



Innovative Thinking for Power Control

OZip Motor Drive
OzCan Device Profile
Functional Specification
FS-0093

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1. Introduction

This document is intended to provide a detailed functional description of the OZip Motor Drive OzCan device profile. It is meant to convey the details of all messages supported by the OZip Motor Drive. General OzCan protocol information can be found in Reference document FS-0046.

1.1 Referenced Documents

Ref.	Document	Description
[1]	UM-0057	OZip Motor Drive User's Manual
[2]	FS-0046	OzCAN CAN Communication Protocol Functional Specification
[3]	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

2. CAN Message ID

This section describes the specific OzCAN protocol ID implementation used by the OZip Motor Drive.

2.1 Message Priority

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

2.2 Group ID

By default, the drive's Group ID is set to a value of 3 (standard value for Oztek Motor Drive's). 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 the OZip Motor Drive. Note that the *Default CAN Identifier* column shows the complete 29-bit message header for each message assuming the default Motor Drive Group ID of "3" and Module ID of "1", and a default Host Group ID of "1" and Module ID of "1". The Drive will accept messages from any source, meaning only the Destination Group and Module are required to match.

Table 1 – Summary of Drive CAN Messages

Message Name	Message Type	Message ID	Default CAN Identifier
Parameter Read	1 - Parameter	0	0x13091080
Parameter Write	1 - Parameter	1	0x13091081
Parameter Read Response	1 - Parameter	2	0x11093082
Parameter Write Response	1 - Parameter	3	0x11093083
Motor Status	2 - Status	0	0x110A3080
System Status	2 - Status	1	0x110A3081
Alarm Status	2 - Status	2	0x110A3082
Drive Status	2 - Status	3	0x110A3083
Illegal CAN Message	2 - Status	4	0x110A3084

3.1 Parameter Access Messages

3.1.1 Parameter Read

This message is sent to the converter to initiate a parameter read request. When received, the converter 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]:** Password - This field specifies the 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.

3.1.2 Parameter Write

This message is sent to the drive to initiate a parameter write. When received, the drive 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]:** Password - This field specifies the 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.

3.1.3 Parameter Read Response

This message is sent by the drive 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, memory fault (CRC error)
 - **7** – FAIL, password required, and incorrect value provided

3.1.4 Parameter Write Response

This message is sent by the drive 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, memory fault (CRC error)
 - **7** – FAIL, password required, and incorrect value provided
 - **8** – FAIL, Parameter cannot be changed while drive is turned on

3.2 Status Messages

Each of the drive's status messages described below are periodically sent at a regular time interval specified by their respective *CAN Update Rate* configuration parameters. To disable periodic transmissions for a given status message, the corresponding *CAN Update Rate* parameter should be set to 0.

3.2.1 Motor Status

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
Speed [7:0]	Speed [15:8]	Speed [23:16]	Current [7:0]	Current [15:8]	Power [7:0]	Power [15:8]	Temp [7:0]

- **Speed [23:0]:** Motor speed, reported in units of 1 RPM.
- **Current [15:0]:** Motor current, reported in units of 0.1 Arms.
- **Power [15:0]:** Motor Power, reported in units of 10 Watts.
- **Temp [7:0]:** Measured Motor Temp, reported in units of 1 °C.

3.2.2 System Status

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
DC Link [7:0]	DC Link [15:8]	Control Mode [7:0]	System State [7:0]	Brake State [7:0]	Temp – Ph A [7:0]	Temp – Ph B [7:0]	Temp – Ph C [7:0]

- **DC Link [15:0]:** DC Link Voltage, reported in units of 0.1 V.
- **Control Mode [7:0]:** Control mode, enumerated as follows:
 - 0 = Open-loop AC Induction Volts/Hertz Controller
 - 1 = Closed-loop Field Oriented Speed Control
 - 2 = Closed-loop Field Oriented Torque Control
- **System State [7:0]:** Operating state, enumerated as follows:
 - 0 = Initializing
 - 1 = Calibrating
 - 2 = Waiting for Charge Command
 - 3 = Charging
 - 4 = Idle
 - 5 = Running
 - 6 = Fault
- **Brake State [7:0]:** Brake state, enumerated as follows:
 - 0 = Disabled
 - 1 = Off
 - 2 = On
- **Temp- Phase A [7:0]:** Measured IGBT Phase A Temp, reported in units of 1 °C.
- **Temp- Phase B [7:0]:** Measured IGBT Phase B Temp, reported in units of 1 °C.
- **Temp- Phase C [7:0]:** Measured IGBT Phase C Temp, reported in units of 1 °C.

3.2.3 Alarm Status

This status message is used to convey the present state of the Motor Drive’s warning and fault bits. In addition to being able to periodically transmit this message on a regulator basis, the drive can also be configured to automatically send this message upon the change of state of any of the 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	Phase A High Temperature
1	Phase B High Temperature
2	Phase C High Temperature
3	PCB High Temperature
4	Motor High Current
5	Motor High Temperature
6	Motor High Speed
7	Torque Limited to Maximum
8	Reserved
9	Torque Limited by High Temp
10	Iq Current Foldback
11	Reserved
12	DC Link High Voltage
13	Skip Zone
14-29	Reserved
30	15V Supply Out of Tolerance
31	5V 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 explicitly cleared by the user. When a fault occurs, the drive will turn OFF immediately and will go to the **Fault** state. The drive will stay in the **Fault** state until the corresponding fault conditions are cleared. The fault bits are mapped as follows:

Bit	Fault
0	Phase A H/W Desat
1	Phase B H/W Desat
2	Phase C H/W Desat
3	Phase A H/W Drive Fault
4	Phase B H/W Drive Fault
5	Phase C H/W Drive Fault
6	H/W DC Link Over Voltage
7	Phase A S/W Over Temp
8	Phase B S/W Over Temp
9	Phase C S/W Over Temp
10	PCB S/W Over Temp
11	Motor Over Current
12	Motor Over Temp
13	Motor Over Speed
14	Motor Align Error
15	Reserved
16	Charge Timeout
17	S/W DC Link Over Voltage
18	EEPROM Error
19	Calibration Error
20	Communications Timeout
21	H/W Interlock

22	Configuration Error
23-31	Reserved

3.2.4 Drive Status

This message consists of the following 2-byte payload:

Byte 0	Byte 1
Freq Out [7:0]	Freq Out [15:8]

- **Output Frequency [15:0]:** Output frequency, reported in units of 0.1 Hz.

3.2.5 Illegal CAN Message

This message is returned whenever a CAN message has been sent to the drive using the correct Group ID and Module ID, but that for some reason, the drive is unable to process. This message consists of the following 5-byte payload:

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]:** The CAN message ID of the offending message received by the converter.
- **ERR [7:0]:** Error code indicating the cause of the error, encoded as follows:
 - **0** – Operation not allowed while the drive is ON
 - **1** – Write data is not within the legal range
 - **2** – Incorrect message payload length specified
 - **3** – Command not allowed, drive is configured for H/W control
 - **4** – Password is required, and incorrect value was provided

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 OZip Inverter. 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
Email techsupport@oztekc corp.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

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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.