

## Summary:

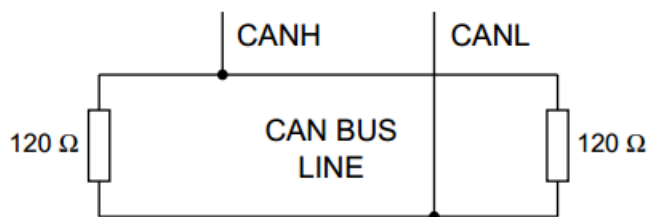
1. How to connect Deutsch 4 pin: .....	3
2. Reference.....	4
3. Default settings.....	4
NMT MESSAGES.....	5
4. Start CANopen node (keypad activation message) .....	5
5. Enter pre-operational .....	5
6. Reset CANopen node.....	5
7. Stop CANopen node .....	6
8. Boot-up service.....	6
9. Heartbeat message.....	6
10. Sync message.....	6
PDO messages .....	7
11. Keys and Encoder state message.....	7
12. Set LED on message .....	8
13. Set LED blink message .....	9
14. Set Backlight brightness level message .....	10
SDO Messages: .....	11
15. Object 1000h: Device Type .....	11
16. Object 1001h: Error Register .....	11
17. Object 1008h: Manufacturer Device Name.....	11
18. Object 1009h: Manufacturer Hardware Revision.....	12
19. Object 100Ah: Manufacturer Firmware Revision .....	12
20. Object 1011h: Restore default parameters.....	12
21. Object 1016h: Consumer heartbeat time.....	13
22. Object 1017h: Producer heartbeat time .....	14
Heartbeat message.....	14
23. Object 1018h: Identity Data .....	15
24. Object 1400h: Receive PDO Communication Parm 0 .....	15
25. Object 1401h: Receive PDO communication Parm 1 .....	16
26. Object 1402h: Receive PDO communication Parm 2 .....	17
27. Object 1600h: Receive PDO mapping Parameter 0.....	18
28. Object 1601h: Receive PDO mapping Parameter 1.....	19
29. Object 1602h: Receive PDO mapping Parameter 2.....	20
30. Object 1800h: .....	21
a) Transmit PDO Communication Parm 0 .....	21

b) Set periodic state transmission.....	22
31. Object 1A00h Transmit PDO Mapping Parameter.....	23
32. Object 2000h: Key and Encoder state .....	24
a) Sub 1 – Key State.....	24
b) Sub 2 - Encoder direction counter .....	25
c) Sub 3 - Encoder tick counter .....	26
• Read encoder tick counter value .....	26
• Set encoder tick counter value .....	26
33. Object 2001h: LED state .....	27
a) Sub 1 – LED #1-18 green state / LED #1-4 red state .....	27
b) Sub 2 - LED #5-18 red state .....	27
c) Sub 3 - LED green #1-18 blink state / LED red #1-4 blink state.....	28
d) Sub 4 - LED red #5-18 blink state .....	28
34. Object 2002h: LED RING state .....	29
a) Sub 1 –RING LED green state .....	29
b) Sub 2 –RING LED red state .....	29
c) Sub 3 RING LED blue state .....	30
d) Sub 4 –RING LED green blink state.....	30
e) Sub 5 –RING LED red blink state .....	31
f) Sub 6 –RING LED blue blink state.....	31
35. Object 2003h: Brightness Level .....	32
a) Set Indicator LEDs brightness level .....	32
b) Set green LEDs backlight brightness level .....	32
c) Set red LEDs backlight brightness level.....	32
d) Set blue LEDs backlight brightness level .....	33
e) Set startup Indicator LEDs brightness level.....	33
f) Set startup green LEDs backlight brightness level .....	33
g) Set startup red LEDs backlight brightness level .....	34
h) Set startup blue LEDs backlight brightness level .....	34
36. Object 2010h: Baud rate setting.....	35
37. Object 2011h: Set Boot-up service .....	35
38. Object 2012h: Set device active on startup.....	36
39. Object 2013h: Set CANopen node ID.....	36
40. Object 2014h: Set startup LED show .....	37
41. Object 2100h: Set DEMO mode.....	37
42. Set CAN protocol .....	37
APPENDIX: DEMO Mode instructions.....	38
43. Revision history.....	39

## 1. How to connect Deutsch 4 pin:



PIN	COLOUR	FUNCTION
1	Blue	CAN L
2	White	CAN H
3	Black	Negative battery
4	Red	Vbatt. (12-24V)

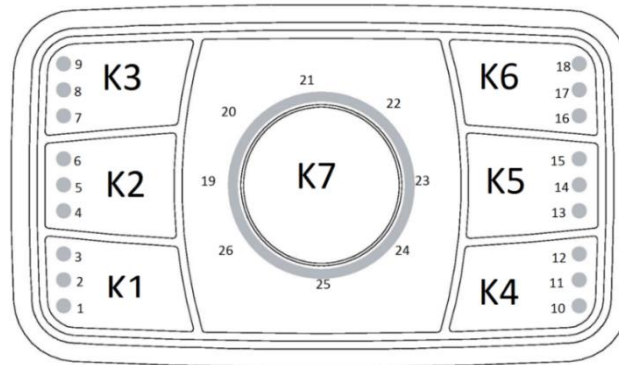


Each end of the CAN bus is terminated with 120Ω resistors in compliance with the standard to minimize signal reflections on the bus. You may need to place a 120Ω resistor between CAN-L and CAN-H.



Warning: to avoid breakage do not tighten the backshell nuts with a torque exceeding 0.8 Nm!

## 2. Reference



## 3. Default settings

Setting	Default state or level	How to change
Baud Rate	125 kbit/s	<a href="#">Object 2010h</a>
CANopen Node ID	15h	<a href="#">Object 2013h</a>
Device active on startup	Not active	<a href="#">Object 2012h</a>
LED Indicator Brightness	3Fh (Maximum brightness)	<a href="#">Object 2003h</a>
Backlight Brightness	00h (OFF)	<a href="#">Object 2003h</a>
Periodic Message Transmission	Disable	<a href="#">Object 1800h</a>
Heartbeat Producer	Disable	<a href="#">Object 1017h</a>
Heartbeat Consumer	Disable	<a href="#">Object 1016h</a>
Boot-up service	Active	<a href="#">Object 2011h</a>
Encoder tick counter value	0000h	<a href="#">Object 2000h</a>
RPDO transmission type	Asynchronous	Object <a href="#">1400h-1401h</a>
TPDO transmission type	Event-driven	<a href="#">Object 1800h</a>
Restore default parameters	-	<a href="#">Object 1011h</a>

## 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 (keypad activation message)

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

Example:

Direction	Identifier	Format	Message
To Keypad	0	Std	01 15

### 5. Enter pre-operational

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

Example:

Direction	Identifier	Format	Message
To Keypad	0	Std	80 15

### 6. Reset CANopen node

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

Example:

Direction	Identifier	Format	Message
To Keypad	0	Std	81 15

## 7. Stop CANopen node

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

Example:

Direction	Identifier	Format	Message
To Keypad	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 Keypad	715h	Std	00h

The keypad 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.

Refer to [Object 1017h](#) for more details

## 10. Sync message

This mechanism modifies the PDO operation in the following way: both the RPDOs and TPDOs are stored at the receiving of the 1<sup>st</sup> SYNC message but, while the RPDOs are always processed with the arrival of the next one, the TPDOs are transmitted each n-th time the SYNC message is received depending on the value chosen for the transmission type. The structure of the SYNC message is:

Identifier	80h	
-	-	No data byte is transmitted

Refer to Objects [1400-1401-1800h](#) for more details.

## PDO messages

PDO (Process Data Object) are fast telegram messages that can simply manage most important functions. There are no answers for this kind of messages. Each PDO message has an equivalent Service Data Object (SDO) message

### 11. Keys and Encoder state message

The keypad must be activated, see NMT Start CANopen Node message.

This message is sent by the PowerTrack to indicate the state of the buttons and of the encoder.

The state of the buttons is transmitted in the Byte 0.

The state of the encoder is represented by 2 counter fields:

- The Direction counter (Byte1) transmits the number of ticks and the direction of the encoder rotation since the last message sent. The MSB of the counter defines the direction.
- The Tick counter (Byte 2 and 3) is a two bytes counter incremented each clockwise tick and decremented each counterclockwise tick.

Identifier	195h (180h + current CAN ID)	Default 195h
Byte 0	Keys from #1 to #7 0 K7 K6 K5 – K4 K3 K2 K1	Keys: 1=ON; 0=OFF
Byte 1	Encoder Direction counter X Y Y Y Y Y Y Y b	X = 0 clockwise, X = 1 counterclockwise. YYYYYYY = number of Ticks. 1 Turn (360° rotation) = 20 Ticks
Byte 2,3	Encoder Tick counter ZZ ZZh	
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	Key and Encoder state
From Keypad	195	Std	00 00 00 00 00 00 00 00	No Key pressed, no Knob turns
From Keypad	195	Std	01 00 00 00 00 00 00 00	Key 1 pressed, no knob turns
From Keypad	195	Std	08 00 00 00 00 00 00 00	Key 4 pressed, no knob turns
From Keypad	195	Std	09 00 00 00 00 00 00 00	Keys 1 and 4 pressed, no knob turn
From Keypad	195	Std	00 81 FF FF 00 00 00 00	No key pressed, 1 tick CCW
From Keypad	195	Std	00 01 03 00 00 00 00 00	No key pressed, 3 ticks CW
From Keypad	195	Std	00 01 01 00 00 00 00 00	No key pressed, 1 tick CW
From Keypad	195	Std	01 00 03 0 00 00 00 00	Key 1 pressed, 3 ticks CW
From Keypad	195	Std	09 00 02 00 00 00 00 00	Keys 1 and 4 pressed, 2 ticks CW

Keys and Encoder state message is mapped into:

- Object 2000h sub 1
- Object 2000h sub 2
- Object 2000h sub 3

Refer to the applicable object for more details.

## 12. Set LED on message

The keypad must be activated, see NMT Start CANopen Node message.

Identifier	215h (200h + current CAN ID)	Default 215h
Byte 0	LG8 LG7 LG6 LG5 - LG4 LG3 LG2 LG1	KEY LED green
Byte 1	LG16 LG15 LG14 LG13 – LG12 LG11 LG10 LG9	KEY LED green
Byte 2	LR4 LR3 LR2 LR1– 0 0 LG18 LG17	KEY LED green and red
Byte 3	LR12 LR11 LR10 LR9 – LR8 LR7 LR6 LR5	KEY LED red
Byte 4	0 0 LR18 LR17 – LR16 LR15 LR14 LR13	KEY LED red
Byte 5	LR26 LR25 LR24 LR23 – LR22 LR21 LR20 LR19	RING LED red
Byte 6	LG26 LG25 LG24 LG23 – LG22 LG21 LG20 LG19	RING LED green
Byte 7	LB26 LB25 LB24 LB23 – LB22 LB21 LB20 LB19	RING LED blue

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	215	Std	00 00 00 00 00 00 00 00	Turn off all the LED
To Keypad	215	Std	01 00 00 00 00 00 00 00	Only green LED #1 ON
To Keypad	215	Std	42 00 00 00 00 00 00 00	Green LED #2 and 7 ON
To Keypad	215	Std	00 00 00 30 03 00 00 00	Red LED #9, 10, 13 and 14 ON
To Keypad	215	Std	00 00 00 00 00 01 00 00	Red ring LED #19 ON
To Keypad	215	Std	00 00 00 00 00 00 02 00	Green ring LED #20 LED ON
To Keypad	215	Std	00 00 00 00 00 FF 00 00	All ring LED red ON

Set LED state message is mapped into:

- Object 2001h sub 1 and sub 2
- Object 2002h sub 1, sub 2 and sub 3

Refer to the applicable objects for more details.



### 13. Set LED blink message

The keypad must be activated, see NMT Start CANopen Node message

Note: if the blink message is sent when the LED is already on, the LED blinks in alternate mode.

Identifier	315h (300h + current CAN ID)	Default 315h
Byte 0	LG8 LG7 LG6 LG5 - LG4 LG3 LG2 LG1	KEY LED green
Byte 1	LG16 LG15 LG14 LG13 – LG12 LG11 LG10 LG9	KEY LED green
Byte 2	LR4 LR3 LR2 LR1– 0 0 LG18 LG17	KEY LED green and red
Byte 3	LR12 LR11 LR10 LR9 – LR8 LR7 LR6 LR5	KEY LED red
Byte 4	0 0 LR18 LR17 – LR16 LR15 LR14 LR13	KEY LED red
Byte 5	LR26 LR25 LR24 LR23 – LR22 LR21 LR20 LR19	RING LED red
Byte 6	LG26 LG25 LG24 LG23 – LG22 LG21 LG20 LG19	RING LED green
Byte 7	LB26 LB25 LB24 LB23 – LB22 LB21 LB20 LB19	RING LED blue

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	315	Std	00 00 00 00 00 00 00 00	Turn off all the blinking LED
To Keypad	315	Std	78 00 00 00 00 00 00 00	Green LED #4, 5, 6 and 7 blink
To Keypad	315	Std	00 00 00 21 00 00 00 00	Red LED #5 and 10 blink
To Keypad	315	Std	00 00 00 00 00 80 00 00	Red ring LED #26 blinks
To Keypad	315	Std	00 00 00 00 00 00 00 20	Blue ring LED #24 blinks
To Keypad	315	Std	00 00 00 00 00 00 01 00	Green ring LED #19 blinks
To Keypad	215	Std	00 00 F0 FF 3F 00 00 00	All key LED blink red and green in alternate mode
To Keypad	315	Std	FF FF F3 FF 3F 00 00 00	
To Keypad	215	Std	00 00 00 00 00 00 03 00	Ring LED #19 and 20 blink green and blue in alternate mode
To Keypad	315	Std	00 00 00 00 00 00 03 03	

Set LED Blink message is mapped into:

- Object 2001h sub 3 and sub 4
- Object 2002h sub 4, sub 5 and sub 6
- Refer to the applicable objects for more details.

## 14. Set Backlight brightness level message

The keypad must be activated, see NMT Start CANopen Node message

Identifier	415h (400h + current CAN ID)	Default 415h
Byte 0	XXh	Green Backlight value 0 – 3Fh (0...100%)
Byte 1	YYh	Red Backlight value 0 – 3Fh (0...100%)
Byte 2	ZZh	Blue Backlight value 0 – 3Fh (0...100%)
Byte 3, 7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	415	Std	00 00 00 00 00 00 00 00	Turn off the backlight
To Keypad	415	Std	10 00 00 00 00 00 00 00	Turn on backlight green color at brightness 25%
To Keypad	415	Std	00 20 00 00 00 00 00 00	Turn on backlight red color at brightness 50%
To Keypad	415	Std	00 00 3F 00 00 00 00 00	Turn on backlight blue color at maximum brightness

Set Backlight message is mapped into:

- Object 2001h sub 3
- Object 2001h sub 4

Refer to the applicable object for more details.

## SDO Messages:

A SDO (Service Data Object) is providing direct access to object entries of a CANopen device's object dictionary.

### 15. Object 1000h: Device Type

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

Example:

Direction	Identifier	Format	Message
To Keypad	615	Std	40 00 10 00 00 00 00 00
From Keypad	595	Std	43 00 10 00 91 01 03 00

Device profile number 30191h.

### 16. Object 1001h: Error Register

This object is not yet implemented in the device.

### 17. Object 1008h: Manufacturer Device Name

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	08h	CAN Object 1008h
Byte 2	10h	
Byte 3, 7	00h	Not used

Odd additional byte

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

Even additional byte

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

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 08 10 00 00 00 00 00	
From Keypad	595	Std	41 08 10 00 19 00 00 00	
To Keypad	615	Std	60 00 00 00 00 00 00 00	
From Keypad	595	Std	00 50 6F 77 65 72 54 72	PowerTr
To Keypad	615	Std	70 00 00 00 00 00 00 00	
From Keypad	595	Std	10 61 63 6B 20 2D 20 42	ack - B
To Keypad	615	Std	60 00 00 00 00 00 00 00	
From Keypad	595	Std	00 6C 69 6E 6B 20 4D 61	link Ma
To Keypad	615	Std	70 00 00 00 00 00 00 00	
From Keypad	595	Std	17 72 69 6E 65 00 00 00	rine

Manufacturer Device Name: PowerTrack – Blink Marine

## 18. Object 1009h: Manufacturer Hardware Revision

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

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 09 10 00 00 00 00 00	
From Keypad	595	Std	43 09 10 00 56 20 30 33	V 03

Manufacturer Hardware Revision: V 03

## 19. Object 100Ah: Manufacturer Firmware Revision

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

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 0A 10 00 00 00 00 00	
From Keypad	595	Std	43 0A 10 00 56 32 2E 37	V2.7

Manufacturer Firmware Revision: V2.7

## 20. Object 1011h: Restore default parameters

With this object the default values of parameters according to the communication profile, device profile, and application profile are restored. This procedure shall only be executed when the specific signature "load" is written to the sub-index 01h. When the message shown in the following table is transmitted, the default values shall be restored after the keypad is reset.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
	23h	Set Device Register
Byte 1	11h	CAN Object 1011h
Byte 2	10h	
Byte 3	00h	Highest sub-index supported
	01h	Restore all parameters
Byte 4	6Ch	Character 1 "l"
Byte 5	6Fh	Character 2 "o"
Byte 6	61h	Character 3 "a"
Byte 7	64h	Character 4 "d"

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 11 10 00 00 00 00 00	Read highest sub-index
From Keypad	595	Std	4F 11 10 00 01 00 00 00	1
To Keypad	615	Std	23 11 10 01 6C 6F 61 64	'load'
From Keypad	595	Std	43 11 10 01 00 00 00 00	

## 21. Object 1016h: Consumer heartbeat time

The consumer heartbeat time object shall indicate the expected heartbeat cycle times. Monitoring of the heartbeat producer shall start after the reception of the first heartbeat.

NOTE 1: the heartbeat consumer time should be greater (typically twice) than the related heartbeat time to be monitored coming from the producer.

NOTE 2: if the keypad does not receive the heartbeat message producer anymore, it turns off all the LEDs eventually ON (both indicators and backlight) and goes to pre-operational state until a new NMT start message is received, even if the producer restarts to transmit the heartbeat.

NOTE 3: if the consumer heartbeat time is set with a value lower than the producer one, the keypad will not be able to change its state from pre-operational to operational.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	23h	Set device register
Byte 1	16h	CAN Object 1016h
Byte 2	10h	
Byte 3	ZZh	00h: Highest sub-index supported (read-only) 01h: Sub-index (read/write)
Byte 4	YYh	YYh: Heartbeat time in milliseconds LSByte
Byte 5	XXh	XXh: Heartbeat time in milliseconds MSByte
Byte 6	NNh	Node to be monitored 01h-7Fh (01h default)
Byte 7	00h	Reserved

Heartbeat time: XYYh (from 000Ah to FEFh: 10ms to 65279 milliseconds)

When the period is set to 0000h, the consumer heartbeat function is disabled.

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 16 10 00 00 00 00 00	Read highest sub-index supported
From Keypad	595	Std	4F 16 10 00 01 00 00 00	01h is the highest sub-index supported
To Keypad	615	Std	23 16 10 01 64 00 7E 00	Set heartbeat time consumer = 100ms expected from the node 7Eh
From Keypad	595	Std	60 16 10 01 00 00 00 00	
To Keypad	615	Std	23 16 10 01 F4 01 01 00	Set heartbeat time consumer= 500ms expected from the node 01h
From Keypad	595	Std	60 16 10 01 00 00 00 00	
To Keypad	615	Std	40 16 10 01 00 00 00 00	Read heartbeat consumer time expected from the node 01h
From Keypad	595	Std	43 16 10 01 F4 01 01 00	Heartbeat consumer time set to 500ms

## 22. 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 LSByte
Byte 5	XXh	XXh: Heartbeat time in milliseconds MSByte
Byte 6, 7	00h	Not used

Heartbeat time: XXYh (from 0001h to FEFFh: 1ms to 65279 milliseconds).

Examples:

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

### 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

Examples:

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

## 23. Object 1018h: Identity Data

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	18h	CAN Object 1018h
Byte 2	10h	
Byte 3	00h	Number of mapped objects
	01h	Vendor Id
	04h	Serial number
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 18 10 00 00 00 00 00	
From Keypad	595	Std	4F 18 10 00 04 00 00 00	4
To Keypad	615	Std	40 18 10 01 00 00 00 00	
From Keypad	595	Std	43 18 10 01 E2 03 00 00	000003E2h

Blink Marine Vendor Id: 000003E2h

## 24. Object 1400h: Receive PDO Communication Parm 0

Describes the Receive Parameters and sets the transmission type for the LED state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
	2Fh	Set Device Register
Byte 1	00h	CAN Object 1400h
Byte 2	14h	
Byte 3	00h	Number of mapped objects
	01h	COB Id
	02h	Transmission Type
Byte 4	XXh	Transmission Type (to be used only in set mode): 00h-F0h: synchronous FEh: event-driven
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 00 14 00 00 00 00 00	
From Keypad	595	Std	4F 00 14 00 02 00 00 00	2
To Keypad	615	Std	40 00 14 01 00 00 00 00	
From Keypad	595	Std	43 00 14 01 15 02 00 00	0000 0215h
To Keypad	615	Std	40 00 14 02 00 00 00 00	
From Keypad	595	Std	4F 00 14 02 FE 00 00 00	FEh
To Keypad	615	Std	2F 00 14 02 01 00 00 00	Set Synchronous RPDO 0
From Keypad	595	Std	60 00 14 02 00 00 00 00	ACK
To Keypad	80	Std	-	SYNC message received
To Keypad	215	Std	01 00 00 00 00 00 00 00	Request Key-LED 1 green ON: the data are buffered
To Keypad	80	Std	-	SYNC message received and message 215 processed

Receive PDO communication Parm 0:

- Number of mapped objects: 2;
- COB id: 0000 0200h + NODE ID;
- Transmission Type: synchronous or event-driven.

## 25. Object 1401h: Receive PDO communication Parm 1

Describes the Receive Parameters and sets the transmission type for the LED blink PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
	2Fh	Set Device Register
Byte 1	01h	CAN Object 1401h
Byte 2	14h	
Byte 3	00h	Number of mapped objects
	01h	COB Id
	02h	Transmission Type
Byte 4	XXh	Transmission Type (to be used only in set mode): 00h-F0h: synchronous FEh: event-driven
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 01 14 00 00 00 00 00	
From Keypad	595	Std	4F 01 14 00 02 00 00 00	2
To Keypad	615	Std	40 01 14 01 00 00 00 00	
From Keypad	595	Std	43 01 14 01 15 03 00 00	0000 0315h
To Keypad	615	Std	40 01 14 02 00 00 00 00	
From Keypad	595	Std	4F 01 14 02 FE 00 00 00	FEh
To Keypad	615	Std	2F 01 14 02 00 00 00 00	Set Synchronous RPDO 1
From Keypad	595	Std	60 01 14 02 00 00 00 00	ACK
To Keypad	80	Std	-	SYNC message received
To Keypad	315	Std	00 00 00 00 00 00 00 01	Request ring LED 19 blue blinking: the data are buffered
To Keypad	80	Std	-	SYNC message received and message 315 processed

Receive PDO communication Parm 1:

- Number of mapped objects: 2;
- COB id: 0000 0300h + NODE ID;
- Transmission Type: synchronous or event-driven.



## 26. Object 1402h: Receive PDO communication Parm 2

Describes the Receive Parameters for the Backlight state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	02h	CAN Object 1402h
Byte 2	14h	
Byte 3	00h	
	01h	COB Id
	02h	Transmission Type
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 0214 00 00 00 00 00	
From Keypad	595	Std	4F 02 14 00 02 00 00 00	2
To Keypad	615	Std	40 02 14 01 00 00 00 00	
From Keypad	595	Std	43 02 14 01 15 04 00 00	0000 0415h
To Keypad	615	Std	40 02 14 03 00 00 00 00	
From Keypad	595	Std	4F 02 14 02 FE 00 00 00	FEh

Receive PDO communication Parm 2:

- Number of mapped objects: 2;
- COB id: 0000 0400h + NODE ID;
- Transmission Type: FEh.

## 27. Object 1600h: Receive PDO mapping Parameter 0

Describes the mapping of LED state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1600h
Byte 2	16h	
Byte 3	00h	
	01h	PDO Mapping Entry 1
	02h	PDO Mapping Entry 2
	03h	PDO Mapping Entry 3
	04h	PDO Mapping Entry 4
	05h	PDO Mapping Entry 5
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 00 16 00 00 00 00 00	
From Keypad	595	Std	4F 00 16 00 05 00 00 00	5
To Keypad	615	Std	40 00 16 01 00 00 00 00	
From Keypad	595	Std	43 00 16 01 18 01 01 20	2001 01 18
To Keypad	615	Std	40 00 16 02 00 00 00 00	
From Keypad	595	Std	43 00 16 02 10 02 01 20	2001 02 10
To Keypad	615	Std	40 00 16 03 00 00 00 00	
From Keypad	595	Std	43 00 16 03 08 01 02 20	2002 01 08
To Keypad	615	Std	40 00 16 04 00 00 00 00	
From Keypad	595	Std	43 00 16 04 08 02 02 20	2002 02 08
To Keypad	615	Std	40 00 16 05 00 00 00 00	
From Keypad	595	Std	43 00 16 05 08 03 02 20	2002 03 08

Receive PDO mapping Parameter 0:

- Number of mapped objects: 5;
- Set KEY LED green 1-18/red 1-4: Object 2001h, Sub index 01h, Length 18h;
- Set KEY LED red 5-18: Object 2001h, Sub index 02h, Length 10h;
- Set RING LED green: Object 2002h, Sub index 01h, Length 08h;
- Set RING LED red: Object 2002h, Sub index 02h, Length 08h;
- Set RING LED blue: Object 2002h, Sub index 03h, Length 08h.

## 28. Object 1601h: Receive PDO mapping Parameter 1

Describes the mapping of LED blink state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	01h	CAN Object 1601h
Byte 2	16h	
Byte 3	00h	
	01h	PDO Mapping Entry 1
	02h	PDO Mapping Entry 2
	03h	PDO Mapping Entry 3
	04h	PDO Mapping Entry 4
	05h	PDO Mapping Entry 5
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 01 16 00 00 00 00 00	
From Keypad	595	Std	4F 01 16 00 05 00 00 00	5
To Keypad	615	Std	40 01 16 01 00 00 00 00	
From Keypad	595	Std	43 01 16 01 18 03 01 20	2001 03 18
To Keypad	615	Std	40 01 16 02 00 00 00 00	
From Keypad	595	Std	43 01 16 02 10 04 01 20	2001 04 10
To Keypad	615	Std	40 01 16 03 00 00 00 00	
From Keypad	595	Std	43 01 16 03 08 04 02 20	2002 04 08
To Keypad	615	Std	40 01 16 04 00 00 00 00	
From Keypad	595	Std	43 01 16 04 08 05 02 20	2002 05 08
To Keypad	615	Std	40 01 16 05 00 00 00 00	
From Keypad	595	Std	43 01 16 05 08 06 02 20	2002 06 08

Receive PDO mapping Parameter 1:

- Number of mapped objects: 5;
- Blink KEY LED green 1-18/red 1-4: Object 2001h, Sub index 03h, Length 18h;
- Blink KEY LED red 5-18: Object 2001h, Sub index 04h, Length 10h;
- Blink RING LED green: Object 2002h, Sub index 04h, Length 08h;
- Blink RING LED red: Object 2002h, Sub index 05h, Length 08h;
- Blink RING LED blue: Object 2002h, Sub index 06h, Length 08h.

## 29. Object 1602h: Receive PDO mapping Parameter 2

Describes the mapping of backlight LED state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	02h	CAN Object 1602h
Byte 2	16h	
Byte 3	00h	
	01h	PDO Mapping Entry 1
	02h	PDO Mapping Entry 2
	03h	PDO Mapping Entry 3
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 02 16 00 00 00 00 00	
From Keypad	595	Std	4F 02 16 00 03 00 00 00	3
To Keypad	615	Std	40 02 16 01 00 00 00 00	
From Keypad	595	Std	43 02 16 01 08 02 03 20	2003 02 08
To Keypad	615	Std	40 02 16 02 00 00 00 00	
From Keypad	595	Std	43 02 16 02 08 03 03 20	2003 03 08
To Keypad	615	Std	40 02 16 03 00 00 00 00	
From Keypad	595	Std	43 02 16 03 08 04 03 20	2003 04 08

Receive PDO mapping Parameter 2:

- Number of mapped objects: 3;
- Set backlight LED green: Object 2003h, Sub index 02h, Length 08h;
- Set backlight LED red: Object 2003h, Sub index 03h, Length 08h;
- Set backlight LED blue: Object 2003h, Sub index 04h, Length 08h.

### 30. Object 1800h:

#### a) Transmit PDO Communication Parm 0

Describes the Transmission Parameters and sets the transmission type for the Key state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
	2Fh	Set Device Register
Byte 1	00h	CAN Object 1800h
Byte 2	18h	
Byte 3	00h	Highest sub-index supported
	01h	COB Id
	02h	Transmission Type
	05h	Event Timer (Periodic transmission type)
Byte 4	XXh	Transmission Type (to be used only in set mode): 01h: synchronous (cyclic every SYNC) 02h: synchronous (cyclic every 2 <sup>nd</sup> SYNC) 03h: synchronous (cyclic every 3 <sup>rd</sup> SYNC) 04h: synchronous (cyclic every 4 <sup>th</sup> SYNC) .... F0h: synchronous (cyclic every 240 <sup>th</sup> SYNC) FEh: event-driven
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 00 18 00 00 00 00 00	
From Keypad	595	Std	4F 00 18 00 05 00 00 00	5
To Keypad	615	Std	40 00 18 01 00 00 00 00	
From Keypad	595	Std	43 00 18 01 95 01 00 00	0000 0195h
To Keypad	615	Std	40 00 18 02 00 00 00 00	
From Keypad	595	Std	4F 00 18 02 FE 00 00 00	FEh: event-driven type
To Keypad	615	Std	40 00 18 05 00 00 00 00	
From Keypad	595	Std	4B 00 18 05 00 00 00 00	0000h: Periodic transmission disabled
To Keypad	615	Std	2F 00 18 02 01 00 00 00	Set the Synchronous transmission (cyclic every SYNC)
From Keypad	595	Std	60 00 18 02 00 00 00 00	ACK
To Keypad	80	Std	-	SYNC message received
Key #1 pressed no knob turns      No message on the CAN bus				
From Keypad	195	Std	00 00 00 00 00 00 00 00	Key status sent/Read key status
To Keypad	80	Std	-	SYNC message received
From Keypad	195	Std	01 00 00 00 00 00 00 00	Key status sent/Read key status

Transmit PDO communication Parm 0:

- Highest sub-index supported;
- Address base: 195h = 180h+ NODE ID;
- Transmission Type: synchronous or event-driven;
- Periodic Transmission timer: XXYY in milliseconds, 0 = OFF.

## b) Set periodic state transmission

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Bh	Set device register
Byte 1	00h	CAN Object 1800h
Byte 2	18h	
Byte 3	05h	Sub index
Byte 4	YYh	YYh: Periodic transmission timer in milliseconds LSByte
Byte 5	XXh	XXh: Periodic transmission timer in milliseconds MSByte
Byte 6, 7	00h	Not used

Event timer period: XXYYh (from 0001h to FFFFh: 1ms to 65279 milliseconds).

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2B 00 18 05 00 00 00 00	Switch off the periodic transmission
From Keypad	595	Std	60 00 18 05 00 00 00 00	
To Keypad	615	Std	2B 00 18 05 32 00 00 00	Set period = 50ms
From Keypad	595	Std	60 00 18 05 00 00 00 00	
To Keypad	615	Std	2B 00 18 05 F4 01 00 00	Set period = 500ms
From Keypad	595	Std	60 00 18 05 00 00 00 00	

### 31. Object 1A00h Transmit PDO Mapping Parameter

Describes the mapping of KEY and Encoder state PDO Message.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1A00h
Byte 2	1Ah	
Byte 3	00h	Number of mapped objects
	01h	PDO Mapping Entry 1
	02h	PDO Mapping Entry 2
	03h	PDO Mapping Entry 3
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 00 1A 00 00 00 00 00	
From Keypad	595	Std	4F 00 1A 00 03 00 00 00	3
To Keypad	615	Std	40 00 1A 01 00 00 00 00	
From Keypad	595	Std	43 00 1A 01 08 01 00 20	2000 01 08
To Keypad	615	Std	40 00 1A 02 00 00 00 00	
From Keypad	595	Std	43 00 1A 02 08 02 00 20	2000 02 08
To Keypad	615	Std	40 00 1A 03 00 00 00 00	
From Keypad	595	Std	43 00 1A 03 10 03 00 20	2000 03 10

Transmit PDO Mapping Parameter:

- Number of mapped objects: 3;
- Switch state: Object 2000h, Sub index 01h, Length 08h;
- Encoder direction counter: Object 2000h, Sub index 02h, Length 08h;
- Encoder tick counter: Object 2000h, Sub index 03h, Length 10h.

## 32. Object 2000h: Key and Encoder state

### a) Sub 1 - Key State

This module contains all the button state information. A one indicates the button is pressed; a zero indicates the button is not pressed.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	01h	Sub index
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 00 20 01 00 00 00 00	
From Keypad	595	Std	4F 00 20 01 00 00 00 00	No Key pressed
			4F 00 20 01 01 00 00 00	Key #1 pressed
			4F 00 20 01 02 00 00 00	Key #2 pressed
			4F 00 20 01 04 00 00 00	Key #3 pressed
			4F 00 20 01 08 00 00 00	Key #4 pressed
			4F 00 20 01 10 00 00 00	Key #5 pressed
			4F 00 20 01 20 00 00 00	Key #6 pressed
			4F 00 20 01 40 00 00 00	Key #7 pressed
			4F 00 20 01 41 00 00 00	Keys #7 and #1 pressed
			4F 00 20 01 07 00 00 00	Keys #1, #2 and #3 pressed
			4F 00 20 01 7F 00 00 00	All Keys pressed



**b) Sub 2 - Encoder direction counter**

This module contains the Encoder direction counter. The command works only in the pre-operational state.

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	02h	Sub index
Byte 4,7	00h	Not used

From Keypad:

Identifier	595h (580h + current CAN ID)	
Byte 0	4Fh	
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	02h	Sub index
Byte 4	XXh	Bit 7: encoder direction <ul style="list-style-type: none"> <li>• 0: Clockwise</li> <li>• 1: Counterclockwise</li> </ul> Bit 0...6: Number of ticks
Byte 5,7	00h	Not used

The number of ticks is counted from the last encoder state message sent.

The counter is reset after the message is sent out.

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	40 00 20 02 00 00 00 00	
From Keypad	595	Std	4F 00 20 02 00 00 00 00	No ticks completed
			4F 00 20 02 01 00 00 00	One tick clockwise
			4F 00 20 02 81 00 00 00	One tick counterclockwise
			4F 00 20 02 02 00 00 00	Two tick clockwise

**c) Sub 3 - Encoder tick counter**

The Tick counter is a two bytes counter incremented each clockwise tick and decremented each counterclockwise tick.

- Read encoder tick counter value**

The following command allows to read the encoder tick counter value

Identifier	615h (600h + current CAN ID)	
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	03h	Sub index
Byte 4,7	00h	Not used

From Keypad:

Identifier	595h (580h + current CAN ID)	
Byte 0	4Bh	
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	03h	Sub index
Byte 4	YYh	Tick counter
Byte 5	XXh	
Byte 6,7	00h	Not used

- Set encoder tick counter value**

The following command allows to set the default desired encoder tick counter value

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Bh	
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	03h	Sub index
Byte 4	YYh	Tick counter value
Byte 5	XXh	
Byte 6,7	00h	Not used

Encoder tick counter value: XXYYh (from 0000h to FFFFh: from 0 to 65535)

Example:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2B 00 20 03 0F 00 00 00	Encoder tick counter value set to 15
To Keypad	595	Std	60 00 20 03 00 00 00 00	

### 33. Object 2001h: LED state

#### a) Sub 1 - LED #1-18 green state / LED #1-4 red state

Identifier	615h (600h + current CAN ID)	
Byte 0	27h	Set Device Register
Byte 1	01h	CAN Object 2001h
Byte 2	20h	
Byte 3	01h	Sub index
Byte 4	LG8 LG7 LG6 LG5 - LG4 LG3 LG2 LG1	LED green 1-8
Byte 5	LG16 LG15 LG14 LG13 – LG12 LG11 LG10 LG9	LED green 9-16
Byte 6	LR4 LR3 LR2 LR1 – 0 0 LG18 LG17	LED green 17-18/ LED red 1-4
Byte 7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	27 01 20 01 00 00 00 00	Turn off all the LED green
To Keypad	615	Std	27 01 20 01 01 00 00 00	Green LED #1 ON
To Keypad	615	Std	27 01 20 01 05 00 00 00	Green LED #1 and 3 ON
To Keypad	615	Std	27 01 20 01 00 00 10 00	Red LED #1 ON
From Keypad	595	Std	60 01 20 01 00 00 00 00	

#### b) Sub 2 - LED #5-18 red state

Identifier	615h (600h + current CAN ID)	
Byte 0	2Bh	Set Device Register
Byte 1	01h	CAN Object 2001h
Byte 2	20h	
Byte 3	02h	Sub index
Byte 4	LR12 LR11 LR10 LR9 – LR8 LR7 LR6 LR5	LED red 5-12
Byte 5	0 0 LR18 LR17 – LR16 LR15 LR14 LR13	LED red 13-18
Byte 6,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2B 01 20 02 02 00 00 00	Red LED #6 ON
To Keypad	615	Std	2B 01 20 02 00 20 00 00	Red LED #18 ON
To Keypad	615	Std	2B 01 20 02 01 00 00 00	Red LED #5 ON
To Keypad	615	Std	2B 01 20 02 00 04 00 00	Red LED #15 ON
From Keypad	595	Std	60 01 20 02 00 00 00 00	

**c) Sub 3 - LED green #1-18 blink state / LED red #1-4 blink state**

Note: if the blink message is sent when the LED is already on, the LED blinks in alternate mode.

Identifier	615h (600h + current CAN ID)	
Byte 0	27h	Set Device Register
Byte 1	01h	CAN Object 2001h
Byte 2	20h	
Byte 3	03h	Sub index
Byte 4	LG8 LG7 LG6 LG5 - LG4 LG3 LG2 LG1	LED green 1-8
Byte 5	LG16 LG15 LG14 LG13 – LG12 LG11 LG10 LG9	LED green 9-16
Byte 6	LR4 LR3 LR2 LR1 – 0 0 LG18 LG17	LED green 17-18/ LED red 1-4
Byte 7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	27 01 20 03 00 00 00 00	No LED green blink
To Keypad	615	Std	27 01 20 03 20 00 00 00	Green LED #6 blinks
To Keypad	615	Std	27 01 20 03 00 44 00 00	Green LED #11 and 15 blink
To Keypad	615	Std	27 01 20 03 00 00 30 00	Red LED #1and 2 blink
From Keypad	595	Std	60 01 20 03 00 00 00 00	

**d) Sub 4 - LED red #5-18 blink state**

Note: if the blink message is sent when the LED is already on, the LED blinks in alternate mode.

Identifier	615h (600h + current CAN ID)	
Byte 0	2Bh	Set Device Register
Byte 1	01h	CAN Object 2001h
Byte 2	20h	
Byte 3	04h	Sub index
Byte 4	LR12 LR11 LR10 LR9 – LR8 LR7 LR6 LR5	LED red 5-12
Byte 5	0 0 LR18 LR17 – LR16 LR15 LR14 LR13	LED red 13-18
Byte 6,7	00h	Not used

Example:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2B 01 20 04 00 00 00 00	No LED red blink
To Keypad	615	Std	2B 01 20 04 18 00 00 00	Red LED #8 and 9 blink
To Keypad	615	Std	2B 01 20 04 00 21 00 00	Red LED #13 and 18 blink
To Keypad	615	Std	2B 01 20 04 00 02 00 00	Red LED #14 blinks
From Keypad	595	Std	60 01 20 04 00 00 00 00	

### 34. Object 2002h: LED RING state

The RING LEDs can be illuminated as indicator and backlight function as well. Each LED on the RING in off state (not used as indicator) will be illuminated according to the backlight command.

#### a) Sub 1 –RING LED green state

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	01h	Sub index
Byte 4	LG26 LG25 LG24 LG23 – LG22 LG21 LG20 LG19	LED green
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2F 02 20 01 00 00 00 00	Turn off all the green LED
To Keypad	615	Std	2F 02 20 01 01 00 00 00	Green LED #19 ON
To Keypad	615	Std	2F 02 20 01 80 00 00 00	Green LED #26 ON
From Keypad	595	Std	60 02 20 01 00 00 00 00	

#### b) Sub 2 –RING LED red state

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	02h	Sub index
Byte 4	LR26 LR25 LR24 LR23 – LR22 LR21 LR20 LR19	LED red
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2F 02 20 02 00 00 00 00	Turn off all the red LED
To Keypad	615	Std	2F 02 20 02 10 00 00 00	Red LED #23 ON
To Keypad	615	Std	2F 02 20 02 04 00 00 00	Red LED #21 ON
From Keypad	595	Std	60 02 20 02 00 00 00 00	

**c) Sub 3 RING LED blue state**

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	03h	Sub index
Byte 4	LB26 LB25 LB24 LB23 – LB22 LB21 LB20 LB19	LED blue
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2F 02 20 03 00 00 00 00	Turn off all the blue LED
To Keypad	615	Std	2F 02 20 03 02 00 00 00	Blue LED #20 ON
To Keypad	615	Std	2F 02 20 03 80 00 00 00	Blue LED #26 ON
From Keypad	595	Std	60 02 20 03 00 00 00 00	

**d) Sub 4 –RING LED green blink state**

Note: if the blink message is sent when the LED is already on, the LED blinks in alternate mode.

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	04h	Sub index
Byte 4	LG26 LG25 LG24 LG23 – LG22 LG21 LG20 LG19	Green LED blink
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2F 02 20 04 00 00 00 00	No green LED blink
To Keypad	615	Std	2F 02 20 04 08 00 00 00	Green LED #21 blinks
To Keypad	615	Std	2F 02 20 04 30 00 00 00	Green LED #23 and 24 blink
From Keypad	595	Std	60 02 20 04 00 00 00 00	

**e) Sub 5 –RING LED red blink state**

Note: if the blink message is sent when the LED is already on, the LED blinks in alternate mode.

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	05h	
Byte 4	LR26 LR25 LR24 LR23 – LR22 LR21 LR20 LR19	Red LED blink
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2F 02 20 05 00 00 00 00	No red LED blink
To Keypad	615	Std	2F 02 20 05 04 00 00 00	Red LED #21 blinks
To Keypad	615	Std	2F 02 20 05 35 00 00 00	Red LED #19, 21, 23 and 24 blink
From Keypad	595	Std	60 02 20 05 00 00 00 00	

**f) Sub 6 –RING LED blue blink state**

Note: if the blink message is sent when the LED is already on, the LED blinks in alternate mode.

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	06h	
Byte 4	LB26 LB25 LB24 LB23 – LB22 LB21 LB20 LB19	Blue LED blink
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Data	LED
To Keypad	615	Std	2F 02 20 06 00 00 00 00	No blue LED blink
To Keypad	615	Std	2F 02 20 06 01 00 00 00	Blue LED #19 blinks
To Keypad	615	Std	2F 02 20 06 22 00 00 00	Blue LED #20 and 24 blink
From Keypad	595	Std	60 02 20 06 00 00 00 00	

## 35. Object 2003h: Brightness Level

### a) Set Indicator LEDs brightness level

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	01h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → min-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 01 10 00 00 00	Brightness = 25%
From Keypad	595	Std	60 03 20 01 00 00 00 00	

### b) Set green LEDs backlight brightness level

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	02h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → 0-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 02 08 00 00 00	Brightness = 12,5%
From Keypad	595	Std	60 03 20 02 00 00 00 00	

### c) Set red LEDs backlight brightness level

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	03h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → 0-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 03 20 00 00 00	Brightness = 50%
From Keypad	595	Std	60 03 20 03 00 00 00 00	



**d) Set blue LEDs backlight brightness level**

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	04h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → 0-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 04 25 00 00 00	Brightness = 62,5%
From Keypad	595	Std	60 03 20 04 00 00 00 00	

**e) Set startup Indicator LEDs brightness level**

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	05h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → min-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 05 05 00 00 00	Brightness = 12,5%
From Keypad	595	Std	60 03 20 05 00 00 00 00	

**f) Set startup green LEDs backlight brightness level**

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	06h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → 0-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 06 10 00 00 00	Brightness = 25%
From Keypad	595	Std	60 03 20 06 00 00 00 00	

**g) Set startup red LEDs backlight brightness level**

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	07h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → 0-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 07 30 00 00 00	Brightness = 75%
From Keypad	595	Std	60 03 20 07 00 00 00 00	

**h) Set startup blue LEDs backlight brightness level**

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	08h	Sub index
Byte 4	XXh	Intensity 00h-3Fh → 0-100%
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 03 20 08 08 00 00 00	Brightness = 12,5%
From Keypad	595	Std	60 03 20 08 00 00 00 00	

### 36. Object 2010h: Baud rate setting

Identifier	615h (600h + current CAN ID)	
Byte 0	2Fh	Set Device Register
Byte 1	10h	CAN Object 2010h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	00h	1000k
	01h	Reserved (force to 125k)
	02h	500k
	03h	250k
	04h	125k (Default)
	05h	Reserved (force to 125k)
	06h	50k
	07h	20k
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 10 20 00 03 00 00 00	Set baud rate = 250k
From Keypad	595	Std	60 10 20 00 00 00 00 00	

### 37. Object 2011h: Set Boot-up service

Object 2011h message enables or disables the boot up message sent by the keypad at power up to the CAN network.

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Fh	Set Device Register
Byte 1	11h	CAN Object 2011h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h: Not active
		01h: Active
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 11 20 00 00 00 00 00	Boot-up service not active
From Keypad	595	Std	60 11 20 00 00 00 00 00	

### 38. Object 2012h: Set device active on startup

If keypad is active on startup don't need the Start CANopen command from host.

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Fh	Set Device Register
Byte 1	12h	CAN Object 2012h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h: Not active
		01h: Active
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 12 20 00 01 00 00 00	Set device active on startup
From Keypad	595	Std	60 12 20 00 00 00 00 00	

### 39. Object 2013h: Set CANopen node ID

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Fh	Set Device Register
Byte 1	13h	CAN Object 2013h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	XX: New node id (01h-7Fh), default 15h
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 13 20 00 18 00 00 00	CANopen node ID = 18h
From Keypad	598	Std	60 13 20 00 00 00 00 00	

#### 40. Object 2014h: Set startup LED show

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Fh	Set Device Register
Byte 1	14h	CAN Object 2014h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h: Not active
		01h: Active
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 14 20 00 00 00 00 00	Startup LED show not active
From Keypad	595	Std	60 14 20 00 00 00 00 00	

#### 41. Object 2100h: Set DEMO mode

This message enables the Demo mode function. Demo mode is a special feature that consists in different LED states for each button pressing. Refer to the appendix "Demo mode instructions" to try these special features. Disconnect and reconnect the keypad after the enable message to enter this mode. To exit the Demo mode, send the Disable Demo mode command or another command message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	2Fh	Set Device Register
Byte 1	00h	CAN Object 2100h
Byte 2	21h	
Byte 3	00h	Sub index
Byte 4	XXh	00h: Not active
		01h: Active
Byte 5,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	615	Std	2F 00 21 00 01 00 00 00	Set DEMO mode Active
From Keypad	595	Std	60 00 21 00 00 00 00 00	

#### 42. Set CAN protocol

This set of messages are used to change to the desired CANbus protocol.

- Change from CANopen to J1939:

Direction	Identifier	Format	Message	Data
To Keypad	615h	Std	2F FF 20 01 01	Change to J1939

- Change from J1939 to CANopen:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 80 00 FF FF FF FF	Change to CANopen

## APPENDIX: DEMO Mode instructions

In DEMO Mode you can try these functions by pressing buttons on the PowerTrack.

For the Key 1, each time that you press the button, there are different steps in this sequence:

- 1) No LEDs on and no backlight;
- 2) All LEDs green on and backlight red;
- 3) All LEDs red on and backlight green;
- 4) Keys LEDs red-green on, keys backlight blue on and encoder ring backlight red-green on
- 5) Return in step 1.

Pressing Key 2 you can see backlight white color on, while keys LEDs and encoder/ring backlight blink red and green in alternate mode.

For the Key 3, each time that you press the button, you can change backlight in this sequence:

- 1) Red;
- 2) Green;
- 3) Blue, red cursor on the encoder ring;
- 4) Amber/orange and encoder yellow/green, red cursor on the encoder ring;
- 5) Cyan, red cursor on the encoder ring;
- 6) Magenta, red cursor on the encoder ring;
- 7) White/light blue, red cursor on the encoder ring;
- 8) Return in step 1.

Pressing Key 4 you can see backlight blue.

In the case that you press key 5, 6 and 7 and/or rotate the encoder (clockwise or counterclockwise) there are no events.

### 43. Revision history

Date	Manual Revision	Comment	Related SW version
18/04/2016	1.3	-	1.4
14/10/2016	1.4	Updated examples for the object 1800h set periodic transmission	1.4
20/02/2018	1.5	New release: <ul style="list-style-type: none"> <li>Added the sentence concerning keypad activation in every PDOs commands</li> <li>Replaced the symbol 'h'(hexadecimal) with the correct one 'b' (binary) in the "keys and encoder state" table</li> <li>Checked and eventually corrected the messages of transmission/reply of command objects</li> <li>Corrected the minimum value of brightness for indicator LEDs brightness level command</li> <li>Added appendix DEMO Mode instructions</li> <li>Added the SET CAN protocol command</li> </ul>	2.x
27/06/2018	1.6	New release: <ul style="list-style-type: none"> <li>In the object 2000h sub-index 03h added the command to set the desired encoder tick counter value</li> <li>Added object 1016h: heartbeat consumer time</li> <li>Enabled synchronous transmission for RPDOs 200h/300h and TPDO 180h</li> </ul>	x.x
18/10/2018	1.7	New release: <ul style="list-style-type: none"> <li>Adjusted SDO 2001h to the corresponding PDOs 215h/315h; modified the related description objects 1600h-1601h</li> </ul>	x.x
21/02/2019	1.8	New release: <ul style="list-style-type: none"> <li>Added warning note at page 3</li> </ul>	x.x
12/03/2019	1.9	New release: <ul style="list-style-type: none"> <li>Added object 1011h</li> </ul>	x.x
16/09/2021	1.10	New release: <ul style="list-style-type: none"> <li>Removed the examples describing the possibility to switch on the KEY-LEDs with amber color from the commands "SET LED ON message"/"Set LED blink message"</li> </ul>	x.x