

Contents

1. Cinch Connector 30 pin:	2
2. CANopen messages structure	2
3. CAN bus Default Settings.....	3
NMT MESSAGES.....	4
4. Start CANopen node.....	4
5. Enter pre-operational.....	4
6. Reset CANopen node.....	4
7. Stop CANopen node	5
8. Boot-up service.....	5
9. Heartbeat message.....	5
PDO messages	6
10. Set output.....	6
SDO messages.....	6
11. Object 2001h: Single Contact status.....	6
12. Object 2010h: Baud Rate Settings.....	7
13. Object 2011h: Set node ID.....	7
14. Object 2012h: Set Boot-up service.....	8
15. Object 2013h: Set device active on startup.....	8
16. Object 1017h: Producer heartbeat time	9
17. Object 1000h: Device Type.....	9
18. Object 1001h: Error register.....	10
19. Object 1008h: Manufacturer Device Name.....	10
20. Object 1009h: Manufacturer Hardware revision	11
21. Object 100Ah: Manufacturer Firmware revision	11
22. Object 1018h: Identity object (future upgrade).....	12
23. Object 1400h: Receive PDO Communication parameter	12
24. Object 1600h: Receive PDO Mapping parameter	13

1. Cinch Connector 30 pin:

Output	Pin
Battery Positive	E1
Battery Ground	F3
RS485 bus	D2
RS485 bus	E2
Contact1	C1, D1
Contact2	C2, C3
Contact3	H1, H2
Contact4	G2, H3
Contact5	D3, E3
Contact6	J1, K1
Contact7	J2, K2
Contact8	J3, K3
Contact9	A1, B1
Contact10	A2, B2
Contact11	A3, B3
Contact12	F2, G3
CAN H	F1
CAN L	G1

2. CANopen messages structure

All the data type used are unsigned integer and the syntax is specified in the following table:

octet number	1.	2.	3.	4.	5.	6.	7.	8.
UNSIGNED8	b7..b0							
UNSIGNED16	b7..b0	b15..b8						
UNSIGNED24	b7..b0	b15..b8	b23..b16					
UNSIGNED32	b7..b0	b15..b8	b23..b16	b31..b24				
UNSIGNED40	b7..b0	b15..b8	b23..b16	b31..b24	b39..b32			
UNSIGNED48	b7..b0	b15..b8	b23..b16	b31..b24	b39..b32	b47..b40		
UNSIGNED56	b7..b0	b15..b8	b23..b16	b31..b24	b39..b32	b47..b40	b55..b48	
UNSIGNED64	b7..b0	b15..b8	b23..b16	b31..b24	b39..b32	b47..b40	b55..b48	b63..b56

NMT MESSAGES

The Network Management messages follow a master-slave structure. Through NMT services, CANopen devices are initialized, started, reset or stopped. All CANopen devices are regarded as NMT slaves. NMT messages have CAN-ID always equal to 00h.

00h	1 byte command specifier	1 byte NODE-ID	6 bytes not used
-----	--------------------------	----------------	------------------

PDO MESSAGES

PDO are fast telegram messages can simply manage most important functions. All PDOs have an equivalent SDO message. There are no answers for this type of messages. PDO messages have identifiers from 180h to 57Fh.

Identifier	8 byte data
------------	-------------

SDO MESSAGES

SDO are more complex messages that completely manage all the functions of the Keybox. SDO messages have identifiers from 580h to 67Fh and have always answers or acknowledge reply.

Identifier	Command byte	2 byte index	1 byte sub index	4 byte data
------------	--------------	--------------	------------------	-------------

Identifier: The messages to the Keybox shall have 600h+current CAN ID identifier.
The messages from the Keybox have 580h+ current CAN ID identifier.

Command byte: 40h: request to read a register 60h: write acknowledge
43h: response with 4 byte data 23h: request to write 4 byte data
4Fh: response with 1 byte data 2Fh: request to write 1 byte data
80h: error response

Every answer have index and sub index echo.

The error response have the byte data containing the abort codes.

Abort codes implemented:

0602 0000h: Object does not exist in the object dictionary
0609 0011h: Sub-index does not exist
0609 0030h: Invalid value for parameter
0601 0002h: Attempt to write a read only object

3. CAN bus Default Settings

Setting	Default status or level	How to change
Baud Rate	125 kbit/s	Object 2010h
CANopen Node ID	15h	Object 2011h
Heartbeat Message	Disable	Object 1017h
Boot-up service	Active	Object 2012h

NMT MESSAGES

The Network Management messages follow a master-slave structure. Through NMT services, CANopen devices are initialized, started, reset or stopped. All CANopen devices are regarded as NMT slaves. NMT messages have CAN-ID always equal to 00h.

4. Start CANopen node

Identifier	00h	
Byte 0	01h	Start CANopen node
Byte 1	XXh	Keybox CAN ID 00h: start all the devices 15h: start the Keybox with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	Identifier	Format	Message
To Keybox	0	Std	01 15

5. Enter pre-operational

Identifier	00h	
Byte 0	80h	Enter pre-operational
Byte 1	XXh	Keybox CAN ID 00h: Enter pre-operational all the devices 15h: Enter pre-operational the Keybox with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	Identifier	Format	Message
To Keybox	0	Std	80 15

6. Reset CANopen node

Identifier	00h	
Byte 0	81h	Reset CANopen node
Byte 1	XXh	Keybox CAN ID 00h: reset all the devices 15h: reset the Keybox with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	Identifier	Format	Message
To Keybox	0	Std	81 15

7. Stop CANopen node

Identifier	00h	
Byte 0	XXh	02h: Stop CANopen node
Byte 1	YYh	Keybox CAN ID 00h: Stop all the devices 15h: Stop the Keybox with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	Identifier	Format	Message
To Keybox	0	Std	02 15

8. Boot-up service

This service is used to signal that a NMT slave has entered the NMT state Pre-operational.

Identifier	700h + current CAN ID	Default 715h
Byte 0	00h	One data byte is transmitted with value 0.

Example:

Direction	Identifier	Format	Message
From Keybox	715h	Std	00h

The Keybox with CAN ID 15h has entered the NMT state Pre-operational.

9. Heartbeat message

The heartbeat mechanism for a CANopen device is established by cyclically transmitting the heartbeat message by the heartbeat producer. One or more CANopen devices in the network are aware of this heartbeat message. If the heartbeat cycle fails for the heartbeat producer the local application on the heartbeat consumer will be informed about that event.

If a CANopen device starts with a value for the heartbeat producer time unequal to 0 the boot-up message is regarded as first heartbeat message.

Identifier	700h + current CAN ID	Default 715h
Byte 0	XXh	XXh :State of heartbeat producer 00h: Boot-up 04h: Stopped 05h: Operational 7Fh: Pre-operational

Example:

Direction	Identifier	Format	Message	Data
From Keybox	715h	Std	00h	Boot up
From Keybox	715h	Std	7Fh	Pre-operational
To keybox	00h	Std	01h 15h	Start keyboxwith CAN id =15h
From Keybox	715h	Std	05h	Operational

PDO messages

10. Set output

Identifier	200h + current CAN ID	Default 215h
Byte 0	K8 K7 K6 K5 K4 K3 K2 K1	'1'= set ON; '0'= set OFF
Byte 1	0 0 0 0 K12 K11 K10 K9	'1'= set ON; '0'= set OFF
Byte 2,7	00h	Not used

Example

Direction	Identifier	Format	Message	Data
To Keybox	215	Std	01 00 00 00 00 00 00 00	Set K1 ON. All the other outputs OFF
To Keybox	215	Std	00 03 00 00 00 00 00 00	Set K9 and K10 ON. All the other outputs OFF

SDO messages

11. Object 2001h: Single Contact status

This object sets and reads the status of each output pins.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1 byte data
Byte 1	01h	CAN Object 2001h
Byte 2	20h	
Byte 3	00h	Highest sub-index supported (readonly)
	01h	K1
	02h	K2
	03h	K3
	04h	K4
	05h	K5
	06h	K6
	07h	K7
	08h	K8
	09h	K9
	0Ah	K10
	0Bh	K11
Byte 4	00h	OFF
	01h	ON
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	2F 01 20 05 01 00 00 00	Set K5 ON
Keybox Reply	595	Std	60 01 20 05 00 00 00 00	ACK
To Keybox	615	Std	2F 01 20 01 00 00 00 00	Set K1 OFF
Keybox Reply	595	Std	60 01 20 11 00 00 00 00	ACK

12.Object 2010h: Baud Rate Settings

This object sets and reads the baud rate.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1 byte data
Byte 1	10h	CAN Object 2010h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	XXh: 00h= 1M; 01h= 800K; 02h=500k 03h= 250k; 04h= 125K; 05h= reserved (125K) 06h= 50k; 07h= 20k
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 10 20 00 00 00 00 00	Read Baudrate
Keybox Reply	595	Std	4F 10 20 00 05 00 00 00	05h= 125k
To Keybox	615	Std	2F 10 20 00 03 00 00 00	Set 02h= 500k
Keybox Reply	595	Std	60 10 20 00 00 00 00 00	ACK
To Keybox	615	Std	2F 10 20 00 04 00 00 00	Set 04h= 250k
Keybox Reply	595	Std	60 10 20 00 00 00 00 00	ACK

13.Object 2011h: Set node ID

This object sets and reads the CANopen node-id.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2F	Write 1 byte data
Byte 1	11h	CAN Object 2011h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	New node id: (01h – 7Fh)
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 11 20 00 00 00 00 00	Read Node ID
Keybox Reply	595	Std	4F 11 20 00 15 00 00 00	ID= 15h
To Keybox	615	Std	2F 11 20 00 16 00 00 00	Set ID= 16h
Keybox Reply	595	Std	60 11 20 00 00 00 00 00	ACK

14.Object 2012h: Set Boot-up service

This object enables and disables the boot-up message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1 byte data
Byte 1	12h	CAN Object 2012h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h= OFF ; 01h: ACTIVE
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 12 20 00 00 00 00 00	Read register
Keybox Reply	595	Std	4F 12 20 00 00 00 00 00	Not active at start
To Keybox	615	Std	2F 12 20 00 01 00 00 00	Set active on start
Keybox Reply	595	Std	60 12 20 00 00 00 00 00	ACK

15.Object 2013h: Set device active on startup

If device is active on startup don' t need start command from master.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1 byte data
Byte 1	13h	CAN Object 2013h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h= OFF ; 01h: ACTIVE
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 13 20 00 00 00 00 00	Read register
Keybox Reply	595	Std	4F 13 20 00 00 00 00 00	Not active at start
To Keybox	615	Std	2F 13 20 00 01 00 00 00	Set active on start
Keybox Reply	595	Std	60 13 20 00 00 00 00 00	ACK

16.Object 1017h: Producer heartbeat time

The producer heartbeat time shall indicate the configured cycle time of the heartbeat.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Bh	Set device register
Byte 1	17h	CAN Object 1017h
Byte 2	10h	
Byte 3	00h	Sub index
Byte 4	YYh	YYh: Heartbeat time in milliseconds
Byte 5	XXh	XXh: Heartbeat time in milliseconds
Byte 5, 7	00h	Not used

Heartbeat time: XYYh minimum 000Ah maximum FFFFh milliseconds.

Examples:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 17 10 00 00 00 00 00	Read heartbeat time
Keybox Reply	595	Std	4B 17 10 00 64 00 00 00	Heartbeat time = 100ms
To Keybox	615	Std	2B 17 10 00 00 00 00 00	Switch off the heartbeat
Keybox Reply	595	Std	60 17 10 00 00 00 00 00	
To Keybox	615	Std	2B 17 10 00 32 00 00 00	Set heartbeat time = 50ms
Keybox Reply	595	Std	60 17 10 00 00 00 00 00	
To Keybox	615	Std	2B 17 10 00 F4 01 00 00	Set heartbeat time = 500ms
Keybox Reply	595	Std	60 17 10 00 00 00 00 00	

17.Object 1000h: Device Type

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1000h
Byte 2	10h	
Byte 3	00h	Sub Index
Byte 4, 7	00h	Not used

Example:

Direction	Identifier	Format	Message
To Keybox	615	Std	40 00 10 00 00 00 00 00
Keybox Reply	595	Std	43 00 10 00 91 01 02 00

Device profile number: 191h generic I/O module.

I/O Functionality: digital output.

Mapping PDOs: pre-defined, generic PDO mapping is supported.

18.Object 1001h: Error register

This object is not yet implemented in the device.

19.Object 1008h: Manufacturer Device Name

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	08h	CAN Object 1008h
Byte 2	10h	
Byte 3, 7	00h	Non used

1° additional byte

Identifier	600h + current CAN ID	Default 615h
Byte 0	60h	Read Device Register Next Byte
Byte 1, 7	00h	Not used

2° additional byte

Identifier	600h + current CAN ID	Default 615h
Byte 0	70h	Read Device Register Next Byte
Byte 1, 7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 08 10 00 00 00 00 00	
Keybox Reply	595	Std	41 08 10 00 0A 00 00 00	
To Keybox	615	Std	60 00 00 00 00 00 00 00	
Keybox Reply	595	Std	00 4B 65 79 42 6F 78 20	Keybox
To Keybox	615	Std	70 00 00 00 00 00 00 00	
Keybox Reply	595	Std	10 2D 20 42 6C 69 6E 6B	- Blink
To Keybox	615	Std	60 00 00 00 00 00 00 00	
Keybox Reply	595	Std	00 20 4D 61 72 69 6E 65	Marine

Manufacturer Device Name: Keybox – Blink Marine

20. Object 1009h: Manufacturer Hardware revision

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	09h	CAN Object 1009h
Byte 2	10h	
Byte 3	00h	Sub index
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 09 10 00 00 00 00 00	
Keybox Reply	595	Std	43 09 10 00 00 00 00 03	03h

Hardware revision: 03h

21. Object 100Ah: Manufacturer Firmware revision

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	0Ah	CAN Object 100Ah
Byte 2	10h	
Byte 3	00h	Sub index
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 0A 10 00 00 00 00 00	
Keybox Reply	595	Std	43 0A 10 00 00 00 00 03	03h

Firmware revision: 03h

22. Object 1018h: Identity object (future upgrade)

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	18h	CAN Object 1018h
Byte 2	10h	
Byte 3	XXh	XX: 00h Highest sub-index supported 01h= Vendor ID
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 18 10 00 00 00 00 00	
Keybox Reply	595	Std	4F 18 10 00 01 00 00 00	01h
To Keybox	615	Std	40 18 10 01 00 00 00 00	
Keybox Reply	595	Std	4F 18 10 01 00 00 00 00	

Vendor ID:

23. Object 1400h: Receive PDO Communication parameter

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1400h
Byte 2	14h	
Byte 3	XXh	00h: Highest sub-index supported
		01h: COB-ID used by PDO
		03h: Transmission type
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 00 14 00 00 00 00 00	
Keybox Reply	595	Std	4F 00 14 00 02 00 00 00	02h
To Keybox	615	Std	40 00 14 01 00 00 00 00	
Keybox Reply	595	Std	43 00 14 01 15 02 00 00	215h
To Keybox	615	Std	40 00 14 02 00 00 00 00	
Keybox Reply	595	Std	4F 00 14 02 FE 00 00 00	FEh

Highest sub-index supported:2,
COB id: 0000 0215h,
Transmission type: FEh event-driven (manufacturer-specific)

24. Object 1600h: Receive PDO Mapping parameter

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1600h
Byte 2	16h	
Byte 3	XXh	00h: Highest sub-index supported
		01h: 1 st application object
		02h: 2 nd application object
		03h: 3 rd application object
		04h: 4 th application object
		05h: 5 th application object
		06h: 6 th application object
		07h: 7 th application object
		08h: 8 th application object
		09h: 9 th application object
		0Ah: 10 th application object
		0Bh: 11 th application object
0Ch: 12 th application object		
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keybox	615	Std	40 00 16 00 00 00 00 00	
Keybox Reply	595	Std	4F 00 16 00 0C 00 00 00	0Ch
To Keybox	615	Std	40 00 16 01 00 00 00 00	
Keybox Reply	595	Std	43 00 16 01 01 01 01 20	2001h sub 01h length 01h
To Keybox	615	Std	40 00 16 02 00 00 00 00	
Keybox Reply	595	Std	43 00 16 02 01 02 01 20	2001h sub 02h length 01h
To Keybox	615	Std	40 00 16 03 00 00 00 00	
Keybox Reply	595	Std	43 00 16 03 01 03 01 20	2001h sub 03h length 01h
To Keybox	615	Std	40 00 16 04 00 00 00 00	
Keybox Reply	595	Std	43 00 16 04 01 04 01 20	2001h sub 04h length 01h
To Keybox	615	Std	40 00 16 05 00 00 00 00	
Keybox Reply	595	Std	43 00 16 05 01 05 01 20	2001h sub 05h length 01h
To Keybox	615	Std	40 00 16 06 00 00 00 00	
Keybox Reply	595	Std	43 00 16 06 01 06 01 20	2001h sub 06h length 01h
To Keybox	615	Std	40 00 16 07 00 00 00 00	
Keybox Reply	595	Std	43 00 16 07 01 07 01 20	2001h sub 07h length 01h
To Keybox	615	Std	40 00 16 08 00 00 00 00	
Keybox Reply	595	Std	43 00 16 08 01 08 01 20	2001h sub 08h length 01h
To Keybox	615	Std	40 00 16 09 00 00 00 00	
Keybox Reply	595	Std	43 00 16 09 01 09 01 20	2001h sub 09h length 01h
To Keybox	615	Std	40 00 16 0A 00 00 00 00	
Keybox Reply	595	Std	43 00 16 0A 01 0A 01 20	2001h sub 0Ah length 01h
To Keybox	615	Std	40 00 16 0B 00 00 00 00	
Keybox Reply	595	Std	43 00 16 0B 01 0B 01 20	2001h sub 0Bh length 01h
To Keybox	615	Std	40 00 16 0C 00 00 00 00	
Keybox Reply	595	Std	43 00 16 0C 01 0C 01 20	2001h sub 0Ch length 01h