Features:

CAN2.0B supported

12V or 24V power supply supported

Electronic overcurrent protection and automotive mini blade fuse

22 switched circuits

Up to 4 low side outputs

Operating temperature range: -20 to +85°C

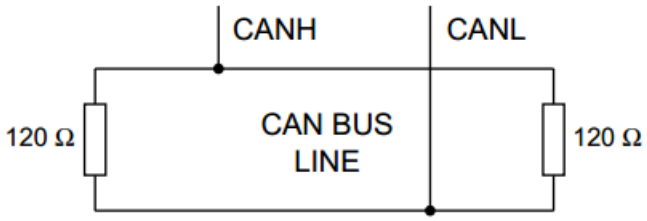
Splash proof (IP65)

Deutsch DRC10-40P-A-004 40pin connector

Contents

1. How to Connect CAN bus:

Connector J5 PIN number	FUNCTION
13	CAN L
22	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 terminating resistor between CAN-L and CAN-H.

NOTE: for some hardware versions the PC21B PCB is equipped with a built-in terminating resistor which can be enabled via software. See command 78h for further details.

2. PC21B Technical Specifications

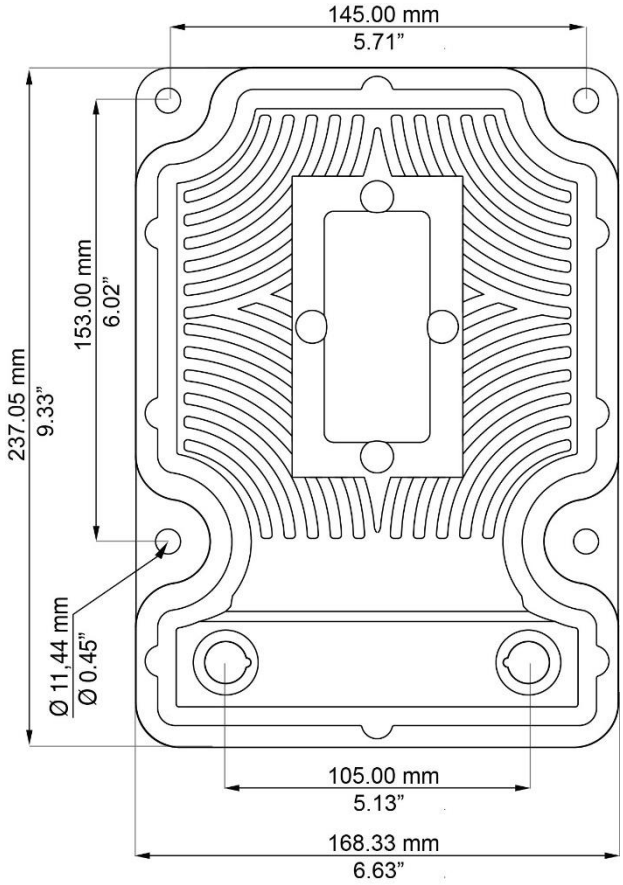
Electrical	**Value**	**Unit**
Supply Voltage (Battery Voltage)	8-32	V
Maximum input current	150	A
Maximum current single pin	15	A
Maximum Digital input voltage	Battery Voltage	V
Digital input low voltage (V_{IL}) max	5,5	V
Environmental	**Value**	**Unit**
Storage temperature range	-40 to +85	°C
Operating temperature range	-20 to +85	°C
Humidity	0 to 98	%

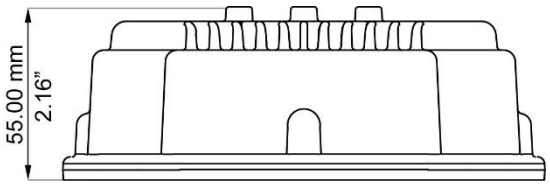
3. Mechanical Features

- Housing: aluminium AB46100 anodic oxidation + powder-coating + zinc-coated bronze ZnCu20
- Seal: EPDM GASKET
- Power studs: Blink Marine CuZn20 UNC#14-20

Mechanical dimensions

Dimensions are in millimeters.





Warning: to avoid breakage do not tighten the nuts of battery terminals with a torque exceeding 3.5 Nm!

4. Connector 40 pin:

The 40-pin automotive connector DRC10-40P-A004 mates with housing for female terminals DRC16-40SA.

Output	PIN
Ch1	1
Ch2	2
Ch3	3
Ch4	4
Ch5	5
Ch6	6
Ch7	7
Ch8	8
Ch9	9
Ch10	10
Ch11	11
TXRX+	12
CANL	13
TXRX+	14
GND	15
Ch16	16
Ch16	17
GND	18
GND	19
Ch20	20
Ch21	21
CANH	22
TXRX-	23
TXRX-	24
GND	25
GND	26
GND	27
GND	28
GND	29
Ch30	30
Ch31	31
Ch32	32
Ch33	33
GND	34
GND	35
GND	36
Ch37	37
Ch38	38
Ch39	39
Ch40	40

5. Electrical Loads Connection

HIGH side switch:

The electrical device is connected between an output pin of the PowerCore and ground.

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

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

The electrical device is ON when the pin state is HIGH and the current consumption of the electrical device is read by the PowerCore.

It is possible to connect the device to two or more pins in parallel to share the load, provided that the function of the pins used is output only.
I/O PINs are not suitable for parallel connection. See Pin Assignment table for further details.

LOW side switch:

The electrical device is connected between an output pin of the PowerCore with Low Side Drive feature and the positive battery pole.

The output pin state can be LOW (pin voltage at ground) or OFF (pin floating).

The current flowing in the low side switch is not read by the PowerCore. A 25A fuse protects the circuit, but a lower current threshold is needed, the connection to the battery's positive pole should be made through a fuse.

The electrical device is ON when the pin state is LOW.

H-Bridge connection:

The electrical device is connected between two output pins of the PowerCore.

The state of each output pin can be HIGH (pin voltage at battery voltage), LOW (pin voltage at ground) or OFF (pin floating).

This connection is common for DC motor to invert the power supply polarity to change the direction of the motor's rotation.

6. Pin Assignment

Pin	Function	Rating	Low Side Driver	Level Sense Input	Tach Sense Input	PWM output	Slew Rate Control
1	O	15A					X
2	O	15A					X
3	O	15A					X
4	O	15A					X
5	O	15A					X
6	O	15A				X	
7	O – HB	15A	X				X
8	O – HB	15A	X				X
9	O – HB	15A	X				X
10	O – HB	15A	X			X	
11	O	15A					X
12	Reserved	-					
13	CANL	-					
14	Reserved	-					
15	GND	-					
16,17*	O	15A					
18	GND	-					
19	GND	-					
20	O	15A					X
21	O	15A					X
22	CANH	-					
23	Reserved	-					
24	Reserved	-					
25	GND	-					
26	GND	-					
27	GND	-					
28	GND	-					
29	GND	-					
30	O	15A					X
31	O	15A				X	
32	O/TSI	15A			X		X
33	O/TSI	15A			X		X
34	GND	-					
35	GND	-					
36	GND	-					
37**	I/O	15A		X			X
38**	I/O	15A		X			X
39**	I/O	15A		X			X
40**	I/O	15A		X			X

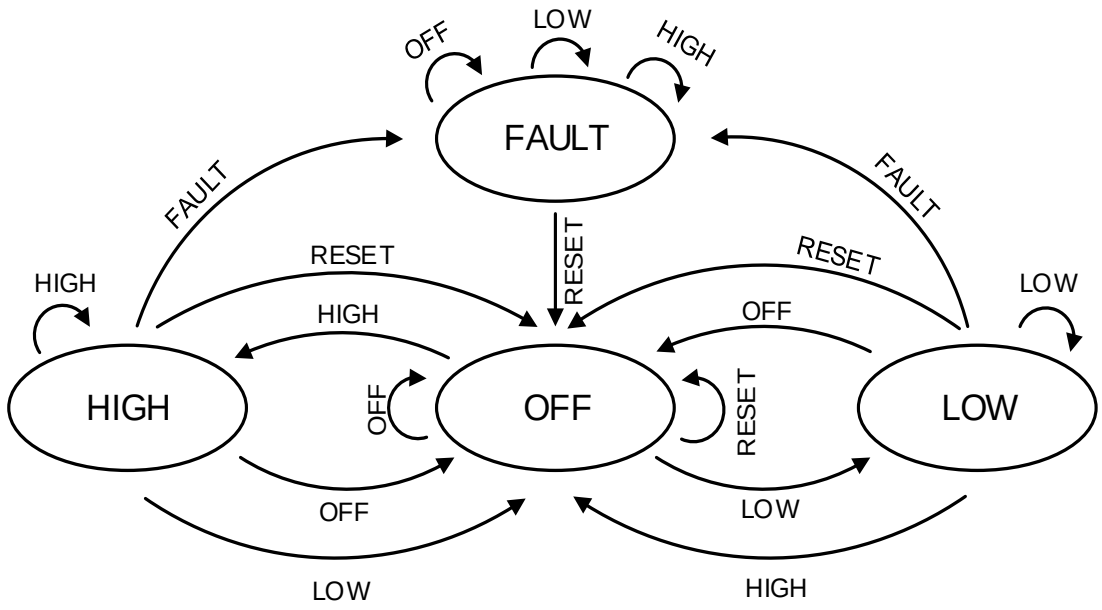
*Pins 16 and 17 are shorted.

**Not recommended for parallel connection.

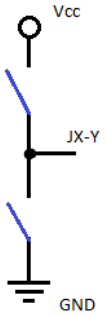
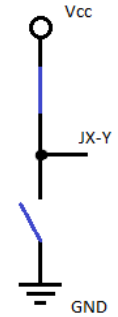
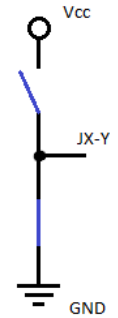
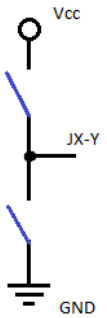
Function Summary:

- **O:** Output high side pin triggered by CAN bus commands.
- **O-HB**: Output high side or low side pin triggered by CAN bus commands (Half Bridge pin).
- **I:** Input pin (Digital level sense).
- **TSI:** Input pin (Tachometer sense).
- **GND:** Internally connected to Negative terminal of the batteries.
- **CAN-L, CAN-H:** CAN bus signals.

7. Output State Machine Diagram



The output pin can be set to one of the 4 states available:

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

To avoid cross conduction, the system does not allow to change the state of an output pin from HIGH to LOW and from LOW to HIGH. The pins must be always set to OFF for at least 300 milliseconds before the polarity can be changed.

As a measure of protection when using inductive loads, longer delays are added so a current peak during the transient period does not active the system's protection against overcurrent.

Each output circuit is protected against short circuits and overcurrent. If a failure event occurs, the pin goes into the FAULT state. To exit the FAULT state, a reset command is needed to return the pin to its initial OFF state.

The LOW state is applicable only on the output pins that a low side driver (refer to the pin assignment table).

8. Message header description

The 29-bit CAN identifier used in J1939 is structured in the following way:

Priority	Reserved	Data Page	PDU Format	PDU Specific	Source Address
3 bits	1 bit	1 bit	8 bits	8 bits	8 bits

The proprietary format used by PC21B is defined as follows:
Priority = **6**.
Reserved = **0**.
Data page = **0**.
PDU Format = EFh (the message is addressable).
PDU Specific = Destination Address.
Parameter Group Number:
61184 (EF00h) used for command type messages;
59904 (EA00h) used for request type messages.

An example of CAN identifier of messages sent to the PC21B is 18EF2100h where:
21h is the destination address (PC21B)
00h is the source address.

An example of CAN identifier of messages sent by the PC21B is 18EFFF21h where:
FFh refers to broadcast messages (no specific destination address)
21h is the source address (PC21B).

9. General Data Format

The proprietary protocol has defined a general format for the data fields in the PGN 61184. The format consists of:
1 header field (2 bytes)
1 command byte
8 bytes (the remaining field) are defined specifically for each command.

The data length is 8 bytes, unused bits and bytes are set to all 1's (0xFF).

Byte 0	04h
Byte 1	1Bh
Byte 2	Command
Byte 3-7	Data required for each specific command

10. Default Settings

Setting	Default status or level	How to change
Baud rate	250kbit/s	Command 6Fh
Source address	21h	Command 70h
PC21B identifier	21h	Command 70h
PX output current threshold	10A	Command 0Dh
Periodic fault message transmission	Disabled	Command 71h
Fault-event message transmission	Enabled	Command 72h
Protection trip delay	100ms	Command 0Eh
Default tachometer counter value	0000h	Command 10h
Slew rate control	Disabled	Command 11h
Normal ON mode	Disabled	Command 12h
Built-in terminating resistor	Disabled	Command 78h
Heartbeat	Disabled	Command 75h
Periodic fault message period	1s	Command 77h

11. Set single pin state (01h)

This message is sent to the PowerCore to set the state of one single output pin.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	01h	Set single pin state
Byte 3	XXh	XX: pin number 01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: P6 07h: P7 08h: P8 09h: P9 0Ah: P10 0Bh: P11 0Ch: P16 0Dh: P20 0Eh: P21 0Fh: P30 10h: P31 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40
Byte 4	YYh	YYh: state 00h: OFF 01h: HIGH 02h: LOW[1] 03h: TOGGLE 04h: RESET
Byte 5,6,7	FFh	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 01 07 02 FF FF FF	PIN 7 LOW
To PowerCore	18EF2100h	Ext	04 1B 01 08 02 FF FF FF	PIN 8 LOW
To PowerCore	18EF2100h	Ext	04 1B 01 01 00 FF FF FF	PIN 1 OFF
To PowerCore	18EF2100h	Ext	04 1B 01 05 01 FF FF FF	PIN 5 HIGH
To PowerCore	18EF2100h	Ext	04 1B 01 0D 01 FF FF FF	PIN 20 HIGH
To PowerCore	18EF2100h	Ext	04 1B 01 06 03 FF FF FF	PIN 6 TOGGLE
To PowerCore	18EF2100h	Ext	04 1B 01 0B 04 FF FF FF	PIN 11 RESET
To PowerCore	18EF2100h	Ext	04 1B 01 16 00 FF FF FF	PIN 40 OFF
To PowerCore	18EF2100h	Ext	04 1B 01 14 04 FF FF FF	PIN 38 RESET

[1] Refer to the Pin assignment table at page 6 for the pins supporting LOW state.

12. Set multiple pin state (02h)

This message is sent to the PowerCore to set the state HIGH, LOW or OFF of more output pins at the same time.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	02h	Set multiple pin state
Byte 3	XXh	XXh: state 00h: OFF 01h: HIGH 02h: LOW
Byte 4	P8 P7 P6 P5 P4 P3 P2 P1	Each bit set a pin
Byte 5	P31 P30 P21 P20 P16 P11 P10 P9	
Byte 6	0 0 P40 P39 P38 P37 P33 P32	
Byte 7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 02 01 01 00 00 00	Set PIN 1 HIGH
To PowerCore	18EF2100h	Ext	04 1B 02 02 C0 00 00 00	Set PINs 7-8 LOW
To PowerCore	18EF2100h	Ext	04 1B 02 02 00 03 00 00	Set PINs 9-10 LOW
To PowerCore	18EF2100h	Ext	04 1B 02 01 00 80 00 00	Set PIN 8 HIGH
To PowerCore	18EF2100h	Ext	04 1B 02 01 00 00 20 00	Set PIN 40 HIGH

13. Set PWM state (03h)

This command enables the PWM state on the outputs (PIN 6, PIN 10 and PIN 31) supporting this feature.

NOTE: if this feature is enabled when the outputs are already HIGH, the previous command is overwritten.
NOTE 2: the PWM state is applicable to a single pin or all the pins supporting this feature at the same time.
NOTE 3: the use of PIN 6 and PIN 31 as PWM state is not recommended for purely inductive loads (e.g.: motor, extractor fan)!
NOTE 4: the PWM state is applicable to a signal whose frequency does not exceed 980Hz (for PIN 6 and PIN 10) or 245Hz (for PIN31 only.)

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	03h	Set PWM state
Byte 3	XXh	Duty cycle level (D) of PIN 6 00h-FFh → 0%-100%
Byte 4	YYh	Duty cycle level (D) of PIN 10 00h-FFh → 0%-100%
Byte 5	ZZh	Duty cycle level (D) of PIN 31 00h-FFh → 0%-100%
Byte 6,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 03 66 00 00 00 00	Set PWM on PIN 6 with D=40%
To PowerCore	18EF2100h	Ext	04 1B 03 00 CC 00 00 00	Set PWM on PIN 10 with D=80%
To PowerCore	18EF2100h	Ext	04 1B 03 00 00 1A 00 00	Set PWM on PIN 31 with D=10%

14. Fault-event message (01h)

This message is sent by the PowerCore when an overcurrent or a fault condition is detected.
NOTE: it might be transmitted more than one message if other fault conditions occur before this event.
NOTE 2: it is possible to disable the transmission of this message by the configuration command 72h.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	01h	Fault message
Byte 3	XXh	XX: pin number 01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: P6 07h: P7 08h: P8 09h: P9 0Ah: P10 0Bh: P11 0Ch: P16 0Dh: P20 0Eh: P21 0Fh: P30 10h: P31 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40
Byte 4	01h	Fault condition detected
Byte 5	YYh	PC21B identifier
Byte 6,7	FFh	Not used

Examples:

Direction	Identifier	Format	Message	Data
From PowerCore	18EFFF21h	Ext	04 1B 01 01 01 21 FF FF	PIN 1 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 02 01 21 FF FF	PIN 2 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 03 01 21 FF FF	PIN 3 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 04 01 21 FF FF	PIN 4 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 0A 01 21 FF FF	PIN 10 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 0E 01 21 FF FF	PIN 21 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 10 01 21 FF FF	PIN 31 fault state
From PowerCore	18EFFF21h	Ext	04 1B 01 14 01 21 FF FF	PIN 38 fault state

Configuration commands

In this section it is shown a list of control messages to configure the PowerCore and/or modify default settings. Where applicable, changes take effect immediately and are stored in non-volatile memory address unless otherwise noted.

Note: the request-type messages have 3-bytes data length. (See ISO 11783-3 for further details)

Note 2: for some commands the set values are kept at the startup.

15. Read Digital Input 8-bit (0Ah)

The following message sent to the PowerCore allows to read the digital input value.

Note: the digital input is applicable only on output pins listed in the table below.

Identifier	18EA2100h	
Byte 0	0Ah	Read digital input 8-bit
Byte 1	00h	Single frame
Byte 2	01h	Enable reading

Answer:

Identifier	18EAFF21h	
Byte 0	0Ah	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	0 0 0 0 P40 P39 P38 P37	'1': digital input
Byte 4,7	00h	Not used

16. Read Fault event (0Bh)

The following message sent to the PowerCore allows to read which output pins have gone into the fault condition.

Identifier	18EA2100h	
Byte 0	0Bh	Read Fault event
Byte 1	00h	Single frame
Byte 2	01h	Enable reading

Answer:

Identifier	18EAFF21h	
Byte 0	0Bh	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	P8 P7 P6 P5 P4 P3 P2 P1	'1' = fault; '0' = not in fault
Byte 4	P31 P30 P21 P20 P16 P11 P10 P9	
Byte 5	0 0 P40 P39 P38 P37 P33 P32	
Byte 6,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	0B 00 01	Read enabled
From PowerCore	18EAFF21h	Ext	0B 00 06 02 00 00 00 00	PIN 2 in fault
To PowerCore	18EA2100h	Ext	0B 00 01	Read enabled
From PowerCore	18EAFF21h	Ext	0B 00 06 40 00 00 00 00	PIN 7 in fault
To PowerCore	18EA2100h	Ext	0B 00 01	Read enabled
From PowerCore	18EAFF21h	Ext	0B 00 06 00 00 02 00 00	PIN 33 in fault

17. Read PowerCore electronic values (0Ch)

The following message sent to the PowerCore allows to read the analog values of the output currents, the total current and the battery voltage.

Identifier	18EA2100h	
Byte 0	0Ch	Read PowerCore electronic values
Byte 1	00h	single frame
Byte 2	XXh	XXh: pin number 01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: P6 07h: P7 08h: P8 09h: P9 0Ah: P10 0Bh: P11 0Ch: P16 0Dh: P20 0Eh: P21 0Fh: P30 10h: P31 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40 17h: battery voltage (32,7=FFh) 18h: total current

Answer:

Identifier	18EAFF21h	
Byte 0	0Ch	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	YYh	Pin number
Byte 4	ZZh	ZZh: Current [A] Voltage=ZZ_d×32,7/255
Byte 5,7	00h	Not used

18. a) Set Output current threshold (0Dh)

This command sets for each output pin the current threshold. Refer to the pin assignment table to check the maximum currents of each pin. The default threshold is 10A.

NOTE: the maximum current of each pin is 15A.

NOTE 2: If it is set a value too high, the threshold is set at the maximum value supported for the selected pin.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	0Dh	Output current threshold
Byte 3	XXh	XX: pin number 01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: P6 07h: P7 08h: P8 09h: P9 0Ah: P10 0Bh: P11 0Ch: P16 0Dh: P20 0Eh: P21 0Fh: P30 10h: P31 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40
Byte 4	YYh	Threshold value in ampere (A)
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 0D 06 0F 00 00 00	Set PIN 6 threshold current to 15A
To PowerCore	18EF2100h	Ext	04 1B 0D 08 06 00 00 00	Set PIN 8 threshold current to 6A
To PowerCore	18EF2100h	Ext	04 1B 0D 0E 0B 00 00 00	Set PIN 21 threshold current to 11A
To PowerCore	18EF2100h	Ext	04 1B 0D 13 05 00 00 00	Set PIN 37 threshold current to 5A

b) Read Output current threshold (0Dh)

The following message sent to the device allows to require the output current threshold value set for the selected pin.

Identifier	18EA2100h	
Byte 0	0Dh	Read output current threshold
Byte 1	00h	single frame
Byte 2	XXh	Pin number

Answer:

Identifier	18EAFF21h	
Byte 0	0Dh	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	YYh	Pin number
Byte 4	ZZh	Threshold current value [A]
Byte 5,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	0D 00 01	Read PIN 1 threshold current
From PowerCore	18EAFF21h	Ext	0D 00 06 01 0A 00 00 00	10A
To PowerCore	18EA2100h	Ext	0D 00 15	Read PIN 39 threshold current
From PowerCore	18EAFF21h	Ext	0D 00 06 17 05 00 00 00	5A

19. a) Protection trip delay (0Eh)

This message is used to set the protection trip delay for each output. It is possible to select a value between 100ms and 900ms.

The default value is 100ms.

Byte 0	04h	Header bytes	
Byte 1	1Bh		
Byte 2	0Eh	Protection trip delay	
Byte 3	XXh	01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: P6 07h: P7 08h: P8 09h: P9 0Ah: P10 0Bh: P11 0Ch: P16 0Dh: P20 0Eh: P21 0Fh: P30 10h: P31 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40	
Byte 4	YYh	XXh: Protection Trip Delay (ms)	
		01h=100 (default) 02h=200 03h=300 04h=400 05h=500	06h=600 07h=700 08h=800 09h=900
Byte 5,7	00h	Not used	

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 0E 03 05 00 00 00	Set protection trip delay for PIN 3 to 500ms
To PowerCore	18EF2100h	Ext	04 1B 0E 10 01 00 00 00	Set protection trip delay for PIN 31 to 100ms

b) Read Protection trip delay (0Eh)

The following message sent to the device allows to require the protection trip delay value set for the selected pin.

Identifier	18EA2100h	
Byte 0	0Eh	Read Protection trip delay
Byte 1	00h	single frame
Byte 2	XXh	Pin number

Answer:

Identifier	18EAFF21h	
Byte 0	0Eh	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	YYh	Pin number
Byte 4	ZZh	Protection trip delay [ms]
Byte 5,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	0E 00 03	Read PIN 3 protection trip delay
From PowerCore	18EAFF21h	Ext	0E 00 06 03 05 00 00 00	500ms
To PowerCore	18EA2100h	Ext	0E 00 10	Read PIN 31 protection trip delay
From PowerCore	18EAFF21h	Ext	0D 00 06 10 01 00 00 00	100ms

20.a) Set Tachometer counter (10h)

This message is used to set the start value of the tachometer counter available for PINs 32 and 33.

The default counter value is 0000h.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	10h	Set Tachometer counter
Byte 3	XXh	01h: PIN 32 02h: PIN 33
Byte 4	YYh	00h-FFh $_{LSB}$
Byte 5	ZZh	00h-FFh $_{MSB}$
Byte 6,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 10 01 03 00 00 00	Set start tachometer counter to 0003h for PIN 32
To PowerCore	18EF2100h	Ext	04 1B 10 02 00 11 00 00	Set start tachometer counter to 1100h for PIN 33

b) Read Tachometer counter value (10h)

The following message sent to the device allows to read the current tachometer counter value for PINs 32 and 33.

Identifier	18EA2100h	
Byte 0	10h	Read Tachometer counter value
Byte 1	00h	single frame
Byte 2	XXh	PIN number 01h: PIN 32 02h: PIN 33

Answer:

Identifier	18EAFF21h		
Byte 0	10h	Command byte	
Byte 1	00h	Single frame	
Byte 2	RRh	06h: command understood 15h: command not accepted	
Byte 3	XXh	PIN number	
Byte 4	YYh	00-FFh LSB	Current tachometer counter value
Byte 5	ZZh	00h-FFh MSB	
Byte 6,7	00h	Not used	

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	10 00 01	Read current tachometer counter value for PIN 32
From PowerCore	18EAFF21h	Ext	10 00 06 01 02 00 00 00	0002h
To PowerCore	18EA2100h	Ext	10 00 01	Read current tachometer counter value for PIN 33
From PowerCore	18EAFF21h	Ext	10 00 06 02 43 56 00 00	5643h

21.a) Slew rate control (11h)

When a PIN is configured as output, this command allows to enable or disable the slew rate control.

When enabled, the slew control limits the rate at which an output rises from 0 to high voltage level in order to reduce current spikes and EMC emissions.

NOTE: for the output PINs 6-10-16-31 this mode is not available.

NOTE 2: the setting is kept at the power on.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	11h	Slew rate control
Byte 3	XXh	01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: -- 07h: P7 08h: P8 09h: P9 0Ah: -- 0Bh: P11 0Ch: -- 0Dh: P20 0Eh: P21 0Fh: P30 10h: -- 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40
Byte 4	YYh	YYh: 00h: disabled (default) 01h: enabled
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 11 03 01 00 00 00	PIN 3 enabled for slew rate control
To PowerCore	18EF2100h	Ext	04 1B 11 09 01 00 00 00	PIN 9 enabled for slew rate control

b) Read Slew rate control (11h)

The following message sent to the device allows to require which output pins have been set for the slew rate control.

Identifier	18EA2100h	
Byte 0	11h	Read Slew rate control
Byte 1	00h	single frame
Byte 2	XXh	Pin number

Answer:

Identifier	18EAFF21h	
Byte 0	11h	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	YYh	Pin number
Byte 4	ZZh	ZZh: 00h: disabled 01h: enabled
Byte 5,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	11 00 03	Read PIN 3 state
From PowerCore	18EAFF21h	Ext	11 00 06 03 01 00 00 00	PIN 3 enabled for slew rate control
To PowerCore	18EA2100h	Ext	11 00 09	Read PIN 9 state
From PowerCore	18EAFF21h	Ext	11 00 06 09 01 00 00 00	PIN 9 enabled for slew rate control

22.a) Normal ON mode (12h)

This command allows configuring the outputs' state in order to be already active (normal ON mode) when the PowerCore is powered on.

The setting is kept at the power on.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	12h	Normal ON mode
Byte 3	XXh	01h: P1 02h: P2 03h: P3 04h: P4 05h: P5 06h: P6 07h: P7 08h: P8 09h: P9 0Ah: P10 0Bh: P11 0Ch: P16 0Dh: P20 0Eh: P21 0Fh: P30 10h: P31 11h: P32 12h: P33 13h: P37 14h: P38 15h: P39 16h: P40
Byte 4	YYh	YYh: 00h: disabled (default) 01h: normal ON enabled
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 12 0B 01 00 00 00	Enable PIN 11 for normal ON mode
To PowerCore	18EF2100h	Ext	04 1B 12 09 01 00 00 00	Enabled PIN 9 for normal ON mode

b) Read Normal ON mode (12h)

The following message sent to the device allows to require which output pins have been set for the normal ON mode.

Identifier	18EA2100h	
Byte 0	12h	Read Normal ON mode
Byte 1	00h	single frame
Byte 2	XXh	Pin number

Answer:

Identifier	18EAFF21h	
Byte 0	12h	Command byte
Byte 1	00h	Single frame
Byte 2	XXh	06h: command understood 15h: command not accepted
Byte 3	YYh	Pin number
Byte 4	ZZh	ZZh: 00h: disabled 01h: normal ON enabled
Byte 5,7	00h	Not used

Examples:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	12 00 0C	Read PIN 16 state
From PowerCore	18EAFF21h	Ext	12 00 06 0C 01 00 00 00	PIN 16 in normal ON mode
To PowerCore	18EA2100h	Ext	12 00 03	Read PIN 3 state
From PowerCore	18EAFF21h	Ext	12 00 06 03 01 00 00 00	PIN 3 in normal ON mode

23. Get software revision (2Ah)

Identifier	18EA2100h	
Byte 0	2Ah	Get software revision
Byte 1	00h	single frame
Byte 2	01h	Enable reading

Answer:

Identifier	18EAFF21h	
Byte 0	2Ah	Command byte
Byte 1	00h	Single frame
Byte 2	SSh	06h: command understood 15h: command not accepted
Byte 3	XXh	SW revision ASCII
Byte 4	YYh	
Byte 5	WWh	
Byte 6	ZZh	
Byte 7	00h	

Example:

Direction	**Identifier**	**Format**	**Message**	**Data**
To PowerCore	18EA2100h	Ext	2A 00 01	Get software revision
From PowerCore	18EAFF21h	Ext	2A 00 06 56 XX 2E XX 00	VX.X

24. Baud rate setting (6Fh)

This message is used to change the baud rate of the CAN bus. Connecting only one PowerCore to the bus when changing the baud rate is recommended. If an invalid value is chosen, then no change is done to the stored value.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	6Fh	Set baud rate message
Byte 3	02h	500kbit/s
	03h	250kbit/s
Byte 4,7	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 6F 02 FF FF FF FF	Set baud rate = 500kbit/s

25. Set Source address (70h)

This message is used to change the PowerCore CAN source Address and/or the PowerCore identifier.

Either or both the Source Address or PowerCore identifier may be changed independently. Connecting only one PC21B to the bus during the address change is recommended. If an invalid value is chosen, then no change is done to the stored value.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	70h	Set address message
Byte 3	XXh	XX: CAN source address From 01h to FEh FFh: no change
Byte 4	YYh	YY: PC21B identifier From 00h to FEh FFh no change
Byte 5,7	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 70 05 21 FF FF FF	Set source address = 05h Set PowerCore identifier = 21h

26. Periodic fault message transmission (71h)

This command enables or disables the periodic transmission of the fault-event message.
When enabled, a message informing if the PIN has entered fault condition is periodically sent for each output of the PC21B.
The period is set to 1s as default value but can be changed by command 77h (see chapter 29 for further details).

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	71h	Periodic fault event message transmission
Byte 3	XXh	XXh: 00h Disabled (default) 01h Enabled
Byte 4,7	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 71 01 FF FF FF FF	Periodic fault event transmission enabled

PowerCore reply message:

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	01h	Fault message
Byte 3	XXh	Pin number (01h-16h)
Byte 4	YYh	00h: normal 01h: fault
Byte 5	21h	PowerCore identifier
Byte 6,7	FFh	Not used

Examples:

Direction	Identifier	Time [s]	Message	Data
From PowerCore	18EFFF21h	0.0406	04 1B 01 01 00 21 FF FF	PIN 1 normal state
From PowerCore	18EFFF21h	0.0456	04 1B 01 02 01 21 FF FF	PIN 2 fault state
From PowerCore	18EFFF21h	0.0506	04 1B 01 03 00 21 FF FF	PIN 3 normal state
From PowerCore	18EFFF21h	0.0557	04 1B 01 04 01 21 FF FF	PIN 4 fault state
From PowerCore	18EFFF21h	0.0607	04 1B 01 05 00 21 FF FF	PIN 5 normal state
From PowerCore	18EFFF21h	0.0656	04 1B 01 06 01 21 FF FF	PIN 6 fault state
From PowerCore	18EFFF21h	0.0706	04 1B 01 07 00 21 FF FF	PIN 7 normal state
From PowerCore	18EFFF21h	0.0756	04 1B 01 08 01 21 FF FF	PIN 8 fault state
From PowerCore	18EFFF21h	0.0806	04 1B 01 09 00 21 FF FF	PIN 9 normal state
From PowerCore	18EFFF21h	0.0856	04 1B 01 0A 01 21 FF FF	PIN 10 fault state
From PowerCore	18EFFF21h	0.0907	04 1B 01 0B 00 21 FF FF	PIN 11 normal state
From PowerCore	18EFFF21h	0.0956	04 1B 01 0C 01 21 FF FF	PIN 16 fault state
From PowerCore	18EFFF21h	0.0965	04 1B 01 0F 01 21 FF FF	PIN 30 fault state
From PowerCore	18EFFF21h	0.1006	04 1B 01 16 00 21 FF FF	PIN 40 normal state
From PowerCore	18EFFF21h	0.1406	04 1B 01 01 00 21 FF FF	PIN 1 normal state
…	…	…	…	…
…	…	…	…	…

27. Fault-event message transmission (72h)

This command enables or disables the transmission of the fault-event message (see chapter 14 for further details). This feature is active by default, but if it is disabled when a PIN enters fault condition the PowerCore will not transmit the related message.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	72h	Fault event transmission
Byte 3	XXh	XX: 00h: Disabled 01h: Enabled (default)
Byte 4,7	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 72 00 FF FF FF FF	Fault event transmission disabled

28. Heartbeat (75h)

This message enables or disables the transmission of Heartbeat message. This message is designed to indicate to other devices on the bus that this unit continues to work.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	75h	Heartbeat
Byte 3	XXh	XX: 00h Disabled (default) 01h Enabled
Byte 4	YYh	YY: Period in milliseconds ÷ 10 From 05h (50ms) to FEh (2.54 sec)
Byte 5,7	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 75 01 32 FF FF FF	Set heartbeat enabled with 500ms period.

Heartbeat generated message:

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	F9h	Heartbeat message
Byte 3	XXh	XX: Message counter, incremented each message sent
Byte 4	0 0 0 0 P40 P39 P38 P37	'1': digital input
Byte 5,7	00h	Not used

Examples:

Direction	Identifier	Format	Message	Data
From PowerCore	18EFFF21h	Ext	04 1B F9 03 01 00 00 00	Heartbeat message with PIN 37 detected high
From PowerCore	18EFFF21h	Ext	04 1B F9 03 02 00 00 00	Heartbeat message with PIN 38 detected high

29. Periodic fault message period (77h)

This message sets the period time for the periodic fault-event message transmission (see chapter 26 for further details). This does not enable or disable the messages.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	77h	Periodic fault event message period
Byte 3	XXh	XX: Period in milliseconds ÷ 10 From 05h (50ms) to FEh (2.54 sec)
Byte 4,7	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 77 64 FF FF FF FF	Period set to 1 sec

30. Enable built-in terminating resistor (78h)

This message allows enabling the terminating resistor built-in on the PCB.
NOTE: this command can be used provided that the external label on the PowerCore reports as date code the year 2022 or later.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	78h	Enable built-in terminating resistor
Byte 3	XXh	00h: disabled 01h: enabled
Byte 4,7	FFh	Not used

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 78 01 FF FF FF FF	Enable built-in terminating resistor

31. Restore default parameters (81h)

The following command allows to reset the PowerCore to factory settings (see chapter 10 for further details). At the end of this procedure the default parameters will be reactivated.

Byte 0	04h	Header bytes
Byte 1	1Bh	
Byte 2	81h	Restore default parameters message
Byte 3	01h	RESET
Byte 4,7	FFh	Not used

Direction	Identifier	Format	Message	Data
To PowerCore	18EF2100h	Ext	04 1B 81 01 FF FF FF FF	Reset PowerCore to factory settings

32. 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 PowerCore	600h + current CAN ID (default 60Ch)	Std	2F FF 20 00 01	Change to J1939

- Change from J1939 to CANopen:

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

33. Revision history

Date	Manual Revision	Comment
05/04/2023	1.0	First release
05/09/2023	1.1	Second release: - Added note on chapters 5-6 - Added sub-index 02h to the *Tachometer counter* command on chapter 20