OZip Motor Drive
Modbus Register Profile

Functional Specification

FS-0094

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1.   Introduction

This document is intended to provide the register map used to communicate with the OZip Motor Drive using the Modbus communication protocol. It provides the Modbus register address for each of the parameter registers supported by the drive. Application details for the registers themselves including scaling, bit assignments, etc., can be found in UM-0057 - *OZip Motor Drive User's Manual*. Details on the actual Modbus protocol as implemented in the Oztek Modbus Module (OMM) firmware can be found in the complementary specification FS-0053 - *Modbus Communication Module Functional Specification*.

1.1   Referenced Documents

Ref.	Document	Description
[1]	www.modbus.org/specs.php	Modbus specification
[2]	FS-0053	Modbus Communication Module Functional Specification
[3]	UM-0057	OZip Motor Drive User's Manual

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
NC	Not Connected
OMM	Oztek Modbus Module
PCB	Printed Circuit Board
PID	Parameter Identifier
PLC	Programmable Logic Controller
PLL	Phase Locked Loop
POR	Power On Reset
PWM	Pulse Width Modulation

2.   Overview

The OMM is a simplified version of the industry standard Modbus protocol. It provides support for a 2-wire, RS-485 physical layer and the RTU transmission mode. More specifically, it provides access to the drive's *Command, Instrumentation,* and *Configuration* parameter registers described in UM-0057 – *OZip Motor Drive User's Manual*. The tables below show the Modbus register address assignments for each of parameters described in the drive's user's manual.

2.1   Handling 32-bit Values

The Modbus protocol specifies that each addressable register holds a 16-bit quantity. In order to write or read 32-bit quantities, the least significant (LSW) and most significant words (MSW) must be accessed independently. When performing 32-bit register writes, it is required that the LSW be written first, immediately followed by the writing the MSW; the drive's internal 32-bit register will not be written until the MSW Modbus register is written.

3.   Command Registers

Table 1 – Command Registers

Modbus Address		PID	Description
Decimal	Hex		
1	0x0001	0x0001	On/Off Control
2	0x0002	0x0002	Reference - Percent
3	0x0003	0x0003	Reference - Frequency
4	0x0004	0x0004	Reference - Speed
5	0x0005	0x0005	Direction
6	0x0006	0x0006	Charge Command
7	0x0007	0x0007	Fault Reset

4.   Instrumentation Registers

Table 2 – Instrumentation Registers

Modbus Address		PID	Description
Decimal	Hex		
2049	0x0801	0x4000	Operating State
2050	0x0802	0x4001	Control Mode
2051	0x0803	0x4002	Motor Speed
2052	0x0804	0x4003	Motor Power
2053	0x0805	0x4004	Motor Current
2054	0x0806	0x4005	Motor Frequency
2055	0x0807	0x4006	Motor Voltage

Modbus Address		PID	Description
Decimal	Hex		
2056	0x0808	0x4007	Control Status
2057	0x0809	0x4008	Brake State
2058	0x080A	0x4009	Inverter A Temperature
2059	0x080B	0x400A	Inverter B Temperature
2060	0x080C	0x400B	Inverter C Temperature
2061	0x080D	0x400C	PCB Temperature
2062	0x080E	0x400D	Motor Temperature
2063	0x080F	0x400E	DC Link Voltage
2064	0x0810	0x400F	Warning Status (LSW)
2065	0x0811		Warning Status (MSW)
2066	0x0812	0x4010	Fault Status (LSW)
2067	0x0813		Fault Status (MSW)
2068	0x0814	0x4011	Configuration Error
2069	0x0815	0x4012	Frequency Reference
2070	0x0816	0x4013	Id Reference
2071	0x0817	0x4014	Iq Reference
2072	0x0818	0x4015	Motor State
2073	0x0819	0x4016	Nominal Slip
2074	0x081A	0x4017	Register Operation Status
2075	0x081B	0x4018	Inverter Software Revision – Major
2076	0x081C	0x4019	Inverter Software Revision – Minor
2077	0x081D	0x401A	Bootloader Revision – Major
2078	0x081E	0x401B	Bootloader Revision – Minor

5.   Configuration Registers

Table 3 – Configuration Control Parameters

Modbus Address		PID	Description
Decimal	Hex		
4097	0x1001	0x8000	Factory Configuration Revision – Major
4098	0x1002	0x8001	Factory Configuration Revision – Minor
4099	0x1003	0x8002	User Configuration Revision

Table 4 – Modbus Interface Parameters

Modbus Address		PID	Description
Decimal	Hex		
4110	0x100E	0x800D	Modbus Device Address
4111	0x100F	0x800E	Modbus Baud Rate
4112	0x1010	0x800F	Modbus Parity

Table 5 – CAN Interface Parameters

Modbus Address		PID	Description
Decimal	Hex		
4117	0x1015	0x8014	CAN Group ID
4118	0x1016	0x8015	CAN Module ID
4119	0x1017	0x8016	CAN Baud Rate
4120	0x1018	0x8017	CAN Timeout
4121	0x1019	0x8018	Status Destination Group ID
4122	0x101A	0x8019	Status Destination Module ID
4123	0x101B	0x801A	Automatic Alarm Transmit Enable
4124	0x101C	0x801B	CAN Update Rate – Motor Status
4125	0x101D	0x801C	CAN Update Rate – Drive Status
4126	0x101E	0x801D	CAN Update Rate – System Status
4127	0x101F	0x801E	CAN Update Rate – Alarm Status

Table 6 – Fault and Warning Parameters

Modbus Address		PID	Description
Decimal	Hex		
4137	0x1029	0x8028	Motor Temperature Fault Threshold
4138	0x102A	0x8029	Motor Temperature Warning Threshold
4139	0x102B	0x802A	Motor Over Current Fault Threshold
4140	0x102C	0x802B	Motor Over Current Warning Threshold
4141	0x102D	0x802C	Motor Over Speed Fault Threshold
4142	0x102E	0x802D	Motor Over Speed Warning Threshold
4143	0x102F	0x802E	DC Link Over Voltage Fault Threshold
4144	0x1030	0x802F	DC Link Over Voltage Warning Threshold
4147	0x1033	0x8032	Motor Temperature Warning Recover Delta
4148	0x1034	0x8033	Motor Over Current Warning Recover Delta
4149	0x1035	0x8034	Motor Over Speed Warning Recover Delta
4150	0x1036	0x8035	DC Link Over Voltage Warning Recover Delta

Table 7 – Drive Control Parameters

Modbus Address		PID	Description
Decimal	Hex		
4167	0x1047	0x8046	Control Mode
4168	0x1048	0x8047	Control Interface
4169	0x1049	0x8048	Motor Type
4170	0x104A	0x8049	Motor Speed Feedback Device Select
4171	0x104B	0x804A	POR Direction
4172	0x104C	0x804B	Reverse Inhibit
4173	0x104D	0x804C	Filter Inductance – Per Phase (LSW)
4174	0x104E		Filter Inductance – Per Phase (MSW)
4177	0x1051	0x8050	PWM Frequency

Table 8 – General Motor Parameters

Modbus Address		PID	Description
Decimal	Hex		
4197	0x1065	0x8064	Motor Pole Pair Count
4198	0x1066	0x8065	Motor Rated Voltage
4199	0x1067	0x8066	Motor Rated Frequency
4200	0x1068	0x8067	Motor Rated Current
4201	0x1069	0x8068	Motor Rated Speed

Table 9 – AC Induction Motor Parameters

Modbus Address		PID	Description
Decimal	Hex		
4207	0x106F	0x806E	AC Motor Mutual Inductance (LSW)
4208	0x1070		AC Motor Mutual Inductance (MSW)
4209	0x1071	0x8070	AC Motor Stator Leakage Inductance (LSW)
4210	0x1072		AC Motor Stator Leakage Inductance (MSW)
4211	0x1073	0x8072	AC Motor Rotor Leakage Inductance (LSW)
4212	0x1074		AC Motor Rotor Leakage Inductance (MSW)
4213	0x1075	0x8074	AC Motor Rotor Resistance (LSW)
4214	0x1076		AC Motor Rotor Resistance (MSW)
4215	0x1077	0x8076	AC Motor Magnetizing Current
4216	0x1078	0x8077	AC Motor Initial Magnetizing Current
4217	0x1079	0x8078	AC Motor Magnetizing Current Slew Rate
4218	0x107A	0x8079	AC Motor Field Weakening Enable
4219	0x107B	0x807A	AC Motor Temperature Coefficient

Table 10 – Permanent Magnet Motor Parameters

Modbus Address		PID	Description
Decimal	Hex		
4227	0x1083	0x8082	PMSM Torque Constant
4228	0x1084	0x8083	PMSM Align at Startup Enable
4229	0x1085	0x8084	PMSM Align Current
4230	0x1086	0x8085	PMSM Align Current Slew Rate
4231	0x1087	0x8086	PMSM Align Time
4232	0x1088	0x8087	PMSM Align Maximum Speed Threshold
4233	0x1089	0x8088	PMSM Align Angle Offset
4234	0x108A	0x8089	PMSM Motor Stator Inductance (LSW)
4235	0x108B		PMSM Motor Stator Inductance (MSW)

Table 11 – Volts/Hertz Drive Parameters

Modbus Address		PID	Description
Decimal	Hex		
4242	0x1092	0x8091	V/Hz Profile
4243	0x1093	0x8092	V/Hz Field Weakening Mode
4244	0x1094	0x8093	V/Hz Inflection Frequency
4245	0x1095	0x8094	V/Hz Inflection Voltage
4246	0x1096	0x8095	V/Hz Zero Hertz Voltage
4247	0x1097	0x8096	V/Hz Synchronous Startup Enable

Table 12 – Volts/Hertz Frequency Reference Parameters

Modbus Address		PID	Description
Decimal	Hex		
4252	0x109C	0x809B	Freq Ref Startup Pause Time
4253	0x109D	0x809C	Freq Ref Slew Rate
4254	0x109E	0x809D	Freq Ref Maximum
4255	0x109F	0x809E	Freq Ref Minimum
4256	0x10A0	0x809F	Freq Ref Preset 1
4257	0x10A1	0x80A0	Freq Ref Preset 2
4258	0x10A2	0x80A1	Freq Ref Preset 3
4259	0x10A3	0x80A2	Freq Ref Preset 4
4260	0x10A4	0x80A3	Freq Ref Preset 5
4261	0x10A5	0x80A4	Freq Ref Preset 6
4262	0x10A6	0x80A5	Freq Ref Preset 7

Table 13 – Volts/Hertz Skip Frequency Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4272	0x10B0	0x80AF	Skip Freq 1
4273	0x10B1	0x80B0	Skip Freq 2
4274	0x10B2	0x80B1	Skip Freq 3
4275	0x10B3	0x80B2	Skip Freq Hysteresis

Table 14 – FOC Speed Reference Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4282	0x10BA	0x80B9	Speed Ref Slew Rate
4283	0x10BB	0x80BA	Speed Ref Maximum
4284	0x10BC	0x80BB	Speed Ref Minimum
4285	0x10BD	0x80BC	Speed Ref Preset 1
4286	0x10BE	0x80BD	Speed Ref Preset 2
4287	0x10BF	0x80BE	Speed Ref Preset 3
4288	0x10C0	0x80BF	Speed Ref Preset 4
4289	0x10C1	0x80C0	Speed Ref Preset 5
4290	0x10C2	0x80C1	Speed Ref Preset 6
4291	0x10C3	0x80C2	Speed Ref Preset 7

Table 15 – FOC Speed Skip Frequency Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4302	0x10CE	0x80CD	Skip Speed 1
4303	0x10CF	0x80CE	Skip Speed 2
4304	0x10D0	0x80CF	Skip Speed 3
4305	0x10D1	0x80D0	Skip Speed Hysteresis

Table 16 – Torque Mode Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4312	0x10D8	0x80D7	Torque Command Slew Rate
4313	0x10D9	0x80D8	Torque Profile Enable
4314	0x10DA	0x80D9	Torque Profile Maximum Torque
4315	0x10DB	0x80DA	Torque Profile Maximum Power
4316	0x10DC	0x80DB	Torque Profile Constant Power*Speed Region Start

Table 17 – Temperature Measurement and Derating Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4327	0x10E7	0x80E6	Inverter Temp Derating Enable
4328	0x10E8	0x80E7	Inverter Temp Derating Low Threshold
4329	0x10E9	0x80E8	Inverter Temp Derating High Threshold
4330	0x10EA	0x80E9	Motor Temperature Sensor Enable
4331	0x10EB	0x80EA	Motor Temp Coefficient A
4332	0x10EC	0x80EB	Motor Temp Coefficient A Scale
4333	0x10ED	0x80EC	Motor Temp Coefficient B
4334	0x10EF	0x80ED	Motor Temp Coefficient B Scale
4335	0x10F0	0x80EF	Motor Temp Coefficient C
4336	0x10F1	0x80F0	Motor Temp Coefficient C Scale
4337	0x10F2	0x80F1	Motor Temp Derating Enable
4338	0x10F3	0x80F2	Motor Temp Derating Low Threshold
4339	0x10F4	0x80F3	Motor Temp Derating High Threshold
4340	0x10F5	0x80F4	Motor Temp Min Derating Factor

Table 18 – Encoder Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4362	0x110A	0x8109	Encoder Line Count
4363	0x110B	0x810A	Encoder Positive Direction
4364	0x110C	0x810B	Motor Speed Low Pass Filter Cutoff Frequency

Table 19 – Current Regulator Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4377	0x1119	0x8118	Current Controller Proportional Gain
4378	0x111A	0x8119	Current Controller Proportional Gain Scale
4379	0x111B	0x811A	Current Controller Integral Time Constant
4380	0x111C	0x811B	Current Controller Integral Time Constant Scale
4387	0x1123	0x8122	Iq Current Foldback Enable
4388	0x1124	0x8123	Iq Current Foldback Modulation Index Threshold
4389	0x1125	0x8124	Iq Foldback Controller Proportional Gain
4390	0x1126	0x8125	Iq Foldback Controller Proportional Gain Scale
4391	0x1127	0x8126	Iq Foldback Controller Integral Time Constant
4391	0x1128	0x8127	Iq Foldback Controller Integral Time Constant Scale

Table 20 – Speed Regulator Parameters

Modbus Address		PID	Description
Decimal	Hex		
4397	0x112D	0x812C	Speed Controller Proportional Gain
4398	0x112E	0x812D	Speed Controller Proportional Gain Scale
4399	0x112F	0x812E	Speed Controller Integral Time Constant
4400	0x1130	0x812F	Speed Controller Integral Time Constant Scale
4401	0x1131	0x8130	Speed Controller Maximum Current
4402	0x1132	0x8131	Speed Controller Minimum Current

Table 21 – Brake Controller Parameters

Modbus Address		PID	Description
Decimal	Hex		
4407	0x1137	0x8136	Brake Controller Enable
4408	0x1138	0x8137	Brake Controller Voltage Threshold
4409	0x1139	0x8138	Brake Controller Recover Voltage Threshold
4410	0x113A	0x8139	Brake Gate Driver Signal is Active High

Table 22 – Precharge Parameters

Modbus Address		PID	Description
Decimal	Hex		
4417	0x1141	0x8140	DC Link Precharge Enable
4418	0x1142	0x8141	Precharge Timeout Threshold
4419	0x1143	0x8142	Precharge DC Link Connect Voltage
4420	0x1144	0x8143	Precharge DC Link Disconnect Voltage
4421	0x1145	0x8144	Precharge DC Link Connect Maximum dv/dt

Table 23 – Analog Output Parameters

Modbus Address		PID	Description
Decimal	Hex		
4427	0x114B	0x814A	Analog Output 1 Parameter Assignment
4428	0x114C	0x814B	Analog Out 1 Min Output
4429	0x114D	0x814C	Analog Out 1 Max Output
4430	0x114E	0x814D	Analog Out 1 Min Scaling
4431	0x114F	0x814E	Analog Out 1 Max Scaling
4432	0x1150	0x814F	Analog Output 2 Parameter Assignment
4433	0x1151	0x8150	Analog Out 2 Min Output
4434	0x1152	0x8151	Analog Out 2 Max Output
4435	0x1153	0x8152	Analog Out 2 Min Scaling
4436	0x1154	0x8153	Analog Out 2 Max Scaling

Table 24 – Analog Input Parameters

| Modbus Address | | PID | Description |
Decimal	Hex		
4442	0x115A	0x8159	Analog Input 1 Mode
4443	0x115B	0x815A	Analog Input 1 Min
4444	0x115C	0x815B	Analog Input 1 Max
4445	0x115D	0x815C	Analog Input 1 Filter Cutoff Frequency

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@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

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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.