

Summary

| | | |
|-----|--|----|
| 1. | How to connect the wires:..... | 5 |
| 2. | Reference..... | 6 |
| 3. | Default settings..... | 7 |
| | NMT MESSAGES..... | 8 |
| 4. | Start CANopen node (keypad activation message) | 8 |
| 5. | Enter pre-operational | 8 |
| 6. | Reset CANopen node..... | 8 |
| 7. | Stop CANopen node | 9 |
| 8. | Boot-up service..... | 9 |
| 9. | Heartbeat message..... | 9 |
| 10. | Sync message..... | 9 |
| | PDO messages | 10 |
| 11. | Keys state message..... | 10 |
| | • PWTR4..... | 10 |
| 12. | Encoder state message..... | 11 |
| 13. | Joystick state message (if available)..... | 12 |
| 14. | Set LED ON message | 13 |
| | • PWTR4..... | 13 |
| 15. | Set LED Blink message | 14 |
| | • PWTR4..... | 14 |
| 16. | LED indicators brightness level..... | 15 |
| 17. | Backlight setting | 15 |
| | SDO Messages: | 16 |
| 18. | Object 2000h: Digital input module, keys states..... | 16 |
| | a) Sub 1 – Key state | 16 |
| | b) Sub 2 – Read encoder direction counter | 17 |
| | c) Sub 3 – Read encoder tick counter | 18 |
| | • Set startup encoder tick counter value..... | 18 |
| | d) Sub 4 – Set/read TOP position encoder | 19 |
| | e) Sub 5 – Read joystick position..... | 19 |
| 19. | Object 2001h: Digital output module..... | 20 |
| | a) Set LED ON..... | 20 |
| | • Sub-index 01..... | 20 |
| | • Sub-index 02..... | 20 |
| | • Sub-index 03..... | 21 |
| | b) Read LED ON..... | 22 |

| | | |
|-----|--|----|
| 20. | Object 2002h: Digital output module | 23 |
| a) | Set LED blink | 23 |
| • | Sub-index 01..... | 23 |
| • | Sub-index 02..... | 23 |
| • | Sub-index 03..... | 24 |
| b) | Read LED ON | 24 |
| 21. | Object 2003h: Brightness Level | 25 |
| a) | LED indicators brightness level: | 25 |
| b) | Backlight brightness level..... | 25 |
| c) | Backlight color | 26 |
| d) | Default backlight color | 27 |
| e) | Default LED indicators brightness level | 27 |
| f) | Default backlight brightness level..... | 28 |
| 22. | Object 2010h: Baud rate setting..... | 29 |
| 23. | Object 2011h: Set Boot-up service | 30 |
| 24. | Object 2012h: Set device active on startup..... | 31 |
| 25. | Object 2013h: Set CANopen node ID..... | 32 |
| 26. | Object 2014h: Set startup LED show | 33 |
| 27. | Object 2100h: Set DEMO mode..... | 34 |
| 28. | Object 1016h: Consumer heartbeat time..... | 35 |
| 29. | Object 1017h: Producer heartbeat time | 36 |
| | Heartbeat message..... | 36 |
| 30. | Object 1000h: Device Type | 37 |
| 31. | Object 1001h: Error Register | 37 |
| 32. | Object 1008h: Manufacturer Device Name..... | 37 |
| 33. | Object 1009h: Manufacturer Hardware Revision..... | 38 |
| 34. | Object 100Ah: Manufacturer Firmware Revision | 38 |
| 35. | Object 100Bh: Model ID | 39 |
| 36. | Object 1011h: Restore default parameters..... | 39 |
| 37. | Object 1018h: Identity Data | 40 |
| 38. | Object 1400h: Receive PDO Communication Parm 0 | 41 |
| 39. | Object 1401h: Receive PDO communication Parm 1 | 42 |
| 40. | Object 1402h: Receive PDO communication Parm 2 | 43 |
| 41. | Object 1403h: Receive PDO communication Parm 3 | 43 |
| 42. | Object 1600h: Receive PDO mapping Parameter 0 | 44 |
| 43. | Object 1601h: Receive PDO mapping Parameter 1 | 45 |
| 44. | Object 1602h: Receive PDO mapping Parameter 2 | 46 |
| 45. | Object 1603h: Receive PDO mapping Parameter 3 | 46 |
| 46. | Object 1800h: | 47 |

| | |
|--|----|
| a) Transmit PDO Communication Parm 0 | 47 |
| b) Set periodic state transmission..... | 48 |
| 47. Object 1801h: | 49 |
| Transmit PDO Communication Parm 1..... | 49 |
| 48. Object 1802h: | 50 |
| Transmit PDO Communication Parm 2..... | 50 |
| 49. Object 1A00h Transmit PDO Mapping Parameter 0..... | 51 |
| 50. Object 1A01h Transmit PDO Mapping Parameter 1..... | 51 |
| 51. Object 1A02h Transmit PDO Mapping Parameter 2..... | 52 |
| 52. Object 2200h: Serial number string..... | 53 |
| 53. Set CAN protocol | 53 |
| APPENDIX: DEMO Mode instructions..... | 54 |
| 54. Revision history..... | 55 |

NOTE: this document complies with the following CAN in Automation (CiA) specifications:

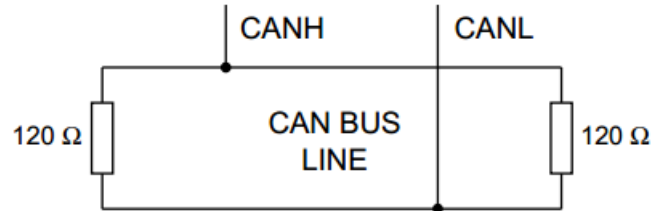
- 301 (CANopen application layer and communication profile)
- 401 (Device profile for generic I/O modules)

1. How to connect the wires:



| Power Supply Connector | | |
|------------------------|---------------------------|----------------|
| Manufacturer | TE Connectivity / Deutsch | Amphenol |
| Connector p/n | DT04-4P | AT04-4P |
| Mating Connector | | |
| Connector p/n | DT06-4S | AT06-4S |
| Wedgelock p/n | W4S | AW4S |
| Terminals p/n | 0462-201-16141 | AT62-201-16141 |

| 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.



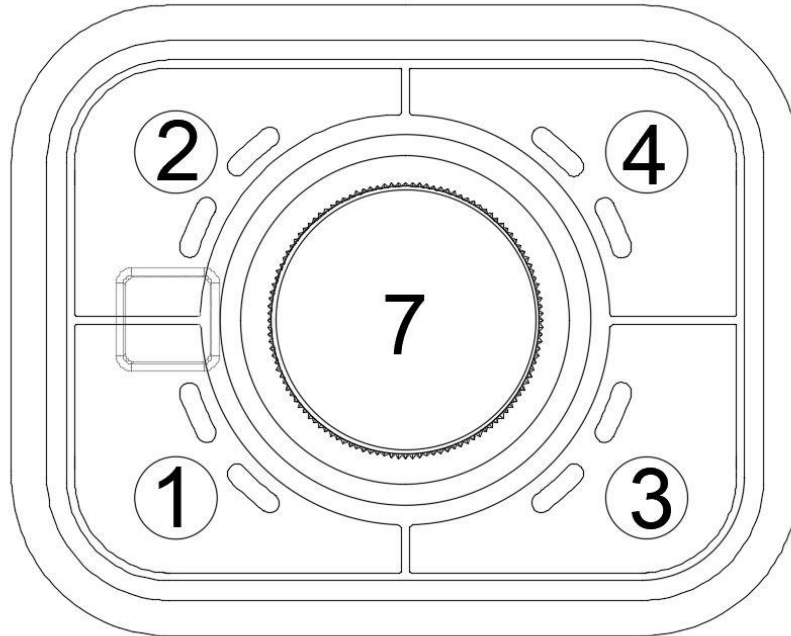
Warning: to avoid breakage do not tighten the backshell nuts with a torque exceeding 1.8 Nm!

2. Reference

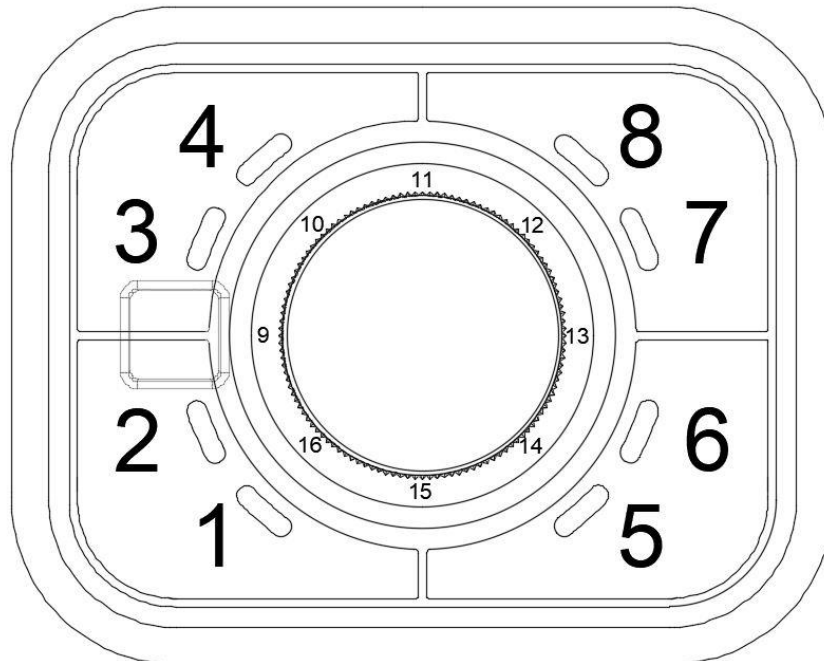
Front view.

PWTR4

KEY REFERENCE



LED REFERENCE



3. Default settings

| Setting | Default state or level | How to change |
|------------------------------------|--------------------------|--|
| Baud Rate | 125 kbit/s | Object 2010h |
| CANopen Node ID | 15h | Object 2013h |
| Device active on startup | Not active | Object 2012h |
| Key Brightness | 3Fh (Maximum Brightness) | Object 2003h |
| Backlight Brightness | 00h (OFF) | Object 2003h |
| Backlight Color | Amber | Object 2003h |
| Startup LED Light Show | Complete LED Sequence | Object 2014h |
| Periodic State Transmission | Disabled | Object 1800h |
| DEMO mode | Disabled | Object 2100h |
| Heartbeat Producer | Disabled | Object 1017h |
| Heartbeat Consumer | Disabled | Object 1016h |
| Boot-up service | Active | Object 2011h |
| Startup encoder tick counter value | 0000h | Object 2000h-sub-index 03h |
| RPDO transmission type | Event-driven | Object 1400h-1401h |
| TPDO transmission type | Event-driven | Object 1800h |
| TOP position | Disabled | Object 2000h-sub-index 04h |
| Restore default parameters | - | Object 1011h |

NMT MESSAGES

The Network Management messages follow a master-slave structure. Through NMT services, CANopen devices are initialized, started, reset or stopped.

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 |
| | | 00h: Stop CANopen node (old PKP sw compatibility) |
| 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 1st SYNC message but, while the RPDOs are always processed with the arrival of next one, the TPDOs are transmitted each n-th time the SYNC message is received depending on the value chosen for 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 message.

11. Keys state message

This message transmits the state of each key. Based on the version used some keys might be not available.

NOTE: the keypad must be activated, see NMT Start CANopen Node message.

NOTE 2: the key 7 identifies the central key (encoder).

- **PWTR4**

| | | |
|------------|---|--------------------------------------|
| Identifier | 180h + current CAN ID | Default 195h |
| Byte 0 | Keys from #1 to #4 and #7 0 K7 0 0 – K4 K3 K2 K1 | Key state: '1'=pressed; '0'=released |
| Byte 1,3 | 00h | Not used |
| Byte 4 | XXh | Tick Timer* |

Examples:

| Direction | Identifier | Format | Message | Key state |
|-------------|------------|--------|----------------|----------------|
| From Keypad | 195 | Std | 00 00 00 00 XX | No Key pressed |
| From Keypad | 195 | Std | 08 00 00 00 XX | Key #4 pressed |
| From Keypad | 195 | Std | 02 00 00 00 XX | Key #2 pressed |
| From Keypad | 195 | Std | 01 00 00 00 XX | Key #1 pressed |
| From Keypad | 195 | Std | 40 00 00 00 XX | Key #7 pressed |

*= this hexadecimal value increases each 100ms regardless a key state variation has occurred or not. This parameter can be used to evaluate the time interval elapsed between two consecutive key states through the difference of the related two tick timer values. Since this counter is coded on 1-byte length, the maximum time interval which can be monitored is about 25 seconds.

12. Encoder state message

This message is sent by the keypad to indicate the state of the encoder.

NOTE: the keypad must be activated, see NMT Start CANopen Node message.

NOTE 2: the encoder is identified with the key number 7. See [chapter 2](#) for further details.

The state of the encoder is represented by 3 counter fields:

- The Direction counter (Byte 0) transmits the direction of the encoder rotation.
- The Tick counter (Byte 1 and 2) is a two bytes counter incremented each clockwise tick and decremented each counterclockwise tick.
- The TOP position (Byte 3): when is different from 00h, it is the maximum value the encoder tick counter will count up to. In this case, with each clockwise tick the counter increases until the TOP position is reached; once reached this value, each further tick in this direction does not increase the counter. On the contrary, with each counterclockwise tick the counter decreases from the current value to zero; once reached zero, each further tick in this direction does not change the counter value.

NOTE: the default TOP position value can be set by using the [Service Data Object 2000h sub-index 04h](#). In case it is selected the value 00h the maximum encoder tick counter value is 65535.

| | | |
|------------|------------------------------|---|
| Identifier | 295h (280h + current CAN ID) | Default 295h |
| Byte 0 | XXh | Encoder direction: 01h: clockwise 81h: counterclockwise |
| Byte 1,2 | YY YYh | Encoder Tick counter |
| Byte 3 | 00h or ZZh | TOP position encoder |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Data | Encoder state |
|-------------|------------|--------|-------------------------|-----------------------------------|
| From Keypad | 295 | Std | 81 FF FF 00 00 00 00 00 | 1 tick CCW |
| From Keypad | 295 | Std | 01 03 00 00 00 00 00 00 | 3 ticks CW |
| From Keypad | 295 | Std | 01 01 00 00 00 00 00 00 | 1 tick CW |
| From Keypad | 295 | Std | 01 03 00 00 00 00 00 00 | 3 ticks CW |
| From Keypad | 295 | Std | 01 02 00 00 00 00 00 00 | 2 ticks CW |
| From Keypad | 295 | Std | 01 04 00 08 00 00 00 00 | 4 ticks CW with 8 as TOP position |

Encoder state message is mapped into:

- Object 2000h sub-indices 2-3-6

Refer to the applicable object for more details.

13. Joystick state message (if available)

This message transmits the cardinal direction of the joystick incline.

NOTE: the keypad must be activated, see NMT Start CANopen Node message.

| | | |
|------------|------------------------------|--|
| Identifier | 395h (380h + current CAN ID) | Default 395h |
| Byte 0 | XXh | Direction: 00h: NEUTRAL 01h: NORTH 02h: NORTH-EAST 04h: EAST 08h: SOUTH-EAST 10h: SOUTH 20h: SOUTH-WEST 40h: WEST 80h: NORTH-WEST |
| Byte 1,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Data | Joystick state |
|-------------|------------|--------|-------------------------|-------------------------------|
| From Keypad | 395 | Std | 01 00 00 00 00 00 00 00 | North direction detected |
| From Keypad | 395 | Std | 04 00 00 00 00 00 00 00 | East direction detected |
| From Keypad | 395 | Std | 08 00 00 00 00 00 00 00 | South-east direction detected |
| From Keypad | 395 | Std | 40 00 00 00 00 00 00 00 | West direction detected |
| From Keypad | 395 | Std | 00 00 00 00 00 00 00 00 | Joystick in neutral position |

14. Set LED ON message

This command allows to switch on/off the key and encoder LED indicators.

NOTE: the keypad must be activated, see NMT Start CANopen Node message.

NOTE 2: in case the RPDO message is transmitted periodically to the keypad, to ensure correct processing of the command the period used must be higher than 50ms; a value equal to 100ms is fairly good for most applications.

NOTE 3: based on the version used, some key LED indicators might not be available.

- **PWTR4**

| | | |
|------------|-----------------------------------|-------------------|
| Identifier | 200h + current CAN ID | Default 215h |
| Byte 0 | KR8 KR7 KR6 KR5 – KR4 KR3 KR2 KR1 | Key-LED red |
| Byte 1 | ER8 ER7 ER6 ER5 – ER4 ER3 ER2 ER1 | Encoder LED red |
| Byte 2 | KG8 KG7 KG6 KG5 – KG4 KG3 KG2 KG1 | Key-LED green |
| Byte 3 | EG8 EG7 EG6 EG5 – EG4 EG3 EG2 EG1 | Encoder LED green |
| Byte 4 | KB8 KB7 KB6 KB5 – KB4 KB3 KB2 KB1 | Key-LED blue |
| Byte 5 | EB8 EB7 EB6 EB5 – EB4 EB3 EB2 EB1 | Encoder LED blue |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | 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 | Key-LED #1 red ON |
| To Keypad | 215 | Std | 00 00 08 00 00 00 00 00 | Key-LED # 4 green ON |
| To Keypad | 215 | Std | 00 00 00 00 80 00 00 00 | Key-LED #8 blue ON |
| To Keypad | 215 | Std | 00 01 00 01 00 01 00 00 | Encoder LED #1 white ON |

15. Set LED Blink message

This command allows to set the key and encoder LED indicators in blink state.

NOTE: the keypad must be activated, see NMT Start CANopen Node message.

NOTE 2: in case the RPDO message is transmitted periodically to the keypad, to ensure correct processing of the command the period used must be higher than 50ms; a value equal to 100ms is fairly good for most applications.

NOTE 3: if the blink message is sent when the LED is already ON, the LED blinks in alternate mode.

NOTE 4: based on the version used, some key LED indicators might not be available.

- **PWTR4**

| | | |
|------------|-----------------------------------|-------------------|
| Identifier | 300h + current CAN ID | Default 315h |
| Byte 0 | KR8 KR7 KR6 KR5 – KR4 KR3 KR2 KR1 | Key-LED red |
| Byte 1 | ER8 ER7 ER6 ER5 – ER4 ER3 ER2 ER1 | Encoder LED red |
| Byte 2 | KG8 KG7 KG6 KG5 – KG4 KG3 KG2 KG1 | Key-LED green |
| Byte 3 | EG8 EG7 EG6 EG5 – EG4 EG3 EG2 EG1 | Encoder LED green |
| Byte 4 | KB8 KB7 KB6 KB5 – KB4 KB3 KB2 KB1 | Key-LED blue |
| Byte 5 | EB8 EB7 EB6 EB5 – EB4 EB3 EB2 EB1 | Encoder LED blue |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | LED |
|-----------|------------|--------|-------------------------|-----------------------------|
| To Keypad | 315 | Std | 02 00 00 00 00 00 00 00 | Key-LED #2 red blinks |
| To Keypad | 315 | Std | 00 00 04 00 00 00 00 00 | Key-LED #3 green blinks |
| To Keypad | 315 | Std | 00 00 00 00 80 00 00 00 | Key-LED #8 blue blinks |
| To Keypad | 315 | Std | 00 08 00 00 00 00 00 00 | Encoder LED #4 red blinks |
| To Keypad | 215 | Std | 00 00 00 01 00 00 00 00 | Encoder LED #1 blinks green |
| To Keypad | 315 | Std | 00 00 00 01 00 01 00 00 | and blue in alternate mode |

16. LED indicators brightness level

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

NOTE: in case the RPDO message is transmitted periodically to the keypad, to ensure correct processing of the command the period used must be higher than 50ms; a value equal to 100ms is fairly good for most applications.

NOTE 2: this setting has temporary effect and at the startup comes back to the default level. If the default level is desired to change, please refer to the [object 2003h sub-index 05h](#).

| | | |
|------------|-----------------------|------------------------------|
| Identifier | 400h + current CAN ID | Default 415h |
| Byte 0 | XXh | Intensity 00h-3Fh → min-100% |
| Byte 1, 7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | LED |
|-----------|------------|--------|-------------------------|------------------------|
| To Keypad | 415 | Std | 20 00 00 00 00 00 00 00 | Brightness = 50% |
| To Keypad | 415 | Std | 00 00 00 00 00 00 00 00 | Minimum brightness set |

17. Backlight setting

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

NOTE: in case the RPDO message is transmitted periodically to the keypad, to ensure correct processing of the command the period used must be higher than 50ms; a value equal to 100ms is fairly good for most applications.

NOTE 2: in case a brightness level value greater than 3Fh is set, the command is neglected.

NOTE 3: if it is selected as brightness level a value inside the valid range and as backlight color a value outside the available range, the backlight is switched on with the current color stored, the default or the last valid temporary one if set.

NOTE 4: the backlight color setting has temporary effect. If the default setting is desired to change, please refer to the [object 2003h sub-index 04h](#).

| | | |
|------------|-----------------------|---|
| Identifier | 500h + current CAN ID | Default 515h |
| Byte 0 | XXh | Brightness level: 00h-3Fh → 0-100% |
| Byte 1 | YYh | Backlight color: |
| | | 01h: red 02h: green 03h: blue 04h: yellow 05h: cyan 06h: violet 07h: white/light blue 08h: amber/orange 09h: yellow/green |
| Byte 2,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | LED |
|-----------|------------|--------|-------------------------|--|
| To Keypad | 515 | Std | 00 00 00 00 00 00 00 00 | Turn off the backlight |
| To Keypad | 515 | Std | 3F 03 00 00 00 00 00 00 | Backlight active at 100% with blue color |

SDO Messages:

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

18. Object 2000h: Digital input module, keys states

a) Sub 1 – Key state

This module contains all the Switch State information.

A one indicates the switch is pressed, a zero indicates the switch is released.

NOTE: for 4-keys version the keys #5 and #6 are not available.

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| 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 40 00 00 00 | Key 7 pressed |
| | | | 4F 00 20 01 4F 00 00 00 | All Keys pressed |

b) Sub 2 – Read encoder direction counter

This module contains the Encoder direction counter.

NOTE: the encoder is identified with the key number 7. See [chapter 2](#) for further details.

| | | |
|------------|------------------------------|----------------------|
| 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 | 01h: Clockwise 81h: Counterclockwise |
| 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 |

c) Sub 3 – Read encoder tick counter

The Tick counter is a two bytes counter incremented each clockwise tick and decremented each counterclockwise tick. The following command allows to read the encoder tick counter value. Note: the encoder is identified with the key number 7. See [chapter 2](#) for further details.

| | | |
|------------|------------------------------|----------------------|
| 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 startup encoder tick counter value**

The following command allows to set the startup encoder tick counter value.

NOTE: in case the TOP position has been set, if it is selected a startup counter value higher than the TOP position, the counter starts from the TOP position.

| | | |
|------------|-----------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| 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 | |

d) Sub 4 – Set/read TOP position encoder

The following command allows to set and read the TOP position value for the encoder tick counter.

NOTE: if the value 00h is selected the maximum tick counter value achievable is 65535.

NOTE 2: the encoder is identified with the key number 1. See [chapter 2](#) for further details.

| | | |
|------------|------------------------------|---|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 2Fh | Set Device Register |
| | 40h | Read Device Register |
| Byte 1 | 00h | CAN Object 2000h |
| Byte 2 | 20h | |
| Byte 3 | 04h | Sub index |
| Byte 4 | XXh | XXh: 00h: Disabled From 01h (1) to 14h (20) |
| Byte 5,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|-----------------------|
| To Keypad | 615 | Std | 2F 00 20 04 08 00 00 00 | Set TOP position to 8 |
| From Keypad | 595 | Std | 60 00 20 04 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 00 20 04 00 00 00 00 | Read the set value |
| From Keypad | 595 | Std | 4F 00 20 04 08 00 00 00 | TOP position set to 8 |

e) Sub 5 – Read joystick position

This message allows to read the value associated with the position reached by the joystick.

Please refer to [chapter 13](#) for further details on the position values.

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 00h | CAN Object 2000h |
| Byte 2 | 20h | |
| Byte 3 | 05h | Sub index |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|-------------------------------|
| To Keypad | 615 | Std | 40 00 20 05 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 00 20 05 00 00 00 00 | Neutral position |
| | | | 4F 00 20 05 01 00 00 00 | North direction detected |
| | | | 4F 00 20 05 20 00 00 00 | South-west direction detected |
| | | | 4F 00 20 05 10 00 00 00 | South direction detected |
| | | | 4F 00 20 05 80 00 00 00 | North-west direction detected |

19. Object 2001h: Digital output module.

This module sets and reads the LED Outputs States.

Each bit position represents the corresponding LED indicator. A one indicates the LED is ON a zero indicates the LED is OFF.

NOTE: based on the version used, some key LED indicators might not be available.

a) Set LED ON

- **Sub-index 01**

| | | |
|------------|-----------------------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| Byte 1 | 01h | CAN Object 2001h |
| Byte 2 | 20h | |
| Byte 3 | 01h | Sub index |
| Byte 4 | KR8 LK7 KR6 KR5 – KR4 KR3 KR2 KR1 | Key-LED red |
| Byte 5 | ER8 ER7 ER6 ER5 – ER4 ER3 ER2 ER1 | Encoder LED red |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------------------------|
| To Keypad | 615 | Std | 2B 01 20 01 02 00 00 00 | Set Key-LED #2 red ON |
| From Keypad | 595 | Std | 60 01 20 01 00 00 00 00 | |
| To Keypad | 615 | Std | 2B 01 20 01 00 40 00 00 | Set Encoder LED #7 red ON |
| From Keypad | 595 | Std | 60 01 20 01 00 00 00 00 | |

- **Sub-index 02**

| | | |
|------------|-----------------------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| Byte 1 | 01h | CAN Object 2001h |
| Byte 2 | 20h | |
| Byte 3 | 02h | Sub index |
| Byte 4 | KG8 KG7 KG6 KG5 – KG4 KG3 KG2 KG1 | Key-LED green |
| Byte 5 | EG8 EG7 EG6 EG5 – EG4 EG3 EG2 EG1 | Encoder LED green |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|-----------------------------|
| To Keypad | 615 | Std | 2B 01 20 02 01 00 00 00 | Set Key-LED #1 green ON |
| From Keypad | 595 | Std | 60 01 20 02 00 00 00 00 | |
| To Keypad | 615 | Std | 2B 01 20 02 00 04 00 00 | Set Encoder LED #3 green ON |
| From Keypad | 595 | Std | 60 01 20 02 00 00 00 00 | |

- **Sub-index 03**

| | | |
|------------|-----------------------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| Byte 1 | 01h | CAN Object 2001h |
| Byte 2 | 20h | |
| Byte 3 | 03h | Sub index |
| Byte 4 | KB8 KB7 KB6 KB5 – KB4 KB3 KB2 KB1 | Key-LED blue |
| Byte 5 | EB8 EB7 EB6 EB5 – EB4 EB3 EB2 EB1 | Encoder LED blue |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|----------------------------|
| To Keypad | 615 | Std | 2B 01 20 03 04 00 00 00 | Set Key-LED #3 blue ON |
| From Keypad | 595 | Std | 60 01 20 03 00 00 00 00 | |
| To Keypad | 615 | Std | 2B 01 20 03 00 80 00 00 | Set Encoder LED #8 blue ON |
| From Keypad | 595 | Std | 60 01 20 03 00 00 00 00 | |

b) Read LED ON

The LED have the same mapping of Set LED ON message.

| | | |
|------------|-----------------------|--|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 01h | CAN Object 2001h |
| Byte 2 | 20h | |
| Byte 3 | XXh | XX: sub-index 01h: sub-index 01 02h: sub-index 02 03h: sub-index 03 |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------------------|
| To Keypad | 615 | Std | 40 01 20 01 00 00 00 00 | Read sub-index 1 |
| From Keypad | 595 | Std | 4B 01 20 01 08 00 00 00 | Key-LED #4 red ON |
| To Keypad | 615 | Std | 40 01 20 02 00 00 00 00 | Read sub-index 2 |
| From Keypad | 595 | Std | 4B 01 20 02 10 00 00 00 | Key-LED #5 green ON |
| To Keypad | 615 | Std | 40 01 20 03 00 00 00 00 | Read sub-index 3 |
| From Keypad | 595 | Std | 4B 01 20 03 00 08 00 00 | Encoder LED #4 blue ON |

20. Object 2002h: Digital output module.

This module sets and reads the LED Blink States.

Each bit position represents the corresponding LED indicator. A one indicates the LED is blinking a zero indicates the LED is not blinking. If the blink message is sent when the LED is already ON, the LED blinks in alternate mode.

NOTE: based on the version used, some key LED indicators might not be available.

a) Set LED blink

- **Sub-index 01**

| | | |
|------------|-----------------------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| Byte 1 | 02h | CAN Object 2002h |
| Byte 2 | 20h | |
| Byte 3 | 01h | Sub index |
| Byte 4 | KR8 KR7 KR6 KR5 – KR4 KR3 KR2 KR1 | Key-LED red |
| Byte 5 | ER8 ER7 ER6 ER5 – ER4 ER3 ER2 ER1 | Encoder LED red |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------------------------|
| To Keypad | 615 | Std | 2B 02 20 01 04 00 00 00 | Key-LED #3 red blinks |
| From Keypad | 595 | Std | 60 02 20 01 00 00 00 00 | |
| To Keypad | 615 | Std | 2B 02 20 01 00 20 00 00 | Encoder LED #6 red blinks |
| From Keypad | 595 | Std | 60 02 20 01 00 00 00 00 | |

- **Sub-index 02**

| | | |
|------------|-----------------------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| Byte 1 | 02h | CAN Object 2002h |
| Byte 2 | 20h | |
| Byte 3 | 02h | Sub index |
| Byte 4 | KG8 KG7 KG6 KG5 – KG4 KG3 KG2 KG1 | Key-LED green |
| Byte 5 | EG8 EG7 EG6 EG5 – EG4 EG3 EG2 EG1 | Encoder LED green |
| Byte 5,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|-----------------------------|
| To Keypad | 615 | Std | 2B 02 20 02 08 00 00 00 | Key-LED #8 green blinks |
| From Keypad | 595 | Std | 60 02 20 02 00 00 00 00 | |
| To Keypad | 615 | Std | 2B 02 20 02 00 01 00 00 | Encoder LED #1 green blinks |
| From Keypad | 595 | Std | 60 02 20 02 00 00 00 00 | |

- **Sub-index 03**

| | | |
|------------|-----------------------------------|---------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 2Bh | Set Device Register |
| Byte 1 | 02h | CAN Object 2002h |
| Byte 2 | 20h | |
| Byte 3 | 03h | Sub index |
| Byte 4 | KB8 KB7 KB6 KB5 – KB4 KB3 KB2 KB1 | Key-LED blue |
| Byte 5 | EB8 EB7 EB6 EB5 – EB4 EB3 EB2 EB1 | Encoder LED blue |
| Byte 6,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|----------------------------|
| To Keypad | 615 | Std | 2B 02 20 03 01 00 00 00 | Key-LED #1 blue blinks |
| From Keypad | 595 | Std | 60 02 20 03 00 00 00 00 | |
| To Keypad | 615 | Std | 2B 02 20 03 00 02 00 00 | Encoder LED #2 blue blinks |
| From Keypad | 595 | Std | 60 02 20 03 00 00 00 00 | |

b) Read LED ON

The LED have the same mapping of Set LED blink message.

| | | |
|------------|-----------------------|--|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 02h | CAN Object 2002h |
| Byte 2 | 20h | |
| Byte 3 | XXh | XX: Sub index 01h: sub-index 01 02h: sub-index 02 03h: sub-index 03 |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------------------------|
| To Keypad | 615 | Std | 40 02 20 01 00 00 00 00 | Read sub-index 1 |
| From Keypad | 595 | Std | 4B 02 20 01 FF 00 00 00 | Key-LED #1-8 red blink |
| To Keypad | 615 | Std | 40 02 20 02 00 00 00 00 | Read sub-index 2 |
| From Keypad | 595 | Std | 4B 02 20 02 00 0F 00 00 | Encoder LED #1-4 green blink |
| To Keypad | 615 | Std | 40 02 20 03 00 00 00 00 | Read sub-index 3 |
| From Keypad | 595 | Std | 4B 02 20 03 00 F0 00 00 | Encoder LED #5-8 blue blink |

21. Object 2003h: Brightness Level

a) LED indicators brightness level:

Set message:

| | | |
|------------|------------------------------|------------------------------|
| 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 | YYh | Intensity 00h-3Fh → min-100% |
| Byte 5,7 | 00h | Not used |

Read message:

| | | |
|------------|------------------------------|----------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 2003h |
| Byte 2 | 20h | |
| Byte 3 | 01h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------------------------|
| To Keypad | 615 | Std | 2F 03 20 01 09 00 00 00 | Brightness = 15% |
| From Keypad | 595 | Std | 60 03 20 01 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 03 20 01 00 00 00 00 | Read brightness level set |
| From Keypad | 595 | Std | 4F 03 20 01 09 00 00 00 | Brightness = 15% |

b) Backlight brightness level

Set message:

| | | |
|------------|------------------------------|----------------------------|
| 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 |

Read message:

| | | |
|------------|------------------------------|----------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 2003h |
| Byte 2 | 20h | |
| Byte 3 | 02h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------------------------|
| To Keypad | 615 | Std | 2F 03 20 02 0D 00 00 00 | Brightness = 20% |
| From Keypad | 595 | Std | 60 03 20 02 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 03 20 02 00 00 00 00 | Read brightness level set |
| From Keypad | 595 | Std | 4F 03 20 02 0D 00 00 00 | Brightness = 20% |

c) Backlight color

Set message:

| | | | |
|------------|------------------------------|---|---|
| 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 | Color 01h: red 02h: green 03h: blue 04h: yellow | 05h: cyan 06h: violet 07h: white/light blue 08: amber/orange 09: yellow/green |
| Byte 5,7 | 00h | Not used | |

Read message:

| | | | |
|------------|------------------------------|----------------------|--|
| Identifier | 615h (600h + current CAN ID) | | |
| Byte 0 | 40h | Read Device Register | |
| Byte 1 | 03h | CAN Object 2003h | |
| Byte 2 | 20h | | |
| Byte 3 | 03h | Sub index | |
| Byte 4,7 | 00h | Not used | |

Example:

| Direction | Identifier | Format | Message | Data |
|-----------------|------------|--------|-------------------------|--------------------------|
| To Keypad | 615 | Std | 2F 03 20 03 05 00 00 00 | Cyan backlight color |
| From Keypad | 595 | Std | 60 03 20 03 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 03 20 03 00 00 00 00 | Read backlight color set |
| From Keypad 595 | 595 | Std | 4F 03 20 03 04 00 00 00 | Cyan backlight color |

d) Default backlight color

Set message:

| | | | |
|------------|------------------------------|---|---|
| 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 | Color 01h: red 02h: green 03h: blue 04h: yellow | 05h: cyan 06h: violet 07h: white/light blue 08: amber/orange 09: yellow/green |
| Byte 5,7 | 00h | Not used | |

Read message:

| | | |
|------------|------------------------------|----------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 2003h |
| Byte 2 | 20h | |
| Byte 3 | 04h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------------------|
| To Keypad | 615 | Std | 2F 03 20 04 06 00 00 00 | Violet backlight color |
| From Keypad | 595 | Std | 60 03 20 04 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 03 20 04 00 00 00 00 | Read default color set |
| From Keypad | 595 | Std | 4F 03 20 04 06 00 00 00 | Violet backlight color |

e) Default LED indicators brightness level

Set message:

| | | |
|------------|------------------------------|------------------------------|
| 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 |

Read message:

| | | |
|------------|------------------------------|----------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 2003h |
| Byte 2 | 20h | |
| Byte 3 | 05h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------------------------|
| To Keypad | 615 | Std | 2F 03 20 05 13 00 00 00 | Brightness = 30% |
| From Keypad | 595 | Std | 60 03 20 05 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 03 20 05 00 00 00 00 | Read brightness level set |
| From Keypad | 595 | Std | 4F 03 20 05 13 00 00 00 | Brightness = 30% |

f) Default backlight brightness level

Set message:

| | | |
|------------|------------------------------|----------------------------|
| 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 |

Read message:

| | | |
|------------|------------------------------|----------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 2003h |
| Byte 2 | 20h | |
| Byte 3 | 06h | Sub index |
| Byte 5,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|--------------------------|
| To Keypad | 615 | Std | 2F 03 20 06 00 16 00 00 | Backlight level = 35% |
| From Keypad | 595 | Std | 60 03 20 06 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 03 20 06 00 00 00 00 | Read backlight level set |
| From Keypad | 595 | Std | 4F 03 20 06 00 16 00 00 | Backlight level = 35% |

22. Object 2010h: Baud rate setting

Set message:

| | | |
|------------|------------------------------|--------------------------|
| 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 |

Read message:

| | | |
|------------|------------------------------|----------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 10h | CAN Object 2010h |
| Byte 2 | 20h | |
| Byte 3 | 00h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------------|
| To Keypad | 615 | Std | 2F 10 20 00 04 00 00 00 | Baud rate = 125k |
| From Keypad | 595 | Std | 60 10 20 00 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 10 20 00 00 00 00 00 | Read command set |
| From Keypad | 595 | Std | 4F 10 20 00 04 00 00 00 | Baud rate = 125k |

23. 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.

Set message:

| | | |
|------------|-----------------------|---------------------|
| 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 |

Read message:

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 11h | CAN Object 2011h |
| Byte 2 | 20h | |
| Byte 3 | 00h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------------------|
| To Keypad | 615 | Std | 2F 11 20 00 01 00 00 00 | Boot-up service active |
| From Keypad | 595 | Std | 60 11 20 00 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 11 20 00 00 00 00 00 | Read command set |
| From Keypad | 595 | Std | 4F 11 20 00 01 00 00 00 | Boot-up service active |

24. Object 2012h: Set device active on startup

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

Set message:

| | | |
|------------|-----------------------|---------------------|
| 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 |

Read message:

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 12h | CAN Object 2012h |
| Byte 2 | 20h | |
| Byte 3 | 00h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------------------------|
| To Keypad | 615 | Std | 2F 12 20 00 01 00 00 00 | Device active on startup |
| From Keypad | 595 | Std | 60 12 20 00 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 12 20 00 00 00 00 00 | Read command set |
| From Keypad | 595 | Std | 4F 12 20 00 00 00 00 00 | Device not active on startup |

25. Object 2013h: Set CANopen node ID

Note: make sure that when changing node ID to the keypad, no other device on the network has the same address set.

Set message:

| | | |
|------------|-----------------------|---|
| 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 |

Read message:

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 13h | CAN Object 2013h |
| Byte 2 | 20h | |
| Byte 3 | 00h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|----------------------------|
| To Keypad | 615 | Std | 2F 13 20 00 3A 00 00 00 | CANopen node ID set to 3Ah |
| From Keypad | 5BA | Std | 60 13 20 00 00 00 00 00 | Command accepted |
| To Keypad | 63A | Std | 40 13 20 00 00 00 00 00 | Read CANopen node ID |
| From Keypad | 5BA | Std | 4F 13 20 00 3A 00 00 00 | CANopen node ID set to 3Ah |

26. Object 2014h: Set startup LED show

Set message:

| | | |
|------------|-----------------------|----------------------------------|
| 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: Disable |
| | | 01h: Complete LED Show (default) |
| | | 02h: Fast Flash |
| Byte 5,7 | 00h | Not used |

Read message:

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 14h | CAN Object 2014h |
| Byte 2 | 20h | |
| Byte 3 | 00h | Sub index |
| Byte 4,7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|-------------------------|
| To Keypad | 615 | Std | 2F 14 20 00 02 00 00 00 | Fast flash show enabled |
| From Keypad | 595 | Std | 60 14 20 00 00 00 00 00 | Command accepted |
| To Keypad | 615 | Std | 40 14 20 00 00 00 00 00 | Read command set |
| From Keypad | 595 | Std | 4F 14 20 00 02 00 00 00 | Fast flash show enabled |

27. 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 | |

28. 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: XXYYh (from 000Ah to FFFFh: from 10 to 65535 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 |

29. 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: XXYYh (from 000Ah to FFFFh: from 10 to 65279 milliseconds).

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

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: Stop 05h: Operational 7Fh: Pre-operational |

Example:

| 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 |

30. 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, 7 | 00h | Not used |

Example:

| Direction | Identifier | Format | Data |
|-------------|------------|--------|-------------------------|
| To Keypad | 615 | Std | 40 00 10 00 00 00 00 00 |
| From Keypad | 595 | Std | 43 00 10 00 91 01 0B 00 |

Device profile number 0xB0191h.

31. Object 1001h: Error Register

This object is not yet implemented in the device.

32. 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 | Not 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 Keypad | 615 | Std | 40 08 10 00 00 00 00 00 | |
| From Keypad | 595 | Std | 41 08 10 00 0B 00 00 00 | |
| To Keypad | 615 | Std | 60 00 00 00 00 00 00 00 | |
| From Keypad | 595 | Std | 00 42 6C 69 6E 6B 4D 61 | BlinkMa |
| 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: BlinkMarine

The first byte of the last data message replied is 17h.

33. 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, 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 5F 30 30 | V_00 |

Manufacturer Hardware Revision: V_00

34. 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, 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 31 2E 30 30 | 1.00 |

Manufacturer Firmware Revision: 1.00

35. Object 100Bh: Model ID

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 0Bh | CAN Object 100Bh |
| Byte 2 | 10h | |
| Byte 3, 7 | 00h | Not used |

1° additional byte

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

2° additional byte

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

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|-------|
| To Keypad | 615 | Std | 40 0B 10 00 00 00 00 00 | |
| From Keypad | 595 | Std | 41 0B 10 00 05 00 00 00 | |
| To Keypad | 615 | Std | 60 00 00 00 00 00 00 00 | |
| From Keypad | 595 | Std | 05 50 57 54 52 34 00 00 | PWTR4 |

Model ID: PWTR4.

36. 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 | 60 11 10 01 00 00 00 00 | |

37. 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

38. Object 1400h: Receive PDO Communication Parm 0

Describes the Receive Parameters and sets the transmission type for the LED ON 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 LED 1 red 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.

39. 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 10 00 00 00 00 00 00 | Request LED 1 green 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.

40. Object 1402h: Receive PDO communication Parm 2

Describes the Receive Parameters for LED indicators brightness level 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 | Highest sub-index supported |
| | 01h | COB Id |
| | 02h | Transmission Type |
| Byte 4,7 | 00h | |
| | Not used | |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------|
| To Keypad | 615 | Std | 40 02 14 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 02 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.

41. Object 1403h: Receive PDO communication Parm 3

Describes the Receive Parameters for backlight setting PDO message.

| | | |
|------------|------------------------------|-----------------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 1403h |
| Byte 2 | 14h | |
| Byte 3 | 00h | Highest sub-index supported |
| | 01h | COB Id |
| | 02h | Transmission Type |
| Byte 4,7 | 00h | |
| | Not used | |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------|
| To Keypad | 615 | Std | 40 03 14 00 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 03 14 00 02 00 00 00 | 2 |
| To Keypad | 615 | Std | 40 03 14 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 03 14 01 15 05 00 00 | 0000 0515h |
| To Keypad | 615 | Std | 40 03 14 02 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 03 14 02 FE 00 00 00 | FEh |

Receive PDO communication Parm 3:

- Number of mapped objects: 2;
- COB id: 0000 0500h + NODE ID;
- Transmission Type: FEh.

42. Object 1600h: Receive PDO mapping Parameter 0

Describes the mapping of set LED ON 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 | 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 |

| 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 03 00 00 00 | 3 |
| To Keypad | 615 | Std | 40 00 16 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 00 16 01 10 01 01 20 | 2001 01 10 |
| 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 10 03 01 20 | 2001 03 10 |

Receive PDO mapping Parameter 0:

- Number of mapped objects: 3;
- PDO Mapping Entry 1: Object 2001h, Sub index 01h, Length 10h;
- PDO Mapping Entry 2: Object 2001h, Sub index 02h, Length 10h;
- PDO Mapping Entry 3: Object 2001h, Sub index 03h, Length 10h.

43. 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 | 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 |

| 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 03 00 00 00 | 3 |
| To Keypad | 615 | Std | 40 01 16 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 16 01 10 01 02 20 | 2002 01 10 |
| To Keypad | 615 | Std | 40 01 16 02 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 16 02 10 02 02 20 | 2002 02 10 |
| To Keypad | 615 | Std | 40 01 16 03 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 16 03 10 03 02 20 | 2002 03 10 |

Receive PDO mapping Parameter 1:

- Number of mapped objects: 3;
- PDO Mapping Entry 1: Object 2002h, Sub index 01h, Length 10h;
- PDO Mapping Entry 2: Object 2002h, Sub index 02h, Length 10h;
- PDO Mapping Entry 3: Object 2002h, Sub index 03h, Length 10h.

44. Object 1602h: Receive PDO mapping Parameter 2

Describes the mapping of LED indicators brightness 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 | Number of mapped objects |
| | 01h | PDO Mapping Entry 1 |
| 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 01 00 00 00 | 1 |
| To Keypad | 615 | Std | 40 02 16 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 02 16 01 08 01 03 20 | 2003 01 08 |

Receive PDO mapping Parameter 2:

- Number of mapped objects: 1;
- LED indicator brightness: Object 2003h, Sub index 01h, Length 08h.

45. Object 1603h: Receive PDO mapping Parameter 3

Describes the mapping of backlight setting PDO Message.

| | | |
|------------|------------------------------|--------------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 03h | CAN Object 1603h |
| Byte 2 | 16h | |
| Byte 3 | 00h | Number of mapped objects |
| | 01h | PDO Mapping Entry 1 |
| | 02h | PDO Mapping Entry 2 |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------|
| To Keypad | 615 | Std | 40 03 16 00 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 03 16 00 02 00 00 00 | 2 |
| To Keypad | 615 | Std | 40 03 16 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 03 16 01 08 02 03 20 | 2003 02 08 |
| To Keypad | 615 | Std | 40 03 16 02 00 00 00 00 | |
| From Keypad | 595 | Std | 43 03 16 02 08 03 03 20 | 2003 03 08 |

Receive PDO mapping Parameter 3:

- Number of mapped objects: 2;
- Backlight brightness level: Object 2003h, Sub index 02h, Length 08h;
- Backlight color: Object 2003h, Sub-index 03h, Length 08h.

46. 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 time) |
| Byte 4 | XXh | Transmission Type (to be used only in set mode): 01h: synchronous (cyclic every SYNC) 02h: synchronous (cyclic every 2 nd SYNC) 03h: synchronous (cyclic every 3 rd SYNC) 04h: synchronous (cyclic every 4 th SYNC) F0h: synchronous (cyclic every 240 th SYNC) FEh: event-driven (default) |
| Byte 5,7 | 00h | Not used |

Examples:

| 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 message on the CAN bus | | | | |
| From Keypad | 195 | Std | 00 00 00 00 XX | Key status sent/ Read key status |
| To Keypad | 80 | Std | - | SYNC message received |
| From Keypad | 195 | Std | 01 00 00 00 XX | Key status sent/ Read key status |

Transmit PDO communication Parm 0:

- Highest sub-index supported: 5;
- 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 |

Periodic Transmission timer: XXYYh (from 0032h to FEFh: from 50 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 state 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 | |

47. Object 1801h:

Transmit PDO Communication Parm 1

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

| | | |
|------------|------------------------------|--|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 01h | CAN Object 1801h |
| Byte 2 | 18h | |
| Byte 3 | 00h | Highest sub-index supported |
| | 01h | COB Id |
| | 02h | Transmission Type |
| | 05h | Event Timer (Periodic transmission time) |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------------------------------------|
| To Keypad | 615 | Std | 40 01 18 00 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 01 18 00 05 00 00 00 | 5 |
| To Keypad | 615 | Std | 40 01 18 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 18 01 95 02 00 00 | 0000 0295h |
| To Keypad | 615 | Std | 40 01 18 02 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 01 18 02 FE 00 00 00 | FEh: event-driven type |
| To Keypad | 615 | Std | 40 01 18 05 00 00 00 00 | |
| From Keypad | 595 | Std | 4B 01 18 05 00 00 00 00 | 0000h: Periodic transmission disabled |

Transmit PDO communication Parm 0:

- Highest sub-index supported: 2;
- Address base: 295h= 280h+ NODE ID;
- Transmission Type: event-driven or periodic (see [Set periodic state transmission](#) for further details).

48. Object 1802h:

Transmit PDO Communication Parm 2

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

| | | |
|------------|------------------------------|-----------------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| | 2Fh | Set Device Register |
| Byte 1 | 02h | CAN Object 1802h |
| Byte 2 | 18h | |
| Byte 3 | 00h | Highest sub-index supported |
| | 01h | COB Id |
| | 02h | Transmission Type |
| | 05h | Event Timer |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|--------------------------------------|
| To Keypad | 615 | Std | 40 02 18 00 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 02 18 00 05 00 00 00 | 5 |
| To Keypad | 615 | Std | 40 02 18 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 02 18 01 95 03 00 00 | 0000 0395h |
| To Keypad | 615 | Std | 40 02 18 02 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 02 18 02 FE 00 00 00 | FEh: event-driven type |
| To Keypad | 615 | Std | 40 02 18 05 00 00 00 00 | |
| From Keypad | 595 | Std | 4B 02 18 05 00 00 00 00 | 0000: Periodic transmission disabled |

Transmit PDO communication Parm 0:

- Highest sub-index supported: 5;
- Address base: 395h= 380h+ NODE ID;
- Transmission Type: event-driven or periodic (see [Set periodic state transmission](#) for further details).

49. Object 1A00h Transmit PDO Mapping Parameter 0

Describes the mapping of Key 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 |
| Byte 4,7 | 00h | Not used |

Examples:

| 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 01 00 00 00 | 1 |
| 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 |

Transmit PDO Mapping Parameter:

- Number of mapped objects: 1;
- Switch state: Object 2000h, Sub index 01h, Length 10h.

50. Object 1A01h Transmit PDO Mapping Parameter 1

Describes the mapping of Encoder state PDO Message.

| | | |
|------------|------------------------------|--------------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 01h | CAN Object 1A01h |
| 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 |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------|
| To Keypad | 615 | Std | 40 01 1A 00 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 01 1A 00 03 00 00 00 | 3 |
| To Keypad | 615 | Std | 40 01 1A 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 1A 01 08 02 00 20 | 2000 02 08 |
| To Keypad | 615 | Std | 40 01 1A 02 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 1A 02 10 03 00 20 | 2000 03 10 |
| To Keypad | 615 | Std | 40 01 1A 03 00 00 00 00 | |
| From Keypad | 595 | Std | 43 01 1A 03 08 04 00 20 | 2000 04 08 |

Transmit PDO Mapping Parameter:

- Number of mapped objects: 3;
- Encoder direction counter: Object 2000h, Sub index 02h, Length 08h;
- Encoder tick counter: Object 2000h, Sub index 03h, Length 10h;
- Top position encoder: Object 2000h, Sub index 04h, Length 08h.

51. Object 1A02h Transmit PDO Mapping Parameter 2

Describes the mapping of Joystick state PDO Message.

| | | |
|------------|------------------------------|--------------------------|
| Identifier | 615h (600h + current CAN ID) | |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 02h | CAN Object 1A02h |
| Byte 2 | 1Ah | |
| Byte 3 | 00h | Number of mapped objects |
| | 01h | PDO Mapping Entry 1 |
| Byte 4,7 | 00h | Not used |

Examples:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|------------|
| To Keypad | 615 | Std | 40 02 1A 00 00 00 00 00 | |
| From Keypad | 595 | Std | 4F 02 1A 00 01 00 00 00 | 1 |
| To Keypad | 615 | Std | 40 02 1A 01 00 00 00 00 | |
| From Keypad | 595 | Std | 43 02 1A 01 08 05 00 20 | 2000 05 08 |

Transmit PDO Mapping Parameter:

- Number of mapped objects: 1;
- Joystick position: Object 2000h, Sub index 06h, Length 08h.

52. Object 2200h: Serial number string

| | | |
|------------|-----------------------|----------------------|
| Identifier | 600h + current CAN ID | Default 615h |
| Byte 0 | 40h | Read Device Register |
| Byte 1 | 00h | CAN Object 2200h |
| Byte 2 | 22h | |
| Byte 3,7 | 00h | Not used |

1° additional byte

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

2° additional byte

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

Example:

| Direction | Identifier | Format | Message | Data |
|-------------|------------|--------|-------------------------|---------|
| To Keypad | 615 | Std | 40 00 22 00 00 00 00 00 | |
| From Keypad | 595 | Std | 41 00 22 00 08 00 00 00 | |
| To Keypad | 615 | Std | 60 00 00 00 00 00 00 00 | |
| From Keypad | 595 | Std | 00 46 46 46 46 46 46 46 | FFFFFFF |
| To Keypad | 615 | Std | 70 00 00 00 00 00 00 00 | |
| From Keypad | 595 | Std | 1D 46 00 00 00 00 00 00 | F |

Serial number: ascii FFFFFFFF

The first byte of the last data message replied is 1Dh.

53. 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 | 600h + current CAN ID (default 615h) | Std | 2B FF 20 01 01 | Change to J1939 |

- Change from J1939 to CANopen:

| Direction | Identifier | Format | Message | Data |
|-----------|---|--------|-------------------------|----------------------|
| To Keypad | 18EFXX00h where XXh is the current CAN source address (default 18EF2100h) | Ext | 04 1B 80 00 FF FF FF FF | Change to CANopen |

APPENDIX: DEMO Mode instructions

In DEMO Mode you can try the following functions by pressing buttons on the PWTR4.

Entering this mode, you turn on the key and encoder LED indicators with red color; for the key 1 each time you press this button you can change the color of the indicators with this sequence:

1. Red;
2. Green;
3. Blue;
4. Yellow;
5. Cyan;
6. Magenta;
7. White/light blue;
8. Amber;
9. Yellow/green;
10. OFF.

Once reached step 10 of the sequence, if the knob is rotated in the clockwise direction the LED indicators turn on sequentially according to the order reported in the LED reference in chapter 2.

Once all the LED indicators are on, a further tick in the same direction makes them turn them off.

NOTE: if during this phase the knob is rotated in the counterclockwise direction, the LED indicators already on change color sequentially.

NOTE 2: in case this feature is carried out when the LED indicators are already on before step 10, the rotation changes sequentially their color.

NOTE 3: the press of key 1, when the knob is rotated, makes change the color of the next LED indicators; the sequence of the colors is listed above.

Pressing key 2, you can increase key and encoder LED indicators brightness.

Pressing key 4, you can decrease key and encoder LED indicators brightness.

For the key 3, each time that you press the button, there are different steps in this sequence:

1. Complete LED show of all colors;
2. Backlight active with LED indicators on in sequence (it is possible to change the color of the indicators by pressing key 1);
3. Encoder and key-LED indicators blink with different colors.

In the case you press the other keys there are no events.

Only for the models supporting the joystick feature: inclining the joystick in one of the eight cardinal directions, the matching LED indicator on the encoder turns on or changes its color (if already on).

54. Revision history

| Date | Manual Revision | Comment |
|------------|-----------------|---|
| 30/08/2023 | 1.0 | First release |
| 25/09/2023 | 1.1 | Second release: <ul style="list-style-type: none">• Changed images on chapter 2• Updated chapter 18.e |
| 31/10/2023 | 1.2 | Third release: <ul style="list-style-type: none">• Updated chapters 47-48• Updated Appendix DEMO MODE instructions |