17. MAINTENANCE AND TROUBLE-SHOOTING

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.

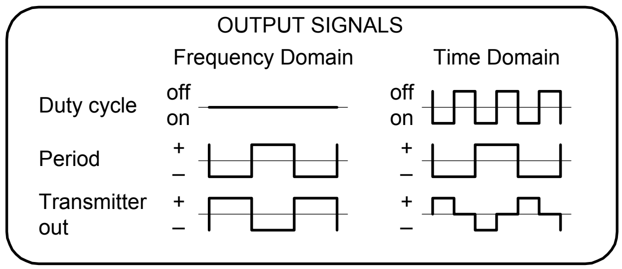

Figure 17.1 - Period and duty cycle control waveform

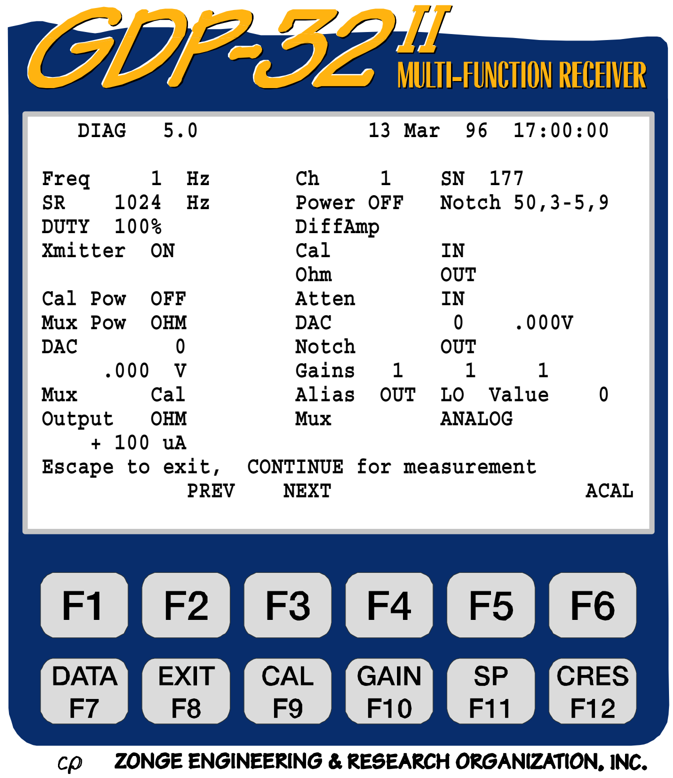

Figure 17.2 (a) - Diagnostic Screen displaying default values on cold startup.

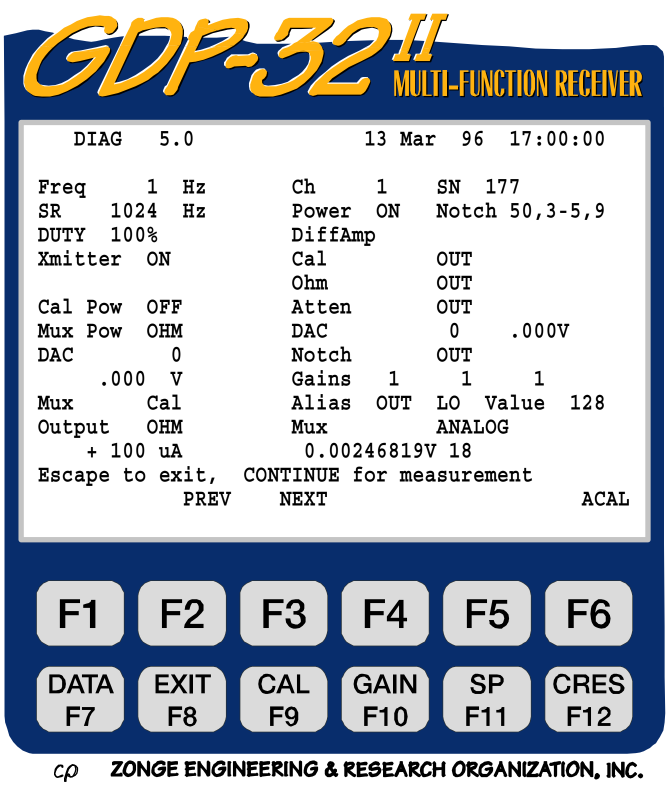

Figure 17.2 (b) - Diagnostic after turning on channel 1. The A/D Output Line is blank until an analog channel is turned on.

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: Press [STOP AVG / Escape] to leave diagnostic mode and return to the Main Program Menu.

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:

   a) The [F3], **NEXT** key circulates in a counter-clockwise motion from Timing to Calibrate to Analog Board menu sections of the screen.

   b) The [F2], **PREV** 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

Frequency (Freq)

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[II] 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 (SR)

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 (Duty)

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 (Auto Tx, used for TEM and NanoTEM)

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 that 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 8.11(b).

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	50,150Hz	
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

Place the cursor at the first "1" to modify 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. 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 Enter.

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 that 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 µa - 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 µa 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 / Pg Dn] to move the cursor to the `Power` field.
4. Press [SELECT DN / End] to turn on Channel `1`.
5. Press [NEXT FIELD / Pg Dn] again to move to the `CAL` relay. Press [SELECT DN / End] 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 DN / End] to turn the calibrate board `ON`.
8. Press [NEXT FIELD / Pg Dn] to move to the `Mux Pow` field, press [SELECT DN / End] to display `CAL.`
9. Press [NEXT FIELD / Pg Dn] [NEXT FIELD / Pg Dn] [NEXT FIELD / Pg Dn] to move to the `Mux CAL` field. Press [SELECT DN / End] [SELECT DN / End] 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 / Home] 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** and the cursor will be on the **Freq** line. Press [SELECT UP / Home] or [SELECT DN / End] 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 Diagnostics program to check out channel 3.

1. From the Main Program Menu press [$ / 4], **TDIP** to enter the ***TDIP Survey Program.***
2. Use the default values in the first menu: **dipole-dipole** survey, **synchronous** mode, **noisy** gains, and **quiet** environment.
3. Press [CONTINUE / Enter] [CONTINUE / Enter] to get to the ***Channel Menu*** and turn on channels 1, 2, and 3.
4. Press [CONTINUE / Enter] 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).
5. Press [CONTINUE / Enter] to gather one cycle of data. This will just be noise, but it sets the gains and SP buckout and gives us some numbers to look at in the ***Diagnostics*** program. After the GDP acquires the data, press [CONTINUE / Enter] to save the data.
6. Press [EXIT / F8] to leave the TDIP program and return to the ***Main Program Menu***.
7. Press [@ / 2], **Utilities** and then press [@ / 2], **Diagnostics**.
8. The screen should now be similar to Figure 17.2(c):

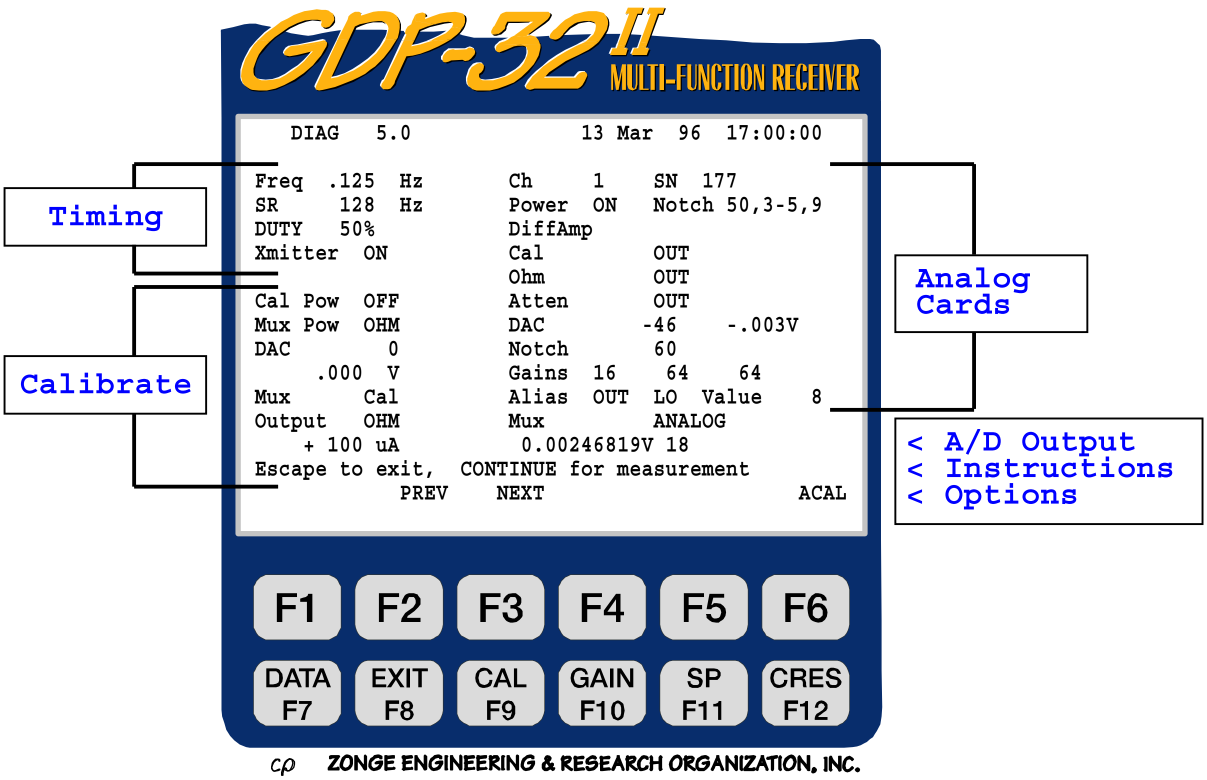

Figure 17.2 (c) Three channel TDIP example

9. Press SELECT UP Home SELECT UP Home to display Channel 3.

10. Press NEXT FIELD Pg Dn NEXT FIELD Pg Dn to get to the **CAL OUT** field. Press SELECT DN End to turn the calibrate input **IN**.

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

12. Press NEXT FIELD Pg Dn to get to **Mux Pow** and press SELECT DN End to set **Mux Pow** to **CAL**.

13. 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.

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

15. Press NEXT FIELD Pg Dn eight times to move to the **Gain Stage** line. Use SELECT UP Home or SELECT DN End to change the gains on the first stage to **1**.

16. Press NEXT FIELD (Pg Dn) to get to the second gain stage. Use SELECT UP (Home) or SELECT DN (End) 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.

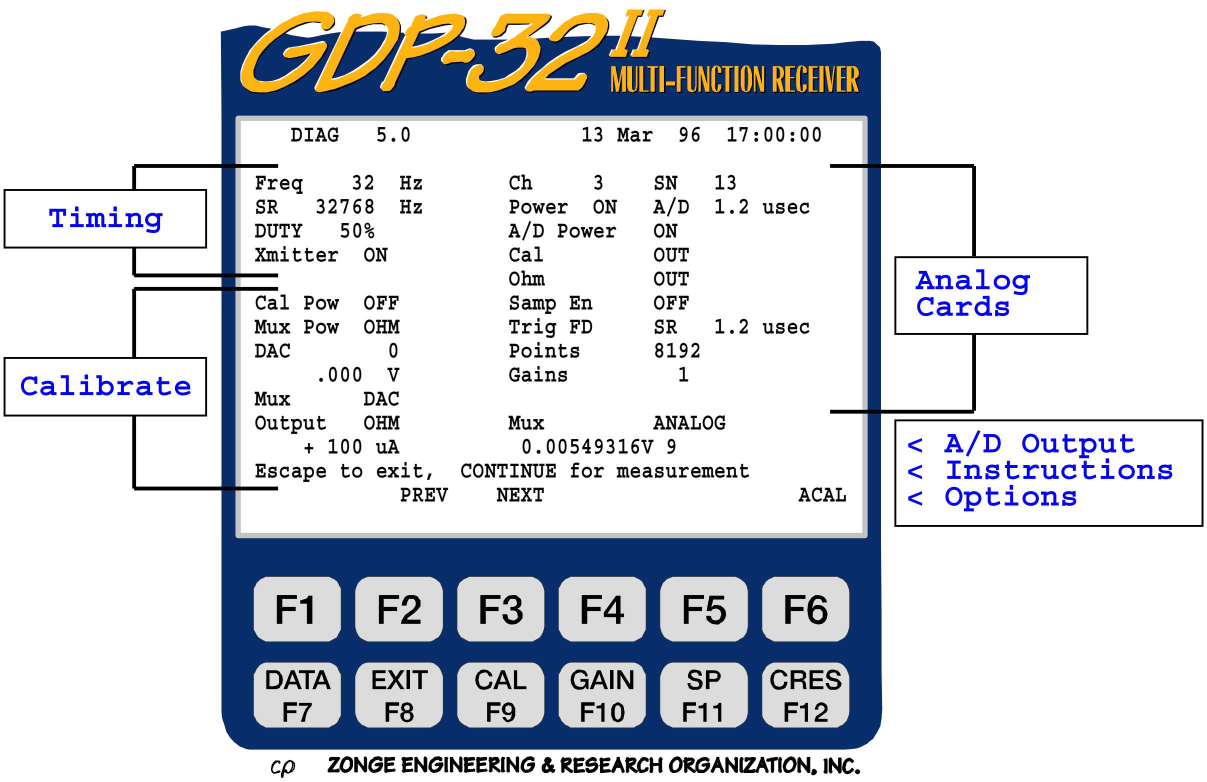

Figure 17.2 (d) NanoTEM example

In the above screen Channel 3 has been turned **ON**.

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 µsec 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* 

.

17.2 HANDLING BOARDS AND EPROMS

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 top and bottom of the card cage. The bar is 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 then 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, disconnect other cables as well.
6. Once the cables are disconnected, remove the boards 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 of both the large and small case GDP-32^{II} 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^II 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^II. 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, hard disk, memory, LAN, and the BD287 board.

The BD287 board 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.

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, call the Zonge Tucson Office, 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.

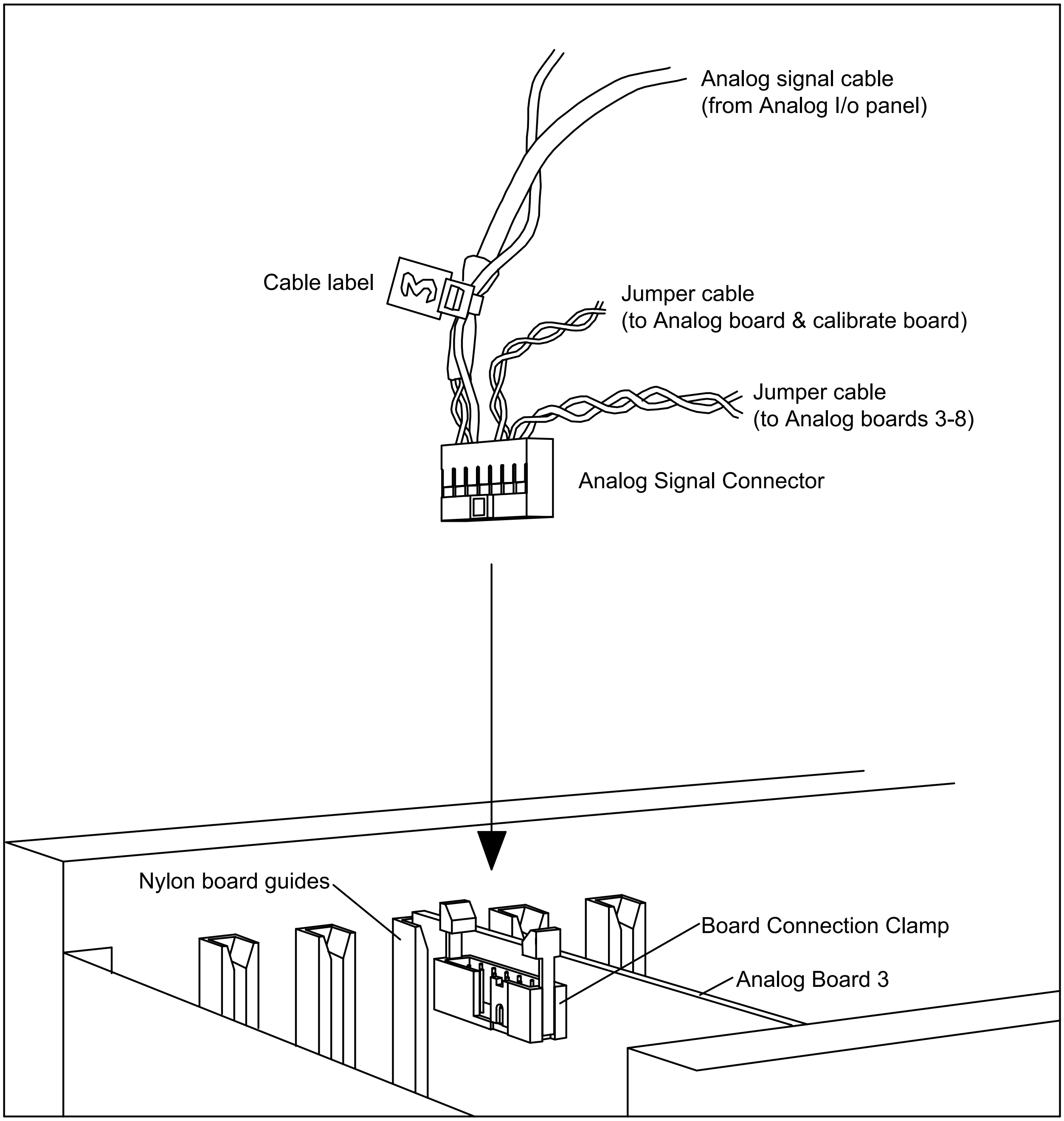


Figure 17.3 Jumper Cable connection to an Analog Board

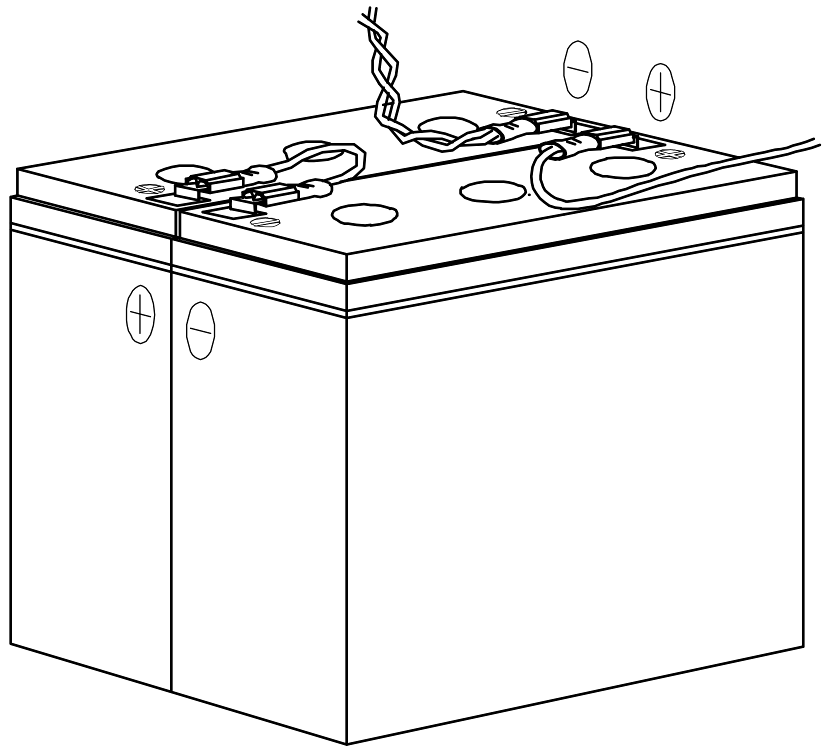


Figure 17.4 (a) - Wiring configuration for batteries in the small case GDP-32^II T

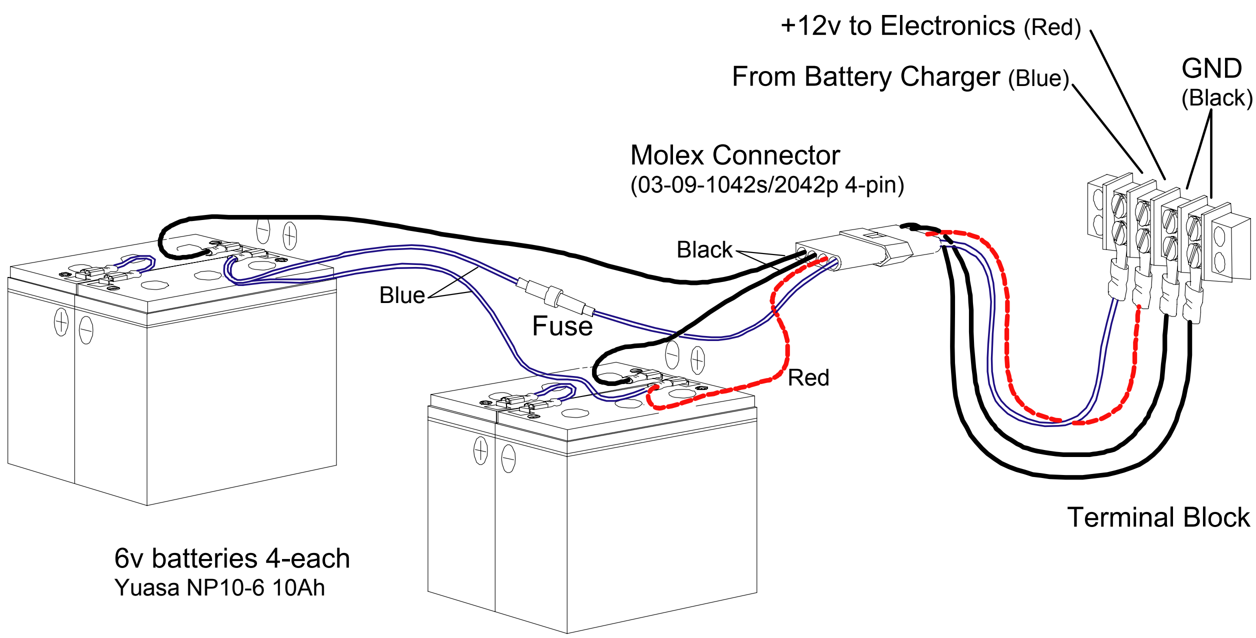


Figure 17.4 (b) - Wiring configuration for batteries in the large case GDP-32^II

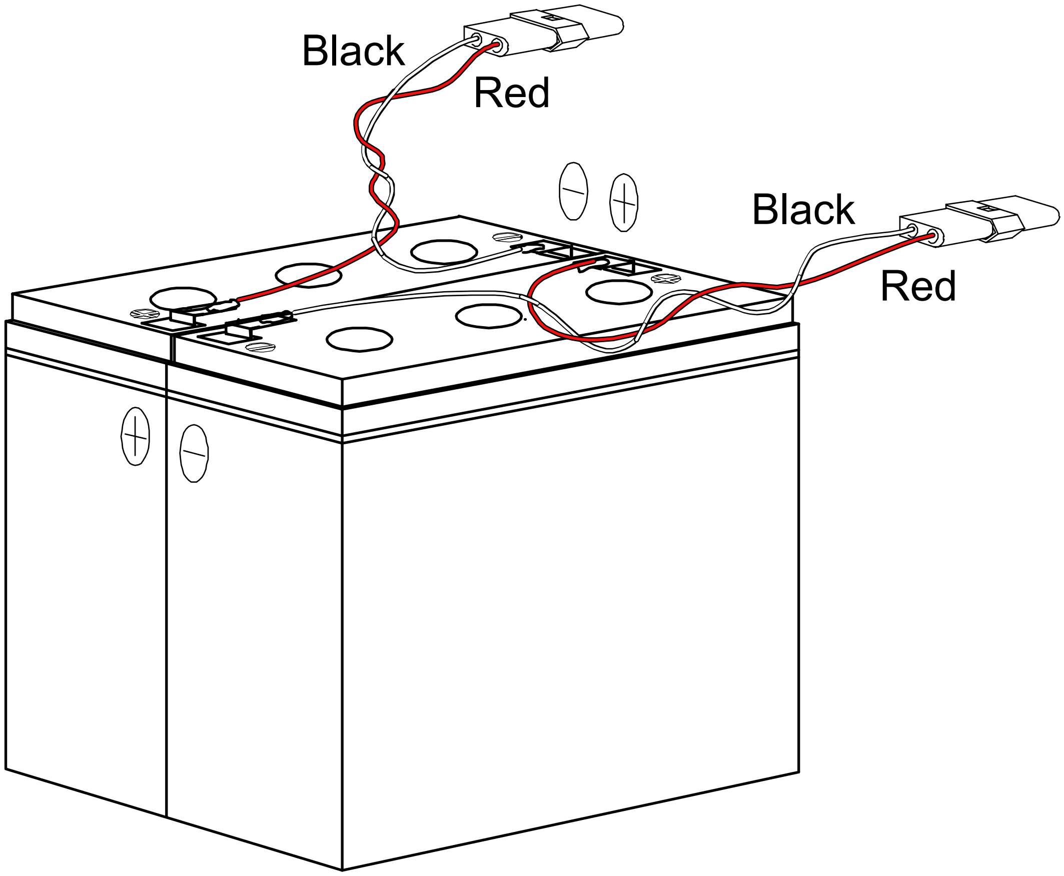


Figure 17.4 (c) – Soldered wiring configuration for batteries in the small case GDP-32^{II}T

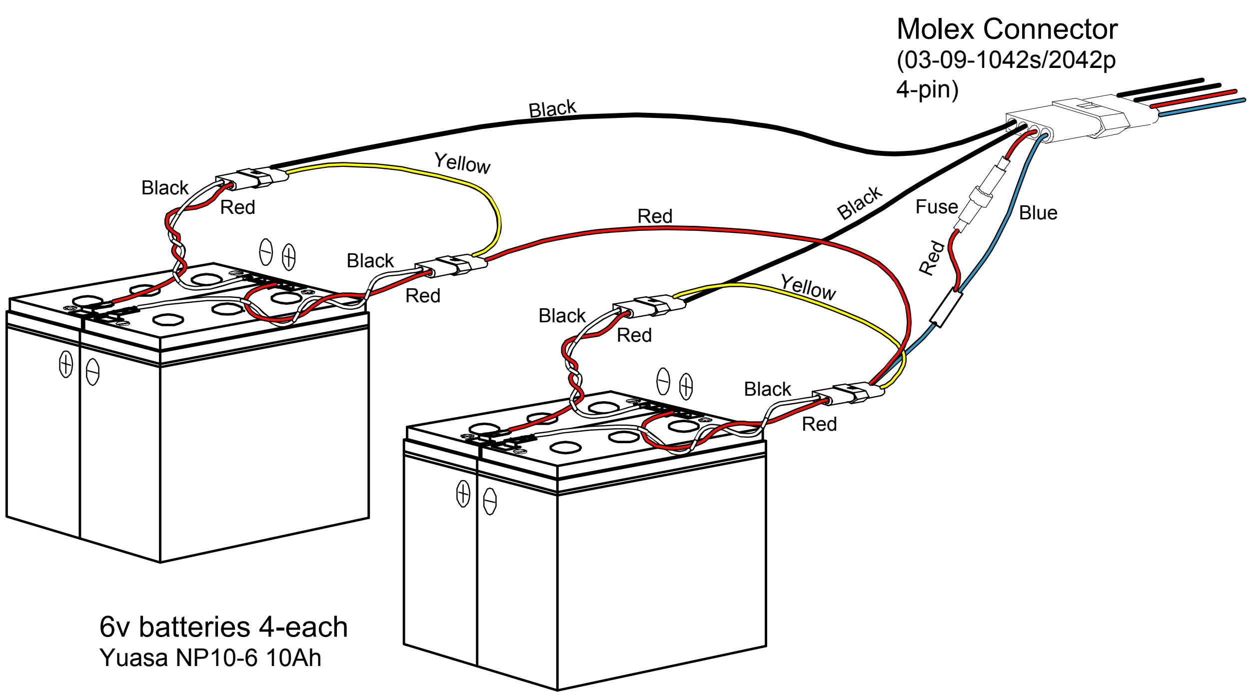


Figure 17.4 (d) – Soldered wiring configuration for batteries in the large case GDP-32^{II}

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 rises 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 ≥ 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.

The actual voltage can be checked at any time with the ***Diagnostics Program*** (***Section 17***), 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 power off 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 

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 okay, 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 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 circuit breaker chip may be damaged. 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 center 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 okay 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 **CONTOL 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 

on the Front Panel. If the MPU board is able to boot up and display the Zonge logo, then the front panel is probably okay (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^{II} will operate effectively with the electronic circuit breaker bypassed.

*Caution 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^{II} 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 connector **J2** (Figure 16.7(c)).
3. Disconnect the used batteries from connector **J1**. 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-32^{II}T are secured 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 batteries may have the wiring harnesses 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.

Crystal Oscillators Too Far Apart In Frequency

If the Crystal 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^II and an older XMT-16), there can be a problem adjusting the frequencies due to relative aging of the two crystals. [1]

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

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^{II} 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^{II} 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^{II} 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^II 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-32^II to its midpoint. To do this, first get into the `Utilities` menu and press [$ / 4] **4) Synchronize to XMT**. Press [CONTINUE / Enter] [CONTINUE / Enter] to get to the `Adjust crystal` menu. Press [SELECT DN / End] 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 [SELECT UP / Home] repetitively for 25 counts (beeps). This will put you in the middle of the adjustment range.
3. Press [STOP AVG / 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 the left 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^II 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^II 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^II 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^{II} (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^{II}. Follow the same procedure as indicated for the GDP-32^{II}T.

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.

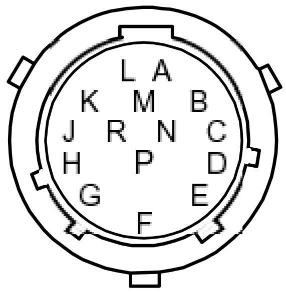
The heater is turned on at the toggle switch found to the left of the Power Switch on the **`Control I/O Panel`**. An in-line thermal switch monitors the panel temperature and cycles the heater as necessary to maintain the display temperature.

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

Transmitter I/O Connector

panel mount connector MS3II2EI4-I5P
pin view, male view
cable connector MS3II6FI4-I5S
(solder view, female pins)



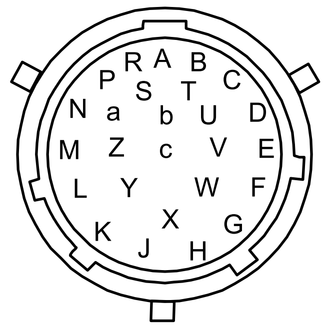
PIN	FUNCTION
A	RESET RETURN
B	COMMON
C	TIME DOMAIN
D	PERIOD
E	(NOT USED)
F	5 MHz CLOCK
G	(NOT USED)
H	(NOT USED)
J	RESET
K	DUTY CYCLE
L	INTERNAL RESET
M	TRANSMITTER CONTROL TYPE
N	COMMON
P	5 MHz SHIELD
R	CONTROLLER TYPE

Figure 17.5 Transmitter I/O Connector

Parallel Connector

panel mount connector MS3II2E16-26P
pin view, male pins

cable connector MS3II6BI2-26S
(solder view, female pins)



PIN FUNCTION	PIN FUNCTION
A SIG GND	P SIG GND
B (NOT USED)	R SIG GND
C SIG GND	S SIG GND
D SIG GND	T SIG GND
E (NOT USED	U SIG GND
F DATA 7	V BUSY
G DATA STROBE	W DATA 6
H DATA 0	X DATA 5
J DATA I	Y DATA 4
K DATA 2	Z SELECT
L DATA 3	a INITIALIZE
M (NOT USED)	b N.C.
N FAULT	c PAPER ERROR

Figure 17.6 Parallel Connector

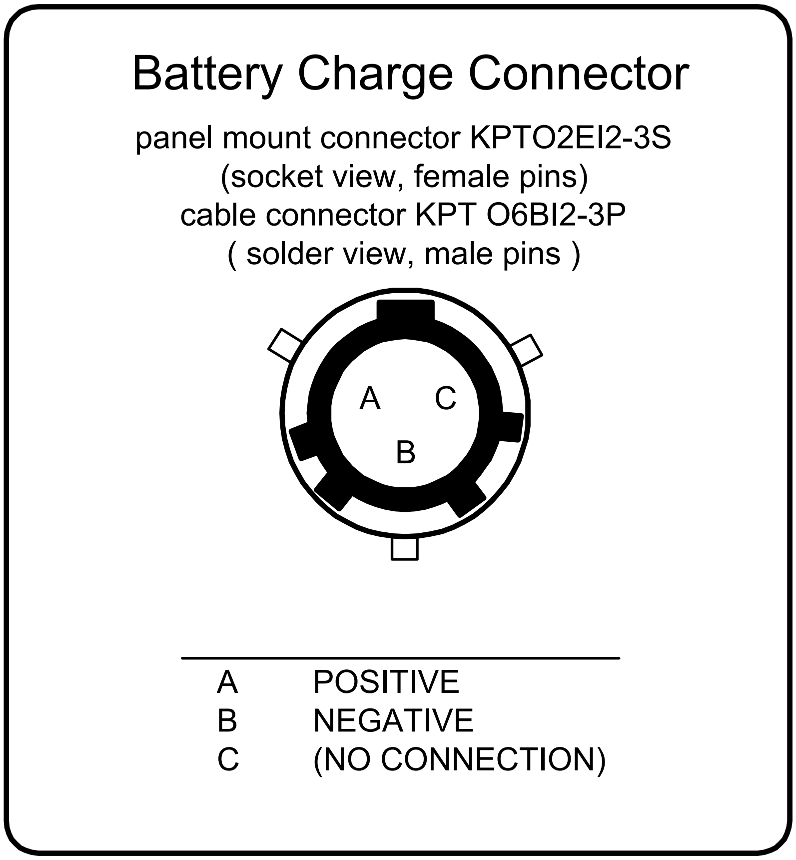


Figure 17.7 Battery Charge Connector

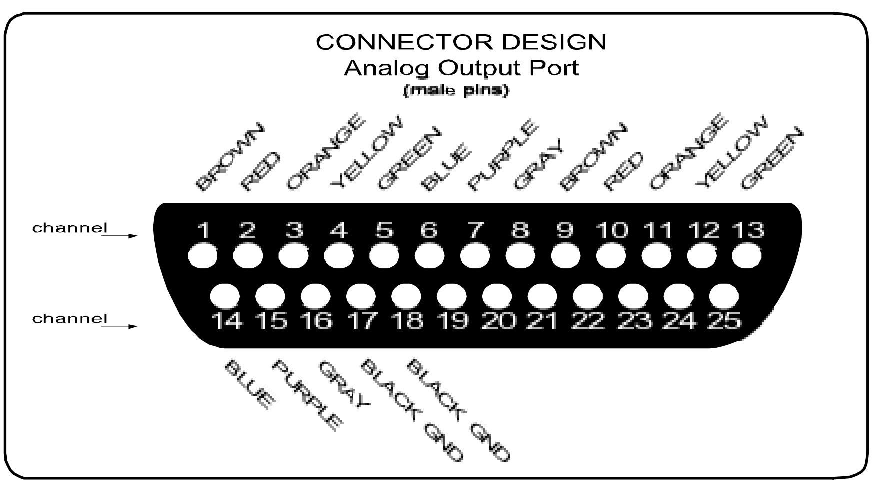
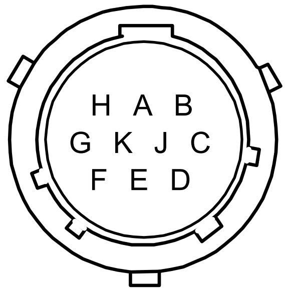


Figure 17.8 Analog Output Ports

Serial Connector

panel moount connector MS3II2E-I0P
pin view, male view
cable connector MS3II6B12-I0S
(solder view, female pins)



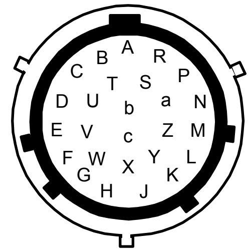
PIN	FUNCTION
A	(NOT USED)
B	(NOT USED)
C	TRANSMITTED DATA
D	CLEAR TO SEND
E	RECEIVE DATA
F	REQUEST TO SEND
G	DATA SET READY
H	(NOT USED)
J	GROUND
K	(NOT USED)

Figure 17.9 Serial Connector

Analog Input Connector Channel 1-8

panel mount connector MS3II2EI6-26S
(socket view, male pins)

cable connector MS3II6J16-26P
(solder view, male pins)



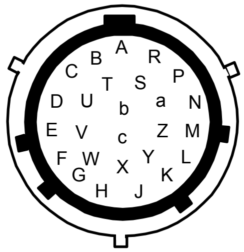
PIN	FUNCTION	PIN	FUNCTION
CH.I	B +IN	CH.5	G +IN
	C -IN		H -IN
	T GUARD		W GUARD
CH.2	A +IN	CH.6	K +IN
	R -IN		J -IN
	S GUARD		Y GUARD
CH.3	b +IN	CH.7	D +IN
	c -IN		E -IN
	U GUARD		V GUARD
CH.4	P +IN	CH.8	M +IN
	N -IN		L -IN
	a GUARD		Z GUARD

F= COMMON X= NO CONNECTION

Analog Input Connector Channel 9-16

panel mount connector MS3II2EI6-26S
(socket view, male pins)

cable connector MS3II6J16-26P
(solder view, male pins)



PIN	FUNCTION	PIN	FUNCTION
CH.9	B +IN	CH.13	G +IN
	C -IN		H -IN
	T GUARD		W GUARD
CH.10	A +IN	CH.14	K +IN
	R -IN		J -IN
	S GUARD		Y GUARD
CH.11	b +IN	CH.15	D +IN
	c -IN		E -IN
	U GUARD		V GUARD
CH.12	P +IN	CH.16	M +IN
	N -IN		L -IN
	a GUARD		Z GUARD

F= COMMON X= NO CONNECTION

Figure 17.10 Analog Input Connector

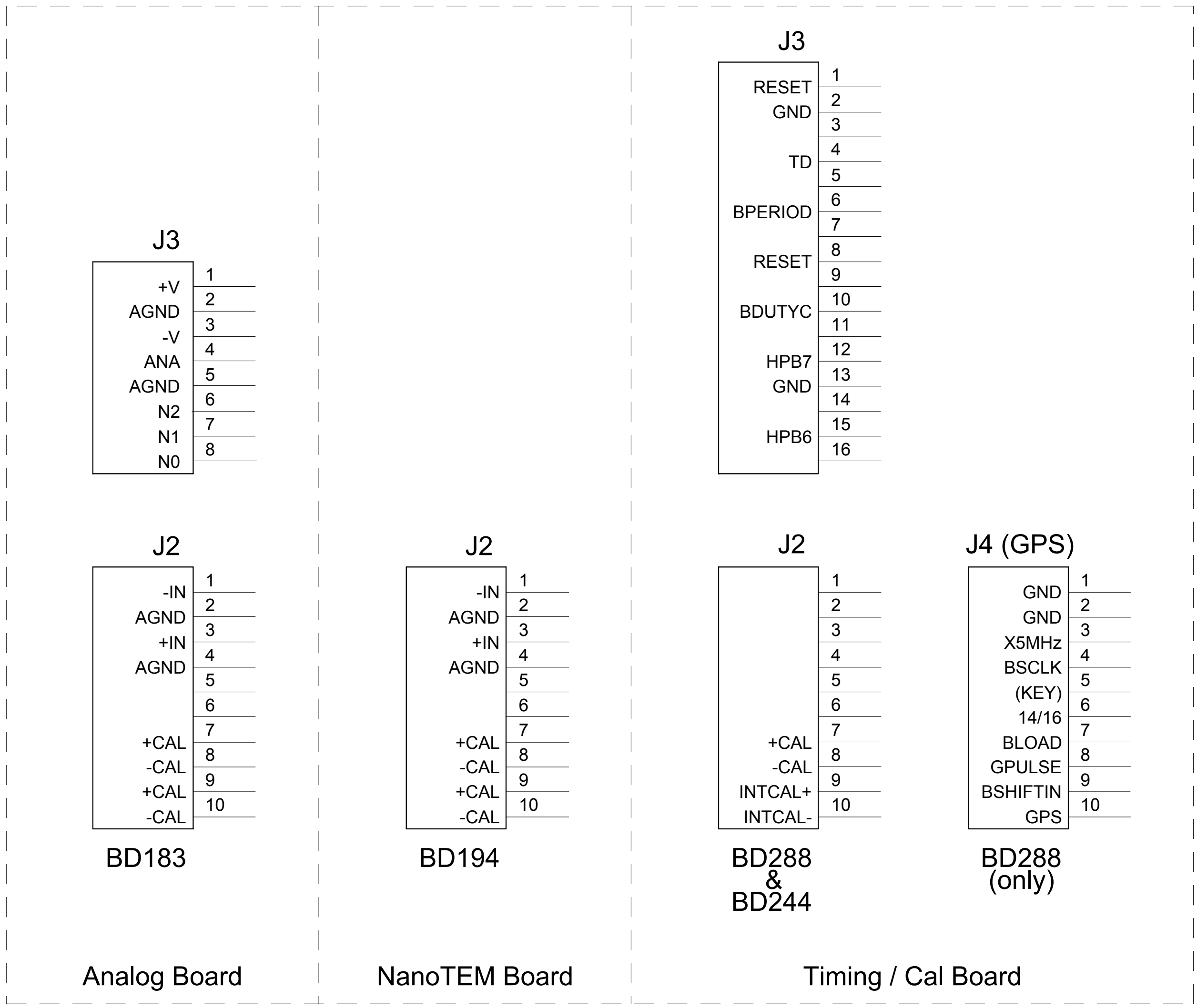


Figure 17.11 I/O Connections

ZONGE BUS MOTHERBOARD CONNECTOR

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

Figure 17.12 Zonge Bus

17.9 ERROR MESSAGES

Not completed at this time.

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