PG8 CANopen Slave

Features:

CAN 2.0A supported

12V-24V power supply supported

8 inputs (contact switch input)

8 inputs (digital / analog)

Operating temperature range: -40 to +85°C

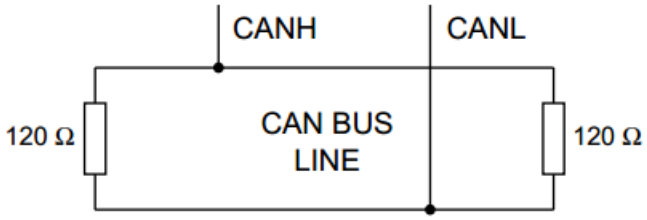
Waterproof (IP67)

Cinch connector SHS 30pin

Contents

1. How to Connect CAN bus:

PIN	FUNCTION
K2	CAN L
K1	CAN H



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 on the CANbus wire harness.

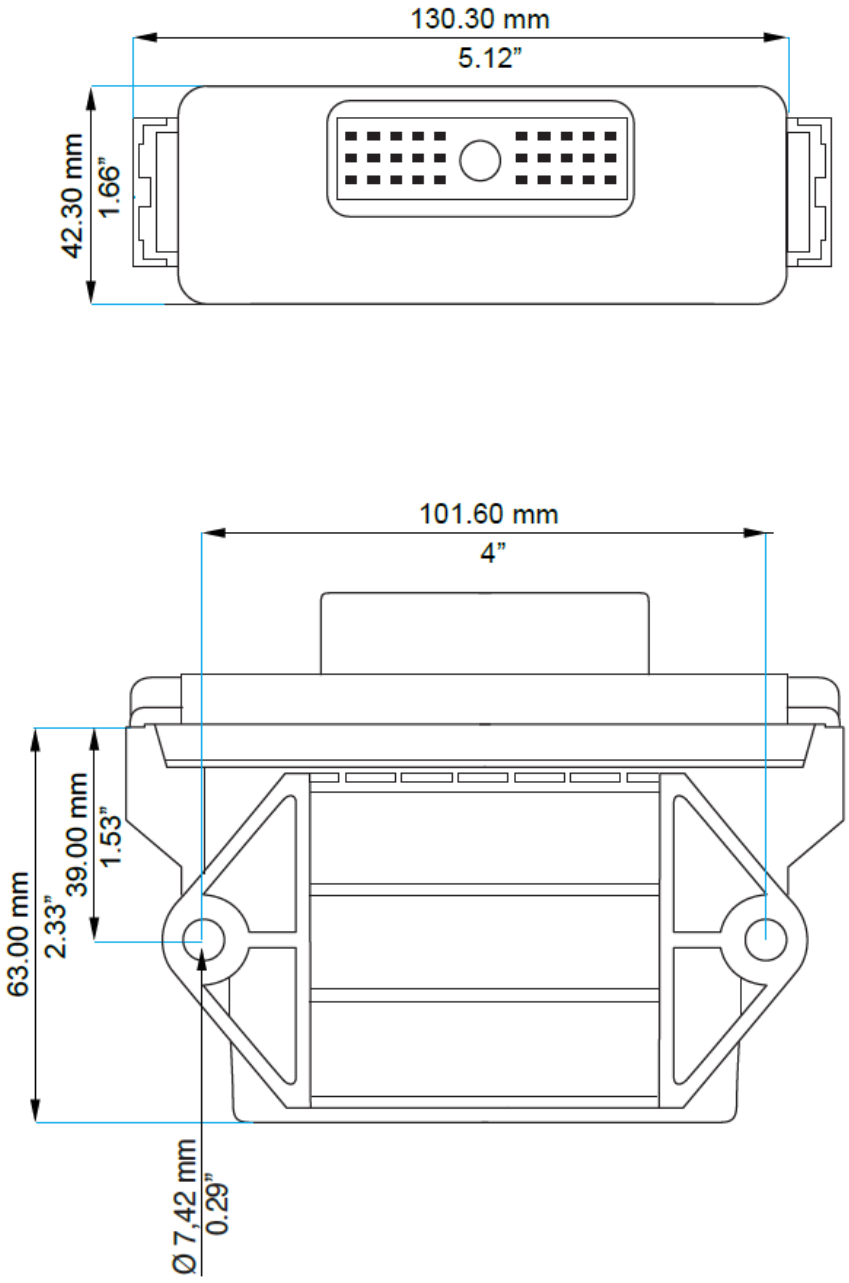
It is possible on demand to have the 120Ω resistor already mounted in the PG8 PCB.

2. PG8 Technical Specifications

Electrical	**Value**	**Unit**
Supply Voltage (Battery Voltage)	8-32V	V
Maximum Standby Current	< 30mA	A
Maximum Source Current output pin	140mA	A
Maximum Digital Input Voltage	Battery Voltage	V
Digital Input Low Voltage max (V_IL max)	5,5	V
Environmental	**Value**	**Unit**
Storage temperature range	-40 to +85	°C
Operating temperature range	-40 to +85	°C
Humidity	0 to 98	%

3. Mechanical dimensions

Dimensions are in millimeters.



4. Connector 30 pin:

Connector Cinch 581-01-30-064

Function	Pin
+Vbatt	A1
RS485_P	A2
RS485_N	A3
KEY B	B1
GND	B2
KEY_B_OUT	B3
KEY C	C1
GND	C2
KEY_C_OUT	C3
KEY D	D1
GND	D2
KEY_D_OUT	D3
KEY E	E1
GND	E2
KEY_E_OUT	E3
KEY F	F1
GND	F2
KEY_F_OUT	F3
KEY G	G1
GND	G2
KEY_G_OUT	G3
KEY H	H1
GND	H2
KEY_H_OUT	H3
KEY J	J1
GND	J2
KEY_J_OUT	J3
CANH	K1
CANL	K2
GND	K3

5. Electrical Loads Connection

The PG8 is an INPUT/OUTPUT versatile device which transmits to a control unit the state of 8 keys of which it is provided, and is able to supply low power electrical loads (the maximum current value sourced must not exceed 140 milliamperes)

The device could be set to control from 1 to 8 outputs.

The electrical load is connected between an output pin of the PG8 and ground, and it is ON when the corresponding pin state is HIGH.

The output pin state can be HIGH (pin voltage at battery voltage) or OFF (pin floating).

A resettable fuse protects each circuit. The fuse rate is 140milliAmps. When the output current exceeds the fuse rate, the output state change from HIGH to FAULT. A reset command is needed to reset the Fault condition.

The device is also provided with 8 digital or analog inputs which can be used in the case the related pins are not used as outputs.

The ground can be connected either to one of the ground pins of the PG8 connector or directly to the battery's negative pole.

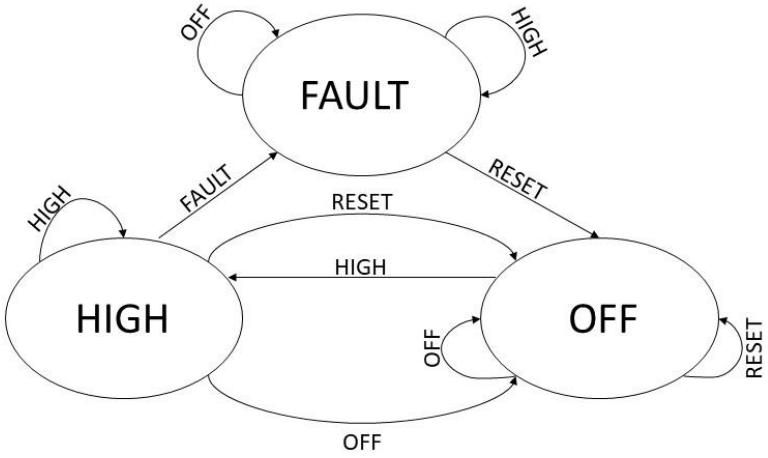
6. Pin Assignment

Connector	Pin	Function	Fuse Rating	Analog INPUT	Level Sense
J1	A1	+12V	NA		
J1	A2	RS485_P	NA		
J1	A3	RS485_N	NA		
J1	B1	I	NA		
J1	B2	GND	NA		
J1	B3	I/O	FH1 max 140mA		X
J1	C1	I	NA		
J1	C2	GND	NA		
J1	C3	I/O	FH2 max 140mA		X
J1	D1	I	NA		
J1	D2	GND	NA		
J1	D3	I/O	FH3 max 140mA		X
J1	E1	I	NA		
J1	E2	GND	NA		
J1	E3	I/O	FH4 max 140mA		X
J1	F1	I	NA		
J1	F2	GND	NA		
J1	F3	I/O	FH5 max 140mA	X	Optional
J1	G1	I	NA		
J1	G2	GND	NA		
J1	G3	I/O	FH6 max 140mA	X	Optional
J1	H1	I	NA		
J1	H2	GND	NA		
J1	H3	I/O	FH7 max 140mA	X	Optional
J1	J1	I	NA		
J1	J2	GND	NA		
J1	J3	I/O	FH8 max 140mA	X	Optional
J1	K1	CANH	NA		
J1	K2	CANL	NA		
J1	K3	GND	NA		

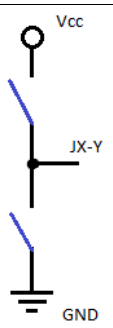
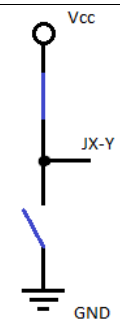
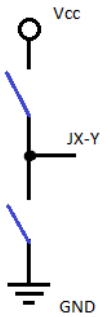
Function Summary

- **I/O: Input/Output**
- **TXRX+, TXRX-:** RS485 bus signals
- **GND:** Internally connected to Negative terminal of the batteries
- **CAN-L, CAN-H:** CAN bus signals

7. Output State Machine Diagram



The output pin of each output circuit can be in one of the 3 following states:

Output state	Pin voltage	Equivalent Circuit
OFF	Floating	
HIGH	Battery Voltage	
FAULT	Floating	

Each output circuit is protected against short circuits and overcurrent by a fuse. A failure event occurs when the output command is HIGH, but the fuse is blown and the voltage level of the pin is not at the battery voltage. To recover the pin from the FAULT state, a reset command is needed. The reset command returns the pin to its initial OFF state.

8. CANopen Messages Structure

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

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

NMT MESSAGES

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

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

PDO MESSAGES

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

Identifier	8-byte data

SDO MESSAGES

SDO are more complex messages that completely manage all the functions of the PG8.

SDO messages have identifiers from 580h to 67Fh and always expect an answer or an acknowledge reply.

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

Identifier: The messages to the PG8 shall have 600h+current CAN ID identifier.
The messages from the PG8 have 580h+ current CAN ID identifier.

Command byte:

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

Every answer has index and sub index echo.

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

Abort codes implemented:

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

9. CAN Messages for Managing Output Pins

Output state	Direction	Can message
HIGH	Write	RPDO 200 + node-ID
	Read/Write	SDO Object 2001h
	Read/Write	SDO Object 2008h sub-index 02h
OFF	Write	RPDO 200h + node-ID
	Read/Write	SDO Object 2001h
	Read/Write	SDO Object 2008h sub-index 01h
FAULT	Read when occur	TPDO 280h + node-ID
	Read	SDO Object 2001h
	Read	SDO Object 2008h sub-index 03h
RESET	Write	SDO Object 2001h

10. CAN bus Default Settings

Setting	Default Status or Level	How to Change
Baud rate	125 kbit/s	Object 2010h
CANopen Node ID	15h	Object 2011h
CANopen Node State	Pre-operational	NMT Message Start CANopen node Object 2013h Device active on startup
Periodic Message Transmission	Disabled	Object 2012h
Producer heartbeat time	Disabled	Object 1017h
Consumer heartbeat time	Disabled	Object 1016h
Boot-up service	Active	Object 2015h
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. All CANopen devices are regarded as NMT slaves. NMT messages have CAN-ID always equal to 00h.

11. Start CANopen Node

Identifier	00h	
Byte 0	01h	Start CANopen node
Byte 1	XXh	PG8 CAN ID 00h: start all the devices 15h: start the PG8 with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	**Identifier**	**Format**	**Message**
To PG8	0	Std	01 15

12. Enter Pre-operational

Identifier	00h	
Byte 0	80h	Enter pre-operational
Byte 1	XXh	PG8 CAN ID 00h: start all the devices 15h: start the PG8 with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	**Identifier**	**Format**	**Message**
To PG8	0	Std	80 15

13. Reset CANopen Node

Identifier	00h	
Byte 0	81h	Reset CANopen node
Byte 1	XXh	PG8 CAN ID 00h: start all the devices 15h: start the PG8 with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	**Identifier**	**Format**	**Message**
To PG8	0	Std	81 15

14. Stop CANopen Node

Identifier	00h	
Byte 0	XXh	02h: Stop CANopen node
Byte 1	YYh	PG8 CAN ID 00h: Stop all the devices 15h: Stop the PG8 with CAN ID = 15h.
Byte 2, 7	00h	Not used

Example:

Direction	Identifier	Format	Message
To PG8	0	Std	02 15

15. Boot-up Service

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

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

Example:

Direction	Identifier	Format	Message
From PG8	715h	Std	00h

The PG8 with CAN ID 15h has entered the NMT state Pre-operational.

16. Heartbeat Message

The heartbeat mechanism for a CANopen device is established by configuring the heartbeat producer to cyclically transmitting the heartbeat message. One or more CANopen devices in the network should be aware of this message. If by any chance the heartbeat producer fails to send the heartbeat message, the local application on the heartbeat consumer will be notified.

In the case the CANopen device starts with a heartbeat producer time different from 0, then the boot-up message is regarded as the first heartbeat message.

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

Example:

Direction	Identifier	Format	Message	Data
From PG8	715h	Std	00h	Boot up
From PG8	715h	Std	7Fh	Pre-operational
To PG8	00h	Std	01h 15h	Start PG8 with CAN id = 15h
From PG8	715h	Std	05h	Operational

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.

17. Key state message

The PG8 must be activated, see NMT Start CANopen Node message.

Identifier	180h + current CAN ID	Default 195h
Byte 0	Keys from #1 to #8 K8 K7 K6 K5 – K4 K3 K2 K1	Standard key state: 1=pressed; 0=released
Byte 1	Keys from #1 to #8 K8 K7 K6 K5 – K4 K3 K2 K1	Additional key state* 1=pressed; 0=released
Byte 2, 3	00h	Not used
Byte 4	XXh	Tick Timer**

Examples:

Direction	Identifier	Format	Message	Key state
From PG8	195	Std	00 00 00 00 XX	Any Key released
From PG8	195	Std	01 00 00 00 XX	Standard Key #1 pressed
From PG8	195	Std	10 00 00 00 XX	Standard Key #5 pressed
From PG8	195	Std	00 80 00 00 XX	Additional Key #8 pressed
From PG8	195	Std	00 04 00 00 XX	Additional Key #3 pressed

*= by the service data object 2017h it is possible to set as input signals also the output pins which can be used as additional keys.

**= 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.

18. Set Output (OFF and HIGH)

Identifier	200h + current CAN ID	Default 215h
Byte 0	P8O P7O P6O P5O P4O P3O P2O P1O	'1'= set OFF '0'= do nothing
Byte 1	P8H P7H P6H P5H P4H P3H P2H P1H	'1'= set HIGH '0'= do nothing
Byte 2,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	215	Std	81 00 00 00 00 00 00 00	Set PINs #8 and #1 OFF
To PG8	215	Std	00 18 00 00 00 00 00 00	Set PINs #9 and #10 HIGH
To PG8	215	Std	01 01 00 00 00 00 00 00	Set PIN 1 OFF

If the same pin is set to more than one state, the priority is OFF and HIGH.

19. Fault Message

This message is sent by the PG8 when a blown fuse is detected.

Note: to recover the pin from the fault state use the reset command of the object 2001h.

Identifier	280h + current CAN ID	Default 295h
Byte 0	P8 P7 P6 P5 P4 P3 P2 P1	'1' = fault '0'= not fault
Byte 1,7	00h	Not used

Examples

Direction	Identifier	Format	Message	Data
From PG8	295	Std	18 00 00 00 00 00 00 00	PINs 4 and 5 fault state
From PG8	295	Std	80 00 00 00 00 00 00 00	PIN 8 fault state

20. RPM message

This message, enabled through the service data object 2016h, is sent by the PG8 when a signal, whose frequency is between 3.1Hz and 1kHz, is applicated to the outputs pin 7-8.

The hex values coded in the bytes 0-1 and 2-3 correspond with the current rpm detected by the PG8 on the output pin 7 and 8, respectively.

Note: the PG8 must be activated, see NMT Start CANopen Node message.

The following table details the message:

Identifier	380h + current CAN ID	Default 395h
Byte 0	XXh_{LSB}	Output pin 7 rpm value: XXXXh: 0000h-FFFFh
Byte 1	XXh_{MSB}	
Byte 2	YYh_{LSB}	Output pin 8 rpm value YYYYh: 0000h-FFFFh
Byte 3	YYh_{MSB}	

Examples

Direction	Identifier	Format	Message	Data
From PG8	395	Std	10 27 00 00	10,000 rpm value detected on the output pin 7
From PG8	395	Std	00 00 88 13	5,000 rpm value detected on the output pin 8

SDO messages

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

This module contains all the Keys State information.
A one indicates the switch is pressed, a zero indicates the switch is released.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 2000h
Byte 2	20h	
Byte 3	XXh	Sub index: 01h: standard keys state 02h: additional keys state*
Byte 4,7	00h	Not used

*= if the output PINs are set as input signals. See Object 2017h for further details.

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 00 20 01 00 00 00 00	Read standard keys state
From PG8	595	Std	4F 00 20 01 00 00 00 00	No standard Key pressed
			4F 00 20 01 01 00 00 00	Standard Key 1 pressed
			4F 00 20 01 02 00 00 00	Standard Key 2 pressed
			4F 00 20 01 04 00 00 00	Standard Key 3 pressed
			4F 00 20 01 08 00 00 00	Standard Key 4 pressed
			4F 00 20 01 10 00 00 00	Standard Key 5 pressed
			4F 00 20 01 20 00 00 00	Standard Key 6 pressed
			4F 00 20 01 40 00 00 00	Standard Key 7 pressed
			4F 00 20 01 80 00 00 00	Standard Key 8 pressed
To PG8	615	Std	40 00 20 02 00 00 00 00	Read additional keys state
From PG8	595	Std	4F 00 20 02 00 00 00 00	No additional Key pressed
			4F 00 20 02 01 00 00 00	Additional Key 1 pressed
			4F 00 20 02 02 00 00 00	Additional Key 2 pressed
			4F 00 20 02 04 00 00 00	Additional Key 3 pressed
			4F 00 20 02 08 00 00 00	Additional Key 4 pressed
			4F 00 20 02 10 00 00 00	Additional Key 5 pressed
			4F 00 20 02 20 00 00 00	Additional Key 6 pressed
			4F 00 20 02 40 00 00 00	Additional Key 7 pressed
			4F 00 20 02 80 00 00 00	Additional Key 8 pressed

22. Object 2001h: Single Pin State

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

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-byte data
Byte 1	01h	CAN Object 2001h
Byte 2	20h	
Byte 3	00h	Highest sub-index supported (read only)
	01h	P1
	02h	P2
	03h	P3
	04h	P4
	05h	P5
	06h	P6
	07h	P7
	08h	P8
Byte 4	00h	OFF
	01h	HIGH
	02h	RESET
	03h	FAULT (read only)
Byte 5,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PG8	615	Std	40 01 20 00 00 00 00 00	Read highest sub-index supported
From PG8	595	Std	4F 01 20 00 08 00 00 00	08h is the highest sub-index
To PG8	615	Std	40 01 20 04 00 00 00 00	Read state PIN 4
From PG8	595	Std	4F 01 20 04 01 00 00 00	PIN 4 HIGH
To PG8	615	Std	40 01 20 02 00 00 00 00	Read state PIN 2
From PG8	595	Std	40 01 20 02 00 00 00 00	PIN 2 OFF
To PG8	615	Std	2F 01 20 05 02 00 00 00	RESET PIN 5
From PG8	595	Std	60 01 20 05 00 00 00 00	ACK
To PG8	615	Std	2F 01 20 08 01 00 00 00	Set PIN 8 to HIGH
From PG8	595	Std	60 01 20 08 00 00 00 00	ACK

23. Object 2002h: Set PIN as input/output or input only

The command message in the table below allows to set the specific PINs which shall be used as output/input or input only.

NOTE: it is necessary to enable the PINs of the PG8 as input signal by using the command object 2017h.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-byte data
Byte 1	02h	CAN Object 2002h
Byte 2	20h	
Byte 3	00h	Highest sub-index supported (read only)
	01h	P1
	02h	P2
	03h	P3
	04h	P4
	05h	P5
	06h	P6
	07h	P7
	08h	P8
Byte 4	00h	INPUT/OUTPUT (default)
	01h	INPUT ONLY
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 02 20 00 00 00 00 00	Read highest sub-index supported
From PG8	595	Std	4F 02 20 00 08 00 00 00	08h is the highest sub-index
To PG8	615	Std	40 02 20 04 00 00 00 00	Read PIN 4
From PG8	595	Std	4F 02 20 04 01 00 00 00	PIN 4 as INPUT ONLY
To PG8	615	Std	40 02 20 02 00 00 00 00	Read PIN 2
To PG8	615	Std	2F 02 20 01 00 00 00 00	Set PIN 1 as INPUT ONLY
From PG8	595	Std	60 02 20 01 00 00 00 00	ACK

24. Object 2003h: Read Digital Input

This object reads digital input values.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	03h	CAN Object 2003h
Byte 2	20h	
Byte 3	00h	Highest sub-index supported
	01h	Read input from PIN1 to PIN8
Byte 4,7	00h	Not used

From PG8:

Identifier	595h (580h + current CAN ID)	
Byte 0	4Fh	Response length 1-byte
Byte 1	03h	CAN Object 2003h
Byte 2	20h	

Byte 3	00h	sub-index
Byte 4	01h	Highest sub-index supported
Byte 5,7	00h	Not used

Byte 3	01h	sub-index
Byte 4	P8 P7 P6 P5 P4 P3 P2 P1	Digital input
Byte 5,7	00h	Not used

25. Object 2004h: Read Analog Input

This object reads analog input values with 8-bit resolution.

Expected value: $(Vin \cdot 7.78)_h$.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	04h	CAN Object 2004h
Byte 2	20h	
Byte 3	00h	Highest sub-index supported
	01h	PIN 5
	02h	PIN 6
	03h	PIN 7
	04h	PIN 8
Byte 4	(Vin ·7.78)h	Expected value
Byte 5,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PG8	615	Std	40 04 20 00 00 00 00 00	Read the highest sub-index supported
From PG8	595	Std	4F 04 20 04 00 00 00 00	04h is the highest sub-index supported
To PG8	615	Std	40 04 20 01 00 00 00 00	Read PIN 5
From PG8	595	Std	4F 04 20 01 3E 00 00 00	8V
To PG8	615	Std	40 04 20 02 00 00 00 00	Read PIN 6
From PG8	595	Std	4F 04 20 02 5D 00 00 00	12V
To PG8	615	Std	40 04 20 03 00 00 00 00	Read PIN 7
From PG8	595	Std	4F 04 20 03 8C 00 00 00	18V
To PG8	615	Std	40 04 20 04 00 00 00 00	Read PIN 8
From PG8	595	Std	4F 04 20 04 1F 00 00 00	4V

26. Object 2008h: Output State

This object sets and reads the state of each output pin.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-bytes
Byte 1	08h	CAN Object 2008h
Byte 2	20h	
Byte 3	00h	Highest sub-index supported (read only)
	01h	Output OFF
	02h	Output HIGH
	03h	Output FAULT (read only)
Byte 4	P8 P7 P6 P5 P4 P3 P2 P1	Each bit sets a pin
Byte 5,7	00h	Always '0'

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PG8	615	Std	2F 08 20 02 08 00 00 00	Set PIN 4 HIGH
From PG8	595	Std	60 08 20 02 00 00 00 00	ACK
To PG8	615	Std	40 08 20 01 00 00 00 00	Who is OFF?
From PG8	595	Std	4F 08 20 01 00 00 00 00	No output OFF
To PG8	615	Std	40 08 20 02 00 00 00 00	Who is HIGH?
From PG8	595	Std	4F 08 20 02 FF 00 00 00	PINs from 1 to 8 are HIGH

27. Object 2010h: Baud rate settings

This object sets and reads the baud rate.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-byte data
Byte 1	10h	CAN Object 2010h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	XXh: 00h: 1000 kbit/s 02h: 500 kbit/s 03h: 250 kbit/s 04h: 125 kbit/s (Default)
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 10 20 00 00 00 00 00	Read baud rate
From PG8	595	Std	4F 10 20 00 03 00 00 00	03h = 250k
To PG8	615	Std	2F 10 20 00 02 00 00 00	Set 02h = 500k
From PG8	595	Std	60 10 20 00 00 00 00 00	ACK
To PG8	615	Std	2F 10 20 00 00 00 00 00	Set 00h = 1000k
From PG8	595	Std	60 10 20 00 00 00 00 00	ACK

28. Object 2011h: Set node ID

This object sets and reads the CANopen node-id.

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

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 11 20 00 00 00 00 00	Read Node ID
From PG8	595	Std	4F 11 20 00 15 00 00 00	ID = 15h
To PG8	615	Std	2F 11 20 00 16 00 00 00	Set ID = 16h
From PG8	595	Std	60 11 20 00 00 00 00 00	ACK

29. Object 2012h: Set Periodic Messages

This object sets the periodic transmission of TPDO 280h (Fault Message).

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Bh	Write 2-byte data
Byte 1	12h	CAN Object 2012h
Byte 2	20h	
Byte 3	00h	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 0005h to FFFEh: from 5 to 65534 milliseconds).

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 12 20 00 00 00 00 00	Read register
From PG8	595	Std	4B 12 20 00 0A 00 00 00	Period = 100ms
To PG8	615	Std	2B 12 20 00 32 00 00 00	Set period = 500ms
From PG8	595	Std	60 12 20 00 00 00 00 00	ACK

30. Object 2013h: Set Device Active on Startup

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

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

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 13 20 00 00 00 00 00	Read register
From PG8	595	Std	4F 13 20 00 00 00 00 00	Not active at start
To PG8	615	Std	2F 13 20 00 01 00 00 00	Set active on start
From PG8	595	Std	60 13 20 00 00 00 00 00	ACK

31. Object 2015h: Set Boot-up Service

This object enables and disables the boot-up message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-byte data
Byte 1	15h	CAN Object 2015h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h: NOT ACTIVE 01h: ACTIVE
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 15 20 00 00 00 00 00	Read register
From PG8	595	Std	4F 15 20 00 00 00 00 00	Not active at start
To PG8	615	Std	2F 15 20 00 01 00 00 00	Set active on start
From PG8	595	Std	60 15 20 00 00 00 00 00	ACK

32. Object 2016h: Set RPM message transmission

When this command is enabled, the device transmits periodically each 100ms the current RPM value for the outputs (PIN7, PIN8) supporting this feature. See chapter 20 for further details.
NOTE: this feature is applicable to a single pin or both pins with a signal whose frequency is between 3.1Hz and 1kHz.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-byte data
Byte 1	16h	CAN Object 2016h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00h: NOT ACTIVE 01h: ACTIVE
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 16 20 00 00 00 00 00	Read register
From PG8	595	Std	4F 16 20 00 00 00 00 00	Command disabled
To PG8	615	Std	2F 16 20 00 01 00 00 00	Enable RPM periodic transmission
From PG8	595	Std	60 16 20 00 00 00 00 00	ACK

33. Object 2017h: PIN I/O signal command

The following message allows to set the output PINs of PG8 as input signals; in this case, the additional keys state is transmitted by the key state message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Fh	Write 1-byte data
Byte 1	17h	CAN Object 2017h
Byte 2	20h	
Byte 3	00h	Sub index
Byte 4	XXh	00: output signal (default) 01: input signal
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 17 20 00 00 00 00 00	Read register
From PG8	595	Std	4F 17 20 00 00 00 00 00	PINs set as output signals
To PG8	615	Std	2F 17 20 00 01 00 00 00	Enable PINs as input signals
From PG8	595	Std	60 17 20 00 00 00 00 00	ACK

34. 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 PG8 does not receive the heartbeat message producer anymore, it turns off all the outputs and goes into 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 PG8 will not 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 FFFEh: from 10 to 65534 milliseconds)
When the period is set to 0000h, the consumer heartbeat function is disabled.

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 16 10 00 00 00 00 00	Read highest sub-index supported
From PG8	595	Std	4F 16 10 00 01 00 00 00	01h is the highest sub-index supported
To PG8	615	Std	23 16 10 01 64 00 7E 00	Set heartbeat time consumer = 100ms expected from the node 7Eh
From PG8	595	Std	60 16 10 01 00 00 00 00	
To PG8	615	Std	23 16 10 01 F4 01 01 00	Set heartbeat time consumer= 500ms expected from the node 01h
From PG8	595	Std	60 16 10 01 00 00 00 00	
To PG8	615	Std	40 16 10 01 00 00 00 00	Read heartbeat consumer time expected from the node 01h
From PG8	595	Std	43 16 10 01 F4 01 01 00	Heartbeat consumer time set to 500ms

35. Object 1017h: Producer Heartbeat Time

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

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
	2Bh	Set device register
Byte 1	17h	CAN Object 1017h
Byte 2	10h	
Byte 3	00h	Sub index
Byte 4	YYh	YYh: Heartbeat time in milliseconds
Byte 5	XXh	XXh: Heartbeat time in milliseconds
Byte 6, 7	00h	Not used

Heartbeat time: XXYYh (from 0005h to FEFFh: 5ms to 65279 milliseconds)

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 17 10 00 00 00 00 00	Read heartbeat time
From PG8	595	Std	4B 17 10 00 64 00 00 00	Heartbeat time = 100ms
To PG8	615	Std	2B 17 10 00 00 00 00 00	Switch off the heartbeat
From PG8	595	Std	60 17 10 00 00 00 00 00	
To PG8	615	Std	2B 17 10 00 32 00 00 00	Heartbeat time = 50ms
From PG8	595	Std	60 17 10 00 00 00 00 00	
To PG8	615	Std	2B 17 10 00 F4 01 00 00	Heartbeat time = 500ms
From PG8	595	Std	60 17 10 00 00 00 00 00	

36. Object 1000h: Device Type

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

Example:

Direction	Identifier	Format	Message
To PG8	615	Std	40 00 10 00 00 00 00 00
From PG8	595	Std	43 00 10 00 91 01 03 00

Device profile number: 30191h generic I/O module.

I/O Functionality: digital I/O.

Mapping PDOs: Device specific PDO supported.

37. Object 1001h: Error Register

This object is not yet implemented in the device.

38. 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 PG8	615	Std	40 08 10 00 00 00 00 00	
From PG8	595	Std	41 08 10 00 0B 00 00 00	
To PG8	615	Std	60 00 00 00 00 00 00 00	
From PG8	595	Std	00 42 6C 69 6E 6B 4D 61	BlinkMa
To PG8	615	Std	70 00 00 00 00 00 00 00	
From PG8	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.

39. 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 PG8	615	Std	40 09 10 00 00 00 00 00	
From PG8	595	Std	43 09 10 00 00 56 30 30	V00

Manufacturer Hardware Revision: V00

40. 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 PG8	615	Std	40 0A 10 00 00 00 00 00	
From PG8	595	Std	43 0A 10 00 31 2E 30 30	1.00

Manufacturer Firmware Revision: 1.00

41. 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

Example:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 0B 10 00 00 00 00 00	
From PG8	595	Std	41 0B 10 00 09 00 00 00	
To PG8	615	Std	60 00 00 00 00 00 00 00	
From PG8	595	Std	00 50 47 38 00 00 00 00	PG8

Model ID: PG8

42. 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	600h + current CAN ID	Default 615
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 PG8	615	Std	40 11 10 00 00 00 00 00	Read highest sub-index
From PG8	595	Std	4F 11 10 00 01 00 00 00	1
To PG8	615	Std	23 11 10 01 6C 6F 61 64	'load'
From PG8	595	Std	60 11 10 01 00 00 00 00	

43. Object 1018h: Identity object

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

Example:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PG8	615	Std	40 18 10 00 00 00 00 00	
From PG8	595	Std	4F 18 10 00 01 00 00 00	01h
To PG8	615	Std	40 18 10 01 00 00 00 00	
From PG8	595	Std	43 18 10 01 E2 03 00 00	000003E2h

Highest sub-index supported: 01h;

BlinkMarine Vendor ID: 000003E2h.

44. Object 1400h: Receive PDO 0 Communication Parameter

Describes the RPDO 0 parameters for setting the output PDO message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1400h
Byte 2	14h	
Byte 3	00h	Highest sub-index supported
	01h	COB-ID used by RPDO
	02h	Transmission type
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 00 14 00 00 00 0 0 00	Read highest sub-index supported
From PG8	595	Std	4F 00 14 00 02 00 00 00	02h
To PG8	615	Std	40 00 14 01 00 00 00 00	
From PG8	595	Std	43 00 14 01 15 02 00 00	0000 0215h
To PG8	615	Std	40 00 14 02 00 00 00 00	
From PG8	595	Std	4F 00 14 02 FE 00 00 00	FEh

Highest sub-index supported: 02h;

COB-ID used by RPDO: 0000 0215h = 0000 0200h + Node-ID;

Transmission type: event-driven (manufacturer-specific).

45. Object 1600h: Receive PDO 0 Mapping Parameter

Describes the RPDO 0 mapping parameters for setting the output PDO message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1600h
Byte 2	16h	
Byte 3	XXh	00h: Number of mapped objects
		01h: PDO Mapping Entry 1
		02h: PDO Mapping Entry 2
Byte 4,7	00h	Not used

Example:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 00 16 00 00 00 00 00	Read number of mapped objects
From PG8	595	Std	4F 00 16 00 02 00 00 00	02
To PG8	615	Std	40 00 16 01 00 00 00 00	
From PG8	595	Std	43 00 16 01 08 01 08 20	2008 01 08
To PG8	615	Std	40 00 16 02 00 00 00 00	
From PG8	595	Std	43 00 16 02 08 02 08 20	2008 02 08

Number of mapped objects: 03h;

PDO Mapping ENTRY 1: set output pin OFF: index 2008h, sub-index 01h, length 08h;

PDO Mapping ENTRY 2: set output pin HIGH: index 2008h, sub-index 02h, length 08h.

46. Object 1800h: Transmit PDO 0 Communication Parameter

Describes the TPDO communication parameters for the Key State PDO message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1800h
Byte 2	18h	
Byte 3	00h	Highest sub-index supported
	01h	COB-ID used by TPDO
	02h	Transmission type
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 00 18 00 00 00 00 00	Read highest sub-index supported
From PG8	595	Std	4F 00 18 00 02 00 00 00	02h
To PG8	615	Std	40 00 18 01 00 00 00 00	
From PG8	595	Std	43 00 18 01 95 01 00 00	0000 0195h
To PG8	615	Std	40 00 18 02 00 00 00 00	
From PG8	595	Std	4F 00 18 02 FE 00 00 00	FEh

Highest sub-index supported: 02h;

COB-ID used by TPDO: 0000 0195h; 0000 0180h + Node-ID;

Transmission type: event-driven (manufacturer-specific).

47. Object 1801h: Transmit PDO 1 Communication Parameter

Describes the TPDO communication parameters for output FAULT state.

Identifier	600h + current CAN ID	Default 615h
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 used by TPDO
	02h	Transmission type
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 01 18 00 00 00 00 00	Read highest sub-index supported
From PG8	595	Std	4F 01 18 00 02 00 00 00	02h
To PG8	615	Std	40 01 18 01 00 00 00 00	
From PG8	595	Std	43 01 18 01 95 02 00 00	0000 0295h
To PG8	615	Std	40 01 18 02 00 00 00 00	
From PG8	595	Std	4F 01 18 02 FE 00 00 00	FEh

Highest sub-index supported: 02h;

COB-ID used by TPDO: 0000 0295h; 0000 0280h + Node-ID;

Transmission type: event-driven (manufacturer-specific).

48. Object 1802h: Transmit PDO 2 Communication Parameter

Describes the TPDO communication parameters for RPM message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	02h	CAN Object 1802h
Byte 2	18h	
Byte 3	00h	Highest sub-index supported
	01h	COB-ID used by TPDO
	02h	Transmission type
Byte 4,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PG8	615	Std	40 02 18 00 00 00 00 00	Read highest sub-index supported
From PG8	595	Std	4F 02 18 00 02 00 00 00	02h
To PG8	615	Std	40 02 18 01 00 00 00 00	
From PG8	595	Std	43 02 18 01 95 03 00 00	0000 0395h
To PG8	615	Std	40 02 18 02 00 00 00 00	
From PG8	595	Std	4F 02 18 02 FE 00 00 00	FEh

Highest sub-index supported: 02h;

COB-ID used by TPDO: 0000 0395h; 0000 0380h + Node-ID;

Transmission type: event-driven (manufacturer-specific).

49. Object 1A00h: Transmit PDO 0 Mapping Parameter

Describes the TPDO 0 communication mapping parameters of Key State PDO message.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	00h	CAN Object 1A00h
Byte 2	1Ah	
Byte 3	00h	Number of mapped objects
	01h	1st application object
	02h	2nd application object
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 00 1A 00 00 00 00 00	Read number of mapped objects
From PG8	595	Std	4F 00 1A 00 02 00 00 00	02
To PG8	615	Std	40 00 1A 01 00 00 00 00	
From PG8	595	Std	43 00 1A 01 08 01 00 20	2000 01 08
To PG8	615	Std	40 00 1A 02 00 00 00 00	
From PG8	595	Std	43 00 1A 02 08 01 00 20	2000 02 08

Number of mapped objects: 2;

1st Application object: Read Standard Key state;
Index 2000h; sub-index 01h; length 08h.

2nd Application object: Read Additional Key state;
Index 2000h; sub-index 02h; length 08h.

50. Object 1A01h: Transmit PDO 1 Mapping Parameter

Describes the TPDO 1 communication parameters for reading output FAULT states.

Identifier	600h + current CAN ID	Default 615h
Byte 0	40h	Read Device Register
Byte 1	01h	CAN Object 1A01h
Byte 2	1Ah	
Byte 3	00h	Number of mapped objects
	01h	1st application object
Byte 4,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PG8	615	Std	40 01 1A 00 00 00 00 00	Read number of mapped objects
From PG8	595	Std	4F 01 1A 00 01 00 00 00	01
To PG8	615	Std	40 01 1A 01 00 00 00 00	
From PG8	595	Std	43 01 1A 01 08 03 08 20	2008 03 08

Number of mapped objects: 1;

Application object: Read output FAULT state;
Index 2008h; sub-index 03h; length 08h.

51. PG8 fuse map

FUSE	PIN
FH1	B3
FH2	C3
FH3	D3
FH4	E3
FH5	F3
FH6	G3
FH7	H3
FH8	J3

52. Revision history

Date	Manual Revision	Comment
22/01/2021	1.0	First release
13/12/2021	1.1	Second release: • Added pictures of the device and the connector; • Modified TPDO key state message; • Corrected calculation formula Object 2004h; • Inserted Object 2017h; • Modified Objects 2000h-2002h-1A00h