



OZDSP2000
TM S320F2808 Control Board
User's Manual
UM-0007

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1. Introduction

The OZDSP2000 is a highly integrated DSP control solution for power control applications. Typical applications include voltage output inverters, grid-tie inverters, AC induction motor controllers, brushless DC motor controllers, and Active Front-End regulators.

The board is designed around a 100MHz, TI TMS320F2808 Digital Signal Processor. Interface circuitry is supplied for the following peripherals:

- RS232/485/422 Communications Port
- CAN Bus Communications Port
- Incremental Encoder Interface
- Hall Effect Position Sensor Interface
- 4 Relay Drivers
- 2 EEPROMs
- 4 Optoisolated Inputs
- 4 Optoisolated Outputs
- 8 LEM Current Sensor Interfaces
- 2 Semikron Three Phase Power Module Interfaces
- Isolated High Voltage Line Sensing
- Isolated High Voltage Output Sensing
- JTAG Debug Interface

Figure 1 provides a block diagram of the circuitry provided on the OZDSP2000.

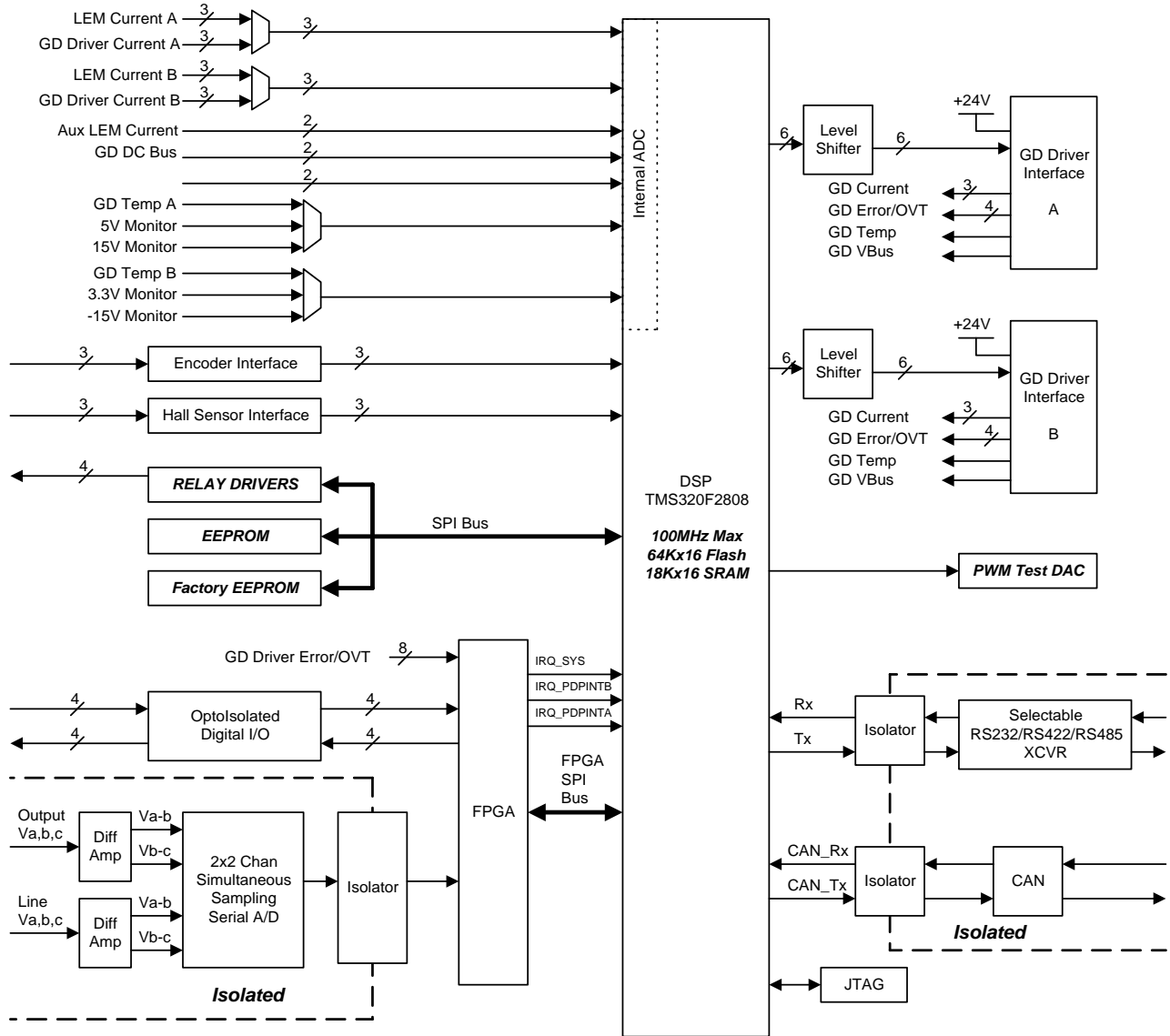


Figure 1 OZDSP2000 Block Diagram

1.1 Referenced Documents

Ref.	Document	Description
[1]	UM-0008	<i>Oztek 280x Software Driver Library API</i>
[2]	SPRS230	<i>TMS320F2808, TMS320F2806, TMS320F2801, UDC9501 Digital Signal Processors</i>
[3]	SLIS088	<i>TPIC44H01 - 4-Channel Serial and Parallel High-Side Pre-FET Driver</i>

1.2 Definitions

AFE	Active Front End
CAN	Controller Area Network
DSP	Digital signal processor
EEPROM	Electrically Erasable Programmable Read Only Memory
EMC	Electro-magnetic compatibility
EMI	Electro-magnetic interference
GND	Ground, low side of input power supply
GTI	Grid Tied Inverter
GUI	Graphical User Interface
HMI	Human Machine Interface
IPM	Intelligent Power Module
N.C.	Not connected
PCB	Printed Circuit Board
PCC	Power Control Center
PI	Proportional and Integral Compensator
PLC	Programmable Logic Controller
PLL	Phase Locked Loop
POR	Power On Reset
PWM	Pulse width modulation
SVM	Space Vector Modulator

1.3 Environmental Specifications

1.3.1 Operating Temperature

The OZDSP2000 is specified for operation within the temperature range of -40°C to +85°C.

1.3.2 Storage Temperature

The OZDSP2000 is specified for unpowered storage within the temperature range of -40°C to +85°C.

2. Hardware Interface

2.1 Mechanical Interface

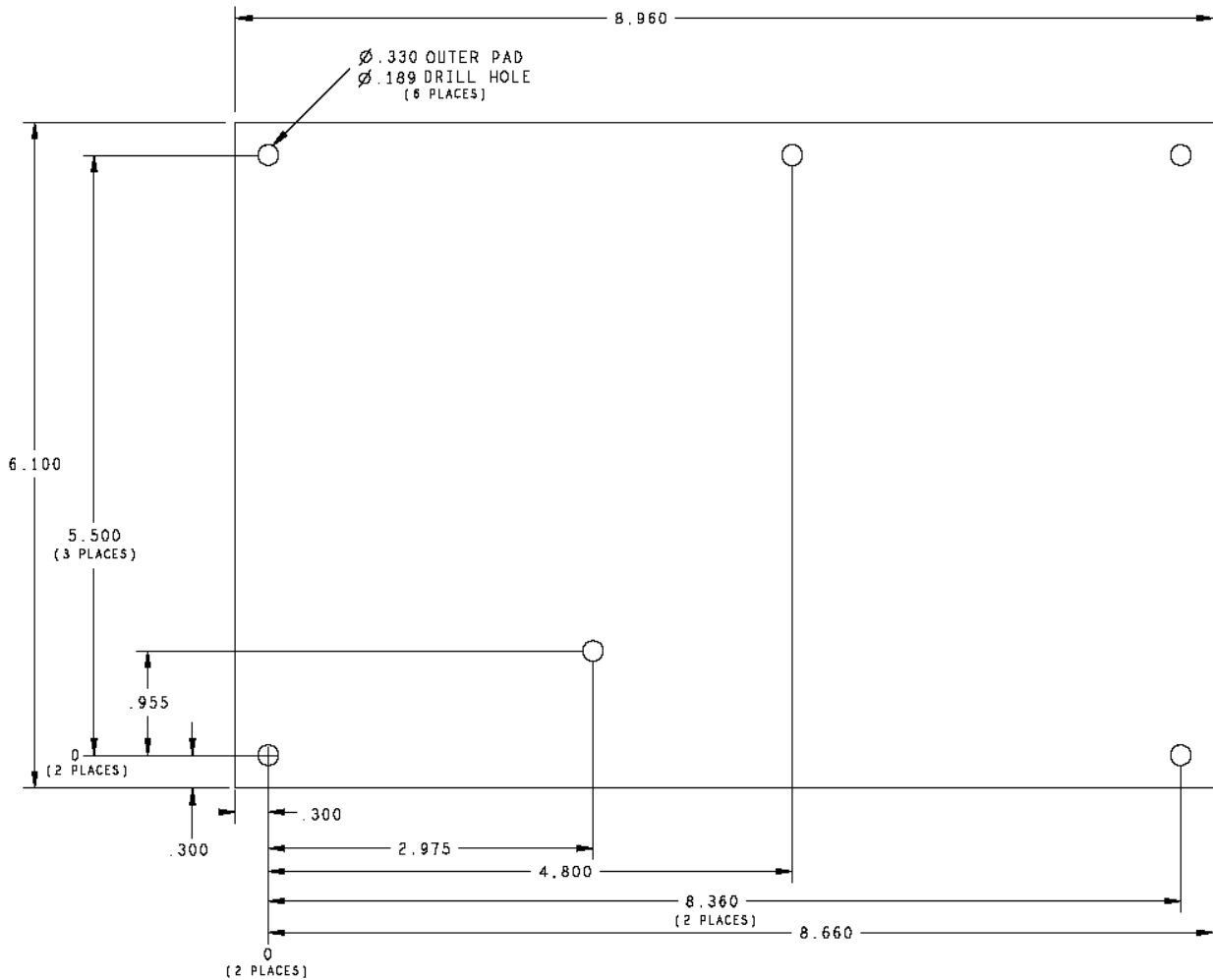


Figure 2 OZDSP2000 Mechanical Dimensions

2.2 Electrical Interfaces

Table 1 provides a description of each connector provided on the OZDSP2000. Table 2 provides a description of the configuration jumpers. The approximate location of the connectors and jumper blocks are illustrated in Figure 3.

Table 1 Connector Descriptions

CONNECTOR	DESCRIPTION
J1	LEM current sensor, Inverter B, Phase U
J2	LEM current sensor, Inverter B, Phase V
J3	LEM current sensor, Inverter B, Phase W
J4	LEM current sensor, Inverter B, Auxiliary
J5	LEM current sensor, Inverter A, Phase U
J6	LEM current sensor, Inverter A, Phase V
J7	LEM current sensor, Inverter A, Phase W
J8	LEM current sensor, Inverter A, Auxiliary
J9	Digital I/O, Auxiliary Analog Inputs
J10	Inverter A Power Module (SKiiP/SKAI)
J11	Inverter B Power Module (SKiiP/SKAI)
J14	DSP JTAG Port
J15	High Voltage Line Sense Inputs
J18	FPGA JTAG Port
J19	FPGA Debug Header
J21	High Voltage Output Sense Inputs
J23	24V Input Power
J24	Relay Driver Outputs
J25	Encoder Interface
J26	Hall Sensor Interface
P1	RS232/RS485/RS422 Interface
P2	CAN Interface

Table 2 Configuration Jumper Descriptions

Jumper	DESCRIPTION
J12	Serial Port Configuration Block
J13	CAN Boot Select
J16	CAN Termination Enable
J17	CAN Termination Enable
J20	Watchdog Disable
J22	EEPROM Write Protect

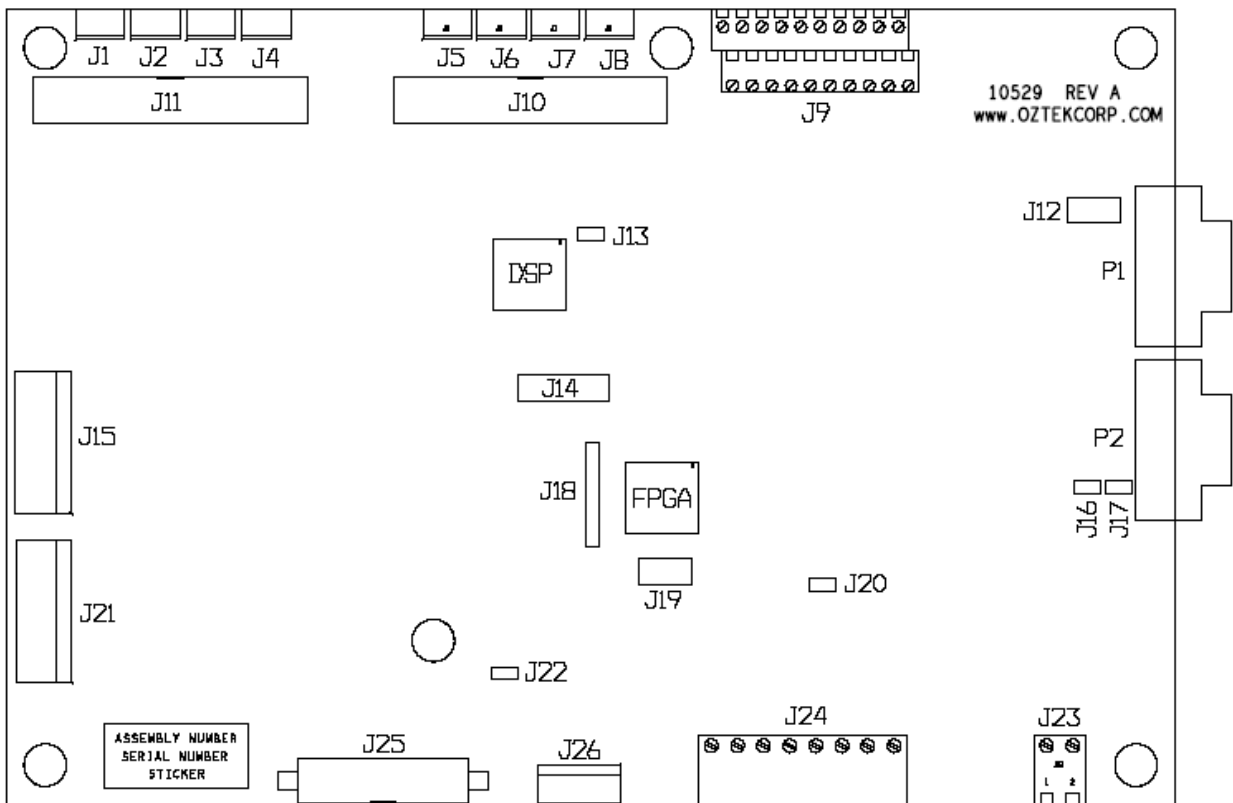


Figure 3 Approximate Connector/Jumper Locations

2.2.1 J1, J2, J3, J4, J5, J6, J7, J8 LEM Current Sensor Interfaces

Connectors J1, J2, J3, J4, J5, J6, J7, and J8 provide interfaces to LEM current sensors. +/-15V power is provided to the sensor. Figure 4 provides the electrical pinout of the connectors.

- **OZDSP2000 Connector Part Number:** (Waldom/Molex) 22-04-1041
- **Mating Connector Part Number:** (Waldom/Molex) 22-01-1042

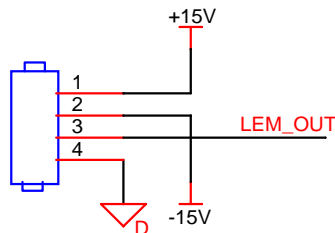


Figure 4 LEM Connector Pinout

2.2.2 J9 Digital I/O, Auxiliary Analog Input Interface

Connector J9 provides an interface for the digital I/O and the two auxiliary Analog inputs. Figure 5 provides the electrical pinout of the connector.

- **OZDSP2000 Connector Part Number:** (Phoenix Contact) 1708110
- **Mating Connector Part Number:** n/a (terminal block style)

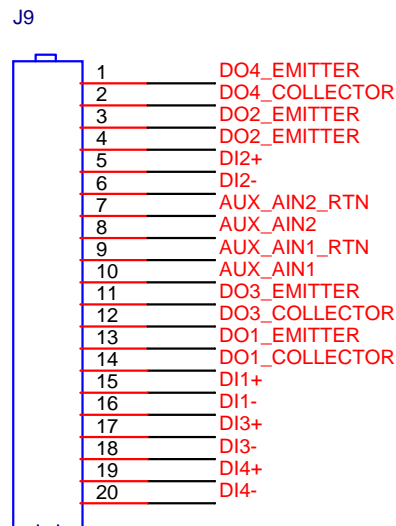


Figure 5 Digital I/O, Auxiliary Analog Input Terminal Block Pinout

2.2.3 J10, J11 SKiiP/SKAI Power Module Interface

Connectors J10 and J11 provide an interface to SKiiP and SKAI style Semikron power modules. This interface complies with Semikron's required specifications. The OZDSP2000 supplies 24V power to the power module via pins 14 and 15. PWM commands (15V logic level) are supplied to the top and bottom switches of each of the three half bridges via signals INV_TOP_U(V,W) and INV_BOT_U(V,W) respectively. Feedback of phase currents, temperature, and DC Link voltage are provided on INV_IOUT_U(V,W), INV_TEMP, INV_UDC signals respectively. Error signals from the module are similarly provided via INV_ERR_U(V,W) and INV_OVT. Please refer to the Semikron datasheet for the particular module being used for more information. Figure 6 provides the electrical pinout of the connectors.

- **OZDSP2000 Connector Part Number:** (AMP) 499922-6
- **Mating Connector Part Number:** (AMP) 1658621-6
- **Power:** 24V @ 1.5A

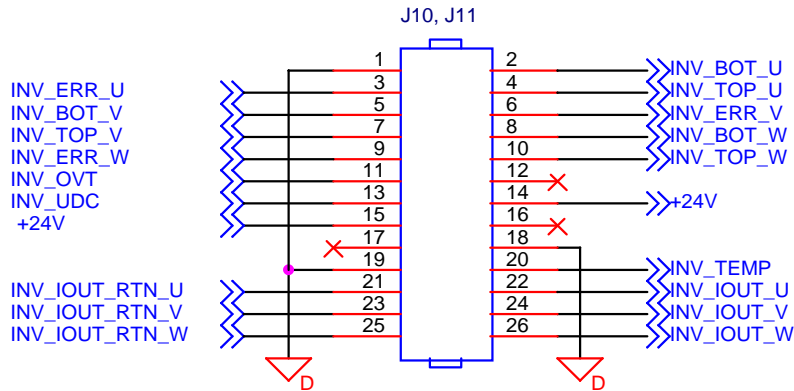


Figure 6 J10, J11 Pinout

Note that when interfacing with SKiiP modules the ribbon cable is a standard, 1:1, 26 pin cable pinout. However, SKAI modules use a 25 pin DB style connector. The pin to pin correspondence is provided in Table 3.

Table 3 J10/J11 Ribbon Cable to DB25 Pin Correspondence

SIGNAL NAME	Ribbon Cable Pin #	DB25 Pin #
GND	1	n/c
INV_BOT_U	2	1
INV_ERR_U	3	14
INV_TOP_U	4	2
INV_BOT_V	5	15
INV_ERR_V	6	3
INV_TOP_V	7	16
INV_BOT_W	8	4
INV_ERR_W	9	17
INV_TOP_W	10	5
INV_OVT	11	18
GND	12	6
INV_UDC	13	19
24V	14	7
24V	15	20
NC	16	8
NC	17	21
GND	18	9
GND	19	22
INV_TEMP	20	10
INV_IOUT_RTN_U	21	23
INV_IOUT_U	22	11
INV_IOUT_RTN_V	23	24
INV_IOUT_V	24	12

SIGNAL NAME	Ribbon Cable Pin #	DB25 Pin #
INV_IOUT_RTN_W	25	25
INV_IOUT_W	26	13

2.2.4 J23 24V Power Interface

Terminal block J23 is the 24V power input for the board.

- **OZDSP2000 Connector Part Number:** (Phoenix Contact) 1733570
- **Mating Connector Part Number:** n/a (terminal block style)
- **Voltage:** 24V nominal, 18V min, 28V max
- **Current:** 4A maximum (Inrush current while powering two SKiiP/SKAI modules)

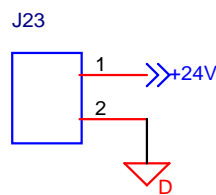


Figure 7 24V Power Input Pinout

2.2.5 J24 Relay Driver Interface

Connector J24 provides an interface to the four relay drivers. Figure 8 illustrates the electrical pinout of the connector.

- **OZDSP2000 Connector Part Number:** (Phoenix Contact) SMKDSP 1.5/8-5.08
- **Mating Connector Part Number:** n/a (terminal block style)

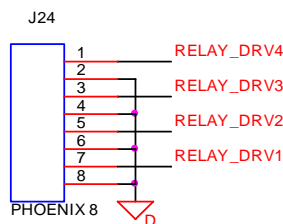


Figure 8 Relay Driver Pinout

Please note that when using the relay driver with one or more unused drivers one of the following schemes must be used to deal with the open-load fault detection:

1. Since the open-load faults are only reported once per state, initialize all relays to 'off' twice: once to set them to 'off' and obtain the faults, and the second time to clear the faults. Then open-load faults will only be reported when the state is changed of a specific relay driver, so as long as the unused relays drivers are left 'off', no new faults will be reported.

2. Since the open-load faults are only reported in a low state, initialize the unused drivers to 'on', and subsequently leave them on. Please note that the unused driver pins will be at a 24V state.
3. Terminate the unused relay drivers with a 5k Ω – 20k Ω 1/8 watt resistor.

2.2.6 J25 Incremental Encoder Interface

Connector J25 provides an interface to an incremental, quadrature encoder. The interface provides for the A and B quadrature signals as well as an index input. 5V power and ground are also provided on the connector to power the encoder. Figure 9 illustrates the electrical pinout of the connector.

- **OZDSP2000 Connector Part Number:** (AMP) 499922-1
- **Mating Connector Part Number:** (AMP) 1658621-1
- **Power:** 5V, 100mA
- **Differential termination:** 100Ohms
- **Electrical Interface:** AM26LV32

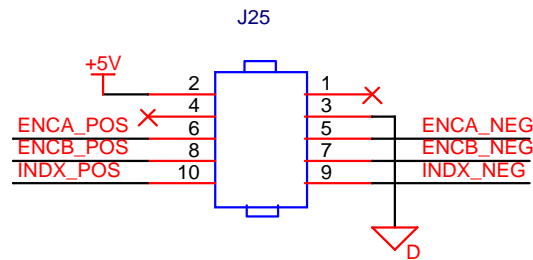


Figure 9 J25 Pinout

2.2.7 J26 Hall Effect Sensor Interface

Connector J26 provides an interface for three Hall Effect position sensors. Both 5V and 15V power options are available to power the sensors. Figure 10 provides the electrical pinout of the connector.

- **OZDSP2000 Connector Part Number:** (Waldom/Molex) 22-23-2061
- **Mating Connector Part Number:** (Waldom/Molex) 22-01-3067
- **Power:** 5V @100mA, 15V @100mA
- **Electrical Interface (HALL1,2,3):** 4.75K Ohm Pull-up to 15V

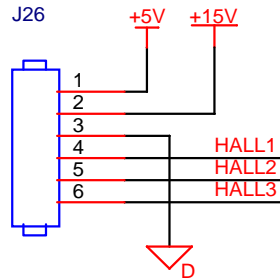


Figure 10 J26 Pinout

2.2.8 P1 Isolated Serial Interface

Connector P1 provides an isolated, configurable, serial communications interface. Depending on the population variant of the OZDSP2000, this port may be configured one of two ways, RS232 mode, or RS422/485 mode. When in RS422/485 mode, jumper block J12 is used to configure the port. In RS232 mode J12 is not needed and all jumpers should be removed.

- **OZDSP2000 Connector Part Number:** (AMP) 747844-5
- **Mating Connector Part Number:** Industry Standard DB9 Male

2.2.8.1 RS232 Configuration

When supplied in the RS232 configuration, the RS232 transceiver device, U32 will be populated while the RS422/485 transceiver device, U28, will be unpopulated. In RS232 mode all jumpers should be removed from jumper block J12. Figure 11 illustrates the pinout of the connector in the RS232 configuration.

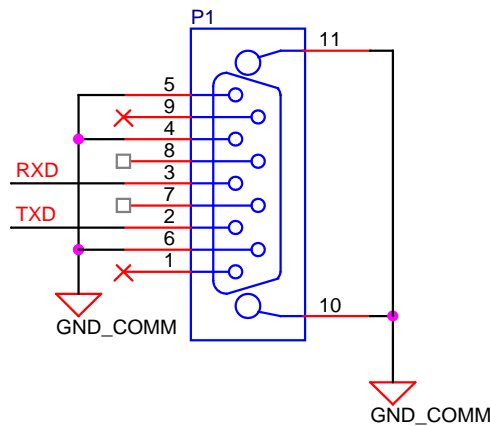


Figure 11 P1 Pinout - RS232 Configuration

2.2.8.2 RS422/485 Configuration

When supplied in the RS422/485 configuration, the RS422/485 transceiver device, U28 will be populated while the RS232 transceiver device, U32, will be unpopulated. In RS422/485 mode jumper block J12 is used to select between the two protocols and configure termination if

desired as detailed in Table 4. Figure 12 illustrates the pinout of the connector in the RS422/485 configuration.

Table 4 J12 RS422/485 Configuration Jumper Settings

JUMPER PINS	PURPOSE
1-2	Install for RS422 Tx Termination or RS485 Termination
3-4	Install for RS422 Rx Termination
5-6	Install to select RS485 mode, uninstall for RS422 mode

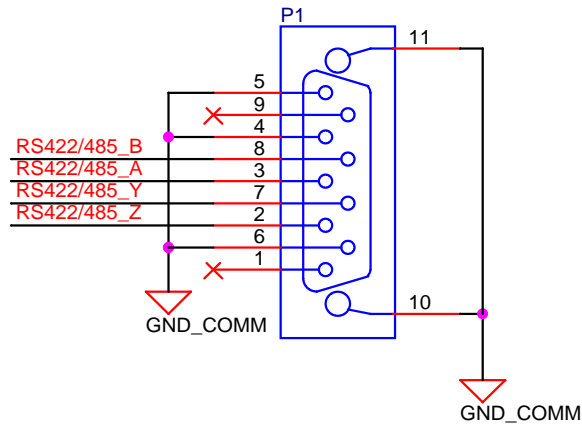


Figure 12 Pinout - RS422/485 Configuration

2.2.9 P2 Isolated CAN Bus Interface

Connector P2 provides an isolated CAN Bus communications interface. The interface is a shielded, female, DB9 style connector. Figure 13 provides the electrical pinout of the connector.

- **OZDSP2000 Connector Part Number:** (AMP) 747844-5
- **Mating Connector Part Number:** Industry Standard DB9 Male

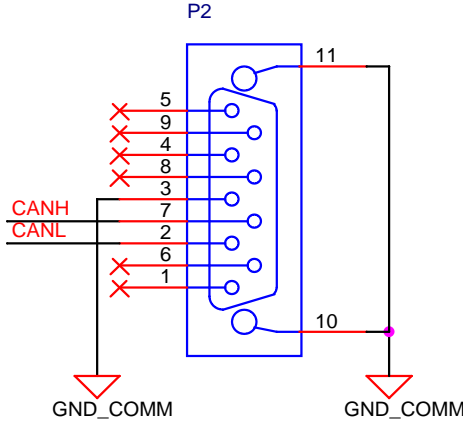


Figure 13 P2 CAN Bus Pinout

2.2.9.1 J16, J17 CAN Termination Jumpers

Jumper blocks J16 and J17 provide a means to terminate the CAN bus lines CAN high (CANH) and CAN low (CANL). Note that termination should only be placed at the end terminals of the CAN communication network, reference **Error! Reference source not found.**

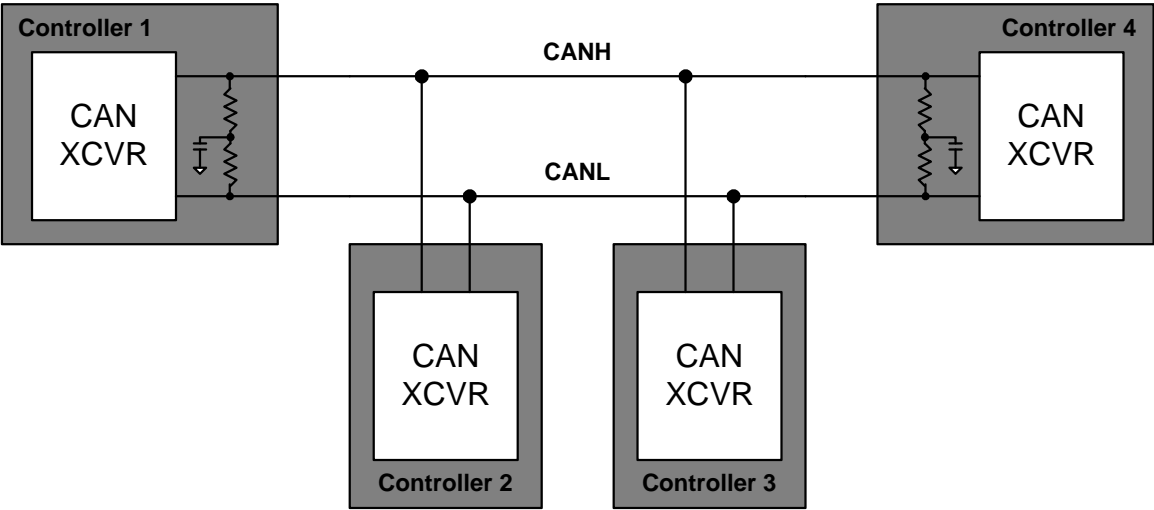


Figure 14 Multi-Node CAN Network Configuration

Standard 0.1" jumpers should be installed on both J16 and J17 to enable the termination. With no jumpers installed, the lines remain unterminated. Reference **Error! Reference source not found.** for the interface circuit.

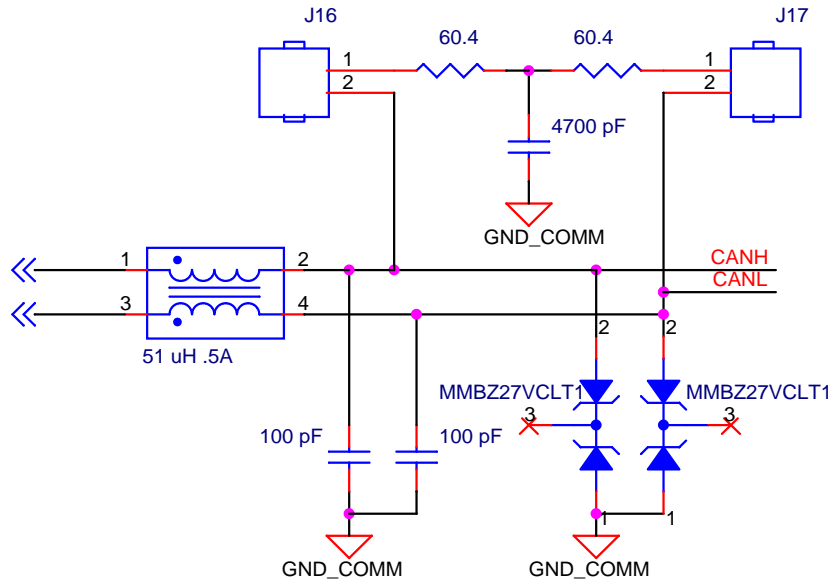


Figure 15 CAN Interface Circuit

3. DSP Interface

3.1 Analog to Digital Converter Interface

The TMS320F2808 provides for 16 channels of A/D conversion. In order to increase the number of A/D inputs, the OZDSP2000 uses multiplexers to switch between different inputs on select A/D channels. More specifically, multiplexers are provided on the three phase currents from each inverter interface to allow the user to select between the Semikron supplied current sense signals and external LEM current transducers. Multiplexers are also provided on the temperature sensing inputs to allow access to the local bias supply voltages for system self-health monitoring, if so desired. Figure 16 illustrates this multiplexing scheme. Note that these MUX control lines are sourced by the FPGA device. Please reference the Software Driver Library Manual for more information on how to control these multiplexers, e.g. API function **oz280xFpgaSelCurrSensor()**. Table 5 provides detailed information on the A/D Channel signal assignments and scaling.

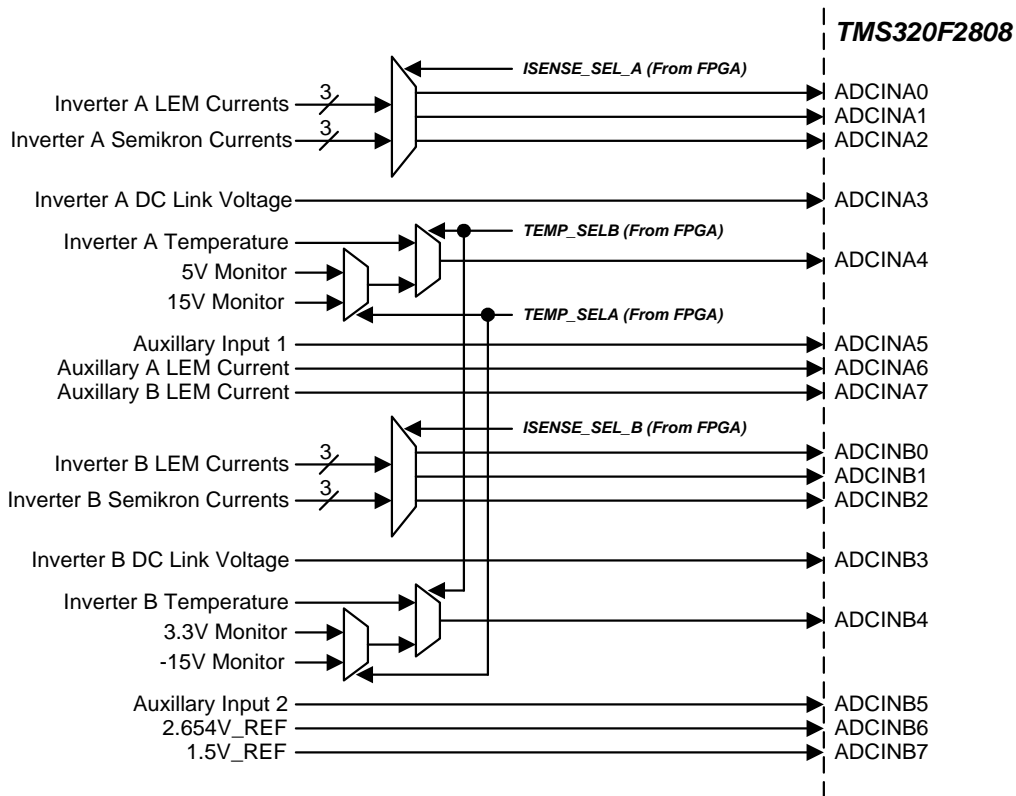


Figure 16 A/D Multiplexed Interface Block Diagram

Table 5 DSP A/D Channel Assignment and Scaling

DSP			MUX'D	SOURCE	SCALING	OFFSET
Pin Name	Pin #	Signal Name				
ADCINA0	23	ISENSE_AU_AD	Y	IA_MUX	n/a	n/a
ADCINA1	22	ISENSE_AV_AD	Y	IA_MUX	n/a	n/a
ADCINA2	21	ISENSE_AW_AD	Y	IA_MUX	n/a	n/a
ADCINA3	20	INVA_UDC_AD	N	J10 pin 13	3.37V/V	0V
ADCINA4	19	INVA_TEMP_AD	Y	TA_MUX	n/a	n/a
ADCINA5	18	AUX_AIN1_AD	N	J9 pin 10	3.315V/V	0V
ADCINA6	17	ISENSE_LEMA_AD	N	J8 pin 3	-2.68V/V	1.5V
ADCINA7	16	ISENSE_LEMB_AD	N	J4 pin3	-2.68V/V	1.5V
ADCINB0	27	ISENSE_BU_AD	Y	IB_MUX	n/a	n/a
ADCINB1	28	ISENSE_BV_AD	Y	IB_MUX	n/a	n/a
ADCINB2	29	ISENSE_BW_AD	Y	IB_MUX	n/a	n/a
ADCINB3	30	INVB_UDC_AD	N	J11 pin13	3.37V/V	0V
ADCINB4	31	INVB_TEMP_AD	Y	TB_MUX	n/a	n/a
ADCINB5	32	AUX_AIN2_AD	N	J9 pin 8	3.315V/V	0V
ADCINB6	33	2.654V_REF	N	Internal Vref	1V/V	0V
ADCINB7	34	1.5V_REF	N	Internal Vref	1V/V	0V

3.1.1 Current Sensor Multiplexers

The OZDSP2000 allows the user to select between the Semikron supplied current sensors and external LEM style current sensors. In some instances, in particular when using SKAI power modules, the accuracy of the Semikron current sensors may not meet the system requirements. In these cases the user can use the LEM interfaces provided on the OZDSP2000 in conjunction with this multiplexer to select the correct A/D inputs. Table 6 and Table 7 provide the detailed information for the Inverter A and Inverter B multiplexers.

Table 6 IA_MUX Control/Signal Decode & Scaling

DSP A/D Input Signal	MUX Control Bit Polarity	Selected MUX Input Signal	SOURCE	SCALING	OFFSET
ISENSE_AU_AD	0	ISENSE_SK_AU	J10 pin 22	-6.67V/V	1.5V
	1	ISENSE_LEM_AU	J5 pin 3	-2.68V/V	1.5V
ISENSE_AV_AD	0	ISENSE_SK_AV	J10 pin 24	-6.67V/V	1.5V
	1	ISENSE_LEM_AV	J6 pin 3	-2.68V/V	1.5V
ISENSE_AW_AD	0	ISENSE_SK_AW	J10 pin 26	-6.67V/V	1.5V
	1	ISENSE_LEM_AW	J7 pin 3	-2.68V/V	1.5V

Table 7 IB_MUX Control/Signal Decode & Scaling

DSP A/D Input Signal	MUX Control Bit Polarity	Selected MUX Input Signal	SOURCE	SCALING	OFFSET
ISENSE_BU_AD	0	ISENSE_SK_BU	J11 pin 22	-6.67V/V	1.5V
	1	ISENSE_LEM_BU	J1 pin 3	-2.68V/V	1.5V
ISENSE_BV_AD	0	ISENSE_SK_BV	J11 pin 24	-6.67V/V	1.5V
	1	ISENSE_LEM_BV	J2 pin 3	-2.68V/V	1.5V
ISENSE_BW_AD	0	ISENSE_SK_BW	J11 pin 26	-6.67V/V	1.5V
	1	ISENSE_LEM_BW	J3 pin 3	-2.68V/V	1.5V

3.1.2 Temperature Multiplexers

The OZDSP2000 allows the user to monitor several of the on-board power supplies to perform self-health functions. Four supply voltages are monitored, 5V, 3.3V, +15V, and -15V. Two of these monitor voltages are multiplexed with each power module temperature signal. Since temperature, by nature, cannot change very fast, user application code could periodically switch to supply monitors for self-health checks. Table 8 and Table 9 provide the detailed information for the Inverter A and Inverter B multiplexers.

Table 8 TA_MUX Control/Signal Decode & Scaling

TEMP_SELB Control Bit Polarity	Selected MUX Input Signal	TEMP_SELA Control Bit Polarity	Selected MUX Input Signal	SOURCE	SCALING	OFFSET
0	INVA_TEMP	n/a	n/a	J10 pin 20	3.315V/V	0V
1	V_MONA	0	5V	Internal	2.074V/V	0V
		1	+15V	Internal	7.666V/V	0V

Table 9 TB_MUX Control/Signal Decode & Scaling

TEMP_SELB Control Bit Polarity	Selected MUX Input Signal	TEMP_SELA Control Bit Polarity	Selected MUX Input Signal	SOURCE	SCALING	OFFSET
0	INVB_TEMP	n/a	n/a	J10 pin 20	3.315V/V	0V
1	V_MONB	0	3.3V	Internal	1.374V/V	0V
		1	-15V	Internal	7.490V/V	2.86V

Warranty and Product Information

Limited Warranty

What does this warranty cover and how long does it last? This Limited Warranty is provided by Oztek Corp. ("Oztek") and covers defects in workmanship and materials in your OZDSP3000 controller. This Warranty Period lasts for 18 months from the date of purchase at the point of sale to you, the original end user customer, unless otherwise agreed in writing. You will be required to demonstrate proof of purchase to make warranty claims. This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period. Subsequent owners also require original proof of purchase as described in "What proof of purchase is required?"

What will Oztek do? During the Warranty Period Oztek will, at its option, repair the product (if economically feasible) or replace the defective product free of charge, provided that you notify Oztek of the product defect within the Warranty Period, and provided that through inspection Oztek establishes the existence of such a defect and that it is covered by this Limited Warranty.

Oztek will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Oztek reserves the right to use parts or products of original or improved design in the repair or replacement. If Oztek repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Oztek.

Oztek covers both parts and labor necessary to repair the product, and return shipment to the customer via an Oztek-selected non-expedited surface freight within the contiguous United States and Canada. Alaska, Hawaii and locations outside of the United States and Canada are excluded. Contact Oztek Customer Service for details on freight policy for return shipments from excluded areas.

How do you get service? If your product requires troubleshooting or warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Oztek directly at:

USA
Telephone: 603-546-0090
Fax: 603-386-6366
Email techsupport@oztekcorp.com

Direct returns may be performed according to the Oztek Return Material Authorization Policy described in your product manual.

What proof of purchase is required? In any warranty claim, dated proof of purchase must accompany the product and the product must not have been disassembled or modified without prior written authorization by Oztek. Proof of purchase may be in any one of the following forms:

- The dated purchase receipt from the original purchase of the product at point of sale to the end user
- The dated dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status
- The dated invoice or purchase receipt showing the product exchanged under warranty

What does this warranty not cover? Claims are limited to repair and replacement, or if in Oztek's discretion that is not possible, reimbursement up to the purchase price paid for the product. Oztek will be liable to you only for direct damages suffered by you and only up to a maximum amount equal to the purchase price of the product. This Limited Warranty does not warrant uninterrupted or error-free operation of the product or cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. This warranty does not apply to and Oztek will not be responsible for any defect in or damage to:

- a) The product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment
- b) The product if it has been subjected to fire, water, generalized corrosion, biological infestations, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the Oztek product specifications including high input voltage from generators and lightning strikes
- c) The product if repairs have been done to it other than by Oztek or its authorized service centers (hereafter "ASCs")
- d) The product if it is used as a component part of a product expressly warranted by another manufacturer
- e) The product if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed
- f) The product if it is located outside of the country where it was purchased
- g) Any consequential losses that are attributable to the product losing power whether by product malfunction, installation error or misuse.

Disclaimer

Product

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY OZTEK IN CONNECTION WITH YOUR OZTEK PRODUCT AND IS, WHERE PERMITTED BY LAW, IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, GUARANTEES, REPRESENTATIONS, OBLIGATIONS AND LIABILITIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONNECTION WITH THE PRODUCT, HOWEVER ARISING (WHETHER BY CONTRACT, TORT, NEGLIGENCE, PRINCIPLES OF MANUFACTURER'S LIABILITY, OPERATION OF LAW, CONDUCT, STATEMENT OR OTHERWISE), INCLUDING WITHOUT RESTRICTION ANY IMPLIED WARRANTY OR CONDITION OF QUALITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE TO THE EXTENT REQUIRED UNDER APPLICABLE LAW TO APPLY TO THE PRODUCT SHALL BE LIMITED IN DURATION TO THE PERIOD STIPULATED UNDER THIS LIMITED WARRANTY. IN NO EVENT WILL OZTEK BE LIABLE FOR: (a) ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, LOST REVENUES, FAILURE TO REALIZE EXPECTED SAVINGS, OR OTHER COMMERCIAL OR ECONOMIC LOSSES OF ANY KIND, EVEN IF OZTEK HAS BEEN ADVISED, OR HAD REASON TO KNOW, OF THE POSSIBILITY OF SUCH DAMAGE, (b) ANY LIABILITY ARISING IN TORT, WHETHER OR NOT ARISING OUT OF OZTEK'S NEGLIGENCE, AND ALL LOSSES OR DAMAGES TO ANY PROPERTY OR FOR ANY PERSONAL INJURY OR ECONOMIC LOSS OR DAMAGE CAUSED BY THE CONNECTION OF A PRODUCT TO ANY OTHER DEVICE OR SYSTEM, AND (c) ANY DAMAGE OR INJURY ARISING FROM OR AS A RESULT OF MISUSE OR ABUSE, OR THE INCORRECT INSTALLATION, INTEGRATION OR OPERATION OF THE PRODUCT. IF YOU ARE A CONSUMER (RATHER THAN A PURCHASER OF THE PRODUCT IN THE COURSE OF A BUSINESS) AND PURCHASED THE PRODUCT IN A MEMBER STATE OF THE EUROPEAN UNION, THIS LIMITED WARRANTY SHALL BE SUBJECT TO YOUR STATUTORY RIGHTS AS A CONSUMER UNDER THE EUROPEAN UNION PRODUCT WARRANTY DIRECTIVE 1999/44/EC AND AS SUCH DIRECTIVE HAS BEEN IMPLEMENTED IN THE EUROPEAN UNION MEMBER STATE WHERE YOU PURCHASED THE PRODUCT. FURTHER, WHILE THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY HAVE OTHER RIGHTS WHICH MAY VARY FROM EU MEMBER STATE TO EU MEMBER STATE OR, IF YOU DID NOT PURCHASE THE PRODUCT IN AN EU MEMBER STATE, IN THE COUNTRY YOU PURCHASED THE PRODUCT WHICH MAY VARY FROM COUNTRY TO COUNTRY AND JURISDICTION TO JURISDICTION.

Return Material Authorization Policy

Before returning a product directly to Oztek you must obtain a Return Material Authorization (RMA) number and the correct factory "Ship To" address. Products must also be shipped prepaid. Product shipments will be refused and returned at your expense if they are unauthorized, returned without an RMA number clearly marked on the outside of the shipping box, if they are shipped collect, or if they are shipped to the wrong location.

When you contact Oztek to obtain service, please have your instruction manual ready for reference and be prepared to supply:

- The serial number of your product
- Information about the installation and use of the unit
- Information about the failure and/or reason for the return
- A copy of your dated proof of purchase

Return Procedure

Package the unit safely, preferably using the original box and packing materials. Please ensure that your product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging. Include the following:

- The RMA number supplied by Oztek clearly marked on the outside of the box.
- A return address where the unit can be shipped. Post office boxes are not acceptable.
- A contact telephone number where you can be reached during work hours.
- A brief description of the problem.

Ship the unit prepaid to the address provided by your Oztek customer service representative.

If you are returning a product from outside of the USA or Canada - In addition to the above, you **MUST** include return freight funds and you are fully responsible for all documents, duties, tariffs, and deposits.

Out of Warranty Service

If the warranty period for your product has expired, if the unit was damaged by misuse or incorrect installation, if other conditions of the warranty have not been met, or if no dated proof of purchase is available, your unit may be serviced or replaced for a flat fee. If a unit cannot be serviced due to damage beyond salvation or because the repair is not economically feasible, a labor fee may still be incurred for the time spent making this determination.

To return your product for out of warranty service, contact Oztek Customer Service for a Return Material Authorization (RMA) number and follow the other steps outlined in "Return Procedure".

Payment options such as credit card or money order will be explained by the Customer Service Representative. In cases where the minimum flat fee does not apply, as with incomplete units or units with excessive damage, an additional fee will be charged. If applicable, you will be contacted by Customer Service once your unit has been received.