



OzCan AFE Device Profile

Functional Specification

FS-0047

About Oztek

Oztek Corp. is proven innovator of power, control, and instrumentation solutions for the most demanding industrial applications. Oztek products include variable motor drives, grid tie inverters, frequency converters, stand alone inverters, DC/DC converters, and DSP based control boards for power control applications.

Trademarks

OzCAN, OZDSP1000, OZDSP1100, OZDSP2000, and OZDSP3000 are trademarks of Oztek Corp. Other trademarks, registered trademarks, and product names are the property of their respective owners and are used herein for identification purposes only.

Notice of Copyright

Oztek OzCan AFE Device Profile © August 2009 Oztek Corp. All rights reserved.

Exclusion for Documentation

UNLESS SPECIFICALLY AGREED TO IN WRITING, Oztek Corp. ("Oztek")

- (A) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.

- (B) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSSES, DAMAGES, COSTS OR EXPENSES, WHETHER SPECIAL, DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK.

- (C) IF THIS MANUAL IS IN ANY LANGUAGE OTHER THAN ENGLISH, ALTHOUGH STEPS HAVE BEEN TAKEN TO MAINTAIN THE ACCURACY OF THE TRANSLATION, THE ACCURACY CANNOT BE GUARANTEED. APPROVED OZTEK CONTENT IS CONTAINED WITH THE ENGLISH LANGUAGE VERSION WHICH IS POSTED AT WWW.OZTEKCORP.COM.

Date and Revision

April 2015 Rev J

Part Number

FS-0047

Contact Information

USA

Telephone: 603-546-0090

Fax: 603-386-6366

Email techsupport@oztekc corp.com

Table of Contents

1. Introduction	2
1.1 Referenced Documents	2
1.2 Definitions	2
2. CAN Message ID.....	2
2.1 Message Priority	2
2.2 Group ID	3
3. CAN Message Summary	3
3.1 Command Messages.....	4
3.1.1 ON/OFF Control.....	4
3.1.2 MODE Control	4
3.1.3 DC Voltage Setpoint	5
3.1.4 Current Setpoint.....	5
3.1.5 Power Factor Setpoint.....	6
3.1.6 Fault Reset.....	7
3.1.7 Configuration Reset.....	7
3.1.8 Configuration Reload	7
3.1.9 AC Voltage Setpoint	8
3.1.10 Start Pre-Charge.....	8
3.2 Parameter Access Messages	8
3.2.1 Parameter Read.....	8
3.2.2 Parameter Write	9
3.2.3 Parameter Read Response	9
3.2.4 Parameter Write Response	10
3.3 Status Messages	10
3.3.1 DC Link Status.....	10
3.3.2 Grid Voltage Status.....	11
3.3.3 Grid Current Status.....	11
3.3.4 Grid Status.....	11
3.3.5 System Status	12
3.3.6 Alarm Status	13
3.3.7 Alarm Status 2	15
3.3.8 Illegal CAN Message	15
3.3.9 Inverter A Current Status	16
3.3.10 Inverter B Current Status	16
Warranty and Product Information.....	17
Return Material Authorization Policy.....	19

1. Introduction

This document is intended to provide a detailed functional description of the OzCan Active Front End (AFE) device profile. It is meant to convey the details of all messages supported by the Oztek AFE device class. General OzCan protocol information can be found in Reference 1.

1.1 Referenced Documents

Ref.	Document	Description
[1]	FS-0046	OzCan CAN Communication Protocol.pdf
[2]	http://en.wikipedia.org/wiki/Controller-area_network	

1.2 Definitions

AFE	Active Front End
CAN	Controller Area Network
DSP	Digital signal processor
EEPROM	Electrically Erasable Programmable Read Only Memory
GTI	Grid Tied Inverter
GUI	Graphical User Interface
HMI	Human Machine Interface
IPM	Intelligent Power Module
PCB	Printed Circuit Board
PCC	Power Control Center
PLL	Phase Locked Loop
POR	Power On Reset
PWM	Pulse width modulation
SVM	Space Vector Modulator

2. CAN Message ID

This section describes specific limitations and/or features of the OzCAN protocol ID, supported by the AFE device class.

2.1 Message Priority

At the present time, this device does not utilize the Message Priority bit for receive messages (i.e. it will accept either High or Normal priority messages). All sent messages will be marked as Normal priority.

2.2 Group ID

By default the AFE Group ID is set to a value of 2. If needed, this can be changed by modifying the appropriate configuration variable.

3. CAN Message Summary

The table below gives a summary of the available CAN messages and their respective IDs for this device class. Note that the Default CAN Identifier column shows the complete 29-bit message header for each message type assuming the default AFE Group ID of “2” and Module ID of “1”, and a default Host Group ID of “1” and Module ID of “1”, AFE devices will accept messages from any source, meaning only the Destination Group and Module are required to match.

Table 1 – Summary of AFE CAN Messages

Message Name	Message Type	Message ID	Default CAN Identifier
On/Off Control	0 - Command	0	0x12081080
Mode Control	0 - Command	1	0x12081081
DC Voltage Setpoint	0 - Command	2	0x12081082
AC Current Setpoint	0 - Command	3	0x12081083
Power Factor Setpoint	0 - Command	4	0x12081084
Fault Reset	0 - Command	5	0x12081085
Configuration Reset	0 - Command	6	0x12081086
Configuration Reload	0 - Command	7	0x12081087
AC Voltage Setpoint	0 - Command	8	0x12081088
Start Pre-Charge	0 - Command	9	0x12081089
Parameter Read	1 - Parameter	0	0x12091080
Parameter Write	1 - Parameter	1	0x12091081
Parameter Read Response	1 - Parameter	2	0x11092082
Parameter Write Response	1 - Parameter	3	0x11092083
DC Link	2 - Status	0	0x110A2080
Grid Voltage Status	2 - Status	1	0x110A2081
Grid Current Status	2 - Status	2	0x110A2082
Grid Status	2 - Status	3	0x110A2083
System Status	2 - Status	4	0x110A2084
Alarm Status	2 - Status	5	0x110A2085
Illegal CAN Message	2 - Status	6	0x110A2086
Inverter A Current Status	2 - Status	7	0x110A2087

Message Name	Message Type	Message ID	Default CAN Identifier
Inverter B Current Status	2 - Status	8	0x110A2088
Alarm Status 2	2 - Status	9	0x110A2089

3.1 Command Messages

3.1.1 ON/OFF Control

This Command message is sent to the AFE to turn the converter ON or OFF. This message contains a one-byte payload of the following format:

Byte 0
ON/OFF [7:0]

- **ON/OFF [7:0]:** This field is used to turn the AFE ON or OFF as follows:
 - **0** – OFF: This turns the AFE OFF.
 - **1** – ON: This turns the AFE ON.
 - **2 to 255** – Not Supported

Values outside of the legal range will be ignored and an “Illegal CAN Message” response will be sent back to the host controller.

3.1.2 MODE Control

This Command message is sent to the AFE to indicate the desired operating mode. The default mode following a power-on reset is specified in the configuration memory. The mode may not be changed while the AFE is ON. If the user attempts to change the mode while the AFE is ON, the message will be ignored and the “Illegal CAN Message” response will be sent. This message contains a one-byte payload of the following format:

Byte 0
MODE [7:0]

- **MODE [7:0]:** This field is used to select the operating mode as follows:
 - **0** – DC Voltage Control: In this mode the DC Link voltage is regulated.
 - **1** – Current Control: In this mode the grid current is regulated.
 - **2** – Standalone AC Voltage Control: In this mode the AC output voltage is regulated.

- **3 to 255** – Not Supported

Values outside of the legal range will be ignored and an “Illegal CAN Message” response will be sent back to the host controller.

3.1.3 DC Voltage Setpoint

This Command message is sent to the AFE to indicate the desired DC output voltage set point when the AFE is operated in DC voltage control mode. The default voltage following a power-on reset is specified in the configuration memory. The value sent in this command does not change the default voltage stored in the configuration memory, rather it merely provides a dynamic and temporary override from the default value. This message contains a two-byte payload of the following format:

Byte 0	Byte 1
V_OUT [7:0]	V_OUT [15:8]

- **V_OUT [15:0]:** This field specifies the DC output voltage set point when operating in DC voltage control mode. This field is specified in units of 0.1 V. For example, 800 V would be entered as 8000 (decimal), or 0x1F40 (hexadecimal).

Legal ranges for this variable depend on the hardware implementation and are documented in the product User’s Manual. Values outside of the legal range will be ignored and an “Illegal CAN Message” response will be sent back to the host controller.

3.1.4 Current Setpoint

This Command message is sent to the AFE to indicate the desired grid current set point when the AFE is operated in current control mode. The default current following a power-on reset is specified in the configuration memory. The value sent in this command does not change the default current stored in the configuration memory, rather it merely provides a dynamic and temporary override from the default value.

Note that the use of the I_OUT_REACTIVE setpoint is optional and is determined by the “Use Power Factor” configuration variable. When using the power factor setpoint, the I_OUT_REACTIVE setpoint in this command is ignored, and instead, the firmware calculates the desired reactive current based on the I_OUT_REAL setpoint and the Power Factor Setpoint.

This message contains a four-byte payload of the following format:

Byte 0	Byte 1	Byte 2	Byte 3
I_OUT_REAL [7:0]	I_OUT_REAL [15:8]	I_OUT_REACTIVE [7:0]	I_OUT_REACTIVE [15:8]

- **I_OUT_REAL [15:0]:** This field specifies the real RMS output current setpoint when operating in current control mode. This field is specified in units of 0.1 A_{rms} in 2's complement, signed format. For example, 20 A_{rms} would be entered as 200 (decimal), or 0x00C8 (hexadecimal). Negative 20 A_{rms} would be represented as -200 (decimal), or 0xFF38 (hexadecimal).
- **I_OUT_REACTIVE [15:0]:** This field specifies the RMS reactive output current set point when operating in current control mode. This field is specified in units of 0.1 A_{rms} in 2's complement, signed format. For example, 20 A_{rms} would be entered as 200 (decimal), or 0x00C8 (hexadecimal). Negative 20 A_{rms} would be represented as -200 (decimal), or 0xFF38 (hexadecimal).

Legal ranges for these variables depend on the hardware implementation and are documented in the product User's Manual. Values outside of the legal range will be ignored and an "Illegal CAN Message" response will be sent back to the host controller.

3.1.5 Power Factor Setpoint

This Command message is sent to the AFE to indicate the desired power factor set point when the AFE is operated in voltage control mode. This set point is also optionally used when in current control mode depending on the "Use Power Factor" configuration variable. The default power factor following a power-on reset is specified in the configuration memory. The value sent in this command does not change the default value stored in the configuration memory; rather it merely provides a dynamic and temporary override from the default value.

Byte 0	Byte 1
PF [7:0]	PF [15:8]

- **PF [15:0]:** This field specifies the power factor set point. This field is a signed 16-bit number that specifies the power factor in units of 0.1 %. For example, a power factor of 0.95 would be entered as 950 (decimal), or 0x03B6 (hexadecimal). A power factor of -0.98 would be entered as -980 (decimal), or 0xFC2C (hexadecimal). A positive number less than 100% indicates grid currents lagging grid voltage (i.e. inductive load); a negative number indicates grid currents leading grid voltage (i.e. capacitive load).

The legal range for this variable is -100.0% to 100.0% (note that -100.0% and +100.0% are equivalent, indicating a power factor of 1.0). Values outside of the legal range will

be ignored and an “Illegal CAN Message” response will be sent back to the host controller.

3.1.6 Fault Reset

This message is used to attempt a reset of any latched fault conditions and to return the controller to the STANDBY state. This message has no accompanying payload requirements – merely receiving this message is adequate to initiate a fault reset attempt.

3.1.7 Configuration Reset

This message is used to reset the complete contents of the non-volatile configuration EEPROM back to the original Factory Default values. Note that this command *does not* reload the system configuration; it just resets the contents of the EEPROM. In order for the newly reset values to take effect in the system, the “Configuration Reload” command must be used or the control board power must be cycled off and then on.

This message uses a 2-byte payload to specify a password required to reset the configuration. This password must match the Configuration Password stored in the configuration memory in order for the Reset command to be processed. If the incorrect password is specified, the message will be ignored and the “Illegal CAN Message” response will be sent.

The configuration memory may not be reset while the AFE is ON. If the user attempts to send this message while the AFE is ON the message will be ignored and the “Illegal CAN Message” response will be sent.

Byte 0	Byte 1
PW [7:0]	PW [15:8]

- **PW [15:0]:** Configuration Password - This field specifies the configuration password required to reset the contents of the configuration memory.

3.1.8 Configuration Reload

This message is used to reload the system configuration from the non-volatile configuration EEPROM. This message (or power cycling the control board) is required following an update of the EEPROM in order for the new configuration parameters to take effect. This configuration command forces an internal watchdog reset of the CPU causing it to reboot and reload the system configuration. This message has no accompanying payload requirements – merely receiving this message is adequate to initiate a configuration reload. The system configuration may not be reloaded while the AFE is ON. If the user attempts to send this message while the AFE is ON the message will be ignored and the “Illegal CAN Message” response will be sent.

3.1.9 AC Voltage Setpoint

This Command message is sent to the AFE to indicate the desired RMS phase-to-phase output voltage set point when the AFE is operated in standalone AC voltage control mode. The default voltage following a power-on reset is specified in the configuration memory. The value sent in this command does not change the default voltage stored in the configuration memory, rather it merely provides a dynamic and temporary override from the default value. This message contains a two-byte payload of the following format:

Byte 0	Byte 1
V_OUT [7:0]	V_OUT [15:8]

- **V_OUT [15:0]:** This field specifies the RMS phase-to-phase AC output voltage set point when operating in standalone control mode. This field is specified in units of $0.1 V_{rms}$. For example, $480 V_{rms}$ would be entered as 4800 (decimal), or 0x12C0 (hexadecimal).

Legal ranges for this variable depend on the hardware implementation and are documented in the product User's Manual. Values outside of the legal range will be ignored and an "Illegal CAN Message" response will be sent back to the host controller.

3.1.10 Start Pre-Charge

This Command message is only used if the AFE's "DC Link Pre-Charge Mode Select" configuration parameter is set to "Manual" pre-charge control. This message is sent to the AFE to indicate that it should begin pre-charging the DC link. Note that the AFE must be in the "WAIT FOR PRECHARGE COMMAND" state in order for this command to take affect; otherwise, this command will be ignored. This message contains a single byte payload of the following format:

Byte 0
STRT_PC

- **STRT_PC:** This byte must be set to '1' to initiate the process of charging the DC link. All other values will be ignored.

3.2 Parameter Access Messages

3.2.1 Parameter Read

This message is sent to the AFE to initiate a parameter read request. When received, the AFE will respond with the Parameter Read Response message (see below). This message consists of a 4-byte payload with the following format:

Byte 0	Byte 1	Byte 2	Byte 3
PID [7:0]	PID [15:8]	PW [7:0]	PW [15:8]

- **PID [15:0]:** Parameter ID - This field specifies the ID of the parameter being read.
- **PW [15:0]:** Configuration Password - This field specifies the configuration password (if necessary) needed to read the selected parameter. This field is not used if the parameter specified by the PID does not require a password.

3.2.2 Parameter Write

This message is sent to the AFE to initiate a parameter write. When received, the AFE will attempt to write the selected parameter and will then respond with the Parameter Write Response message (see below). This message consists of an 8-byte payload with the following format:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
PID [7:0]	PID [15:8]	WDATA [7:0]	WDATA [15:8]	WDATA [23:16]	WDATA [31:24]	PW [7:0]	PW [15:8]

- **PID [15:0]:** Parameter ID - This field specifies the ID of the parameter being written.
- **WDATA [31:0]:** Parameter Write Data – This field specifies the data to be written to the selected parameter.
- **PW [15:0]:** Configuration Password - This field specifies the configuration password (if necessary) needed to write to the selected parameter. This field is not used if the parameter specified by the PID does not require a password.

3.2.3 Parameter Read Response

This message is sent by the AFE in response to a Parameter Read message. This message consists of a 7-byte payload with the following format:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
PID [7:0]	PID [15:8]	RDATA [7:0]	RDATA [15:8]	RDATA [23:16]	RDATA [31:24]	STAT [7:0]

- **PID [15:0]:** Parameter ID - This field specifies the ID of the parameter being read.
- **RDATA [31:0]:** Parameter Read Data – This field returns the read data for the selected parameter. If the read is not successful (as indicated by the STAT field), this field will return all zeros.
- **STAT [7:0]:** Read Status - encoded as follows:

- **0** – SUCCESS
- **1** – FAIL, invalid PID
- **2** – FAIL, parameter not read-able
- **3** – FAIL, parameter not write-able (*not applicable for reads*)
- **4** – FAIL, parameter write data out of range (*not applicable for reads*)
- **5** – FAIL, memory fault (timeout)
- **6** – FAIL, incorrect data CRC
- **7** – FAIL, password required and incorrect value provided

3.2.4 Parameter Write Response

This message is sent by the AFE in response to a Parameter Write message. This message consists of a 7-byte payload with the following format:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
PID [7:0]	PID [15:8]	WDATA [7:0]	WDATA [15:8]	WDATA [23:16]	WDATA [31:24]	STAT [7:0]

- **PID [15:0]**: Parameter ID - This field specifies the ID of the parameter being written.
- **WDATA [31:0]**: Parameter Write Data – This field returns the write data that was sent by the host.
- **STAT [7:0]**: Write Status - encoded as follows:
 - **0** – SUCCESS
 - **1** – FAIL, invalid PID
 - **2** – FAIL, parameter not read-able (*not applicable for writes*)
 - **3** – FAIL, parameter not write-able
 - **4** – FAIL, parameter write data out of range
 - **5** – FAIL, memory fault (timeout)
 - **6** – FAIL, incorrect data CRC
 - **7** – FAIL, password required and incorrect value provided

3.3 Status Messages

3.3.1 DC Link Status

This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 2-byte payload:

Byte 0	Byte 1
V_LINK [7:0]	V_LINK [15:0]

- **V_LINK [15:0]**: Measured DC Link voltage, reported in units of 0.1 V.

3.3.2 Grid Voltage Status

This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 6-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
V_AB [7:0]	V_AB [15:8]	V_BC [7:0]	V_BC [15:8]	V_CA [7:0]	V_CA [15:8]

- **V_AB [15:0]:** RMS Grid Voltage Measured Phase A to B, reported in units of $0.1 V_{rms}$.
- **V_BC [15:0]:** RMS Grid Voltage Measured Phase B to C, reported in units of $0.1 V_{rms}$.
- **V_CA [15:0]:** RMS Grid Voltage Measured Phase C to A, reported in units of $0.1 V_{rms}$.

3.3.3 Grid Current Status

This message reports the RMS grid currents. When dual interleaved inverters are enabled, this is sum of both inverter currents. This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 6-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
I_A [7:0]	I_A [15:8]	I_B [7:0]	I_B [15:8]	I_C [7:0]	I_C [15:8]

- **I_A [15:0]:** RMS Grid Current Phase A, reported in units of $0.1 A_{rms}$.
- **I_B [15:0]:** RMS Grid Current Phase B, reported in units of $0.1 A_{rms}$.
- **I_C [15:0]:** RMS Grid Current Phase C, reported in units of $0.1 A_{rms}$.

3.3.4 Grid Status

This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 4-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 3
FREQ [7:0]	FREQ [15:8]	PLL [7:0]	POWER FACTOR [7:0]	POWER FACTOR [15:8]

- **FREQ [15:0]:** Measured Grid Frequency, reported in units of 0.1 Hz.
- **PLL [7:0]:** PLL status data bit-mapped as follows:

Bit	Status
0	Lock: 0 = not locked, 1 = locked
1-7	<i>Reserved for future use</i>

- **POWER FACTOR [15:0]:** Measured Power Factor, reported in units of 0.1 %, in 2's complement signed format.

3.3.5 System Status

This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 6-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
INVA_TEMP [7:0]	AUX_TEMP [7:0]	CONT_STAT [7:0]	AFE_STATE [7:0]	AFE_MODE [7:0]	INVB_TEMP [7:0]

- **INVA_TEMP [7:0]:** Measured Inverter A Temperature, reported in units of 1.0 °C.
- **INVB_TEMP [7:0]:** Measured Inverter B Temperature, reported in units of 1.0 °C.
- **AUX_TEMP [7:0]:** Measured Auxiliary Temperature, reported in units of 1.0 °C.
- **CONT_STAT [7:0]:** Contactor Status bit mapped as follows:

Bit	Status
0	Grid Contactor: 0 = Open, 1 = Closed
1	Pre-Charge Contactor: 0 = Open, 1 = Closed
2-7	<i>Reserved for future use</i>

- **AFE_STATE [7:0]:** AFE Operating state enumerated as follows:

Value	State
0	Initializing
1	Calibrating
2	Pre-Charge
3	Charge Wait
4	Idle
5	On
6	Fault
7	Turning Off
8	Unknown
9	Low DC link
10	Waiting For Charge Command

Value	State
11-255	<i>Unknown: Reserved for future use</i>

- **AFE_MODE [7:0]:** AFE Operating Mode enumerated as follows:

Value	Mode
0	DC Link Voltage Regulation
1	Current Regulation
2	Stand-Alone Voltage Mode
3-255	<i>Reserved for future use</i>

3.3.6 Alarm Status

This status message is used to convey the present state of the Warning and Fault bits. This message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. The controller can also be configured to automatically send this message upon the change of state of any of the warning or fault bits (checked at 1ms intervals). This message consists of the following 8-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
WARNINGS [7:0]	WARNINGS [15:8]	WARNINGS [23:16]	WARNINGS [31:24]	FAULTS [7:0]	FAULTS [15:8]	FAULTS [23:16]	FAULTS [31:24]

- **WARNINGS [31:0]:** Warning bits are active when set to '1', and not present when set to '0'. The warning bits are mapped as follows:

Bit	Warning
0-6	<i>Reserved</i>
7	DC Link Under Voltage
8	Inverter A High Temperature
9	DC Link High Voltage
10	PLL not locked
11	Phase A High Current – Inverter A
12	Phase B High Current – Inverter A
13	Phase C High Current – Inverter A
14	Grid Frequency Out of Tolerance
15	Grid Voltage A-to-B Out of Tolerance
16	Grid Voltage B-to-C Out of Tolerance
17	Grid Voltage C-to-A Out of Tolerance
18	Auxiliary High Temperature
19	Inverter B High Temperature
20	Phase A High Current – Inverter B

Bit	Warning
21	Phase B High Current – Inverter B
22	Phase C High Current – Inverter B
23-26	<i>Reserved</i>
27	24V Supply Out of Tolerance
28	15V Supply Out of Tolerance
29	5V Supply Out of Tolerance
30	3.3V Supply Out of Tolerance
31	-15V Supply Out of Tolerance

- FAULTS [31:0]:** Fault bits are active when set to a ‘1’ and not present when set to a ‘0’. If a fault occurs, the corresponding bit is set to a ‘1’ and remains set until the Fault Reset message is received. When a fault occurs, the controller will go to the FAULT state and the AFE will stop operating. The controller will stay in the FAULT state until the Fault Reset message is received. The fault bits are mapped as follows:

Bit	Fault
0	Inverter A Hardware Over Temperature
1	Inverter A IGBT Error
2	Pre-Charge Timeout
3	Pre-Charge Contactor
4	Grid Contactor
5	Relay Driver
6	Communications Timeout
7	Configuration Memory
8	Inverter A S/W Over Temperature
9	S/W DC Link Over Voltage
10	PLL Lost Lock
11	Inverter A S/W Phase A Over Current
12	Inverter A S/W Phase B Over Current
13	Inverter A S/W Phase C Over Current
14	Grid Line Frequency
15	Grid Voltage, Phase A-to-B
16	Grid Voltage, Phase B-to-C
17	Grid Voltage, Phase C-to-A
18	Auxiliary Over Temperature
19	Calibration Error
20	Inverter B Hardware Over Temperature
21	Inverter B IGBT Error
22	Inverter B S/W Over Temperature
23	Inverter B S/W Phase A Over Current
24	Inverter B S/W Phase B Over Current

Bit	Fault
25	Inverter B S/W Phase C Over Current
26	S/W DC link under Voltage
27-31	<i>Reserved for future use</i>

3.3.7 Alarm Status 2

This status message is used to convey the present state of additional Fault bits. This message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. The controller can also be configured to automatically send this message upon the change of state of any of the warning or fault bits (checked at 1ms intervals). This message consists of the following 8-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3
FAULTS 2 [7:0]	FAULTS 2 [15:8]	FAULTS 2 [23:16]	FAULTS 2 [31:24]

- **FAULTS [31:0]:** Fault bits are active when set to a '1' and not present when set to a '0'. If a fault occurs, the corresponding bit is set to a '1' and remains set until the Fault Reset message is received. When a fault occurs, the controller will go to the FAULT state and the AFE will stop operating. The controller will stay in the FAULT state until the Fault Reset message is received. The fault bits are mapped as follows:

Bit	Fault
0	Stand Alone RMS Current Overload Phase A
1	Stand Alone RMS Current Overload Phase B
2	Stand Alone RMS Current Overload Phase C
3	Stand Alone I ² T Current Overload Phase A
4	Stand Alone I ² T Current Overload Phase B
5	Stand Alone I ² T Current Overload Phase C
6-31	<i>Reserved for future use</i>

3.3.8 Illegal CAN Message

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4
ID [7:0]	ID [15:8]	ID [23:16]	ID [31:24]	ERR [7:0]

- **ID [31:0]:** This is the CAN message ID of the offending message.
- **ERR [7:0]:** This Error Code indicates the cause of the error, encoded as follows:
 - **0** – Operation Not Allowed While AFE is ON
 - **1** – Command Data Out of Range

- **2** – Incorrect message payload length generated if the payload length of a received message does not correspond to the protocol.
- **3** – ON/OFF from CAN not allowed – configured for H/W control
- **4** – Password required, incorrect value provided

3.3.9 Inverter A Current Status

This message is only sent when dual interleaved inverter operation is enabled. This message reports the RMS currents for the first inverter (Inverter A). This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 6-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
I_A [7:0]	I_A [15:8]	I_B [7:0]	I_B [15:8]	I_C [7:0]	I_C [15:8]

- **I_A [15:0]**: Measured RMS Inverter A Current Phase A, reported in units of 0.1 A_{rms}.
- **I_B [15:0]**: Measured RMS Inverter A Current Phase B, reported in units of 0.1 A_{rms}.
- **I_C [15:0]**: Measured RMS Inverter A Current Phase C, reported in units of 0.1 A_{rms}.

3.3.10 Inverter B Current Status

This message is only sent when dual interleaved inverter operation is enabled. This message reports the RMS currents for the second inverter (Inverter B). This status message is periodically sent at a regular time interval specified in the configuration memory. To disable periodic transmissions of this message, the time interval can be set to 0 ms in the configuration memory. This message consists of the following 6-byte payload:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
I_A [7:0]	I_A [15:8]	I_B [7:0]	I_B [15:8]	I_C [7:0]	I_C [15:8]

- **I_A [15:0]**: Measured RMS Inverter B Current Phase A, reported in units of 0.1 A_{rms}.
- **I_B [15:0]**: Measured RMS Inverter B Current Phase B, reported in units of 0.1 A_{rms}.
- **I_C [15:0]**: Measured RMS Inverter B Current Phase C, reported in units of 0.1 A_{rms}.

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.