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WARRANTY



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OM-DAQXL Modbus Interface



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1 Introduction

1.1 Purpose

The following document defines the Modbus protocol support and register mapping used by the OM-DAQXL.

The Modbus interface is available on all communication channels and support is provided for MODBUS/TCP/IP transactions.

1.2 Definition of Terms and Acronyms

I2C	2-wire Serial Interface	ADC	Analog to Digital Converter
AC	Alternating Current	DAC	Digital to Analog Converter
DC	Direct Current	ESD	Electro Static Discharge
CS	Chip Select	FW	Firmware
RS232	Electrical Signals used for Serial Communications	HW	Hardware
CSV	Comma Separated Values	I/O	Input/Output
COTS	Commercially-Off-The-Shelf	LED	Light Emitting Diode
Hexadecimal	Values Expressed using Base 16 (2 ⁴)		

1.3 Supporting Documents

Doc. #	Name / Description

2 Modbus Interface

The Modbus interface is fully described in MODBUS APPLICATION PROTOCOL SPECIFICATION (V1.1b3).

The Modbus specification allows accessing to up 65535 internal 'holding' registers using register READ, register WRITE and WRITE MULTIPLE commands. Each Modbus holding register is defined as a 16-bit entity structured as BIG ENDIAN values (most significant byte always presented first).

The OM-DAQXL Modbus interface provides access to the internal database of the OM-DAQXL by internally mapping Modbus holding registers to specific database items.

Modbus is structured using a MASTER-SLAVE topology, in which there is one MASTER device and up to 255 slave devices. All transactions are initiated by the MASTER device.

Modbus slave devices are individually accessed using a one byte SLAVE address. The MASTER device initiates a transaction by sending a request packet to a specific slave. The SLAVE device processes the transaction and returns either response packet indicating success or failure.

Address 0 is reserved as a 'broadcast' address, in which all slave devices will accept and process the transaction but will not send a response.

2.1 Modbus Functions

The Modbus interface supports the following Modbus FUNCTION requests. The OM-DAQXL Modbus interface will support, as a minimum, the 0x03, 0x06 and 0x10. The Modbus specification outlines other requirements regarding minimum support requirements.

Function Code	Mnemonic	Description
0x03	Read Holding Register	Reads one or more consecutive 16-bit holding registers
0x06	Write Single Register	Writes a specific 16-bit holding register
0x07	Read Exception status	Reads structured status information
0x08	Diagnostic	Read/Write diagnostic information
0x10	Write Multiple Registers	Write one or more consecutive 16-bit holding registers
0x0b	Get Comm events	Read communication event counters

2.2 Data Formats

Modbus holding registers are represented as 16-bit entities. The following encoding is used for extended data items. Note that 'byte 0' will be the first byte received/transmitted.

For data types that can be represented in 16-bit (Boolean, byte, char, int16 and uint16) a single register is used.

For data types that require 32-bits two consecutive registers are used. The lower number register will represent the most significant data. The 2nd register represents the least significant data.

2.2.1 Multiple Register Reads

When reading a dual register entity, the lower order register should be used as the requested 'holding register', with a request for a minimum of 2 registers.

2.2.2 Multiple Register Writes

When writing a dual register entity, the lower order register should be used as the requested 'holding register', with a request for minimum of 2 registers.

Data Types	Number of Registers	Byte				Description
		0	1	2	3	
Boolean	1	--	LSB	N/A		Zero = OFF, non-zero = ON
Byte, Char	1	--	LSB			Entity contained in LSB of register, Byte 0 ignored.
Int16, uint16	1	MSB	LSB			Entity contained in MSB/LSB of register.
		0	1	2	3	(dual register data)
Int32, uint32	2	MSB	B-1	B-2	LSB	Requires 2 consecutive registers, MSB transferred first
float	2	Sign+Exp	Mantissa MSB	B-1	Mantissa LSB	IEEE formatted value contained in 2 consecutive registers

2.2.3 Request Packet Sizes

Multiple consecutive registers may be accessed in a single transaction.

The OM-DAQXL Modbus interface imposes a maximum of 64 bytes for the total transaction. Allowing for the required framing, addressing and integrity checks results in the following data size restrictions using the READ and WRITE MULTIPLE functions.

Format	Protocol Overhead	Maximum Read data	Maximum Write data
TCP/IP	8	23 Registers	23 Registers

3 OM-DAQXL Modbus Register Assignments

All accesses to the OM-DAQXL database information is made thru the following Modbus registers.

Data types are:

R – Single 16-bit register (may be Boolean, byte, char, and int16 or uint16 data)

L – Dual 32-bit register (may be int32 or uint32 data)

F – IEEE Floating point value

All data is transferred using Big Endian formatting, where the most significant byte is transmitted first.

3.1 Non-Volatile Memory Accesses

The NV column indicates volatility. An ‘R’ indicates the parameter is ‘Read Only.’ An ‘NV’ indicates a non-volatile parameter which should be only written during configuration. Modbus traffic should allow a minimum of 500 msec following a write to non-volatile memory. Standard memory accesses should be limited to 10 transactions / second.

Index		Mnemonic	NV	Type	Description
500	0x01F4	Model Number	R	R	Model Number of OM-DAQXL
501	0x01F5	Battery Percentage	R	R	Remaining battery percentage
502	0x01F6	AC/DC adapter status	R	R	Enumerated Value- AC/DC adapter status
530	0x0212	Channel 1 Reading	R	F	Channel 1 Reading
532	0x0214	Channel 2 Reading	R	F	Channel 2 Reading
534	0x0216	Channel 3 Reading	R	F	Channel 3 Reading
536	0x0218	Channel 4 Reading	R	F	Channel 4 Reading
538	0x021a	Channel 5 Reading	R	F	Channel 5 Reading
540	0x021c	Channel 6 Reading	R	F	Channel 6 Reading
542	0x021e	Channel 7 Reading	R	F	Channel 7 Reading
544	0x0220	Channel 8 Reading	R	F	Channel 8 Reading
546	0x0222	Channel 9 Reading	R	F	Channel 9 Reading
548	0x0224	Channel 10 Reading	R	F	Channel 10 Reading
550	0x0226	Channel 11 Reading	R	F	Channel 11 Reading
552	0x0228	Channel 12 Reading	R	F	Channel 12 Reading
554	0x022a	Channel 13 Reading	R	F	Channel 13 Reading
556	0x022c	Channel 14 Reading	R	F	Channel 14 Reading
558	0x022e	Channel 15 Reading	R	F	Channel 15 Reading
560	0x0230	Channel 16 Reading	R	F	Channel 16 Reading
562	0x0232	Digital Channel 1 Reading	R	F	Digital Channel 1 Reading
564	0x0234	Digital Channel 2 Reading	R	F	Digital Channel 2 Reading
566	0x0236	Digital Channel 3 Reading	R	F	Digital Channel 3 Reading
568	0x0238	Digital Channel 4 Reading	R	F	Digital Channel 4 Reading
Data Capture Configuration					
630	0x0240	Log Data Format	RW	R	Enumerated Format of log file

Index		Mnemonic	NV	Type	Description
631	0x0241	Log File Save Location	RW	R	Enumerated Log File Save location
632	0x0242	Sample Rate	RW	R	Enumerated Sample Rate
633	0x0243	Log Rate	RW	R	Enumerated Log Rate
634	0x0244	Log Mode	RW	R	Enumerated Log Mode
635	0x0245	External 24V Excitation	RW	R	Enumerated Toggle

3.2 Enumerated Values

The following define the Enumerated values.

3.2.1 Control/System Parameters

Toggle		
0	DISABLE	Feature or option is disabled
1	ENABLE	Feature or option is enabled
AC/DC Adapter Status		
0	UNPLUGGED	AC/DC Adapter is not plugged into unit
1	PLUGGED	AC/DC Adapter is plugged into unit
Model		
1	OM-DAQXL-1	
2	OM-DAQXL-2	
3	OM-DAQXL-1-EW	
4	OM-DAQXL-2-EW	

3.2.2 Data Capture Configuration & Formatting

Log Data Format		
0	TEXT	Log file will be save in a text file (.txt)
1	CSV	Log file will be save in a csv file (.csv)
Log File Save Location		
0	USB	Log file will be saved to USB storage device
1	SD CARD	Log file will be saved to SD card
2	INTERNAL	Log file will be saved to internal NAND flash
Sample Rate		
2	125 Samples/Sec	
3	50 Samples/Sec	
4	25 Samples/Sec	
5	10 Samples/Sec	
6	5 Samples/Sec	
7	1 Sample/Sec	
8	12 Samples/Minute	
9	6 Samples/Minute	
10	2 Samples/Minute	
11	1 Sample/Minute	
12	12 Samples/Hour	
13	6 Samples/Hour	
14	2 Samples/Hour	
15	1 Sample/Hour	
Log Rate		

2	125 Samples/Sec	
3	50 Samples/Sec	
4	25 Samples/Sec	
5	10 Samples/Sec	
6	5 Samples/Sec	
7	1 Sample/Sec	
8	12 Samples/Minute	
9	6 Samples/Minute	
10	2 Samples/Minute	
11	1 Sample/Minute	
12	12 Samples/Hour	
13	6 Samples/Hour	
14	2 Samples/Hour	
15	1 Sample/Hour	
Log Mode		
0	INTERVAL	Log at the log rate
1	AVERAGE	Log the average

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