CrossFire™ MX1b

CANopen Slave Developers Guide

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Introduction

Background

The CrossFire™ MX1b is a CAN bus node, and by configuring the node properties, the module can be set up to automatically send and receive I/O to and from the CAN bus network.

The CrossFire™ MX1b supports the CANopen protocol: one of the leading protocols used for CAN bus networks.

This document describes how the CrossFire™ MX1b CANopen node should be used. The reader should be familiar with the CANopen standard in order to fully understand the manual.

References

CAN in Automation - CANopen standard: http://www.can-cia.org

History

Rev   **Date**
1.0   2008-09-01

CANopen Slave Development

Port Overview

The CrossFire™ MX1b is highly configurable. The configuration can be changed by writing to the object dictionary in the Manufacturer-Specific Profile Area (0x2000 to 0x5FFF).

ID Interface
The node id is configurable via the ID connector unless the ports are configured as analog or digital inputs.

ID Interface Lookup Table

CANopen Node ID	ID3	ID2	ID1	ID0
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
….				
16	1	1	1	1

》 State 0 is reached by wiring corresponding ID pin to pin 3 (GND)
》 State 1 is reached by leaving corresponding ID pin disconnected.

Analog Inputs
There are three types of Analog Inputs available on the CrossFire™ MX1b. Only ports 9 through 16 are configured by default. Ports 17 through 20 must be reconfigured in the object dictionary (index 0x2000) in order to be used as Analog Inputs.

Digital Inputs
There are three types of Digital Inputs available on the CrossFire™ MX1b. Only ports 17 to 20, however, are available by default. The desired ports must therefore be reconfigured as Digital Inputs in order to be used (See object dictionary, index 0x2000). Digital Input Types 1 and 2 have a software selectable voltage range.

Digital ON/OFF Outputs
None of the ports are configured as Digital Outputs by default, and must therefore be configured in the object dictionary (index 0x2000) in order to be used.

PWM Outputs (Regulated & Non-Regulated)
There are two types of PWM outputs, namely Regulated and Non-Regulated PWM Outputs. The Non-regulated PWM Outputs are not enabled by default. In order to enable them, the corresponding ports must be configured as Analog Outputs by writing an SDO to the object dictionary (address 0x2000).

Pulse Counter / Shaft Encoder Inputs
By default, these Inputs are not available. In order to use these inputs, reconfigure the ports in the object dictionary at index 0x2000.

LED indicators

LED indicators

LED Description	Blink Pattern	Meaning
ST (Red) "CAN Status"	Off	Communication OK
	Single flash	CAN error state
	Double flash	Guarding of other node failed
	On	Bus off
CAN (Green) CANopen status	Off	No power to unit
	Blinking	Preoperational mode
	Single flash	Stopped mode
	On	Operational mode
PS (Red) Power	On	CrossFire™ MX1b power OK
	Off	No CrossFire™ MX1b power, or power too low

CANopen Interface

Overview:

》 The CrossFire™ MX1b supports the CANopen protocol.
》 The default CANopen Node ID is 0.
》 However, during the preoperational stage, the Node ID pins will be read.
》 If no pins have been tied to GND then the Node ID will be set to 16.
》 The default baudrate is 125 kbits/s
》 The CrossFire™ MX1b supports both heartbeat and node guarding.
》 The CrossFire™ MX1b is an NMT slave device. It is a heartbeat producer.
》 The CrossFire™ MX1b is a SYNCH message consumer.

EMCY object overview

The following error codes are supported according to DS-401 and DS-301. Up to 127 errors codes are stored at index 0x1003 of the object dictionary.

EMCY Object

Error code	Error register	Manufacturer-Specific Error Field	Meaning
0x8110	0x1	Not used	Buffer overrun. A CAN buffer overrun has occurred in the CrossFire™ MX1b. Index 0x1029 specifies the action to take when this error occurs.
0x6100	0x1	SW error code	An internal software error has occurred. This error can be a result of a bug in the software. Please note the manufacturer specific error field of the message, and report the error to CC Systems. Index 0x1029 specifies the action to take when this error occurs.
0x8130	0x1	Not used	Guarding of node failed. This will occur if the CrossFire™ MX1b is guarded with Node Guarding and the master has failed to send a guarding remote frame within the time specified in object 0x100C. Error will also occur if the CrossFire™ MX1b is configured as a heartbeat consumer with object 0x1016 and another node has failed to send its heartbeat message. Index 0x1029 specifies the action to take when this error occurs.
0x8210	0x11	Not used	PDO not processed because of length error. A PDO with the wrong length has been received and thereby ignored. Index 0x1029 specifies the action to take when this error occurs
0x8140	0x1	Not used	The CrossFire™ MX1b has recovered from Bus off.
0x8120	0x1	Not used	The CrossFire™ MX1b has recovered from CAN error state.
0x1000	0x1	0x1	The CrossFire™ MX1b runs in EEPROM Error mode. This means that the EEPROM has malfunctioned. The CrossFire™ MX1b reverts to the default values for EEPROM, instead of the real values in EEPROM. The CrossFire™ MX1b can still work as desired if all the desired settings are sent by SDO's at startup.

Receive PDO's (Digital Outputs, PWM Outputs)

This section describes the Receive PDO information to the CrossFire™ MX1b. The information received on these PDO's will directly affect the CrossFire™ MX1b outputs.

Ports 1 – 8 and 13 – 16 are configurable as outputs. These ports can be configured as either PWM Outputs (analog) or Digital Outputs. By default, ports 1 to 8 are configured as PWM Output ports, and 13 to 16 as Analog Inputs. To reconfigure the ports, index 0x2000 is used. For further information, see description of Object Dictionary.

By default, the PDO's of the node are mapped to the I/O following the mapping described in DS401.

Receive PDO 1: (COB ID: 200h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0..7 Regulated PWM Outputs configured as Digital ON/OFF Output Ports 1 to 8*	0..3 Digital ON/OFF Output Ports 13 to 16* 4..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused	0..7 Unused

* Only bits that corresponds to port configured as Digital Output will be used

There are 2 bytes for each PWM Output, however valid values range from 0 to 1023.

Receive PDO 2: (COB ID: 300h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
PWM Output Port 1 *		PWM Output Port 2 *		PWM Output Port 3 *		PWM Output Port 4 *	

* Value will only be used if port is configured as Analog Output.

Receive PDO 3: (COB ID: 400h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
PWM Output Port 5 *		PWM Output Port 6 *		PWM Output Port 7*		PWM Output Port 8 *	

* Value will only be used if port is configured as Analog Output.

Receive PDO 4: (COB ID: 500h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
PWM Output Port 13 *		PWM Port Output 14 *		PWM Output Port 15*		PWM Output Port 16*	

* Value will only be used if port is configured as Analog Output.
Note: ports 13 to 16 are non-regulated.

Transmit PDO's (Digital Inputs, Analog Inputs & Status Bits)

This section describes the Transmit PDO information from the CrossFire™ MX1b. The information transmitted on these Transmit PDO's directly reflects the status of the CrossFire™ MX1b inputs.

Ports 9 to 20 can be configured as either Analog or Digital Inputs. By default, ports 17 to 20 are configured as Digital Inputs but ports 9 to 16 are configured as Analog Inputs. To reconfigure the ports, the index 0x2000, sub-indices 9 – 20 are used. For further information, see description of the Object Dictionary.

The default transmission type for the Transmit PDO's is 255 (Event Triggered). This means that the Transmit PDO's will be sent only when a change occurs. By default, the PDO's of the node are mapped to the I/O following the mapping described in DS401:

Transmit PDO 1: (COB ID: 180h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0..7 Digital Input Ports 9 – 16*	0..7 Status Bits for PWM Output Ports 1 – 4. 2 bits per port	0..7 Status Bits for PWM Output Ports 5 – 8 2 bits per port	0..7 Status Bits for Digital Output Ports 13 – 16** 2 bits per port	0..3 ID bits or Digital Input Ports 17 – 20 4..7 unused	0..7 Unused	0..7 Unused	0..7 Unused

* Only bits that correspond to ports configured as Digital Inputs will be used.
** Status bits only valid for ports configured as Digital or PWM Outputs.
Status bits: 00 – no error, 01 – open load, 10 – over current, 11 – short to ground.
Note: by default, the transmission of PDO 1 will only be triggered if a change in status occurs.

Transmit PDO 2: (COB ID: 280h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Analog Input Port 9 *		Analog Input Port 10 *		Analog Input Port 11 *		Analog Input Port 12*	

* Value will only be valid if port is configured as an Analog Input.

Transmit PDO 3: (COB ID: 380h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Analog Input Port 13 *		Analog Input Port 14 *		Analog Input Port 15 *		Analog Input Port 16*	

* Value will only be valid if port is configured as an Analog Input.

Transmit PDO 4: (COB ID: 480h + Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Analog Input Port 17 *		Analog Input Port 18 *		Analog Input Port 19 *		Analog Input Port 20*	

* Value will only be valid if port is configured as an Analog Input.

Pulse Counters – Additional Transmit PDO5
The Mixed I/O ports 13 and 14 can also be configured as Pulse Counters by writing the value 4 to index 0x2000, sub index 13 and 14. The pulse counters may only count upwards, and may be reset by writing to index 0x200A, sub-index 13 and 14.

The most effective way to send the Pulse Count values is to enable a 5th PDO by writing to index 0x1804 in the object dictionary. This is done by specifying a valid COB ID at sub-index 1. The default PDO mapping for PDO 5 is shown below.

Transmit PDO 5: (COB ID: 180h + Unused Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Pulse Count - Port 13*				Pulse Count - Port 14*			

* Value will only be valid if respective port is configured as a Pulse Counter, and if PDO 5 is enabled.

Shaft Encoder – Additional Transmit PDO5
Ports 13 and 14 may also be configured to act together and accept inputs from a shaft encoder. The CrossFire™ MX1b can process these inputs and therefore act as a Shaft Decoder.

There are two primary signals from an encoder, called A and B. By comparing the states of these two digital signals, magnitude and direction information are extracted. This information allows the MX1b to either add or subtract subsequent pulses to a cumulative total which represents the shaft position.

Shaft Position is relative and should therefore be reset to zero at startup or when the mechanism is in its home position.

The most effective way to send the Shaft Encoder values is to enable a 5th PDO by writing to index 0x1804 in the object dictionary. This is done by specifying a valid COB ID at sub-index 1. A suggested PDO mapping for PDO 5 is shown below.

Transmit PDO 5: (COB ID: 180h + Unused Node ID)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Shaft Position*				Unused			

* Value will only be valid if ports 13 and 14 are both configured as Shaft Encoder Inputs and if PDO 5 is enabled.

Object Dictionary

Communication Profile Area; Index 0x1000 to 0x1FFF

Index	S-Idx	Type	Default	Saved	Description
0x1000	0	u32, ro	0xf0191	-	Device type: DS401, analog in/out, digital in/out.
0x1001	0	u8, ro	0	-	Error Register: Bit coded as specified in DS301.
0x1003	0	u32, ro	0	-	Pre-Defined Error Field: Number of entries. Value is increased each time a new error is encountered.
	1..127	u32, ro	0	-	Error Code History: New sub indices are created every time new error is encountered. See section 3.1
0x1005	0	u32, rw	0x80	No	COB ID Synch Object: SYNC configuration as specified in DS301. This module cannot generate sync messages.
0x1008	0	str, ro	CrossFire MX1b	-	Device name.
0x1009	0	str, ro	1.0	-	Hardware version.
0x100A	0	str, ro	1.0	-	Software version.
0x100C	0	u16, rw	0	No	Guard time: as specified in DS301.
0x100D	0	u8, rw	0	No	Life time factor: as specified in DS301.
0x1014	0	u32, rw	0x80 + node ID	No	EMCY COB ID: as specified in DS301.
0x1016	0	u8, rw	0	No	Heartbeat: Number of entries. (Number of heartbeat-guarded nodes)
	1 - 127	u32, rw	0	No	Heartbeat: Consumer Time: Monitoring time for node xx as specified in DS301.
0x1017	0	u16, rw	0	Yes	Producer heartbeat time: as specified in DS301
0x1018	0	u8, ro	4	-	Identity Object: Number of entries.
	1	u32, ro	0xF2	-	Vendor ID.
	2	u32, ro	100	-	Product code.
	3	u32, ro	0	-	Revision number.
	4	u32, ro	0	-	Serial number.
0x1029	0	u8, rw	9	No	Error Behaviour: Number of entries. 0 = Preoperational (if already operational) 1 = no state change 2 = Stopped
	1	u8, rw	0	No	Communication (mandatory) Not used.
	2	u8, rw	0	No	Bus off.
	3	u8, rw	0	No	CAN error state.
	4	u8, rw	0	No	CAN buffer overrun.
	5	u8, rw	0	No	SW error.
	6	u8, rw	0	No	Guarding of other node failed.
	7	u8, rw	0	No	Heartbeat from other node failed.

Index	S-Idx	Type	Default	Saved	Description
	8	u8, rw	1	No	PDO with wrong length received.
	9	u8, rw	1	No	EEPROM runs in error mode (revert to default values because EEPROM failed).
					Communication Parameters for Receive PDO's
0x1400	0	u8, ro	5	-	Receive PDO 1: Number of entries.
	1	u32, rw	0x200 + Node ID	No	COB ID for receive PDO 1.
	2	u8, rw	255	No	Transmission type for receive PDO 1.
	3	u16, rw	0	No	Inhibit time. Not used for receive PDO's.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer. Not used for receive PDO's.
0x1401	0	u8, ro	5	-	Receive PDO 2: Number of entries.
	1	u32, rw	0x300 + Node ID	No	COB ID for receive PDO 2.
	2	u8, rw	255	No	Transmission type for receive PDO 2.
	3	u16, rw	0	No	Inhibit time. Not used for receive PDO's.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer. Not used for receive PDO's.
0x1402	0	u8, ro	5	-	Receive PDO 3: Number of entries.
	1	u32, rw	0x400 + Node ID	No	COB ID for receive PDO 3.
	2	u8, rw	255	No	Transmission type for receive PDO 3.
	3	u16, rw	0	No	Inhibit time. Not used for receive PDO's.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer. Not used for receive PDO's.
0x1403	0	u8, ro	5	-	Receive PDO 4: Number of entries.
	1	u32, rw	0x500 + Node ID	No	COB ID for receive PDO 4.
	2	u8, rw	255	No	Transmission type for receive PDO 4.
	3	u16, rw	0	No	Inhibit time. Not used for receive PDO's.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer. Not used for receive PDO's.
					PDO mappings for receive PDO's
0x1600	0	u8, rw	2	No	Receive PDO 1: Number of entries. Maximum 8.
	1	u32, rw	0x62000108	No	First mapped object for receive PDO 1.
	2	u32, rw	0x62000208	No	Second mapped object for receive PDO 1.
	3 - 8	u32, rw	-	No	Third to eighth mapped object for receive PDO 1.
0x1601	0	u8, rw	4	No	Receive PDO 2: Number of entries. Maximum 8.
	1	u32, rw	0x64110110	No	First mapped object for receive PDO 2.

Index	S-Idx	Type	Default	Saved	Description
	2	u32, rw	0x64110210	No	Second mapped object for receive PDO 2.
	3	u32, rw	0x64110310	No	Third mapped object for receive PDO 2.
	4	u32, rw	0x64110410	No	Fourth mapped object for receive PDO 2.
	5 – 8	u32, rw	-	No	Fifth to eighth mapped object for receive PDO 2.
0x1602	0	u8, rw	4	No	Receive PDO 3: Number of entries. Maximum 8.
	1	u32, rw	0x64110510	No	First mapped object for receive PDO 3.
	2	u32, rw	0x64110610	No	Second mapped object for receive PDO 3.
	3	u32, rw	0x64110710	No	Third mapped object for receive PDO 3.
	4	u32, rw	0x64110810	No	Fourth mapped object for receive PDO 3.
	5 – 8	u32, rw	-	No	Fifth to eighth mapped object for receive PDO 3.
0x1603	0	u8, rw	4	No	Receive PDO 4: Number of entries. Maximum 8.
	1	u32, rw	0x64110910	No	First mapped object for receive PDO 4.
	2	u32, rw	0x64110A10	No	Second mapped object for receive PDO 4.
	3	u32, rw	0x64110B10	No	Third mapped object for receive PDO 4.
	4	u32, rw	0x64110C10	No	Fourth mapped object for receive PDO 4.
	5 – 8	u32, rw	-	No	Fifth to eighth mapped object for receive PDO 4.
					Communication Parameters for Transmit PDO's
0x1800	0	u8, ro	5	-	Transmit PDO 1: Number of entries.
	1	u32, rw	0x180 + Node ID	No	COB ID for transmit PDO 1.
	2	u8, rw	255	No	Transmission type for transmit PDO 1.
	3	u16, rw	500	No	Inhibit time for transmit PDO 1.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer for transmit PDO 1.
0x1801	0	u8, ro	5	-	Transmit PDO 2: Number of entries.
	1	u32, rw	0x280 + Node ID	No	COB ID for transmit PDO 2.
	2	u8, rw	255	No	Transmission type for transmit PDO 2.
	3	u16, rw	500	No	Inhibit time for transmit PDO 2.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer for transmit PDO 2.
0x1802	0	u8, ro	5	-	Transmit PDO 3: Number of entries.
	1	u32, rw	0x380 + Node ID	No	COB ID for transmit PDO 3
	2	u8, rw	255	No	Transmission type for transmit PDO 3.
	3	u16, rw	500	No	Inhibit time for transmit PDO 3.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer for transmit PDO 3.

Index	S-Idx	Type	Default	Saved	Description
0x1803	0	u8, ro	5	-	Transmit PDO 4: Number of entries.
	1	u32, rw	0x180 + Node ID	No	COB ID for transmit PDO 4.
	2	u8, rw	255	No	Transmission type for transmit PDO 4.
	3	u16, rw	500	No	Inhibit time for transmit PDO 4.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer for transmit PDO 4.
0x1804	0	u8, ro	5	-	Transmit PDO 5: Number of entries.
	1	u32, rw	0x180 + unused Node ID	No	COB ID for transmit PDO 5.
	2	u8, rw	255	No	Transmission type for transmit PDO 5.
	3	u16, rw	500	No	Inhibit time for transmit PDO 5.
	4	-	-	-	Not used.
	5	u16, rw	0	No	Event timer for transmit PDO 5.
PDO mappings for transmit PDO's					
0x1A00	0	u8, rw	5	No	Transmit PDO 1: Number of entries. Maximum 8.
	1	u32, rw	0x60000108	No	First mapped object for transmit PDO 1.
	2	u32, rw	0x60000308	No	Second mapped object for transmit PDO1.
	3	u32, rw	0x60000408	No	Third mapped object for transmit PDO1.
	4	u32, rw	0x60000508	No	Fourth mapped object for transmit PDO1.
	5	u32, rw	0x60000208	No	Fifth mapped object for transmit PDO1.
	6 – 8	u32, rw	-	No	Sixth to eighth mapped object for transmit PDO 1.
0x1A01	0	u8, rw	4	No	Transmit PDO 2: Number of entries. Maximum 8.
	1	u32, rw	0x64010110	No	First mapped object for transmit PDO 2.
	2	u32, rw	0x64010210	No	Second mapped object for transmit PDO2.
	3	u32, rw	0x64010310	No	Third mapped object for transmit PDO 2.
	4	u32, rw	0x64010410	No	Fourth mapped object for transmit PDO 2.
	5 – 8	u32, rw	-	No	Fifth to eighth mapped object for transmit PDO 2.
0x1A02	0	u8, rw	4	No	Transmit PDO 3: Number of entries. Maximum 8.
	1	u32, rw	0x64010510	No	First mapped object for transmit PDO 3.
	2	u32, rw	0x64010610	No	Second mapped object for transmit PDO3.
	3	u32, rw	0x64010710	No	Third mapped object for transmit PDO 3.
	4	u32, rw	0x64010810	No	Fourth mapped object for transmit PDO 3.
	5 – 8	u32, rw	-	No	Fifth to eighth mapped object for transmit PDO 3.
0x1A03	0	u8, rw	4	No	Transmit PDO 4: Number of entries. Maximum 8.
	1	u32, rw	0x64010910	No	First mapped object for transmit PDO 4.

Index	S-Idx	Type	Default	Saved	Description
	2	u32, rw	0x64010A10	No	Second mapped object for transmit PDO4.
	3	u32, rw	0x64010B10	No	Third mapped object for transmit PDO 4.
	4	u32, rw	0x64010C10	No	Fourth mapped object for transmit PDO 4.
	5 – 8	u32, rw	-	No	Fifth to eighth mapped object for transmit PDO 4.
0x1A03	0	u8, rw	2	No	Transmit PDO 5: Number of entries. Maximum 8.
	1	u32, rw	0x64020120	No	First mapped object for transmit PDO 5.
	2	u32, rw	0x64020220	No	Second mapped object for transmit PDO5.

Note on Mapping Addresses

The mapping area controls where the received data in the receive PDOs will be stored. If these values are not changed then the default values will be used. The values can be read as follows:

Eg: 0x62000108

6200 = address in manufacturer specific area of Object Dictionary.
01 = sub index 1
08 = 1 byte (10 = 2 bytes, 20 = 4 bytes, etc.)

Object Dictionary – continued

Manufacturer Specific Profile Area; Index 0x2000 to 0x5FFF

Index	S-Idx	Type	Default (possible)	Saved	Description
0x2000	0	u8, ro	20	-	Port Configuration: Number of entries. The values used have the following meaning for sub-indices 1 to 20: 0 = Analog Input 1 = Analog Output (and PWM Output) 2 = Digital Input 3 = Digital Output 4 = Pulse Counter Input 5 = Shaft Encoder Input
	1	u8, rw	1 (3)	Yes	Port configuration for port 1:
	2	u8, rw	1 (3)	Yes	Port configuration for port 2:
	3	u8, rw	1 (3)	Yes	Port configuration for port 3:
	4	u8, rw	1 (3)	Yes	Port configuration for port 4:
	5	u8, rw	1 (3)	Yes	Port configuration for port 5:
	6	u8, rw	1 (3)	Yes	Port configuration for port 6:
	7	u8, rw	1 (3)	Yes	Port configuration for port 7:
	8	u8, rw	1 (3)	Yes	Port configuration for port 8:
	9	u8, rw	0 (2)	Yes	Port configuration for port 9:
	10	u8, rw	0 (2)	Yes	Port configuration for port 10:
	11	u8, rw	0 (2)	Yes	Port configuration for port 11:
	12	u8, rw	0 (2)	Yes	Port configuration for port 12:
	13	u8, rw	0 (1,2,3,4,5)	Yes	Port configuration for port 13: 5 = Encoder In (must also configure port 14 as Encoder In)
	14	u8, rw	0 (1,2,3,4,5)	Yes	Port configuration for port 14: 5 = Encoder In (must also configure port 13 as Encoder In)
	15	u8, rw	0 (1,2,3)	Yes	Port configuration for port 15:
	16	u8, rw	0 (1,2,3)	Yes	Port configuration for port 16:
	17	u8, rw	2 (0)	Yes	Port configuration for port 17: If Node ID = 0, this port used as ID input
	18	u8, rw	2 (0)	Yes	Port configuration for port 18: If Node ID = 0, this port used as ID input
	19	u8, rw	2 (0)	Yes	Port configuration for port 19: If Node ID = 0, this port used as ID input

Index	S-Idx	Type	Default (possible)	Saved	Description
	20	u8, rw	2 (0)	Yes	Port configuration for port 20: If Node ID = 0, this port used as ID input
0x2001	0	u8, ro	20	-	Voltage Range: Number of entries. The following values are valid: 5 = 0 – 5 Volts 32 = 0 – 32 Volts
	1	u16,ro	0	-	Not used.
	2	u16,ro	0	-	Not used.
	3	u16,ro	0	-	Not used.
	4	u16,ro	0	-	Not used.
	5	u16,ro	0	-	Not used.
	6	u16,ro	0	-	Not used.
	7	u16,ro	0	-	Not used.
	8	u16,ro	0	-	Not used.
	9	u16,rw	5 (32)	Yes	Voltage range for port 9:
	10	u16,rw	5 (32)	Yes	Voltage range for port 10:
	11	u16,rw	5 (32)	Yes	Voltage range for port 11:
	12	u16,rw	5 (32)	Yes	Voltage range for port 12:
	13	u16,rw	5 (32)	Yes	Voltage range for port 13 (not used when configured as digital out):
	14	u16,rw	5 (32)	Yes	Voltage range for port 14 (not used when configured as digital out):
	15	u16,rw	5 (32)	Yes	Voltage range for port 15 (not used when configured as digital out):
	16	u16,rw	5 (32)	Yes	Voltage range for port 16 (not used when configured as digital out):
	17	u16,ro	5	-	Voltage range for port 17:
	18	u16,ro	5	-	Voltage range for port 18:
	19	u16,ro	5	-	Voltage range for port 19:
	20	u16,ro	5	-	Voltage range for port 20:
0x2002	0	u8, ro	20	-	Logic Threshold: Number of Entries. Only used when respective Analog Input ports are configured as Digital Inputs This index specifies the theshold above which voltages are interpreted as logic hi. Valid values are from 0 to 1023. If port set on 0-5 V range: 512 = 2.5V If port set on 0-32 V range: 512 = 16 V
	1-8	u16,ro	0	-	Unused.
	9	u16,rw	512	Yes	Logic Threshold for port 9.
	10	u16,rw	512	Yes	Logic Threshold for port 10.
	11	u16,rw	512	Yes	Logic Threshold for port 11.
	12	u16,rw	512	Yes	Logic Threshold for port 12.
	13-20	u16,rw	512	Yes	Logic Threshold for ports 13 to 20.

Index	S-Idx	Type	Default (possible)	Saved	Description
0x2004	0	u16,rw	100	Yes	Global PWM Ripple Frequency: Specify the ripple frequency in Hz. Valid values are 0 to 1000 Hz. Valid for all ports 1 to 8.
0x200A	0	u8, ro	14	-	Pulse Counters: Number of Entries.
	1-12	u8,ro	0	-	Unused.
	13	u8, rw	0	No	Pulse Counter 13 / Shaft Position: To reset, overwrite with nonzero value.
	14	u8, rw	0	No	Pulse Counter 14: To reset, overwrite with nonzero value.
0x2010	0	u8, rw	0	Yes	CANopen Node ID. The default node ID is 0. Valid values are 0 – 127. In the preoperational stage, if the node ID is 0, then the ID pins will be read to set the new node ID according to the truth table at the end of section 2.1. If the node ID is changed with an SDO, then the new Node ID will be activated when the node is restarted or reset.
0x2011	0	u8, rw	4	Yes	CAN baudrate index. The new baudrate is activated when the node is restarted or reset. Possible values are: 0 = 1000 kbit/s 1 = 800 kbit/s 2 = 500 kbit/s 3 = 250 kbit/s 4 = 125 kbit/s 5 = 100 kbit/s 6 = 50 kbit/s 7 = 20 kbit/s 8 = 10 kbit/s
0x2012	0	u8, rw	0	No	Reset EEPROM function. By writing a nonzero value to this index, the EEPROM will reset to its default values the next time the node is restarted or reset.

Object Dictionary - continued

Device specific entries (DS401); Index 0x6000 to 0x9FFF

Index	S-Idx	Type	Default	Saved	Description
0x6000	0	u8, ro	2	-	Digital Inputs: Number of entries.
	1	u8, ro	0	-	Digital Input Ports 9 – 16. Bit 0 – Port 9 Bit 1 – Port 10 Bit 2 – Port 11 Bit 3 – Port 12 Bit 4 – Port 13 Bit 5 – Port 14 Bit 6 – Port 15 Bit 7 – Port 16 Each bit is only used when the corresponding port is configured as Digital Input.
	2	u8, ro	0	-	ID bits or Digital Input Ports 17 – 20. Bit 0 – Port 17 Bit 1 – Port 18 Bit 2 – Port 19 Bit 3 – Port 20 Each bit is only used when the corresponding port is configured as Digital Input.
	3	u8, ro	00000000	-	Status bits for PWM Outputs: Ports 1 – 4.
	4	u8, ro	00000000	-	Status bits for PWM Outputs: Ports 5 – 8.
	5	u8, ro	00000000	-	Status bits for Digital or PWM Outputs: Ports 13 – 16.
0x6200	0	u8, ro	2	-	Digital Outputs: Number of entries.
	1	u8, rw	0	No	Digital Outputs: Ports 1 – 8. Bit 0 – Port 1 Bit 1 – Port 2 Bit 2 – Port 3 Bit 3 – Port 4 Bit 4 – Port 5 Bit 5 – Port 6 Bit 6 – Port 7 Bit 7 – Port 8 Each bit is only used when the corresponding port is configured as a Digital Output.
	2	u8, rw	0	No	Digital Outputs: Ports 9 to 12. Bit 0 – Port 9 Bit 1 – Port 10 Bit 2 – Port 11 Bit 3 – Port 12 Bit 4 to 7 – Unused Each bit is only used when the corresponding port is configured as a

Index	S-Idx	Type	Default	Saved	Description
					Digital Output.
0x6401	0	u8, ro	12	-	Analog Inputs: Number of entries. Each sub-index is only valid when the corresponding port is configured as an Analog Input.
	1	u16, ro	0	-	Analog Input port 9.
	2	u16, ro	0	-	Analog Input port 10.
	3	u16, ro	0	-	Analog Input port 11.
	4	u16, ro	0	-	Analog Input port 12.
	5	u16, ro	0	-	Analog Input port 13.
	6	u16, ro	0	-	Analog Input port 14
	7	u16, ro	0	-	Analog Input port 15.
	8	u16, ro	0	-	Analog Input port 16.
	9	u16, ro	0	-	Analog Input port 17
	10	u16, ro	0	-	Analog Input port 18.
	11	u16, ro	0	-	Analog Input port 19.
	12	u16, ro	0	-	Analog Input port 20.
0x6402	0	u8,ro	2	-	Analog Inputs (Pulse Counters): Number of Entries.
	1	u32, ro	0	-	Pulse Counter / Shaft Encoder Port 13
	2	u32,ro	0	-	Pulse Counter / Shaft Encoder Port 14
0x6411	0	u8, ro	12	-	Analog Outputs: Number of entries. Each sub-index is used only when the corresponding port is configured as an Analog (PWM) Output. Valid values range from 0 to 1023.
	1	u16, rw	0	No	Analog Output port 1
	2	u16, rw	0	No	Analog Output port 2.
	3	u16, rw	0	No	Analog Output port 3.
	4	u16, rw	0	No	Analog Output port 4.
	5	u16, rw	0	No	Analog Output port 5.
	6	u16, rw	0	No	Analog Output port 6.
	7	u16, rw	0	No	Analog Output port 7.
	8	u16, rw	0	No	Analog Output port 8.
	9	u16, rw	0	No	Analog Output port 13.
	10	u16, rw	0	No	Analog Output port 14
	11	u16, rw	0	No	Analog Output port 15.
	12	u16, rw	0	No	Analog Output port 16.

Appendix 1 – Environmental Tolerances

Environmental Tolerances

Environmental Test	Level			Standard
High temperature	Functional During test +75 °C, 16 hours			IEC 60068-2-2 Ab
Low temperature	Functional During test -40 °C, 16 hours			IEC 60068-2-1 Bb
Change of temperature	Functional During test -40 °C – +30 °C, 5 °C/min 3 hour hold time, 2 cycles			IEC 60068-2-14 Nb
Damp heat	Functional During test +25 °C / +55 °C, Rel. Humidity > 95% 6 x 24 hours			IEC 60068-2-30 Db
Shock	Functional During test 50 g / 6 ms 3 impulses in 6 directions			IEC 60068-2-27
Vibration	ASD-level 5 m^2/s^3 10 – 200 Hz ASD-level 1 m^2/s^3 200 – 500 Hz 60 min in 3 directions			IEC 60068-2-6
Electrical Transients	Conducted transients Pulse 1: -50 V 2: +25 V 3a: -220 V 3b: +220 V 4: -5 V 5: +70 V			ISO 7637-2
EMC Susceptibility (Component)	RF electromagnetic field 200 – 1000 MHz 30 V/m 1 kHz sine			ISO 11452-2
	Bulk Current Injection 20 – 200 MHz 60 mA 1 kHz sine			ISO 11452-4
EMC Emissions (Component)	Frequency MHz	Narrowb. dBμV/m	Broadb. dBμV/m	ISO 14982
	30-75 75-400 400-1000	54-44 44-55 55	64-54 54-65 65	
Electrostatic Discharge	+/- 4 kV air/contact			ISO/TR 10605
Enclosure	IP67			IEC 60529

Technical Support

Contact your reseller or supplier for help with possible problems with your CrossFire™ MX1b. In order to get the best help, you should have access to your CrossFire™ MX1b and be prepared with the following information before you contact support.

》 Part number and serial number of the unit, which you find on the brand label
》 Date of purchase, which is found on the invoice
》 The conditions and circumstances under which the problem arises
》 LED indicator colours and blink patterns.
》 EMCY object error codes (if possible)
》 Description of external equipment which is connected to the CrossFire™ MX1b

Trade Mark, etc