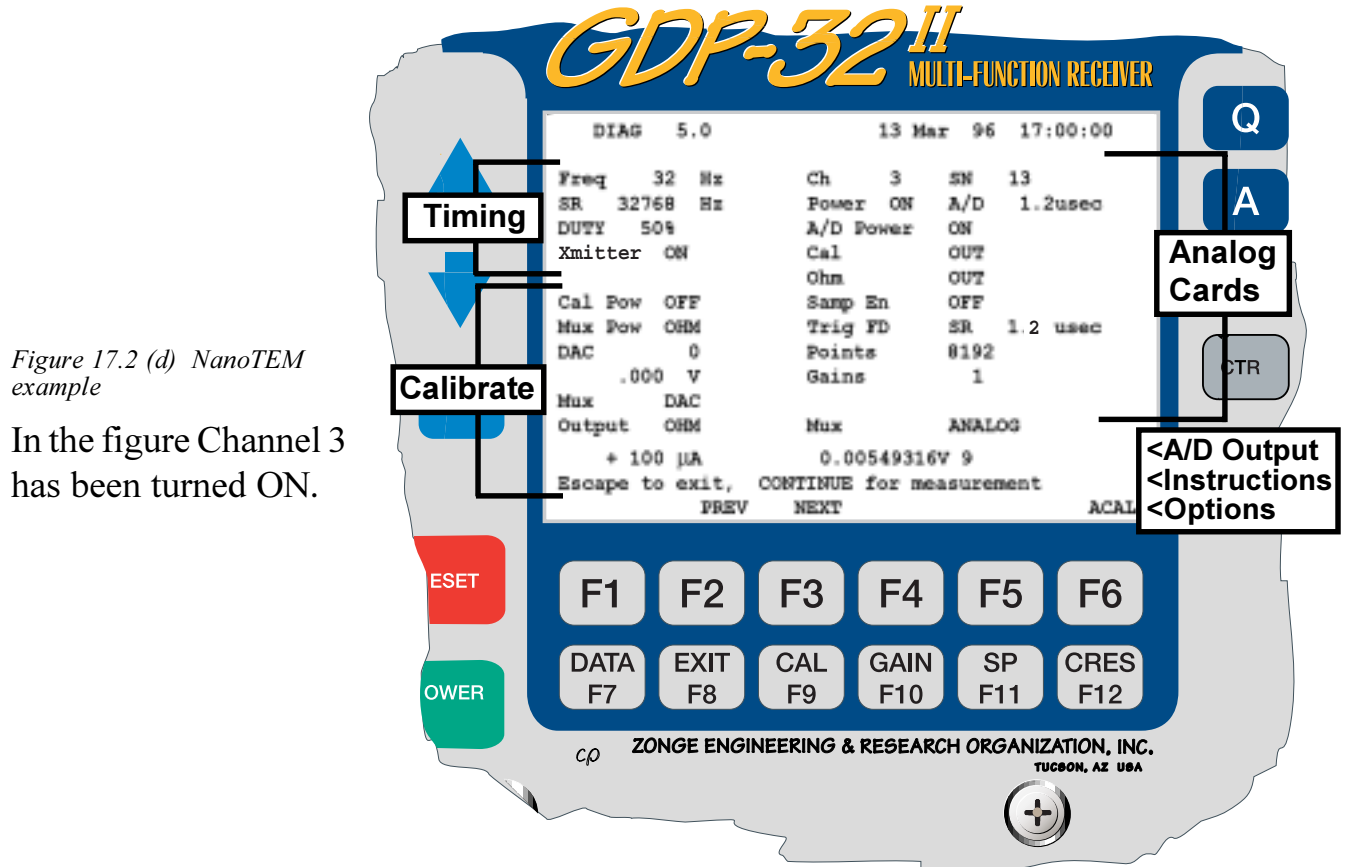
Press **NEXT FIELD** to get to the second gain stage. Use **SELECT UP** or **SELECT DOWN** to change it to 1. At this point you can now adjust the gains and DAC (SP) to watch the effect on the meter.

It is a good idea for operators to become familiar with the Diagnostic program. These routines provide added insight into the operation of the timing and calibration board and analog boards. Clients may be required to access the Diagnostics Program to facilitate trouble-shooting over the telephone.

If you have any questions concerning this program, please do not hesitate to contact our office.

NANOTEM DIAGNOSTICS (FOR BOARD 194)

The NanoTEM diagnostics program is an abbreviated form of the main diagnostics program, and is valid when a NanoTEM board is installed.



Notice that the Timing and Calibrate parameters are the same as for the standard analog card diagnostic screen, but the right-hand side is configured for the NanoTEM card only.

- **Power ON**

Turn the power to the board ON and OFF.

- **A/D 1.2 usec**

The high speed A/D and firmware has been installed on this board, enabling a 1.2 μ sec sample period.

- **A/D Power ON**

The A/D power is turned on automatically when **Power ON** is selected, but the A/D power can be turned off with this selection (**A/D Power OFF**).

- **Cal OUT**

Connect (IN) or disconnect (OUT) the calibration signal input from the calibrate board.

- **Ohm OUT**

Connect (IN) or disconnect (OUT) the ohmmeter connection for measuring contact resistance.

- **Samp En ON**

Enable (ON) or disable (OFF) the sample rate circuit on the NanoTEM card. Used in conjunction with **Trig**.

- **Trig TD**

Enable taking data upon transmitter turn-off (Time Domain - TD) or at the start of the positive cycle (Frequency Domain - FD).

- **SR 1.6 usec**

The operator can select sample periods of 1.2 or 1.6 microseconds.

- **Points 8192**

The number of points to average for the calculated voltage displayed on the A/D output line.

- **Gains 1**

Gain setting for the NanoTEM card is limited to x1, x2, x4, x8, or x16.

- **Mux Analog**

The input mux to the A/D can select between:

- Analog - Analog input with the alias filter IN
- Alias - Analog input with the alias filter OUT
- Ground - should be 0.00 volts
- Battery - should be around 12 volts
- Reference - should be close to 10 volts

*NOTE: To leave diagnostic mode and return to the Main Program Menu, press **ESCAPE**.*

17.2 HANDLING BOARDS

All receiver boards are easily removed and reinserted on the motherboard.

Before handling, removing, or inserting any board, place the receiver on an anti-static pad and attach a grounding strap between your arm and the COM binding post on the Analog I/O Panel, or between you and the anti-static pad. This ground reference minimizes the chance that static discharge will destroy integrated circuits on one of the boards.

REMOVING AND INSERTING BOARDS

NOTE: Always turn the power completely OFF before removing or inserting any board.

Board Access and Removal, Small Case

1. Remove the Analog I/O side panel.
2. One or more cables may need to be disconnected to gain access to the boards. The analog boards are secured by a retaining bar on the bottom of the card cage. The bars are held in place by two screws.
3. After removing the retaining bar, disconnect the input cables from the analog boards and the calibration and timing board, and gently pull the board toward you.

Board Access and Removal, Large Case

1. Open the battery case.
2. Disconnect the Molex connector that connects the batteries to the terminal strip mounted on the aluminum analog card cage access panel.
3. Remove 12 Phillips head screws from the lower case panel and remove the panel.
4. Disconnect the input cables to the analog boards (BD183) and the timing and calibration board (BD244 or BD288).
5. If removing the timing and calibration board, it is necessary to disconnect

other cables as well.

6. Once the cables are disconnected, the boards are removed by pulling them gently towards you.

Board Insertion

NOTE: The boards are connected to the motherboard with a 64-pin DIN connector. These connectors and their mating sockets are polarized so they cannot be inserted improperly.

1. Locate the appropriate bus slot. The boards in the analog card cage in of both the large and small case GDP-32 are oriented so that the board component side faces right as you look into the card cage.
2. Ensure that the board faces the correct direction before inserting it.
3. Slide the board into the nylon guide rails and push the board in until it is firmly seated in the bus connector.
4. Make sure all cards are in their proper place.
5. Reconnect all cables, making sure that they are all connected in the proper sequence.
6. When replacing analog boards, push the black cable connector into its blue socket. The connector retaining clamps -should overlap the edge of the black connector to prevent accidental dislodging. If they do not overlap, wiggle the connector to ensure that it is firmly seated. Be careful not to bend any pins.

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17.3 DIGITAL BOARD PROBLEMS

The GDP-32 has a modular design. One advantage of a modular design is that board problems are often solved by simply inserting a replacement board. Repairs of the original board are then saved for Zonge Engineering repair representatives. This procedure saves valuable field time.

NOTE: All digital boards are sensitive to static discharge, so make sure you use a grounding mat and strap when you handle the boards.

THE CALIBRATION AND TIMING BOARD

The Calibration and Timing Board (BD244 or BD288) supplies the timing reference for the time and frequency domain waveforms utilized by the GDP-32. See Section 17.1 for instructions on using the Diagnostics program for trouble-shooting problems. Defective boards should be replaced. *Do not attempt to repair a faulty board.*

NOTE: Do not turn on power to the receiver unless the Calibrate and Timing Board is plugged into the analog card cage, and all board wiring connections are made.

THE FRONT PANEL ASSEMBLY (MPU AND BD287 BOARDS)

The Front Panel Assembly (see Figure 16.2 (a)) includes the panel with its membrane keyboard, the display, the MPU board, disk, memory, LAN, and the BD287 board.

The BD287 performs all peripheral digital functions not available directly on the MPU board. Included on BD287 are sockets for the MPU and Flash RAM cards.

Defective boards should be replaced. *Do not attempt to repair a faulty board.*

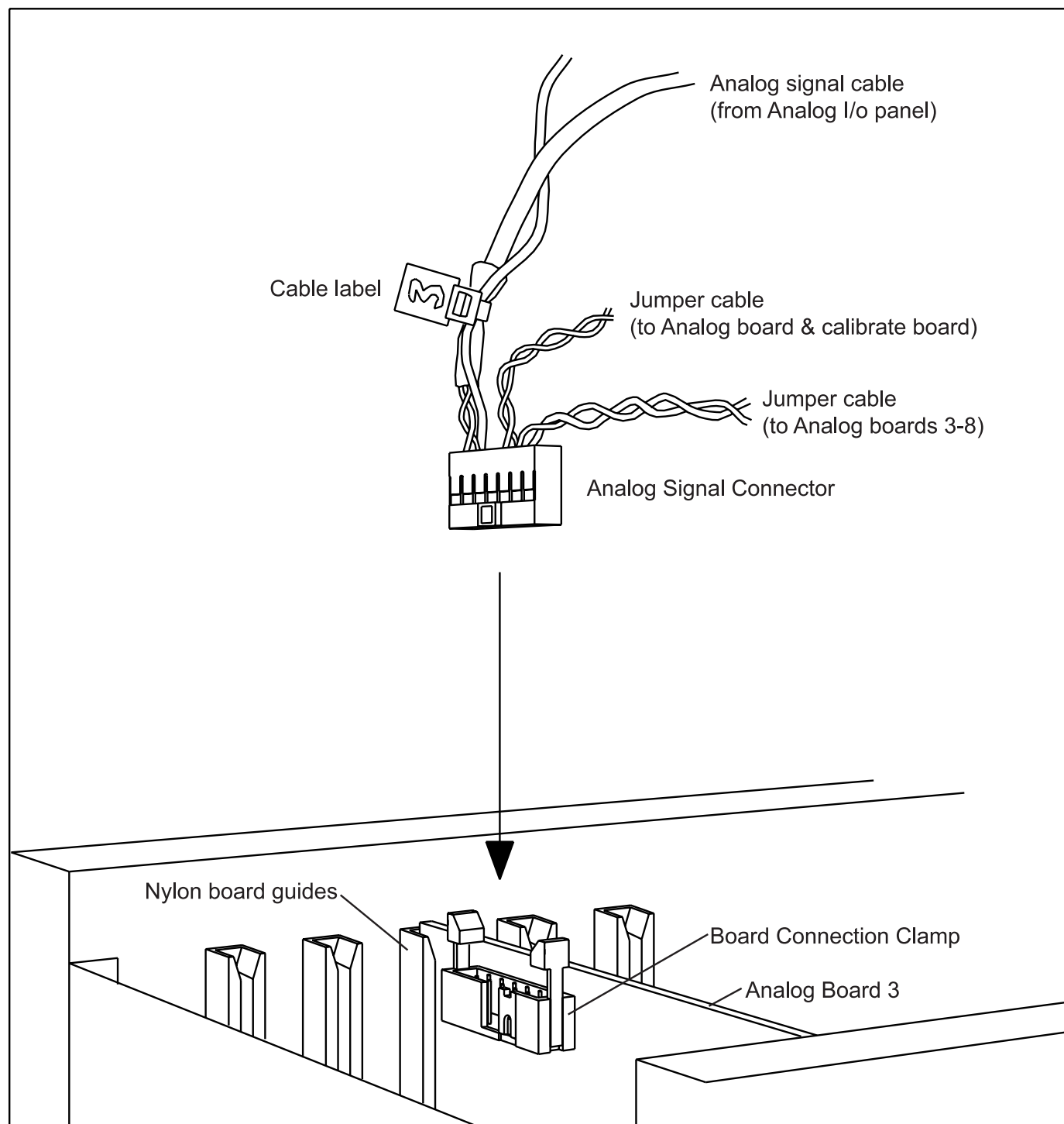


Figure 17.3 Jumper Cable connection to an Analog Board

17.4 ANALOG BOARD PROBLEMS

Analog Boards are easily checked for proper operation with the Diagnostics software (See Section 17.1 above). Defective boards should be replaced.

Do not attempt to repair a faulty board

REMOVING ANALOG BOARDS

1. Disconnect the input cables from the calibrate/timing board and the analog cards.
2. Pull the board straight out of the bus connector.

REPLACING ANALOG BOARDS

1. Make sure that board components face to the right as you are looking into the card cage. See Section 17.2 above.
2. Insert the replacement board.
3. Reattach the input cables to each analog card and the calibrate/ timing card. Make sure the analog cards are connected in order.

In order for all boards to work correctly, all boards must be plugged in and wired consecutively, without any missing boards or connections.

Before trying to debug problems with any of the boards, give our office a call, or send us a fax or email message with a description of the problem. Our staff is more than happy to help with any problems concerning our equipment.

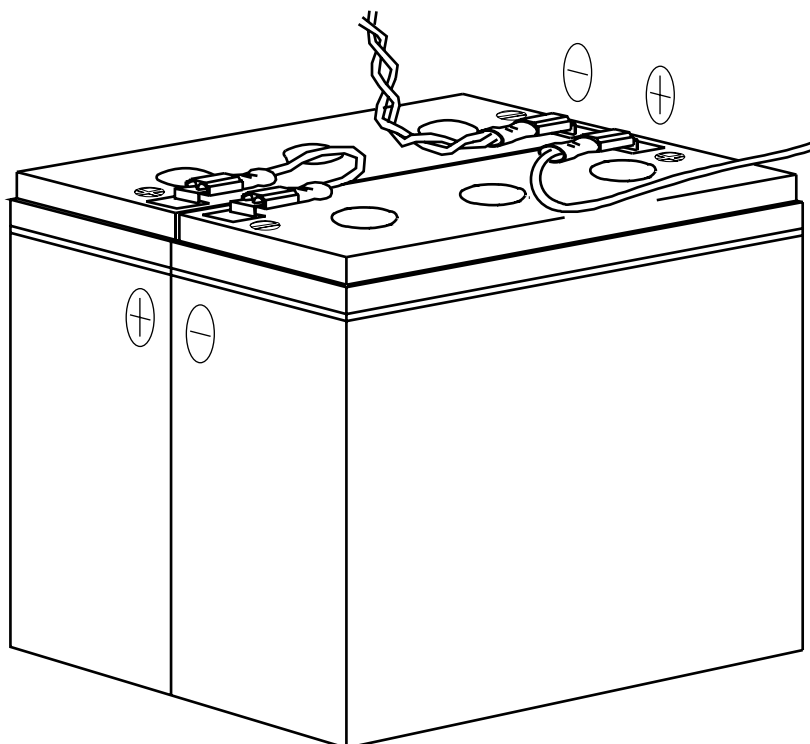


Figure 17.4 (a) - Wiring configuration for batteries in the small case GDP-32T

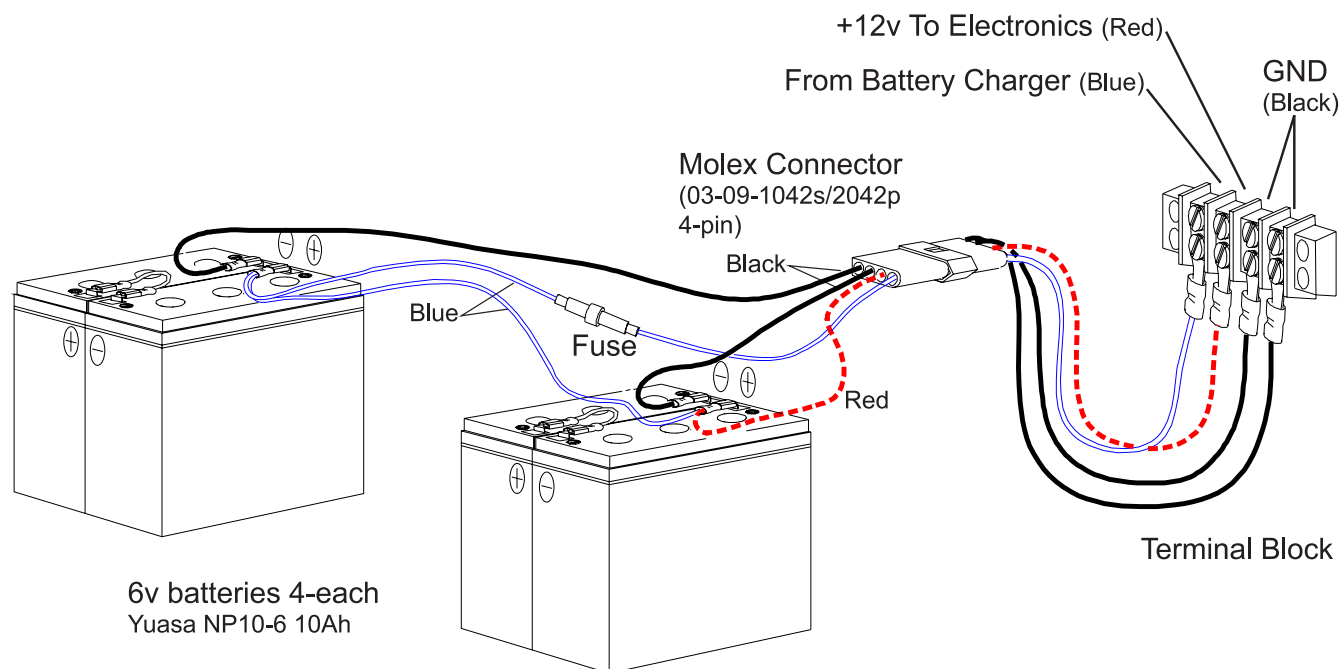
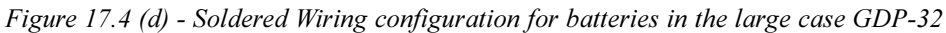
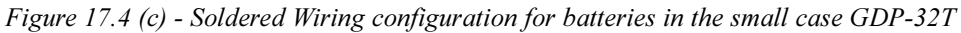


Figure 17.4 (b) - Wiring configuration for batteries in the large case GDP-32



17.5 BATTERY AND POWER PROBLEMS

TROUBLE-SHOOTING POWER PROBLEMS

There are two general types of power problems:

- low battery voltage
- zero battery voltage as measured by the receiver

Low Battery Voltage

If the receiver is functioning, some battery power remains. When the voltage drops below 10.6 volts or raises above 15.5v, the *Electronic Circuit Breaker* activates and powers down the receiver. The circuit breaker also activates in an overcurrent situation (e.g. $I \geq 3$ A).

Once the fault condition has been eliminated (e.g., the batteries have been fully charged), the circuit breaker should remain inactive when the power is cycled.

A

Actual voltage can be checked at any time with the Diagnostics program (Section 17.1), or by using a voltmeter to measure the voltage at the BATTERY CHARGE connector on the Control I/O panel. See Figure 17.7.

Checking the Electronic Circuit Breaker (U35, BD287)

The Electronic Circuit Breaker turns off power whenever a fault condition exists. If the Crystal LED on the front panel fails to illuminate altogether or just flashes momentarily, follow the steps below to isolate the problem:

1. Make sure the batteries are fully charged and the fuse in the battery compartment is good.
2. Disconnect the wide blue ribbon cable at the motherboard that connects the front panel board to the motherboard. Disconnect the red/blue/black 3-wire power cable at the 3-pin Molex connector. This disconnects the front panel assembly from the analog and timing section of the receiver.
3. Turn the receiver on with the power button on the CONTROL I/O panel.

If the Crystal LED stays illuminated:

Press the **POWER ON** button on the front panel to see if the MPU board boots up and displays the Zonge logo. If the Zonge logo is displayed the circuit breaker is operating properly. This indicates that there is a problem with the Analog Card Cage Subassembly.

1. Turn the receiver off.
2. Reconnect the blue motherboard cable and the red/blue/black power cable, and prepare the receiver to remove the analog cards.
3. Pull the timing card and each analog card loose from the motherboard socket. It is not necessary to remove the boards completely
4. Re-insert the timing card and cycle the receiver ON. If the receiver will not turn on, there is probably a short on the timing card and it needs to be repaired.
5. Assuming the timing card works OK, re-insert the channel 1 analog card and cycle the receiver ON. If the receiver will not turn on, pull the analog card completely out of the receiver and re-insert the channel 2 analog card and turn the receiver ON.
6. Continue this process until the receiver will cycle on and off with all the cards left in the receiver. Send the faulty cards back to Zonge Engineering for repair.

If the Crystal LED flashes briefly:

Watch carefully to determine whether the Crystal LED flashes briefly when the power is cycled. If it does, that is an indication that the electronic circuit breaker is operating and that there is a problem with BD287. Remove the front panel board (BD287) and inspect the 0.08 ohm resistor (R3) which is next to the fuse (F1). Replace R3 if it shows signs of stress.

If the Crystal LED does not illuminate:

If the Crystal LED appears totally dead, the 0.08 ohm resistor may be damaged, or the circuit breaker chip may be damaged. If the 0.08 ohm resistor looks good, try replacing U35 (UC2543) a socketed integrated circuit on BD287 (See Figure 16.4). If this does not work, see the following discussion on bypassing the electronic circuit breaker, or contact Zonge Engineering or

other authorized service centers for repair information.

Bypassing the Electronic Circuit Breaker

Refer to the following instructions on the rare occasion that it may be necessary to bypass the Electronic Circuit Breaker:

If the circuit breaker chip (U35, UC2543) is OK but the current sense resistor (R3, 0.08 ohm) is blown, and you do not have a replacement, a piece of small gauge wire can be installed in place of R3. This will permit operation of the receiver, but the overcurrent turn-off capability will be lost. The 0.08 ohm resistor should be replaced as soon as possible.

If the circuit breaker chip is not functioning, the following steps may be taken to continue use of the receiver for a limited period.

Caution: when U35 is removed, as explained below, the receiver will remain in a continuous ON state. The only way to turn it off is to disconnect the batteries in the battery compartment.

1. Remove the Electronic Circuit Breaker chip from its socket (U35, BD287; See Figure 16.4 for chip location).
2. Cycle the POWER ON/OFF button on the CONTROL I/O panel. If the Crystal LED does not illuminate, there is a problem on board BD287. Contact Zonge Engineering in Tucson.
3. If the Crystal LED on the front panel illuminates, press the **POWER ON** key on the Front Panel. If the MPU board is able to boot up and display the Zonge logo, then the front panel is probably OK (with the exception of the circuit breaker chip U35 and, possibly R3) and the fundamental problem lies somewhere else. Or the problem could be a one-time event generated by a combination of events coupled with a low battery situation.
4. The circuit breaker should immediately be replaced. However, in a pinch, if a problem has been located and repaired, the GDP-32 will operate effectively with the electronic circuit breaker bypassed.

NOTE AGAIN: Once U35 has been removed, the only way to turn off power is to disconnect the batteries!

Checking battery connections

Zero battery voltage can indicate a disconnected battery cable or a blown fuse. Check the fuses and then enter the battery compartment and check for good connections at the terminals for each battery, the 3-pin white Molex connector, and at the terminal block (on the GDP-32 large case) as shown in Figure 16.8(b).

Checking the battery compartment

If a zero battery voltage still exists check the battery compartment for the following:

- Improperly inserted batteries
- Water in the battery compartment
- Bad batteries

Checking for a bad battery

If you are in the field and wish to continue fieldwork without interruption, replace the batteries as described below.

To check for a dead or low battery directly:

1. Follow the instructions above to access the battery compartment.
2. Use a voltmeter to check the voltage on each battery. When fully charged, the battery voltage should be approximately 6.8 volts. The battery is not operational without charging if the voltage is less than 5.8 volts.

REPLACING BATTERIES

Batteries are good for several hundred charges. It is usually good practice to replace all batteries in a pack if one goes bad.

If you need battery power to supplement exhausted batteries in the field, plug a 12 volt battery into the Battery Charge Port using a special cable available from Zonge Engineering. **MAKE SURE YOU HAVE THE POLARITY CORRECT: PIN A IS POSITIVE 12V, PIN B IS NEGATIVE.**

Replacing Batteries without losing power – Large Case

If there is power to the receiver but the batteries are getting low, the batteries can be replaced while retaining power (thereby maintaining synchronization with the XMT-32 transmitter controller). This is accomplished with a spare set of batteries mounted in a spare battery compartment panel with the proper connector attached.

1. Leave the used batteries plugged in.
2. Plug the charged spare battery pack into the 4 pin Molex connector (Figure 16.8(b)).
3. Disconnect the used batteries from the other connector. The receiver is now powered by the backup battery pack.
4. Connect the new battery compartment to the receiver. The receiver is ready to resume operation.

Replacing Faulty Batteries - Small Case

The batteries for the small case GDP-32T are secured to in the battery compartment accessible by removing the front panel.

1. Remove the 4 screws securing the lid to the battery compartment.
2. Lift each battery out and remove the spade lugs that connect the battery cable harness to the battery. Note that some batteries may have the wiring harnesses soldered to the battery lugs.
3. Replace the old batteries with two new 10.0 A-h, 6 V sealed-lead acid batteries (YUASA Type NP10-6)

Replacing Faulty Batteries - Large Case

1. Use a non-metallic object to gently pry each cell up to that it can be grasped and removed.
2. Replace the old batteries with four new 10.0 A-h, 6 V sealed lead-acid batteries (YUASA Type NP10-6)
3. Note that some battery packs may have the wiring harness soldered to the battery lugs.

17.6 SYNCHRONIZATION PROBLEMS

FAILURE TO RESET OR ADJUST FREQUENCY

Inability to adjust the frequency of the receiver to match the transmitter controller or to synchronize (reset) the receiver and transmitter controller may have several possible origins:

- **Faulty Synchronization Cable**

Sometimes wires can be crimped or pins loosened or broken in the synchronization cable. The best way to check for this problem is to replace the cable with a spare cable and see if the problem is corrected.

If a cable must be repaired, check continuity and pin designation with the diagram in Figure 17.5. Or contact Zonge Engineering for a replacement cable.

- **Insufficient Warm-up Time**

Crystal clocks will not stabilize at the proper frequency unless given at least 60 minutes for the crystal oven to heat up.

- **Crystals Oscillators Too Far Apart In Frequency**

If the Crystals Oscillator frequencies are far enough apart that the frequencies cannot be made identical by adjusting the electronic tuning circuit on the GDP-32^{II} and the oscillator trim potentiometer on the XMT-32, the solution is to adjust the mechanical trim on either the GDP-32^{II} or the XMT-32 crystals..

This problem should not occur with a GDP-32^{II} and an XMT-32 that were shipped together as a system, since the frequencies are adjusted before shipping. But if you own a newer receiver and an older controller (e.g., a GDP-32 and an older XMT-16), there can be a problem adjusting the frequencies due to relative aging of the two crystals. ¹

MECHANICAL ADJUSTMENT OF CRYSTALS

There is rarely a need to mechanically adjust Crystal Oscillators. Always attempt to adjust Crystal Oscillators electronically first (Section 6.2). If mechanical adjustment is necessary, begin with adjusting the crystal on the XMT.

NOTE: It is always best to contact a Zonge engineer before attempting to perform mechanical adjustments.

Mechanical adjustment of the XMT-32 crystal

After both the receiver and transmitter controller have had power applied for at least 60 minutes, the following procedure can be used to adjust the mechanical trim on the crystals:

1. Set the 20-turn crystal adjust trim pot on the XMT to its mid point (turn the slotted screw 20 complete turns in one direction, then turn the screw 10 complete turns in the opposite direction). This provides for the maximum electrical adjustment range after the mechanical adjustment is made.
2. Turn the power switch on the XMT to OFF.
3. Loosen the 4 hand screws on the right side of the front panel and remove the battery.
4. Remove the 6 screws holding down the left front panel and carefully lift it and the attached boards out of the case.
5. Locate the crystal and the mechanical adjustment access hole cover.
6. Using a small flat-bladed screwdriver, carefully remove the adjustment hole screw located in the middle of the base of the crystal (located next to the coaxial output connector).
7. Attach the battery and turn the Power switch to the ON position. Wait at least 15 minutes for the crystal to warm up again.
8. Connect the synchronization cable between the GDP-32 and the XMT-32.
9. Set the BATT/PHASE switch on the XMT-32 to PHASE, and observe the motion in the meter due to the frequency differences between the crystals.
10. Use the plastic trim tool supplied with the GDP-32 to adjust the mechanical trim pot inside the crystal can. Very carefully rotate the pot about 1/4

turn in one direction and then the other to determine which direction it should be turned to bring the two crystals into synchronization.

11. Adjust the mechanical trim to stop the motion in the phase meter. This should never take more than 1/2 turn in either direction. If more rotation is needed, it could indicate that you have a faulty crystal in either the GDP-32 or the XMT-32.
12. Wait for about one minute to determine that the adjustment is stable. If movement in the phase meter resumes, very carefully adjust the mechanical trim to stop the motion.
13. TURN THE POWER SWITCH TO OFF, replace the screw covering the adjustment hole, and put the XMT-32 back together again.
14. Turn the power switch to ON and wait for 10 minutes before attempting to synchronize the two units again.

Mechanical adjustment of the small case GDP-32 crystal

After both the receiver and transmitter controller have had power applied for at least 60 minutes, the following procedure can be used to adjust the mechanical trim on the crystals:

1. Set the 20-turn crystal adjust trim pot on the XMT to its mid point. This provides for the maximum electrical adjustment range after the mechanical adjustment is made.
2. Set the electrical trim in the GDP to its midpoint. To do this, first get into the utilities menu and select **4) Synchronize to XMT**. Push CONTINUE twice to get to the "Adjust crystal" menu. Hold the SELECT DOWN key down until the beeps change from a slow to a high repetition rate. This puts you on the outside range of the electronic adjustment. Now press the SELECT UP key repetitively for 25 counts (beeps). This will put you in the middle of the adjustment range.
3. Press ESCAPE to exit the utility program and turn off the receiver in the proper manner. Cycle the POWER ON/OFF button on the Control I/O panel to OFF. The red crystal light will be off.
4. Remove the 12 screws holding down the Front Panel.

5. On the front panel assembly, very carefully disconnect the wide blue ribbon cable and the multi-colored cable, both of which go to the card cage motherboard. Also, disconnect the single, black ground wire at the single wire Molex connector.
6. Fold the front panel assembly over toward the left without disconnecting any more cables. Make sure you have something for the front panel to rest upon on the left-hand side of the receiver (a stack of books or something similar).
7. The crystal is located to of the card cage and along the side of the battery pack or on top of the battery pack.
8. Use a flat-bladed screwdriver to carefully remove the adjustment hole screw located in the middle of the base of the crystal (next to the coaxial output connector).
9. Cycle the POWER ON/OFF button to ON. Wait at least 15 minutes for the crystal to warm up again.
10. Connect the synchronization cable between the GDP-32 and the XMT-32.
11. Set the BATT/PHASE switch on the XMT-32 to PHASE, and observe the motion in the meter due to the frequency differences between the crystals.
12. Use the plastic trim tool supplied with the GDP-32 to adjust the mechanical trim pot inside the crystal can. Very carefully rotate the pot about 1/4 turn in one direction and then the other to determine which direction it should be turned to bring the two crystals into synchronization.
13. Adjust the mechanical trim to stop the motion in the phase meter. This should normally take less than 1/2 turn in either direction. If more rotation is needed, it could indicate that you have a faulty crystal in either the GDP-32 or the XMT-32.
14. Wait for about one minute to determine that the adjustment is stable. If movement in the phase meter resumes, very carefully adjust the mechanical trim to stop the motion.
15. CYCLE THE POWER ON/OFF BUTTON TO OFF, replace the screw covering the adjustment hole, and put the receiver back together again.
16. Turn on the power and wait for 10 minutes before attempting to fine-tune

the crystal frequency. Synchronize the two units by executing the **Synchronize to XMT** option in the **Diagnostic** program of the GDP-32 (Press 2 in the main menu).

The above procedure should permit accurate synchronization once again.

Mechanical adjustment of the large case GDP-32 crystal

After both the receiver and transmitter controller have had power applied for at least 60 minutes, the procedure above can be used to adjust the mechanical trim. The crystal in the large case configuration is mounted on the calibration and timing board. The board is located in the left most slot of the analog card cage, accessible by opening the battery compartment (bottom lid) of the GDP-32. Follow the same procedure as indicated for the GDP-32T

17.7 COLD WEATHER OPERATION

An optional LCD heater is used to heat the display when the ambient temperature is below -18° C (0° F). In particular it is used when the display response becomes too slow to be useful.

The heater is turned on at the toggle switch found to the left of the power switch on the control panel. An in-line thermal switch monitors the panel temperature and cycles the heater as necessary to maintain the display temperature.

NOTE: The heater draws 25% or more of the total unit power consumption and will therefore deplete the internal batteries rapidly. Additionally, the battery life at 0 °C is approximately 85% and at -8 °C the battery life is approximately 60% of the capacity at +23 °C.

17.8 PINOUTS FOR CONNECTORS

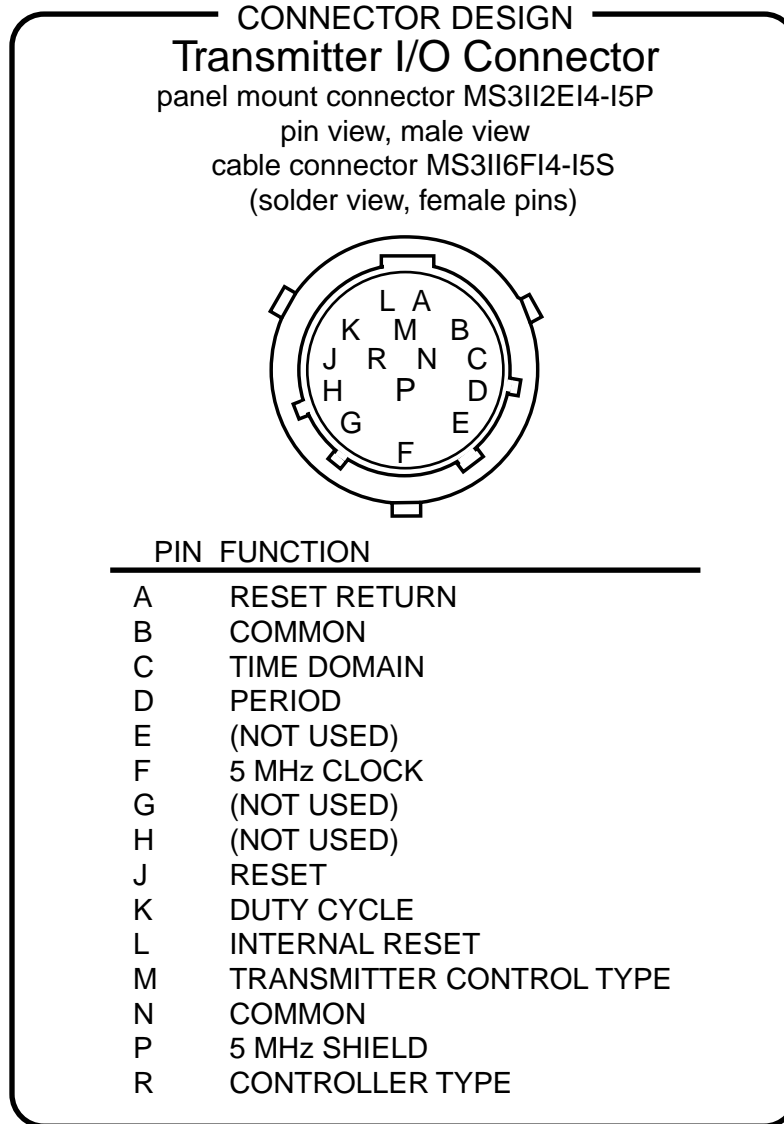


Figure 17.5 Transmitter I/O Connector

CONNECTOR DESIGN

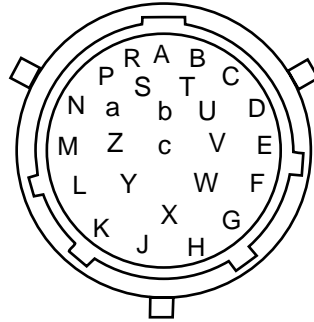
Parallel Connector

panel mount connector MS3II2E16-26P[

pin view, male pins

cable connector MS3II6BI2-26S

(solder view, female pins)



PIN FUNCTION

A SIG GND
B (NOT USED)
C SIG GND
D SIG GND
E (NOT USED)
F DATA 7
G DATA STROBE
H DATA 0
J DATA 1
K DATA 2
L DATA 3
M (NOT USED)
N FAULT

PIN FUNCTION

P SIG GND
R SIG GND
S SIG GND
T SIG GND
U SIG GND
V BUSY
W DATA 6
X DATA 5
Y DATA 4
Z SELECT
a INITIALIZE
b N.C.
c PAPER ERROR

Figure 17.6 Parallel Connector

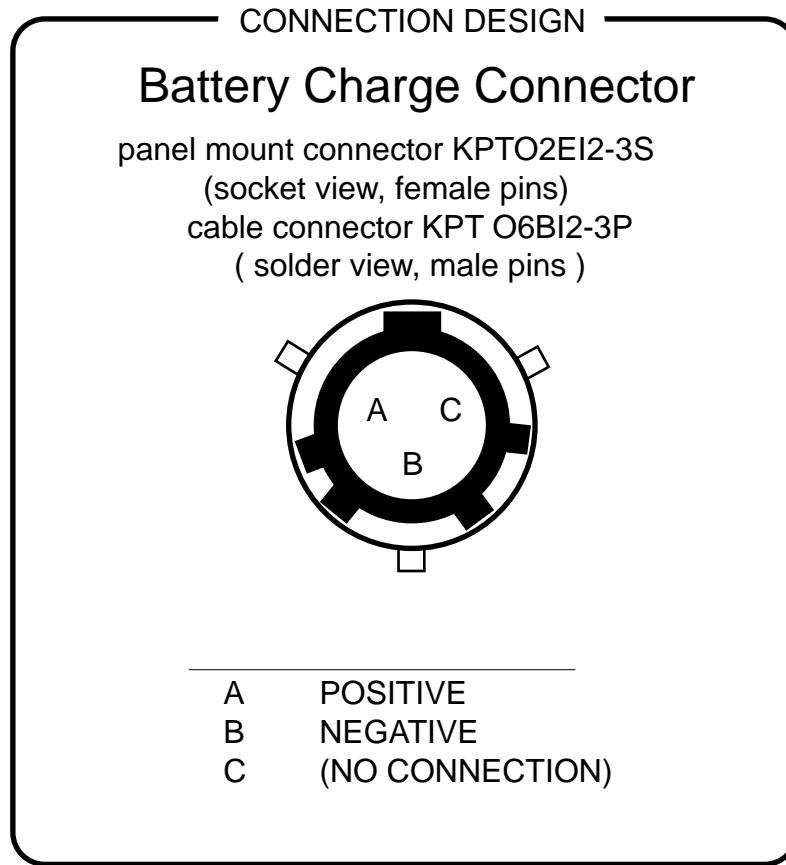


Figure 17.7 Battery Charge Connector

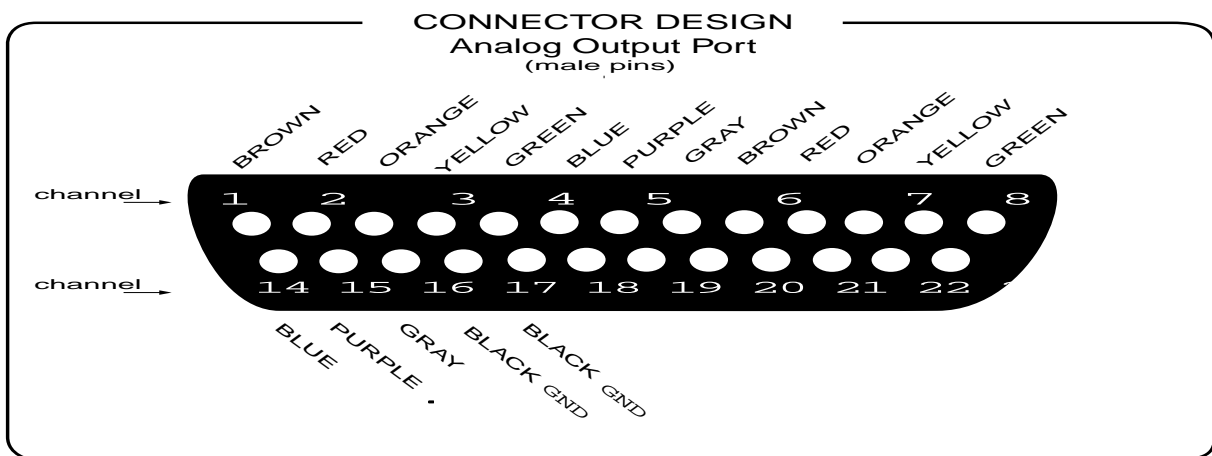


Figure 17.8 Analog Output Ports

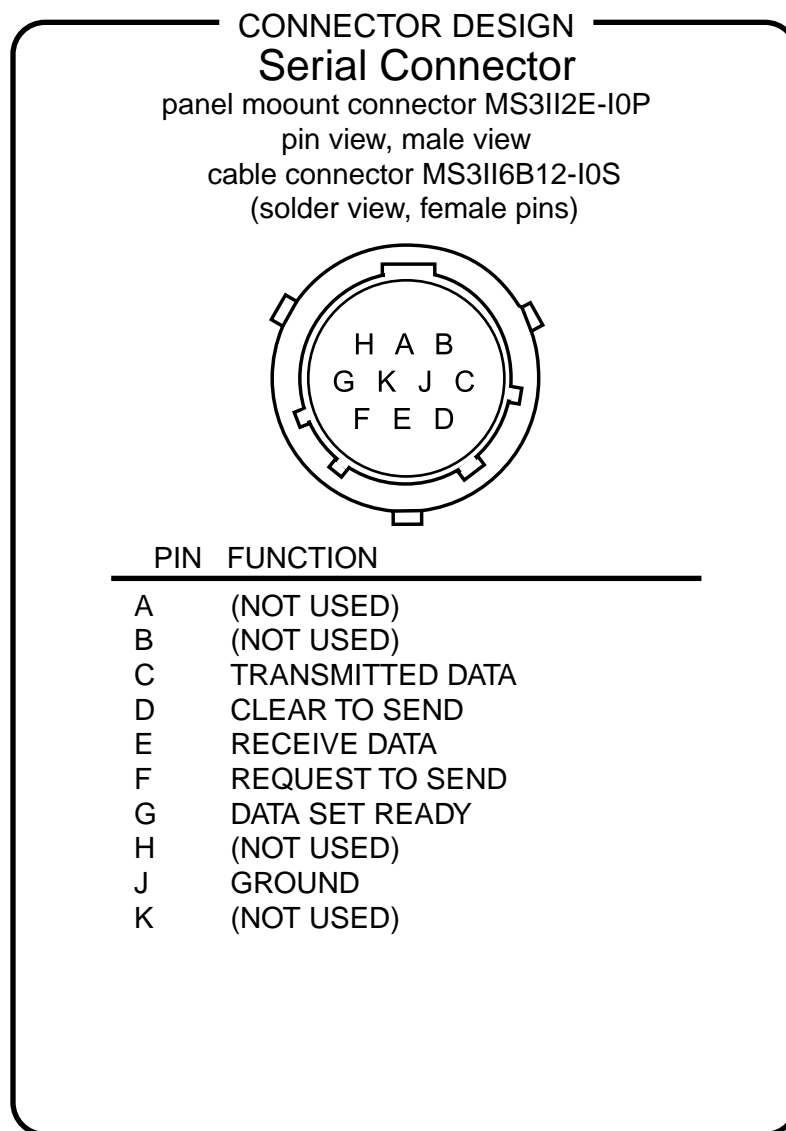


Figure 17.9 Serial Connector

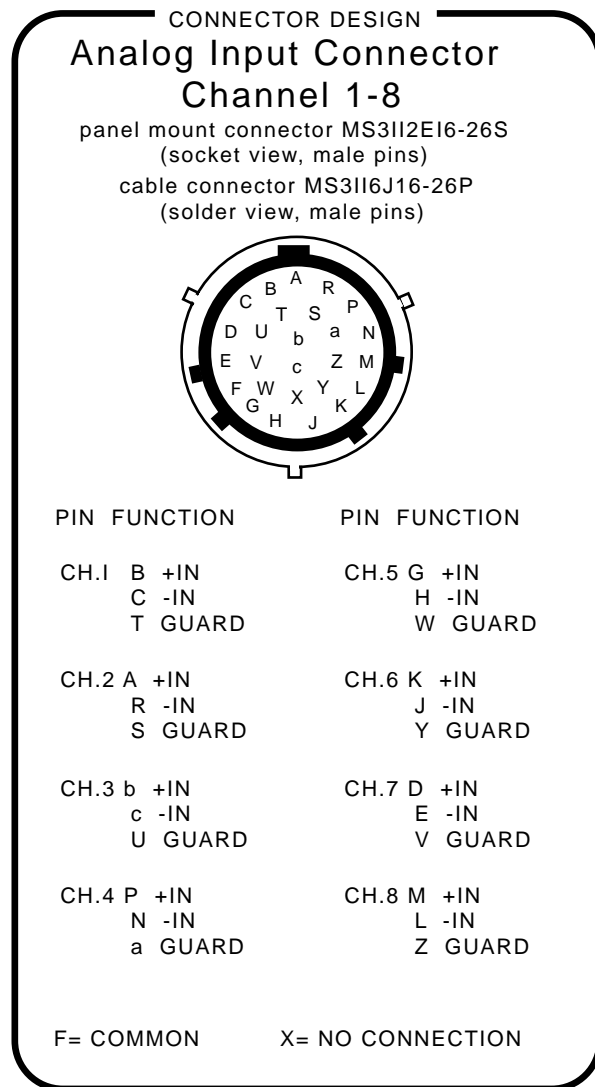
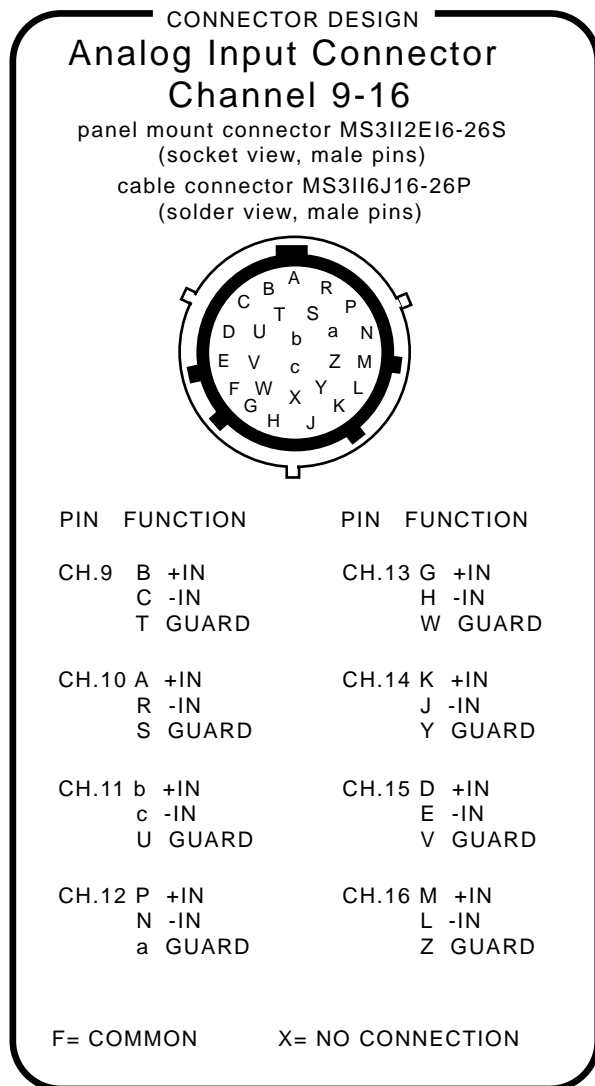


Figure 17.10 Analog Input Connector

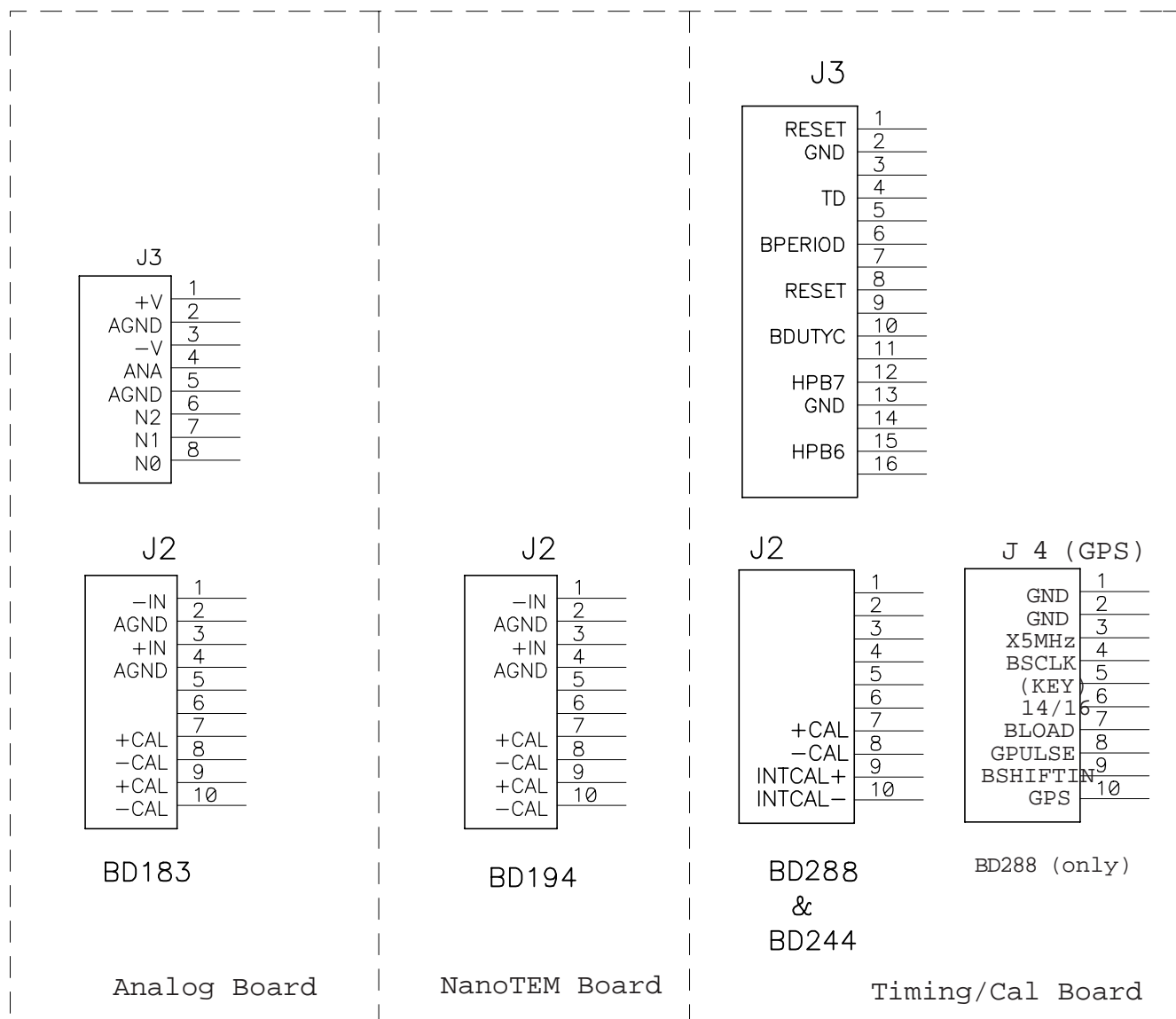


Figure 17.11 I/O Connections for:
(a) Analog Cards, (b) NanoTEM Card, (c) Timing/Calibrate Card.

MAINTENANCE

		BD183	BD194	BD244/288	BD187/287
		to	to	to	to
		BD185/271 J1-J16	J1-J16	J17	J18
ZONGE BUS MOTHERBOARD CONNECTOR	SBHE*	A1	-SBHE*		-BSBHE*
	AGND	A2	-AGND		-GND
	RESET	A3			-RESETZMB
	+5V	A4	-+5VB		-+5V
	METER	A5	-ANAOUT		
		A6			
		A7			
	PERIOD	A8	-PERIOD	-PERIOD	
	DUTY	A9	-DUTYCYCLE	-DUTYCYCLE	
	DGND	A10	-DGND	-DGND	-GND
	DGND	A11	-DGND	-DGND	
	BD8	A12	-BD8		-BD8
	BD9	A13	-BD9		-BD9
	BD10	A14	-BD10		-BD10
	BD11	A15	-BD11		-BD11
	BD12	A16	-BD12		-BD12
	BD13	A17	-BD13		-BD13
	BD14	A18	-BD14		-BD14
	BD15	A19	-BD15		-BD15
	4MHZ	A20	-4MHZ		
	AEN	A21	-BAEN	-AEN	-AEN
	DA15	A22	-DA15		
	DA14	A23	-DA14		
	DA13	A24	-DA13		
	DA12	A25	-DA12		
	IRQ11	A26			-IRQ11
	BCLK	A27			
	BALE	A28			-GND
	+5V	A29	-+5VB		-+5V
	AGND	A30	-AGND		-GND
	CNVRT	A31	-CNVRT	-CNVRT	
	EOC	A32	-ADCEOC		
	-5A		-5AB		-GND
	IOCHK*	B1			
	BD7	B2	-BD7	-BD7	-BD7
	BD6	B3	-BD6	-BD6	-BD6
	BD5	B4	-BD5	-BD5	-BD5
	BD4	B5	-BD4	-BD4	-BD4
	BD3	B6	-BD3	-BD3	-BD3
	BD2	B7	-BD2	-BD2	-BD2
	BD1	B8	-BD1	-BD1	-BD1
	BD0	B9	-BD0	-BD0	-BD0
	2.5MHZ	B10	-2.5MHZ	-2.5MHZ	
	IOCS16*	B11			-IOCS16*
	BIOW*	B12	-BIOW*	-BIOW*	-BIOW*
	BIOR*	B13	-BIOR*	-BIOR*	-BIOR*
	+VBAT	B14	-+VANA	-+VT/C	-+VT/C
	+VBAT	B15	-+VANA	-+VT/C	-+VT/C
		B16			
	BA15	B17	-BA15	-BA15	-BA15
	BA14	B18	-BA14	-BA14	-BA14
	BA13	B19	-BA13	-BA13	-BA13
	BA12	B20	-BA12	-BA12	-BA12
	BA11	B21	-BA11	-BA11	-BA11
	BA10	B22	-BA10	-BA10	-BA10
	BA9	B23	-BA9	-BA9	-BA9
	BA8	B24	-BA8	-BA8	-BA8
	BA7	B25	-BA7	-BA7	-BA7
	BA6	B26	-BA6	-BA6	-BA6
	BA5	B27		-BA5	-BA5
	BA4	B28		-BA4	-BA4
	BA3	B29			-BA3
	BA2	B30	-BA2	-BA2	-BA2
	BA1	B31	-BA1	-BA1	-BA1
	BA0	B32	-BA0	-BA0	-BA0
	+5A		+5AB		-GND

Figure 17.12 Zonge Bus

1

17.9 ERROR MESSAGES (NOT COMPLETED AT THIS TIME)

See footnote page 16.23: GDP-32 Design, The Calibration and Timing Board, Timing Section, Frequency Generator.