ENGINEERING
TOMORROW

Danfoss

User Guide

ePowerpack ED-EP130

www.danfoss.com

Revision history

Table of revisions

Date	Changed	Rev
January 2026	Updated section: Basic parameter configure	0203
November 2025	Updated document	0202

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General information

This user guide is the installation, operation and maintenance user guide for the ePowerpack ED-EP130 product.

Intended use of the user guide

This user guide provides essential instructions for the safe handling, installation, operation, and maintenance of the product. It is crucial reading for all personnel involved in the installation, operation, or maintenance of the product and associated equipment.

Strict adherence to all safety warnings and instructions in this user guide is mandatory to prevent personal injury and property damage. Only qualified and authorized personnel, possessing knowledge of relevant health and safety regulations and national legislation, are permitted to handle, install, operate, and maintain the product.

Illustrations in this user guide are examples and may not depict all system features.

Retain this user guide for future reference during installation, operation, and maintenance.

Product naming convention

In this user guide, ePowerpack ED-EP130 is referred to as power unit or product.

The model number of the product reflects the size and electrical characteristics of the power unit. The following naming conventions are used to indicate the power unit model:

- ED-EP130-TXX-XX-XXXX

Part of the name	Meaning
ED	Electric drive components
EP	Power unit ePowerpack
130	Motor size
TXX	Maximum torque / Nm
XX	Rated voltage / V
XXXX	Maximum speed / rpm

Conformity according to standards

The power unit has been designed to be in conformity with the following directives and to meet the requirements specified in the following standards:

Applicable directives and standards

Standard	Explanation
Low Voltage Directive 2006/95/EC (until 19.4.2016) and Low Voltage Directive 2014/35/EU (from 20.4.2016 onwards)	Electrical equipment means any equipment designed for use with a voltage rating of between 50 and 1000 V for alternating current. This electric machine is subject to the Low Voltage Directive 2006/95/EC or 2014/35/EC.
IEC 60034-1:2010	Rotating electrical machines - Part 1: Rating and performance
IEC 60034-5:2001/A1:2007	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification
IEC 60034-6:1991	Rotating electrical machines - Part 6: Methods of cooling
IEC 60034-7:1992/A1:2001	Rotating electrical machines - Part 7: Classification of types of construction, mounting arrangements and connection box position (IM Code)

General information

Applicable directives and standards (continued)

Standard	Explanation
IEC 60034-8:2007/A1:2014	Rotating electrical machines - Part 8: Terminal markings and direction of rotation
IEC 60034-14:2004/A1:2008	Amendment 1 - Rotating electrical machines - Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity.

Warranty

Danfoss offers warranty against defects in workmanship and materials for its products. For more information, see General terms and conditions of sale at *https://www.danfoss.com/en/terms/sales-conditions/*.

Warranty validity requires adherence to the instructions in this document and all related materials, including product installation and maintenance guidelines, and compliance with all applicable national standards and regulations.

The warranty does not cover defects resulting from improper or negligent use, operation, or installation; failure to perform regular preventive maintenance; or damage caused by external factors or the use of non-Danfoss supplied/recommended equipment and components.

Any unauthorized repairs or modifications made without Danfoss' prior written consent will invalidate the warranty.

Terms and abbreviations

The following tables define symbols, terms, and abbreviations that may appear in this user guide.

Symbols

Symbol	Variable	Unit
U	Rated voltage (phase-to-phase AC)	V_{rms}
I	Rated current (AC)	A_{rms}
P	Rated Power (S1)	kW
T	Rated torque (S1) at rated speed	Nm
T_{max}	Maximum torque	Nm
n	Rated speed	rpm
Max n	Maximum speed	rpm
f	Rated supply frequency at nominal speed	Hz
PF	Power factor ($\cos\varphi$)	
Q_c	Rated coolant liquid flow	l/min
T_c	Rated coolant liquid input temperature	°C
T_{amb}	Rated ambient temperature	°C
RES_COS	Cosine signal received from the resolver	deg
RES_SIN	Sinusoidal signal received from the resolver	deg
Ω (Ohm)	Resistance	Ω

General information

Terms and abbreviations

Term / abbreviation	Explanation
Resolver	Rotation meter in electric machines, used for measuring degrees of rotation
AC	Alternating current
DC	Direct current
GND	Ground in electrical connections
PMSM	Permanent Magnet Synchronous Machine
SRPM	Synchronous Reluctance assisted Permanent Magnet
S1	Duty type according to the IEC60034; Continuous running duty
S9	Duty type according to the IEC60034; Duty with non-periodic load and speed variations

Responsibility of the manufacturer

Danfoss guarantees the safety, reliability, and performance of the product only when the following conditions are met:

- Handling, mounting, installation, operation, and maintenance are performed by qualified and authorized personnel.
- The system installation adheres to all applicable regulations.
- The product is operated according to the instructions in this user guide.
- The product is installed, maintained, and serviced according to the instructions in this user guide.

Safety information

General safety statement

- Designed for use as a component in industrial and commercial installations, the product requires that the end product comply with all relevant regulations.
- The product cannot be used in hazardous areas unless specifically designed for that purpose.
- Only qualified personnel familiar with health and safety requirements and national legislation should install, use, and maintain this product. Failure to comply with these instructions may void all applicable warranties.
- These instructions are essential for the safe and correct installation, operation, and maintenance of the product. Make sure everyone who installs, operates, or maintains the product or related equipment has access to and understands these instructions.
- This user guide covers products with rotating parts and electric current that can cause serious injuries. To prevent injury, always follow safety precautions.

Safety message signal words

Safety message signal words indicate the severity of a potential hazard.

DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. CAUTION may also alert against unsafe practices.

NOTICE Indicates a potentially hazardous situation which, if not avoided, could result in property damage.

Safety symbols

The following safety and information symbols are used in this user guide and on the product.

STOP	**Danger** **This symbol warns of a dangerous situation that could result in serious injury or death. Do not perform the action indicated by this symbol.**
⚠	**General warning** **This symbol indicates a potentially hazardous situation.**
⚡	**Electric shock warning** **This symbol indicates the presence of dangerous voltage that could cause electric shock.**
♨	**Burn warning** **This symbol warns of a hot surface that could cause burns. The device should be installed to prevent contact with its potentially hot surfaces.**
🧲	**Magnet warning** **This symbol warns of a strong magnetic field that could be harmful to people or property.**
⚙	**Rotating shaft warning** **This symbol warns of a strong rotating shaft that could be harmful to people or property.**
❗	**This symbol indicates that the following content is for general Information.**

Safety information

	This symbol indicates that you need to refer to the user guide for instructions.

Personal protective equipment

To prevent injury during handling, installation, and maintenance of the product, use appropriate personal protective equipment when necessary.

	Wear safety goggles or a mask when working on the product. Bearing grease, melted nitrile rubber (from the radial lip seal), glycol, or other fluids could splash and cause permanent eye damage.
	Wear hearing protection when working on the product. Exposure to noise levels above 85 dBA can cause hearing damage.
	Wear a helmet when lifting the product to protect yourself from potential head injuries caused by falling objects.
	Wear cut-resistant gloves when handling and maintaining the product to protect against cuts.
	Wear protective footwear when lifting or moving the product to prevent foot injuries in case of lifting system or bracket failure.

Safety features

Controller adopts dual MCU main control chip control system, MCU1 is used for motor control, MCU2 is used for functional safety detection and vehicle information interaction, which improves the real-time performance of motor control and system security.

The product has also the following safety features.

Safety function 1: Speed limitation
- Category 2 architecture
- PLc capable

Safety function 2: Safety stop
- Category 2 architecture
- PLc capable

Note that in order to activate the above safety functions, the cross check functions need to be enabled.

Generic programs do not cover all application needs. If you have special requirements, contact a Danfoss representative for further support.

Electromagnetic compatibility (EMC)

	When connecting to other equipment, ensure that only specified and compatible components of the system are used.

Safety information

	Individuals with heart pacemakers, metal implants, or hearing aids should be aware that electric products generate magnetic and electromagnetic fields that can be a health hazard.
	These individuals should consult a doctor due to the risks posed by current-carrying conductors and permanent magnets before entering the following areas:
	• **Areas where electrical equipment and parts are operating**
	• **Areas where electrical equipment with permanent magnets is stored, assembled, operated, or repaired**
	If necessary, perform a dedicated EMC test on the installation.

Electromagnetic compatibility (EMC) is the ability of electrical equipment to function correctly in its electromagnetic environment without causing interference to other devices. Meeting EMC requirements is a legal obligation for all equipment used within the European Economic Area (EEA)

Our products are designed with high standards of EMC in mind. Connect the power cables and groundings along the instructions in this user guide to achieve the required level of electromagnetic interference (EMI) shielding.

The installer is responsible for ensuring that the equipment or system into which this product is integrated complies with the EMC legislation of the country where it will be used. Within the European Union, equipment incorporating this product must comply with the EMC Directive 2014/30/EU.

Product overview

!	This product is intended as a component for integration into a larger system, requiring more planning and effort than a typical standalone product.
!	To provide optimal solutions for various applications, the product is available in several sizes. This user guide covers the following: • **ED-EP130-T20-24-3600** • **ED-EP130-T22-24-4000** • **ED-EP130-T29-48-4000**

ePowerpack is intelligently designed for maximizing efficiency and compactness. It consists of a high-performance, interior permanent magnet motor and a high-power, passive air-cooled converter with a full-featured digital signal processor. Variants include optional gear pumps with different power settings in software. Gear pumps are sold separately.

These systems are optimal for MEWP and off-highway applications, providing hydraulic flows that fit demanding criteria.

The product offer several advanced features:

- Competitive and compact size allows for easy installation
- Integrated structure provides up to 93 % efficiency
- High enclosure class IP67 – sealed from moisture and dust
- Embedded with SAE flange for quick coupling with a pump
- Package test ensures the whole unit is within higher consistency
- Low energy consumption and environmentally friendly

Intended use of the product

This product is intended to operate as a power unit and is designed to be integrated into machinery, such as:

- Scissor lift
- Boom lift
- Hydraulic station
- Buss steering
- Mini excavator

This product is exclusively for professional use and should only be operated and maintained by trained professionals.

Prohibited uses of the product

The following uses, handling procedures, and maintenance practices are prohibited (this list is not exhaustive):

- Using the product for purposes not specified in this user guide
- Failing to comply with this user guide, safety signs, and rating plate information of the product
- Operating, adjusting, or performing maintenance on the product before reading this user guide
- Operating the product beyond its designed limits
- Using non-genuine service parts or parts with incorrect materials, potentially causing corrosion and eventual mechanical failures
- Operating and maintaining the product without using the appropriate personal protective equipment
- Using product parts, such as the frame, for climbing or to support other structures
- Subjecting the product to any kind of impact forces (for example, hitting, hammering, or dropping objects)

Product overview

- Operating the product using electrical connections not described in the user guide or other documentation
- Operating the product when connections are not properly tightened
- Operating the product with power cables that are not routed according to the instructions
- Touching the product's connection terminals or performing maintenance or adjustments while the power is connected
- Lifting the product from incorrect lifting points or without appropriate lifting equipment
- Lifting additional loads with the product
- Storing the product outdoors in wet or dusty environments
- Storing the product without proper support to prevent it from rolling or falling
- Using the product in potentially explosive environments
- Allowing dirt or liquid to enter the product or connection box
- Using cables that cannot withstand the maximum currents of the product

System introduction

Danfoss electric system solutions are optimized and packaged for use in specific vehicle functions. They are fully tested and validated to ensure compatibility with the design and configuration of your application.

ePowerpack is part of the Danfoss low-voltage electrification portfolio. Consisting of a high-performance interior permanent magnet motor and a high-power, air-cooled converter with a full-feature digital signal processor, it is designed for maximal efficiency and compactness. Variants include optional gear pumps with power settings that can be changed using software.

It is recommended to use a Danfoss inverter for optimized performance.

Connections and interfaces

Electric systems are mechanically and electrically integrated into machinery.

Mechanical interfaces:
- Flange mounting (D-end and N-end)
- Shaft connection(s)

Electrical interfaces:
- Power grounding connection
- Signal connections grounding

Rating plate

Each product has a rating plate which can be found on the frame. The rating plate contains product rating and identification. See product data sheet for more details.

Rating plate

TYPE : ED-EP130	WEIGHT : 13.5 KG
POWER : 3.5 kW	PROTECTION CLASS : IP67
RATED VOLTAGE : 24 VDC	VOLTAGE RANGE : 16.8-33 VDC
RATED TORQUE : 9.6 N.m	MAX TORQUE : 22 N.m
RATED SPEED : 3000 RPM	INSULATION CLASS : F
COOLING METHOD : AIR	S/N CODE : ZL23501925
MADE IN CHINA P/N : 11318627	MFG : 20231010

QR CODE
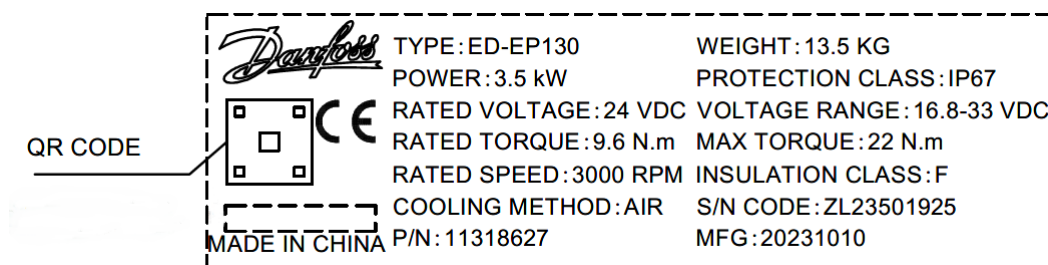
Product overview

Tightening torques

⚠	Unless otherwise specified, the acceptable tightening torque range is within +/- 5 % of the stated value.

Connection	Tightening torque
Pump mounting bolts	16-20 Nm
Foot fixing bolts (M8)	15 Nm
B+ and B- cable (M6)	7-8 Nm

System design

The EP130 uses permanent magnet synchronous motor technology.

- The magnetic field is generated by the permanent magnet, which avoids the magnetic field generated by the excitation current, and the power density is high and the excitation loss is reduced

- It operates over a wide range of speeds and efficiently over the entire operating range

- Internal permanent magnet (IPM) structure, reliable and stable operation

- Small starting current and large torque; The torque ripple is small and the operation is stable

- Compared to brushed DC motors, the system is maintenance-free and does not require the replacement of carbon brushes

Compared with standard permanent magnet motors, the speed and torque capabilities are extended, and the starting current is small and the torque is large.

Application scenarios:

- Scissor aerial work platform
- Electro-hydraulic actuators (EHAs)
- DC-powered power units for various types of hydraulic subsystems
- Bus steering
- Mini excavator

Main components
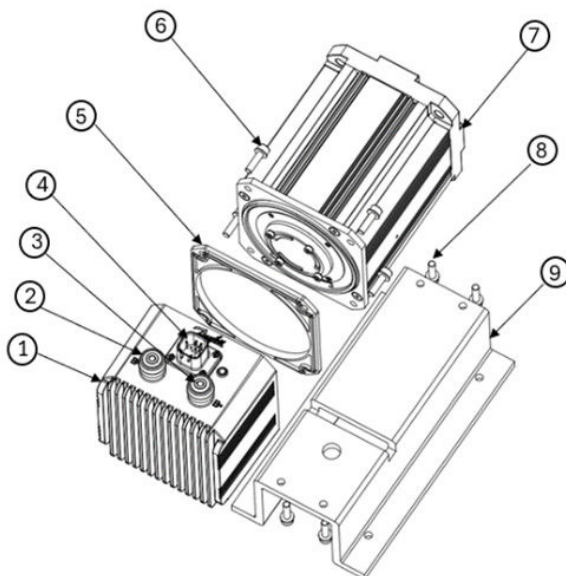
Part number	Part name
1	Motor controller body
2	Battery-powered negative end B-
3	Battery-powered positive B+
4	I/O signal interface
5	Washer
6	Motor fixing bolts
7	Motor body
8	Foot fixing bolts
9	Feet with threads

System design

Main dimensions

ED-EP130-T20-24-3600
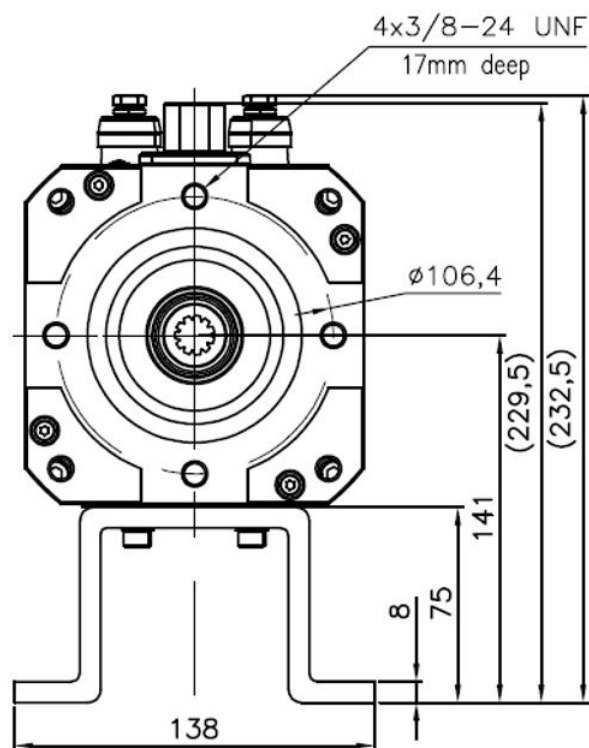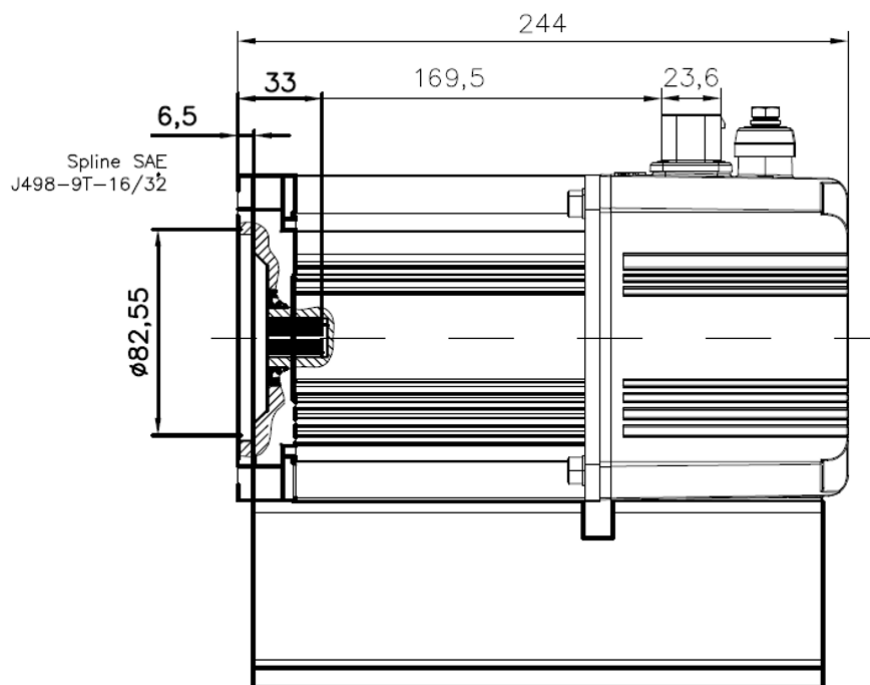
System design

System design

ED-EP130-T22-24-4000, ED-EP130-T29-48-4000

System design
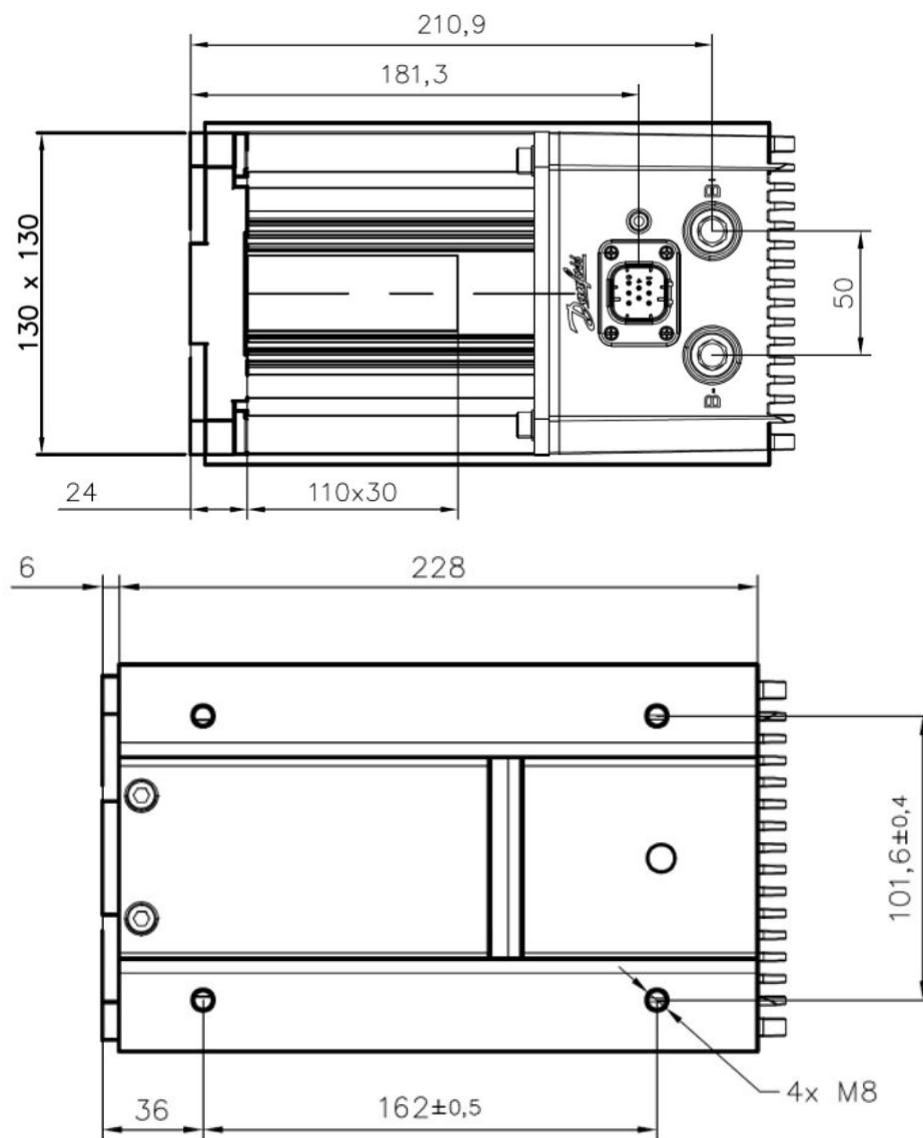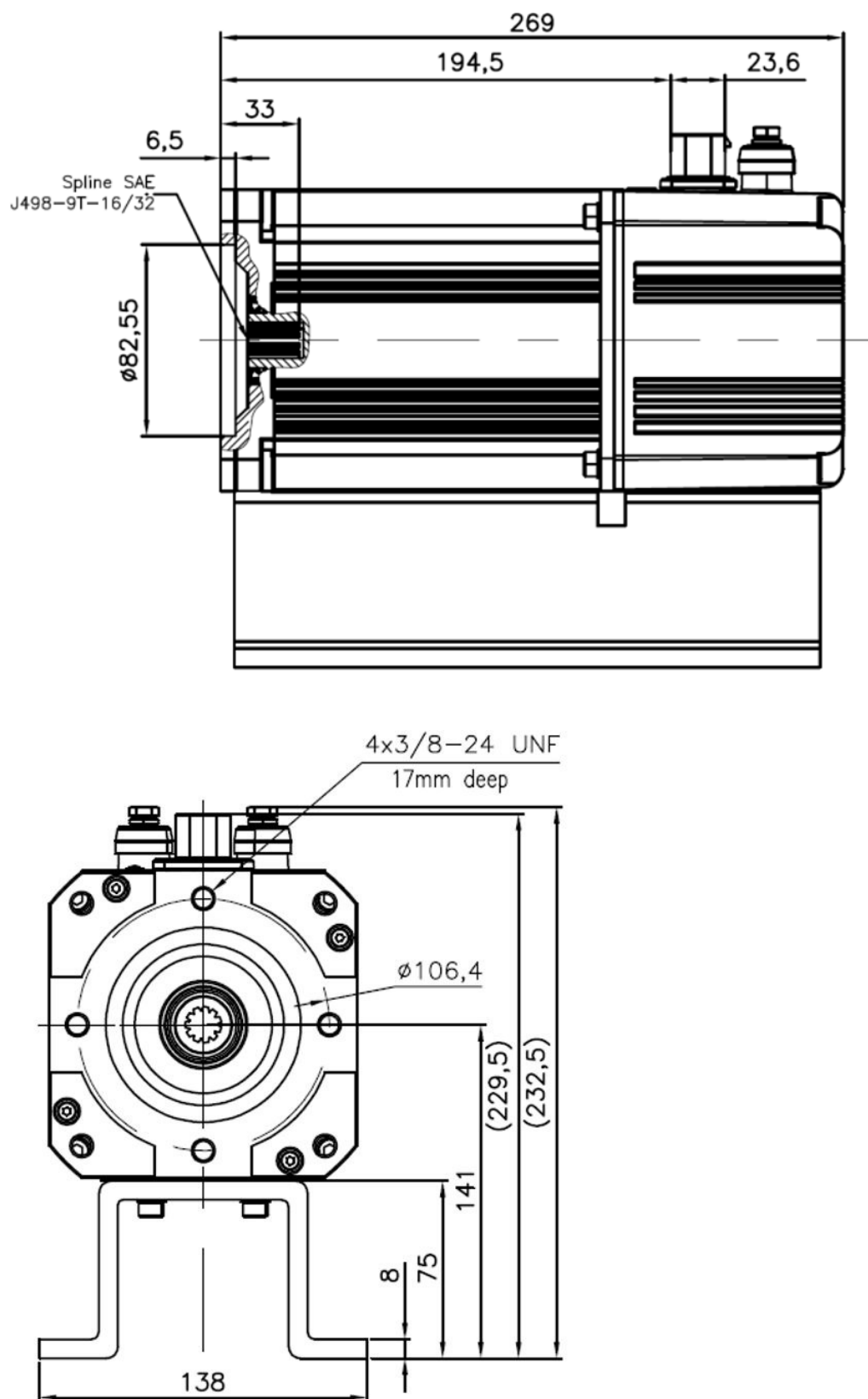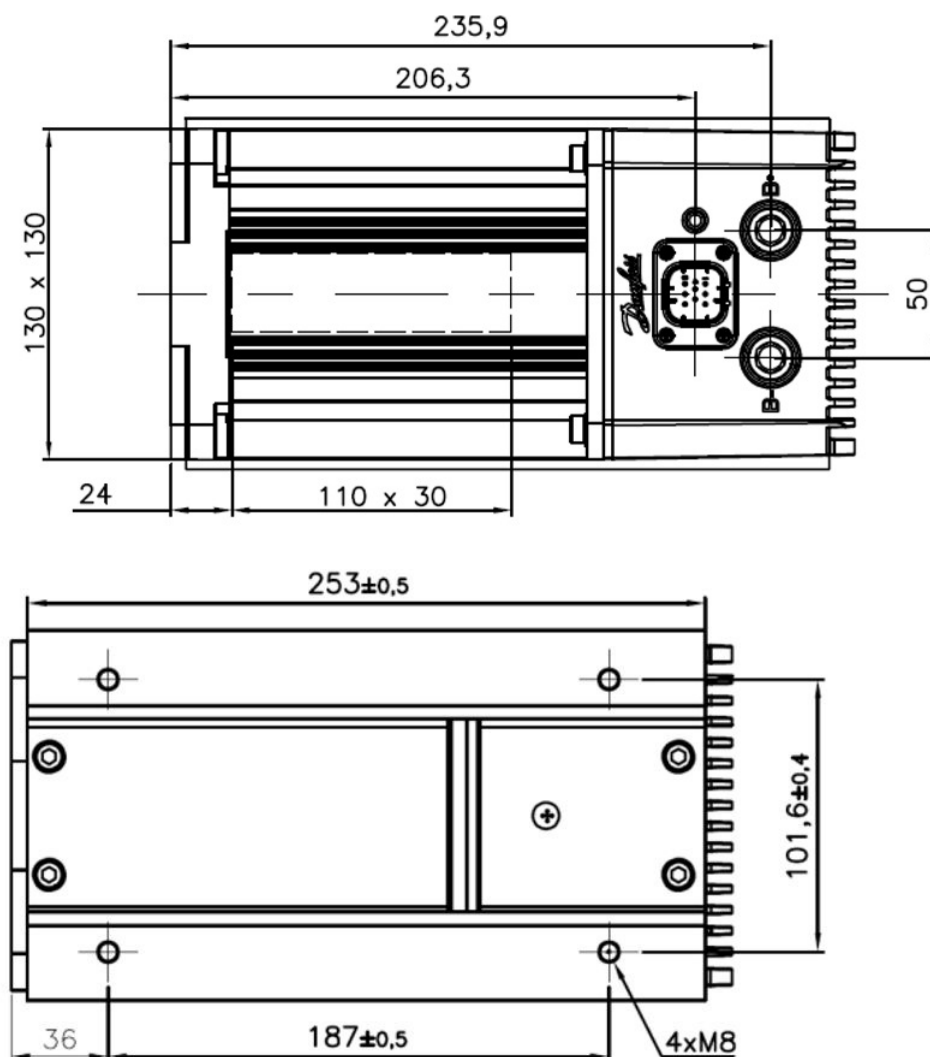
Transportation and storage

Transportation

⚠	**Handle with care during transportation.**

The product is shipped in first class condition. It has been inspected and packed correctly to prevent damage from ordinary handling during shipment. During transportation, shocks, fails and humidity should be avoided.

The weight of the electric machine can be found on the machine rating plate, and in the product data sheet.

Receiving and unpacking

⚡	**Do not touch the electrical terminals when the rotor is rotated. The electrical terminals have dangerous voltage during rotation. Contact Danfoss representative if the rotor can not be rotated.**
⚠	**Remove the transportation supports of the product.**

Check upon arrival and unpacking

- The product and the package must be inspected immediately upon arrival. Make sure that the rating plate data in the cover letter complies with the purchase order. Any external damage (in shaft-ends, flanges, electrical interfaces and paint) must be photographed and reported immediately.

Storage

⚡	**Do not touch the electrical terminals when the shaft is rotated. The electrical terminals have dangerous voltage during rotation.**
⚠	**Keep the product on a correct base and support it to prevent accidental turning and falling.**

- Always store the electric machine indoors. Storage temperature must be above -20ºC and relative humidity less than 60 %.
- The storage should be dry, dust free and vibration free.
- Treat the unprotected surfaces against corrosion. Seal the cable exit holes and cooling bores for storage.
- Avoid external vibrations stronger than those in the intended application to avert damage to the electrical components.

Installation

The following safety and information related symbols may appear in this user guide and on the product.

⚡	**Risk of electric shock.**
🧲	**Magnetic and electromagnetic fields generated near the current-carrying conductors and permanent magnets in electric equipment represent a health danger to persons with heart pacemakers, metal implants and hearing aids. Persons with a heart pacemaker, metal implants or hearing aids must consult a doctor before they enter the following areas:** • **Areas in which electric equipment and parts are operated.** • **Areas in which electric equipment with permanent magnets are stored, mounted, operated or repaired.**
⚠️	**Only trained and qualified personnel familiar with the relevant safety requirements can work with the product.**
👓🎧 👷🧤 👢	**Use correct personal protective equipment when you are near the product.**
📖	**Read the instructions in this user guide before you install the product.**

Required tools

Following tools are required to install the electric machine:
- Ratchet torque wrench
- Hex head wrench kit with different metric sizes
- Socket wrench kit with different metric sizes
- Cable skinning knife
- Crimping tool for cable lugs (consult cable lug manufacturer for correct size and crimping)

Mechanical installation

Allowed mounting positions

The product can be mounted in any position and rotated freely on its axis. Make sure the device is securely assembled in the chosen position.

Mounting the product

For mounting the product, follow the steps below.
1. Lift the product on the mounting structure while supporting it.
2. Attach the mounting bolts.
3. Connect the connectors and cables.

Electrical installation

Installation

Power connections

Connection diagram

The electric machines are intended to be powered and controlled by three-phase alternating current, supplied by an inverter or inverters. The electric machine is not suitable for direct online use.

The amount of inverters depends on the electric machine and converter current ratings. See also the relevant wiring diagrams.

Low voltage connections

Grounding

⚠	**Ground the product from its frame to make sure it functions correctly and safely.**

Operation

Operation conditions

The product should be used for its intended purpose only and within limits specified by the manufacturer, concerning:

- Loading.
- Cooling.
- Speed range.
- Ambient condition such as temperature and moisture.

The product is designed for the following conditions:

- Storage temperature limits: -40°C...+85°C.
- Operating temperature limits: -40°C...+65°C.
- Maximum altitude above sea level: 2000 m without limitation, 5000 m with limitation. See the product data sheet for more information.
- IP class IP67

Condition monitoring during operation

⚠️	**Supervise the device during operation to make sure that it operates correctly and has a designed lifetime.**
⚠️	**If you notice any deviations from the normal operation, for example elevated temperatures, noise or vibration, stop the device and contact Danfoss service.**

Power unit control

The EP130 has two typical wiring methods, namely the typical CAN bus wiring diagram and the typical analog control wiring diagram, as shown below.

Typical CAN bus wiring diagram
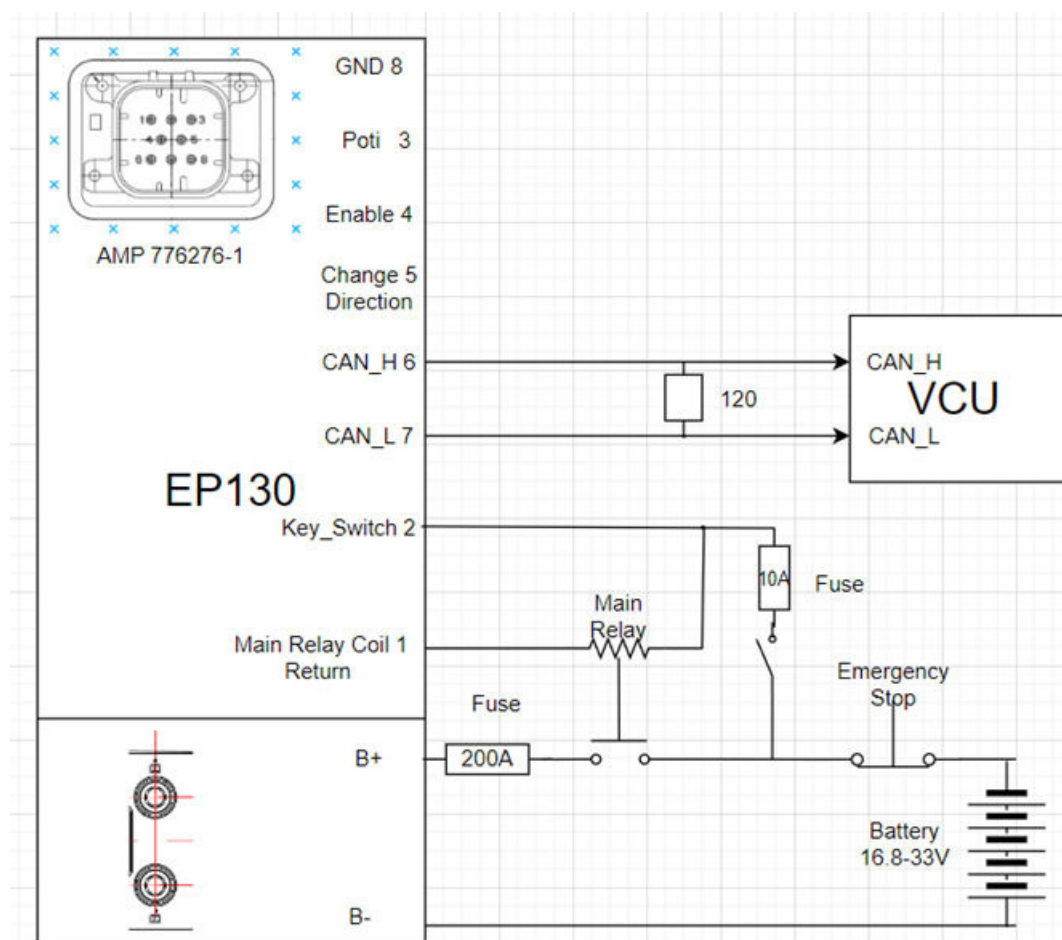
Power unit control

Typical analog control wiring diagram
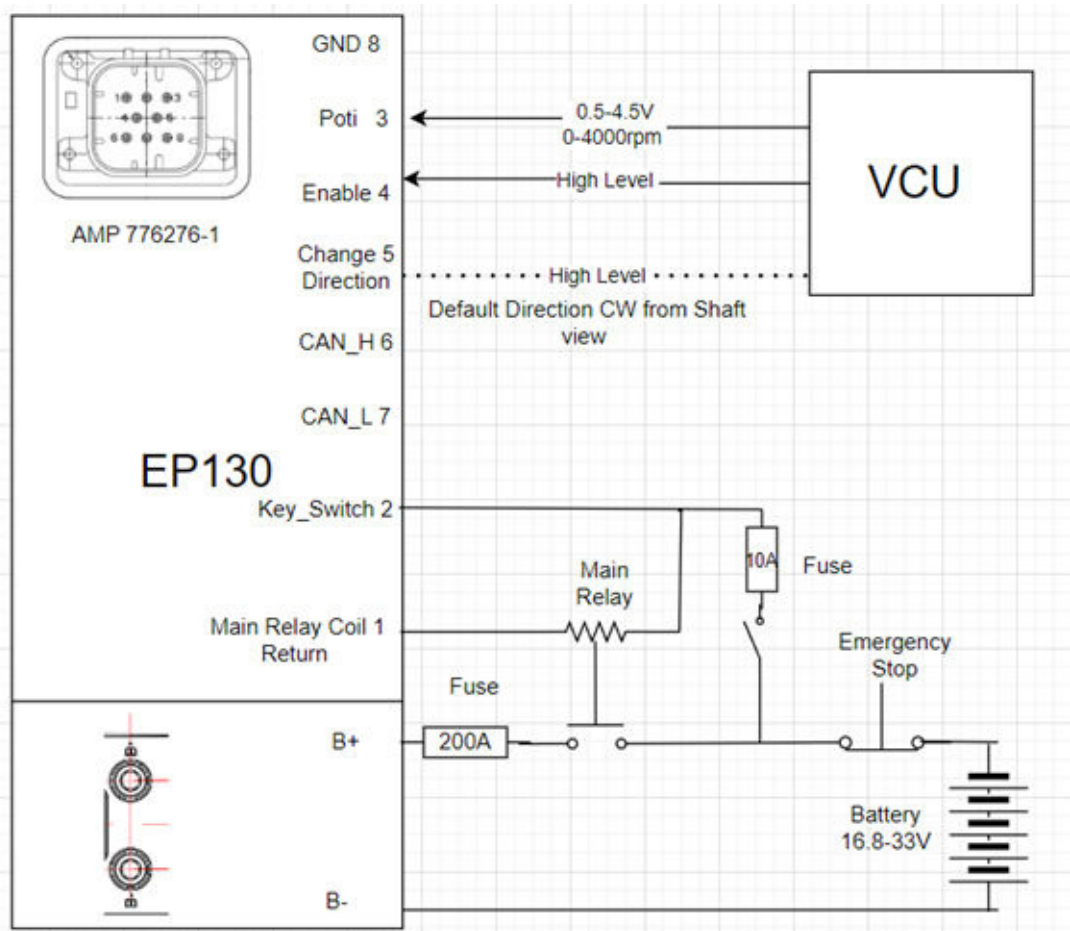
The controller has two power interfaces and a signal connector, and the power interface is used to provide DC bus voltage for the controller, which is the power source of the entire power system. **The I/O signal connector is used for key switch power supply**, CAN communication command and other low-voltage signal transmission.

The controller adopts dual MCU main control chip control system, MCU1 is used for motor control, MCU2 is used for functional safety detection and vehicle information interaction, which improves the real-time performance of motor control and system security. The control system has two strategies: overcurrent hardware protection and software protection, which has higher timeliness than the conventional single software protection strategy, so as to reduce the failure rate of motor electronic control. Isolated CAN circuit is used to reduce the impact of external interference on the controller system.

Power unit control

Schematic of the CAN circuits
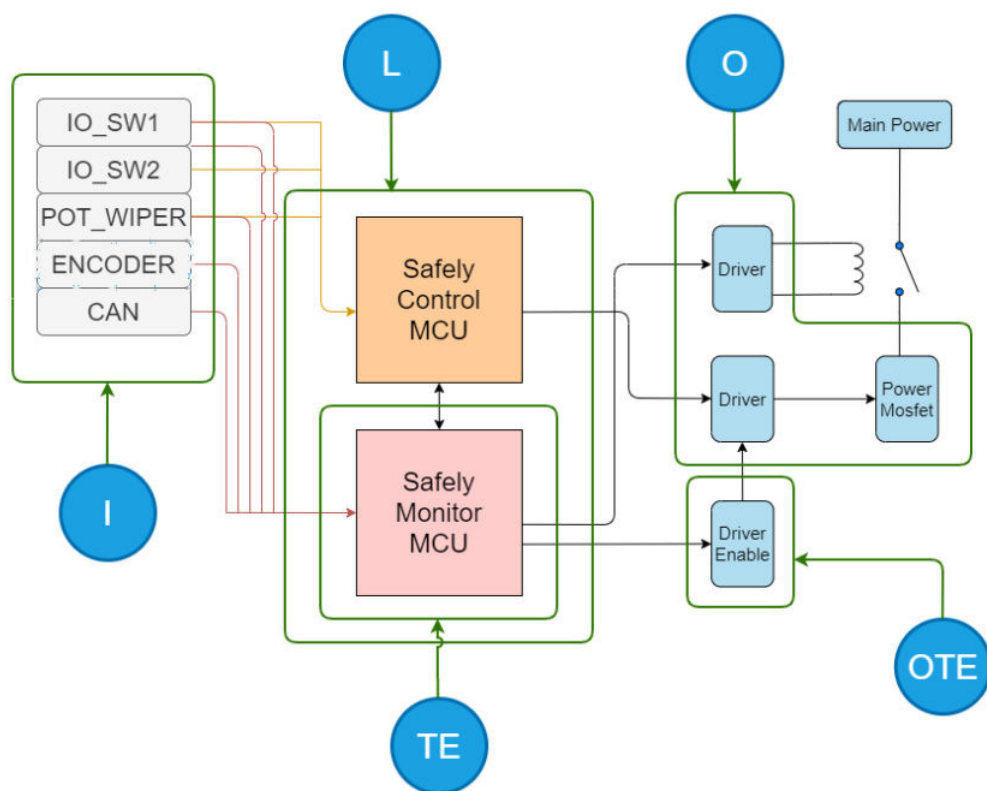
Interfaces

Power Interface:
- B+ battery powered positive end
- B- Battery-powered negative end
- B+ and B- cable >= 35 mm^2, M6 Torque : 7~8 Nm

Pump Interface:
- Electric motor side: SAE A, Spline: 9T
- Pump Screw : 3, 8-24-UNF, Fix Torque: 16-20 Nm

I/O Signal Interface:

The ePowerpack is available with an 8 pin AMP 776276-1 connector, as shown in the pinout diagram below.

Power unit control

Signal connector
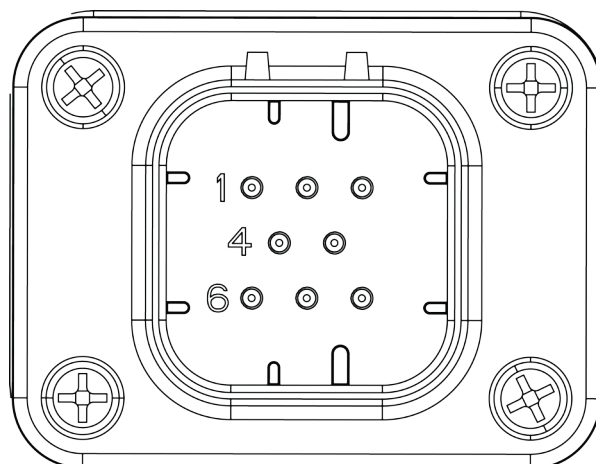
The selection between the two control inputs is done by parameters; Analog or CAN bus.

Signal connector pinout

PIN	Signal name	Description	Note
1	Main Relay Coil Driver	The main relay is driven (connected to the negative end of the relay drive)	Continuous output current ≤1.5A
2	Key Switch	Key input switch, providing power to logic	Max input current 2A, Voltage: 16.8-33V_{DC}
3	Pot Wiper	Analog throttle signal input	Input impedance 75KΩ±10%, Voltage: 0-5V
4	ENABLE	Enable signal input	Maximum voltage 33V High Level >=7V±0.3V Low level: <=4V±0.3V
5	DIRECTION	Directional signal input	Maximum voltage 33V High Level >=7V±0.3V Low level: <=4V±0.3V
6	CAN_H	CAN H	Max 500Kbs, without 120Ω inside
7	CAN_L	CAN L	Max 500Kbs, without 120Ω inside
8	I/O GND	I/O GND	

I/O signal cables

For low-voltage signal input cables, it is recommended to use cables of 0.5 mm^2. AMP776286-1 is recommended for the corresponding female connectors.

It is recommended to keep the low-voltage signal cable and the power cable as far away as possible, and the distance between the two cables should be 100 mm.

When the controller is working, there is a large current flowing on the bus of the motor controller, and even if the power cable of reasonable wire diameter is selected, it will also cause a significant voltage drop between the negative terminal of the battery and the negative terminal of the controller, which means that different units in the whole control system There may be a voltage differential between the GND reference grounds, so it is highly recommended that all input/output pins of the sensor provided by the motor controller be connected directly to the corresponding input/output of the controller. Do not connect the signal wires arbitrarily, resulting in the instability of the whole system.

To avoid electromagnetic interference on the CAN bus, it is recommended to use twisted pair cables for the CAN connection lines. Ensure that the CAN cabling is kept at a distance from power cables. If crossing is necessary, the cables should intersect at 90° angles rather than running parallel to each other.

Use high-quality copper terminals and copper wires with excellent insulation properties and tightly connect the controller and battery according to the recommended torque values.

Power unit control

For optimum immunity to electromagnetic interference, the battery cables (B+, B-) do not cross the center of the controller as much as possible.

If there are multiple high-current power units in the system, please connect the negative end of the power unit with the negative terminal of the battery according to the star pattern.

MCU with platform software

ePowerpack software supports CANopen/CAN 1939 protocol control, but also analog control mode. The platform has a universal version of the program, the initial settings are as follows:
- CANbus standard protocol
- The external main relay is enabled by default

The motor rotation direction can be adjusted through parameters. The default rotation direction is right-handed. For more details, see section *Software* on page 31 in this user guide.

Efficiency

Efficiency curve

ED-EP130-T22-24-4000
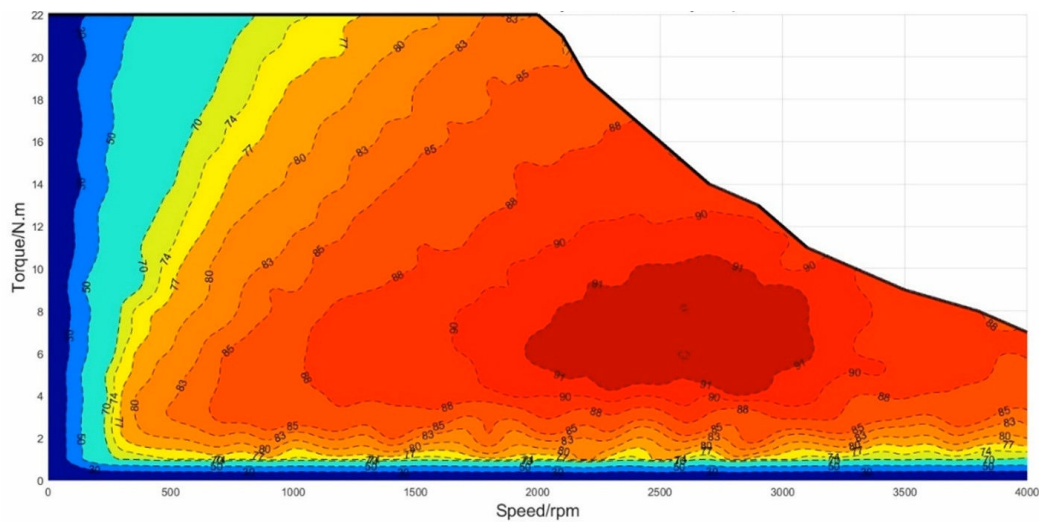
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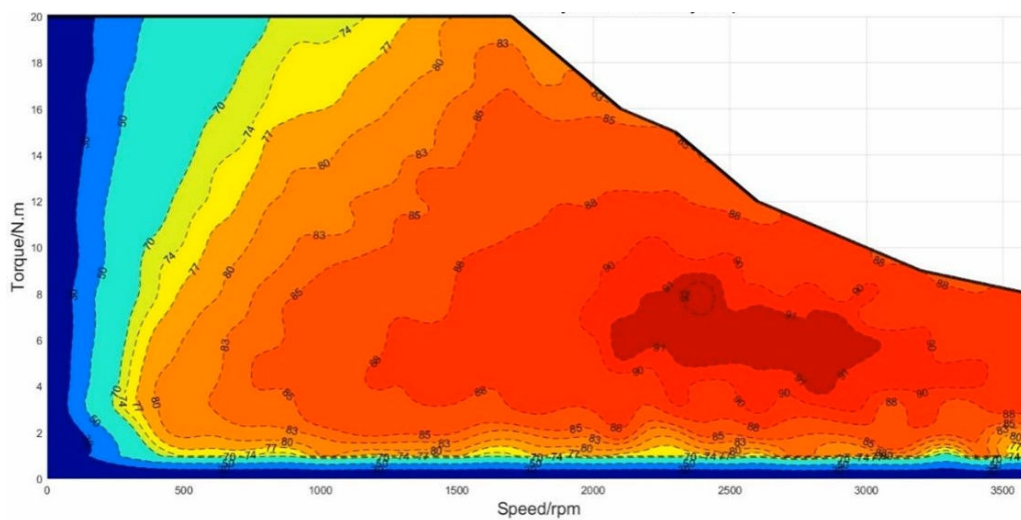
Efficiency

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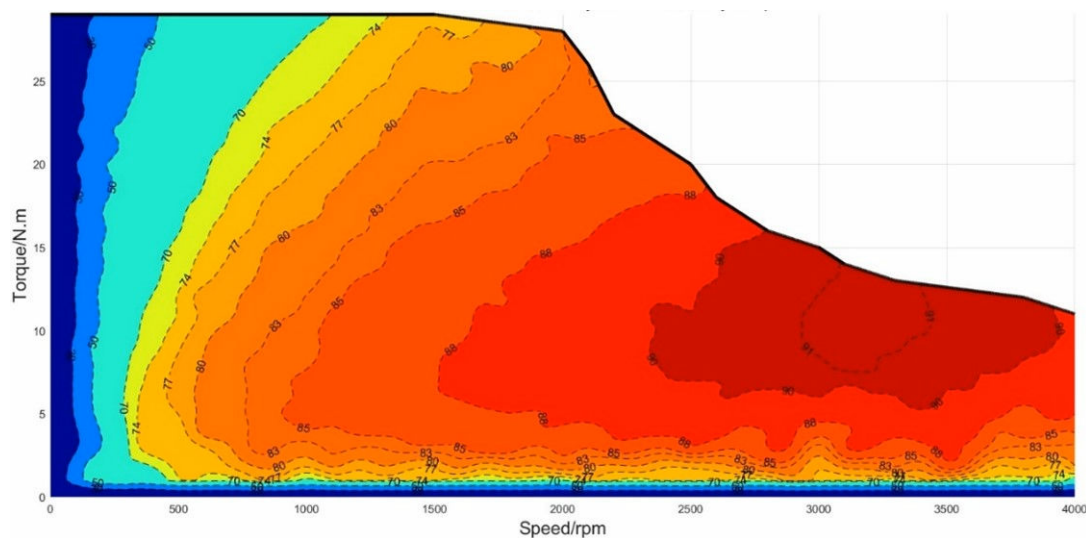
External characteristic curves under different duty cycles

ED-EP130-T22-24-4000
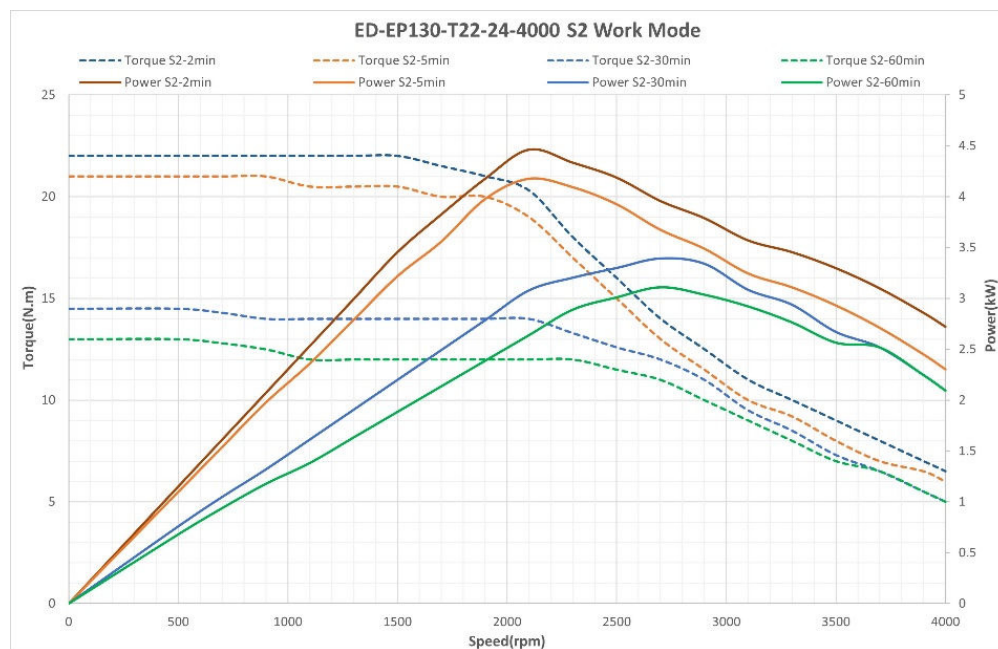
Efficiency

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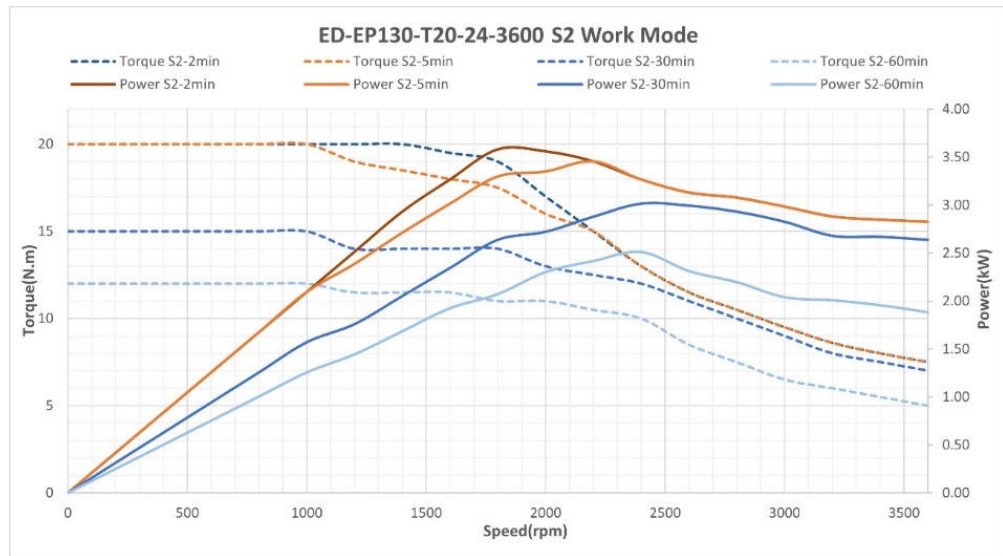
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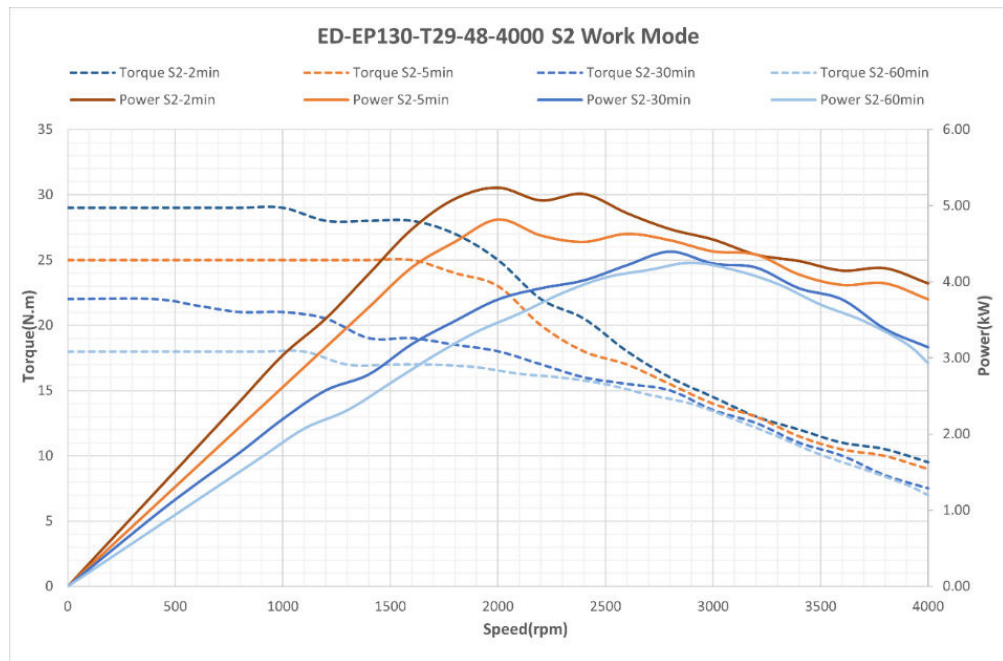
Software

System debug window

This interface contains real-time data display of ED-EP130 series products, manual speed request of motor and software version information display. The specific interface is shown in the figure below.

ePowerpack system debug window
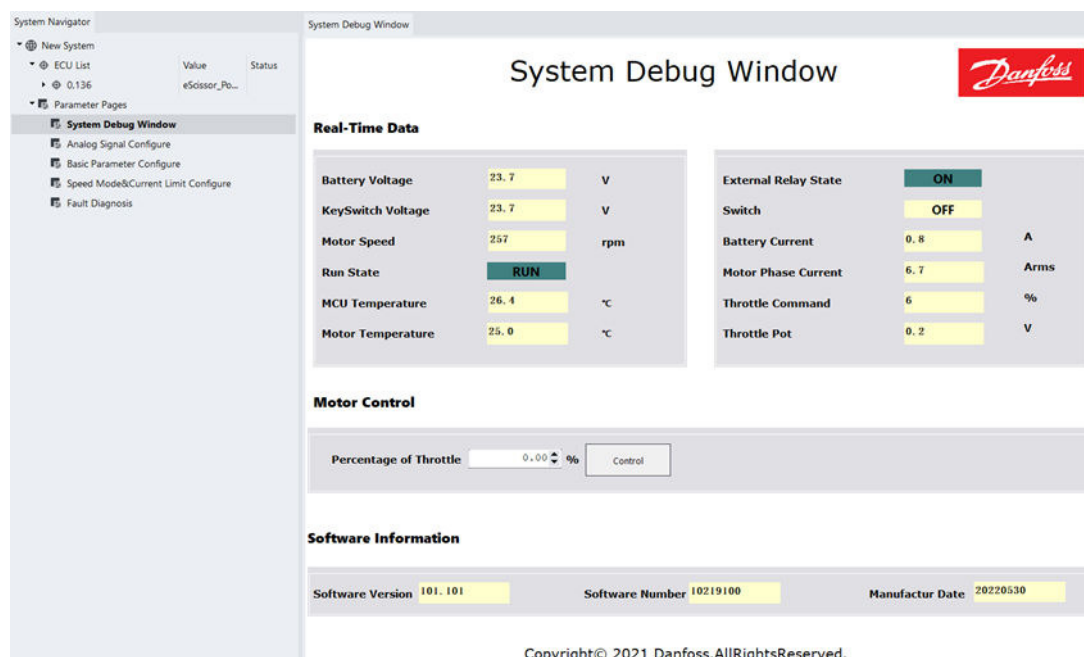
The parameters in the ePowerpack system debug window interface are explained in the following table.

Real-Time Data:

Real-Time Data are monitored values and cannot be modified.

Parameter name	Default value	Range	Unit	Description
Battery Voltage	/	0-200	V	Current battery voltage
Key Voltage	/	0-200	V	Current key voltage
Motor Speed	/	-20000–20000	RPM	Actual speed of current motor
Run State			/	Motor running status
MCU Temperature	/	-100-300	℃	Current MCU temperature value
Motor Temperature	/	-100-300	℃	Current motor temperature value
External Relay State	/	/	/	External contactor enabled or not
Switch	/	/	/	Enable identification, corresponding to Pin4;
Battery Current	/	0-2000	A	Battery current
Motor Phase Current	/	0-2000	Arms	Motor phase current
Throttle Command	/	0-100	%	Throttle command
Throttle Pot	/	0-5.5	V	Requested throttle command voltage

Motor control:

Software

After entering the value required in the data field corresponding to "Percentage of Throttle", click the "Control" button to write the value and further control the motor speed. Note: The value entered is a percentage value, and this function requires setting Rx Type to 5 in the "Basic Parameter Configure" interface.

Software Information:

Parameter name	Default value	Range	Unit	Description
Software Version	/	/	/	Current software version
Software Number	/	/	/	Current software No.
Manufactur Date	/	/	/	Manufacturing date

Analog signal configure

Throttle settings:

Software

Parameter name	Default value	Range	Unit	Description
Throttle Type	1	1-6	/	Throttle type: The throttle types can be configured as follows: (it is required to adjust the "User PDO Tx Enable" and "User PDO Rx Enable" to 0) 1: Single-ended voltage throttle; (used with Enable signal) 2: WigWag bilateral voltage throttle. 3-6: Reserved.
Gear Type	1	0-3	/	Motor rotation type: Corresponding to Pin5, if Pin5 is high level, Gear type is 0, the motor is subject to right-hand rotation, and if Pin5 is low level, Gear type is 1, and the motor is subject to left-hand rotation; 2 or 3 no function
Throttle Fliter	10	0.5-125	Hz	Throttle filtering
Fault Max Voltage	5.5	0-24	V	Maximum alarm voltage
Fault Min Voltage	0	0-24	V	Minimum alarm voltage
RxType	0			Set the form of data reception
TxType	0			Set the form of sending data

Forward (right-hand rotation) settings:

Parameter name	Default value (V)	Range	Description
Offset Voltage	0.01	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage1	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage2	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage3	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage4	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage5	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage6	/	0.01-5	Actual input throttle signal, corresponding to MAP
Max Voltage	5	0.01-5	Actual input throttle signal, corresponding to MAP
Parameter name	Default value (%)	Range	Remarks
Offset Map	0	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map1	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map2	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map3	/	0-100	Actual input throttle percentage, corresponding to the throttle signal

Software

Parameter name	Default value (V)	Range	Description
Map4	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map5	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map6	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Max Map	100	0-100	Actual input throttle percentage, corresponding to the throttle signal

Reverse (left-hand rotation) settings:

Parameter name	Default value (V)	Range	Description
Offset Voltage	0.01	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage1	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage2	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage3	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage4	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage5	/	0.01-5	Actual input throttle signal, corresponding to MAP
Input Voltage6	/	0.01-5	Actual input throttle signal, corresponding to MAP
Max Voltage	5	0.01-5	Actual input throttle signal, corresponding to MAP
Parameter name	Default value (%)	Range	Remarks
Offset Map	0	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map1	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map2	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map3	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map4	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map5	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Map6	/	0-100	Actual input throttle percentage, corresponding to the throttle signal
Max Map	100	0-100	Actual input throttle percentage, corresponding to the throttle signal

Software

Basic parameter configure

CAN interface:

Parameter name	Default value	Range	Description
BaudRate	250	125-500	Set the baud rate for CAN bus communication
PDOID	8	0-120	Set the process data object address
TxType	1	0-10	Set the form of sending data: the sending type is as follows: 0: Not send PDO message, analog control; 1: send ZAPI protocol message; 2: reserved; 3: reserved; 4: send Curtis protocol message; 7: send ZAPI protocol message; 5, 6, 8-10: reserved
RxType	1	0-10	Set the form of data reception: Receive message, 0: motor control by analog throttle; 1: Receive message of ZAPI protocol; 2: Motor control using DS14; 3: Aging test cycle forward and reverse control; 4: Receive message of Curtis protocol; 5: Service tool for motor control. 6-10: Reserved;
PDO1 TxMessage	/	/	Set the period of sending PDO1 data (ms)
PDO2 TxMessage	/	/	Set the period of sending PDO2 data (ms)
PDO1 RxTimeout	/	/	Set the PDO1 receiving data timeout (ms)
PDO2 RxTimeout	/	/	Set the PDO2 receiving data timeout (ms)
PDO Start Timeout	/	/	Set the PDO data exchange timeout (ms)

Software

Battery:

Parameter name	Default value	Range	Description
OverVoltage	135	105-200	Set the battery overvoltage value (%)
UnderVoltage	67	5-95	Set the EM undervoltage value (%)

Motion limitations:

Parameter name	Default value	Range	Description
Forward Max Speed	/	0-4000	Set the maximum forward speed (rpm)
Reverse Max Speed	/	0-4000	Set the maximum reverse speed (rpm)
Soft stop speed	300	0-Maximum speed	Point where soft stop starts (rpm)

Motor:

Parameter name	Default value	Range	Description
PMSM ENC Angle Offset	0.5	/	PMSM resolver angle zero setting
Motor Max Temp	149	-40-150	Maximum motor temperature ℃
HPD SRO type	0	0-4	0: Disable 1: Enable 2-4: Customer specifics Enable the verification of High Pedal Detection Prevent unintended acceleration ratios
MotorTemp LOS Speed	800	Customer specifically depends on load cycle	If there is no feedback from temperature sensor motor is going to defined speed

External contactor:

Parameter name	Default value	Range	Description
Contactor Enable	/	0, 1	Enable=1 to enable the external contactor function. Enable=0 to enable the external contactor function;
Contactor PullIn Voltage	/	0-100	Pull-in voltage (V), according to the actual contactor parameters;
Contactor Holding Voltage	/	0-100	Holding voltage (V), according to the contactor holding parameters;
Contactor DNC Threshold	/	/	DNC threshold (V), contactor DNC fault voltage threshold, this parameter not used;

Software

Speed mode & current limit configure

Control mode select:

Parameter name	Set range	Description
Control Mode Select	0	0: EP130 (Speed mode express, recommended for EP130) 1: EC-C24 (Speed mode, recommended for EC-C24) 2: In use for Debugging 3: Reserved

Speed mode 0:

Parameter name	Default value	Range	Description
Kp	10	0-100	P-value setting (%): Bottom layer adjusted, do not adjust unless necessary.
Ki	5	5-100	I-value setting (%): Bottom layer adjusted, do not adjust unless necessary.

Forward:

Parameter name	Default value	Range	Description
AccelRate	0.4	0.2-30	Acceleration time (S)
DecelRate	1	0.2-30	Deceleration time (S)
CAN timeout Decelrate	0.1	0.1-30	Cut-off time after bus failure
Partial decel rate	0.1	0.1-30	Reduce the speed to a value which is not zero (Just for speed mode)

Reverse:

Software

Parameter name	Default value	Range	Description
AccelRate	0.4	0.2-30	Acceleration time (S)
DecelRate	1	0.2-30	Deceleration time (S)
CAN timeout Decelrate	0.1	0.1-30	Cut-off time after bus failure
Partial decel rate	0.1	0.1-30	Reduce the speed to a value which is not zero (Just for speed mode)

Current limit page:

Parameter name	Current value	Range	Description
Drive Current Limit	100	1-100%	Drive current limit (%): Set the maximum phase current that the controller provides to the motor during drive operation, expressed as a percentage of the controller's nominal maximum current. Reducing this value will reduce the maximum drive torque.
Regen Current Limit	50	1-100%	Regenerative brake limit current (%): Set the maximum phase regenerative current, expressed as a percentage of the controller's nominal maximum current. The regenerative current limit applies to neutral throttle braking, reverse braking and downhill driving speed limit.
PL Normal Speed	1000	100-5000	PL rated speed (rpm): Set the base speed to be used in the drive and regenerative power limit mapping curves.
Delta Speed	200	50-1000	Delta speed (rpm): Set the speed increment used in the drive and regenerative power limit mapping curves

Drive limiting map:

Parameter name	Current value	Range	Description
Drive Normal Current	100	0-100	Rated drive current (%)
Plus Delta Current	100	0-100	Percentage of maximum drive current corresponding to the base speed.
Plus 2*Delta Current	100	0-100	Percentage of maximum drive current corresponding to the base speed plus 1x incremental speed.
Plus 4*Delta Current	75	0-100	Percentage of maximum drive current corresponding to the base speed plus 2x incremental speed
Plus 6*Delta Current	58	0-100	Percentage of maximum drive current corresponding to the base speed plus 3x incremental speed.
Plus 8*Delta Current	40	0-100	Percentage of maximum drive current corresponding to the base speed plus 4x incremental speed
Plus 16*Delta Current	38	0-100	Percentage of maximum drive current corresponding to the base speed plus 5x incremental speed

Software

Service tool

Schematic diagram of analog throttle control
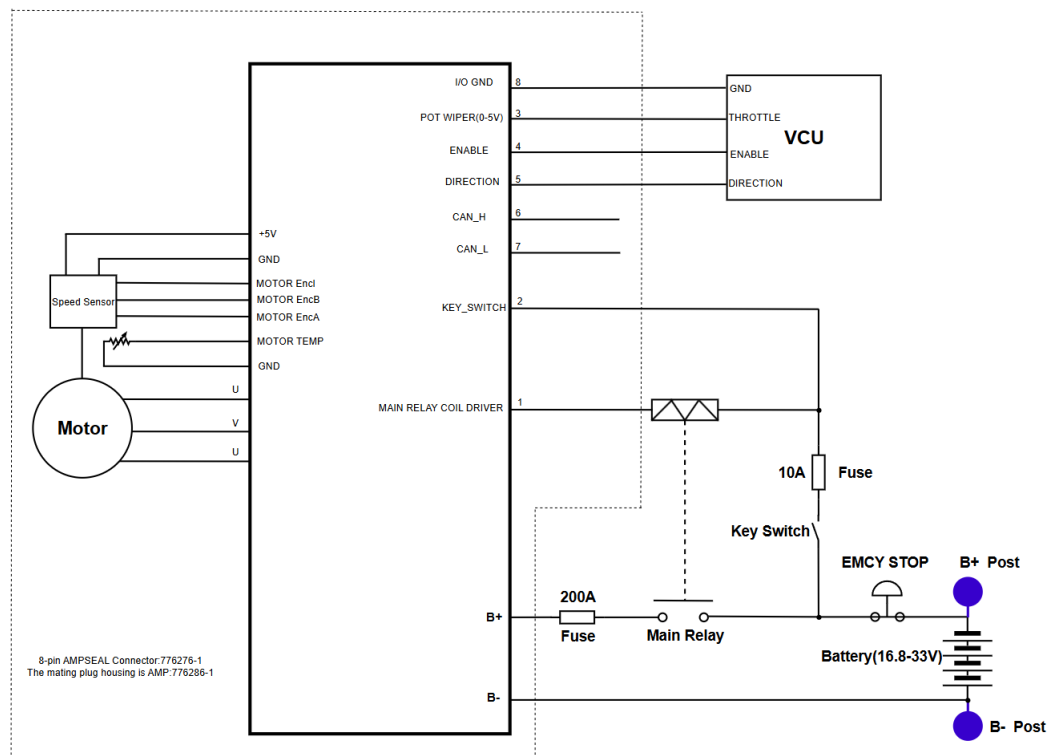
Schematic diagram of bus control
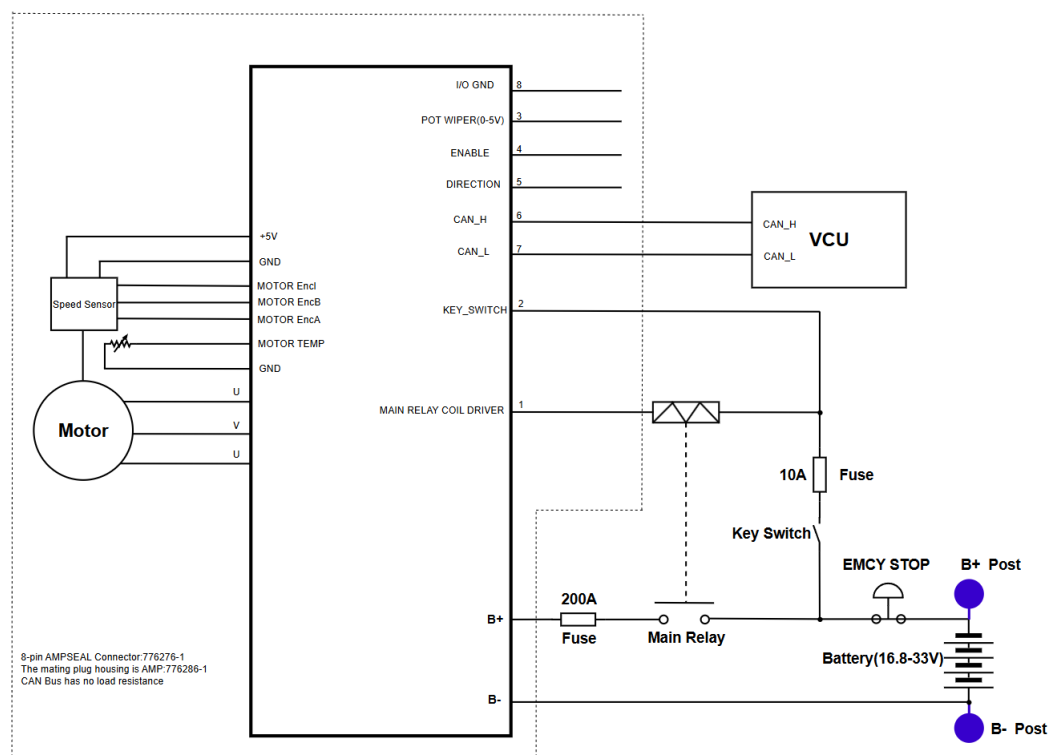
Software

J1939 communication protocol

This standard specifies the communication protocol between the Motor Control Unit (MCU) and the Vehicle Control Unit (VCU) of vehicles. The CAN identifier of this standard is 29 bits, and the communication baud rate is 250 Kbps. This standard refers to the relevant provisions of CAN 2.0B and SAE J1939 protocol.

Format convention

Terminology

CAN: Controller Area Network

VCU: Vehicle Control Unit

MCU: Motor Control Unit

Data format

This protocol follows the Intel format with the low bit first and the high bit last. The data format follows the following specifications: Data sent by VCU and MCU: Actual Data = Message Data * Resolution + Offset. Suppose the data resolution is k, x is the data sent by the message, y is the actual value, and b is the offset, then:

$y=kx+b$

$x=(y-b)/k$

Datatype:

No.	Name of data type	Data type	Description
1	1 bit Bit Data	Bit	0~1
2	8 bit Unsigned Integer	UINT8	0~255
3	8 bit Signed Integer	SINT8	-128~127
4	16 bit Unsigned Integer	UINT16	0~65535
5	16 bit Signed Integer	SINT16	-32768~32767
6	32 bit Unsigned Integer	UINT32	0~4294967295
7	32 bit Signed Integer	SINT32	-2147483648~ 2147483647

Address allocation

Module	Abbreviation	Address	Note
Vehicle Control Unit	VCU	229 (0xE5)	New definition **(Address configurable)**
Motor Control Unit	MCU	46 (0x2E)	SAE1939 definition **(Address configurable)**

Protocol Data Unit (PDU) format

The SAE J1939-21 specification defines two PDU formats: PDU1 format (PS for the target address) and PDU2 format (PS for group extension). The PDU2 format is used for transmissions that do not point to a specific destination address. This standard adopts the PDU2 format. The frame format is as shown in the following figure:

Software
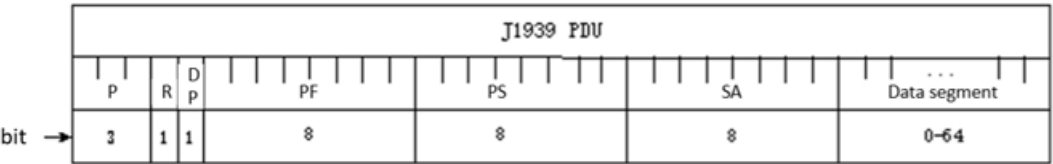
Definition: P is the priority, R is the reserved bit, DP is the data page, PF is the PDU format, PS is the specific PDU, and SA is the source address.

CAN data frame definition

MCU Receive Data

Whether CRC-8 (Init 0x00) and Stuffing are enabled can be controlled by the corresponding parameter values. The PS and SA for MCU data reception can be modified through the J1939 Receive PS and J1939 Receive SA parameters.

Software

R.1 VCU Command Frame

OUT	IN	LEN	ID						Period (ms)
VCU	MCU	8	0x18FF21E5						100
			P	R	DP	PF	PS	SA	
			6	0	0	255	33	229	

Data

Position		Data Name	Datatype	Resolution	Offset	Value Range
BYTE	BIT					
BYTE1	7~0	Target Speed	UINT16	1 rpm/bit	0	0~8000
BYTE2	7~0	(Low byte first)				(0~8000rpm)
BYTE3	0	Reserved	1bit	Reserved	Reserved	Reserved
	1	Interlock Enable	1bit	1/bit	0	('1' signal must be sent to initiate rotation)
	2	Reserved	1bit	Reserved	Reserved	Reserved
	3	Forward	1bit	1/bit	0	1: Forward (Configure rotation direction)
	4	Reverse	1bit	1/bit	0	1: Reverse (Opposite direction of forward)
	6~5	Reserved	2bit	Reserved	Reserved	Reserved
	7	Stuffing	1bit	1/bit	0	0, 1 is sent alternately (Customizable)
BYTE4	7~0	Acceleration Time	UINT16	1 ms/bit	0	Optional (0x00 allowed)
BYTE5	7~0					
BYTE6	7~0	Deceleration Time	UINT16	1 ms/bit	0	Optional (0x00 allowed)
BYTE7	7~0					
BYTE8	7~0	CRC-8	UINT8	1/bit	0	CRC-8 verification code (Customizable)

Stuffing and CRC check can be configured to be enabled or not. If enabled, the VCU must send according to the rules for the message to be effectively recognized.

If the first 7 bits of the sent message are respectively: 0xD0 0x07 0x0A 0x00 0x00 0x00 0x00, through CRC-8 verification, the eighth byte needs to send 0x1E. That is ID: 0x18FF21E5| Data: D0 07 0A 00 00 00 00 1E.

MCU Send Data

In the communication direction, data is transmitted from the MCU to the VCU, and the VCU receives the data frame for parsing. Display the corresponding MCU parameters and respond to the faults reported by the MCU.

Software

The PS (Parameter Group Number) and SA (Source Address) of the first message ID sent by the MCU can be modified via the J1939 Send PS and J1939 Send SA parameters. For subsequent message IDs, the PS value increments sequentially based on the first message's PS (i.e., PS = Initial PS + 1, cumulative).

T.1 MCU Transmit Frame 1

OUT	IN	LEN	ID							Period(ms)
MCU	VCU	8	0x18FF222E							100
			P	R	DP	PF	PS	SA		
			6	0	0	255	34	46		

Data							
Position		**Data Name**	**Datatype**	**Resolution**	**Offset**	**Value Range**	
BYTE	**BIT**						
BYTE1	7~0	Speed	SINT16	1 rpm/bit	0	-8000~8000	
BYTE2	7~0	(Low byte first)				(-8000~8000 rpm)	
BYTE3	0	Work Status	1bit	1/bit	0	1: Run / 0: Stop	
	1	Main Relay Status	1bit	1/bit	0	0: Main Relay open / 1: Main Relay close	
	7~2	Reserved	6bit	Reserved	Reserved	Reserved	
BYTE4	7~0	Reserved	UINT8	Reserved	Reserved	Reserved	
BYTE5	0	Interlock Status	1bit	1/bit	0	0: Interlock Disability / 1: Interlock ability	
	1	Forward	1bit	1/bit	0	1: Forward	
	2	Reverse	1bit	1/bit	0	1: Reverse	
	6~3	Reserved	4bit	Reserved	Reserved	Reserved	
	7	Stuffing	1bit	1/bit	0	0, 1 is sent alternately	
BYTE6	7~0	Reserved	UINT8	Reserved	Reserved	Reserved	
BYTE7	7~0	Reserved	UINT8	Reserved	Reserved	Reserved	
BYTE8	7~0	CRC-8	UINT8	1/bit	0	CRC-8 verification code (Customizable)	

If the first 7 bits of the sent message are respectively: 0x01 0x02 0x03 0x04 0x05 0x06 0x08, through CRC-8 verification, the eighth byte needs to send 0xF5. That is ID: 0x18FF222E | Data: 01 02 03 04 05 06 08 F5.

Software

T.2 MCU Transmit Frame 2

OUT	IN	LEN	ID						Period (ms)
MCU	VCU	8	0x18FF232E						100
			P	R	DP	PF	PS	SA	
			6	0	0	255	35	46	

Data

Position		Data Name	Datatype	Resolution	Offset	Value Range
BYTE	BIT					
BYTE1	7~0	Fault Code	UINT16	1/bit	0	See Fault Code Table
BYTE2	7~0					
BYTE3	7~0	Phase Current	SINT16	0.1 A/bit	0	-32768~32767 (-3276.8~3276.7 A)
BYTE4	7~0					
BYTE5	7~0	Torque	SINT16	0.1 Nm/bit	0	-32768~32767 (-3276.8~3276.7 Nm)
BYTE6	7~0					
BYTE7	7~0	Motor Temperature	UINT8	1 ℃/bit	-40	0~255 (-40~215 ℃)
BYTE8	7~0	CRC-8	UINT8	1/bit	0	CRC-8 verification code (Customizable)

If the first 7 bits of the sent message are respectively: 0x01 0x02 0x03 0x04 0x05 0x06 0x08,   through CRC-8 verification, the eighth byte needs to send 0xF5. That is ID: 0x18FF232E | Data: 01 02 03 04 05 06 08 F5.

Software

T.3 MCU Transmit Frame 3

OUT	IN	LEN	ID							Period (ms)
MCU	VCU	8	0x18FF242E							100
			P	R	DP	PF	PS	SA		
			6	0	0	255	36	46		

Data

Position		Data Name	Datatype	Resolution	Offset	Value Range
BYTE	**BIT**					
BYTE1	7~0	Bus Voltage	UINT16	0.1 V/bit	0	0~1050 (0.0~105.0 V)
BYTE2	7~0					
BYTE3	7~0	Bus Current	SINT16	0.1 A/bit	0	0~10000 (0.0~1000.0 A)
BYTE4	7~0					
BYTE5	7~0	BDI	UINT8	1 %/bit	0	0~100 (0~100 %) Reserved for BDI, the value is not for reference
BYTE6	7~0	Reserved	UINT8	Reserved	Reserved	Reserved
BYTE7	7~0	Controller Temperature	UINT8	1 ℃/bit	-40	0~255 (-40~215 ℃)
BYTE8	7~0	CRC-8	UINT8	1/bit	0	CRC-8 verification code

If the first 7 bits of the sent message are respectively: 0x01 0x02 0x03 0x04 0x05 0x06 0x08，through CRC-8 verification, the eighth byte needs to send 0xF5. That is ID: 0x18FF242E | Data: 01 02 03 04 05 06 08 F5.

Software

T.4 MCU Transmit Frame 4

OUT	IN	LEN	ID						Period (ms)
MCU	VCU	8	0x18FF252E						100
			P	R	DP	PF	PS	SA	
			6	0	0	255	37	46	

Data						
Position		**Data Name**	**Datatype**	**Resolution**	**Offset**	**Value Range**
BYTE	**BIT**					
BYTE1	7~0	SSW Version	UINT16	0.01/bit	0	0~65535
BYTE2	7~0					(0~655.35)
BYTE3	7~0	TSW Version	UINT16	0.01/bit	0	0~65535
BYTE4	7~0					(0~655.35)
BYTE5	7~0	Lamp Display Code	UINT8	1/bit	0	See Fault Code Table
BYTE6	7~0	Reserved	UINT8	Reserved	Reserved	Reserved
BYTE7	7~0	Reserved	UINT8	Reserved	Reserved	Reserved
BYTE8	7~0	CRC-8	UINT8	1/bit	0	CRC-8 verification code

DM1

DM1, which stands for Active Diagnostic Trouble Codes, is one of the most critical diagnostic messages defined in the SAE J1939 protocol family. The DM1 message is used to proactively and in real-time report currently existing, active faults to other devices on the network.

Send DM1 messages according to the J1939-73 protocol. The message transmission rules for no-fault or single-fault conditions are as follows:

The SPNs for Proprietary Diagnostics cover the range 520192 to 524287.

Software

T.5 DM1 No-fault or Single-DTC Transmit Frame 5

OUT	IN	LEN	ID							Period (ms)
MCU	VCU	8	0x18FECA2E							1000
			P	R	DP	PF	PS	SA		
			6	0	0	254	202	46		

Data

Position		Data Name	Datatype	Resolution	Offset	Value Range
BYTE	**BIT**					
BYTE1	7~6	Malfunction Indicator Lamp Status	2bit	1/bit	0	00: Lamp Off 01: Lamp On
	5~4	Red Stop Lamp Status	2bit	1/bit	0	00: Lamp Off 01: Lamp On
	3~2	Amber Warning Lamp Status	2bit	1/bit	0	00: Lamp Off 01: Lamp On
	1~0	Protect Lamp Status	2bit	1/bit	0	00: Lamp Off 01: Lamp On
BYTE2	7~6	Flash Malfunction Indicator Lamp	2bit	1/bit	0	11: Reserved
	5~4	Flash Red Stop Lamp	2bit	1/bit	0	11: Reserved
	3~2	Flash Amber Warning Lamp	2bit	1/bit	0	11: Reserved
	1~0	Flash Protect Lamp	2bit	1/bit	0	11: Reserved
BYTE3	7~0	SPN	UINT8	1/bit	0	8 least significant bits of SPN (Most significant at bit 8)
BYTE4	7~0		UINT8	1/bit	0	The second byte of SPN (Most significant at bit 8)
BYTE5	7~5		3bit	1/bit	0	3 most significant bits (Most significant at bit 8) SPN See Fault Code
	4~0	FMI	5bit	1/bit	0	(most significant at bit 5) See Fault Code Table
BYTE6	7	SPN Conversion Method	1bit	1/bit	0	0: 0 Mode
	6~0	Occurrence Count	7bit	1/bit	0	0~127
BYTE7	7~0	Reserved	UINT8	Reserved	Reserved	0xFF: Reserved
BYTE8	7~0	Reserved	UINT8	Reserved	Reserved	0xFF: Reserved

e.g., currently, there is an active fault with:

SPN = 455596 (0x6F3AC) FMI = 1 OC = 1 CM = 0, So DTC = AC F3 C1 01, Lamp Status = 0x04

If there is a single fault, the message is ID: 0x18FECA2E | Data: 04 FF AC F3 C1 01 FF FF.

If there is no fault, the message is ID: 0x18FECA2E | Data: 00 FF 00 00 00 00 FF FF.

Multi-DTC Message Transmission via J1939-21 TP.CM_BAM Protocol.

Software

T.6 TP.CM_BAM

OUT	IN	LEN	ID						Period (ms)
MCU	VCU	8	0x18ECFF2E						100
			P	R	DP	PF	PS	SA	
			6	0	0	236	255	46	

Data

Position		Data Name	Datatype	Resolution	Offset	Value Range
BYTE	BIT					
BYTE1	7~0	Control Byte	UINT8	1/bit	0	32(0x20): Broadcast Announce Message
BYTE2	7~0	Total Message Size	UINT16	1/bit	0	10~1785
BYTE3	7~0					Number of bytes
BYTE4	7~0	Packets Number	UINT8	1/bit	0	2~255 Total number of packets
BYTE5	7~0	Reserved	UINT8	Reserved	Reserved	0xFF: Reserved
BYTE6	7~0	PGN	UINT24	1/bit	0	0x00FECA: Parameter Group Number of the packeted message
BYTE7	7~0					
BYTE8	7~0					

T.7 TP.DT

OUT	IN	LEN	ID						Period (ms)
MCU	VCU	8	0x18EBFF2E						50~200 (Since the last message cycle of BAM/DT)
			P	R	DP	PF	PS	SA	
			6	0	0	235	255	46	

Data

Position		Data Name	Datatype	Resolution	Offset	Value Range
BYTE	BIT					
BYTE1	7~0	Sequence Number	UINT8	1/bit	0	1~255
BYTE2	7~0	Packetized Data	UINT8	1/bit	0	
BYTE3	7~0	Packetized Data	UINT8	1/bit	0	Populate DTC1, DTC2…
BYTE4	7~0	Packetized Data	UINT8	1/bit	0	in sequence, the extra bytes
BYTE5	7~0	Packetized Data	UINT8	1/bit	0	should be filled with 0xFF.
BYTE6	7~0	Packetized Data	UINT8	1/bit	0	SPN& FMI see Fault Code Table
BYTE7	7~0	Packetized Data	UINT8	1/bit	0	
BYTE8	7~0	Packetized Data	UINT8	1/bit	0	

e.g., currently, there are two active faults:

Fault #1

Software

SPN = 521132(0x7F3AC), FMI = 1, OC = 1, CM = 0, DTC = AC F3 E1 01, Lamp Status = 0x04

Fault #2

SPN = 455472(0x6F330), FMI = 3, OC = 2, CM = 0, DTC = 30 F3 C3 02, Lamp Status = 0x10

The data to be transmitted is as follows: 0x10 0xFF AC F3 E1 01 30 F3 C3 02.

Multi-Fault Message is as follows:

TP.CM_BAM ID: 0x18ECFF2E | Data: 20 0A 00 02 FF CA FE 00.

TP.DT1 ID: 0x18EBFF2E | Data: 01 10 FF AC F3 E1 01 30.

TP.DT2 ID: 0x18EBFF2E | Data: 02 F3 C3 02 FF FF FF FF.

Other CAN message

This Message is only used to connect with upper computer software.

T.8 Upper Computer Connection Status Frame

OUT	IN	LEN	ID		Period (ms)
VCU	MCU	1	0x780+NodeID DS14		100
Data					
Position		**Data Name**	**Datatype**	**Resolution**	**Offset**	**Value Range**
BYTE	**BIT**					
BYTE1	7~0	Connect Status	UINT8	1/bit	0	0x00：Not Connect 0xAA：Connect

Fault codes

ED-EP130 series fault code table

Lamp Display	Fault Name	Lamp Display Code (Hex)	Fault Code (Hex)	DM1				
				Lamp	Lamp Status	SPN (Hex)	SPN (Dec)	FMI
1long 2short	Controller Overcurrent	0x12	0xFFC4	Red Stop	0x10	0x703	1795	0
1 long 3short	Current Sensor Fault1	0x13	0x7010	Red Stop	0x10	0x703	1795	12
1 long 3short	Current Sensor Fault2	0x13	0x7010	Red Stop	0x10	0x703	1795	12
1long 4short	Controller Severe Undertemp	0x14	0x7011	Red Stop	0x10	0x470	1136	1
1long 5short	Controller Severe Overtemp	0x15	0x4210	Red Stop	0x10	0x470	1136	0
1long 6short	B+ Severe Undervoltage	0x16	0xFF42	Red Stop	0x10	0x9E	158	1
1long 7short	B+ Severe Overvoltage	0x17	0xFFEB	Red Stop	0x10	0x9E	158	0
1long 8short	Controller Temp Sensor Fault	0x18	0x4211	Amber Warning	0x04	0x470	1136	12

Software

ED-EP130 series fault code table (continued)

Lamp Display	Fault Name	Lamp Display Code (Hex)	Fault Code (Hex)	DM1				
				Lamp	Lamp Status	SPN (Hex)	SPN (Dec)	FMI
2long 1short	Controller Undertemp Cutback (Controller low temperature drop current)	0x21	0x7011	Amber Warning	0x04	0x470	1136	18
2long 2short	Controller Overtemp Cutback (Controller high temperature drop current)	0x22	0x4210	Amber Warning	0x04	0x470	1136	16
2long 3short	B+ Undervoltage Cutback (B+ undervoltage drop current)	0x23	0xFF42	Amber Warning	0x04	0x9E	158	18
2long 4short	B+ Overvoltage Cutback (B+ overvoltage drop current)	0x24	0xFFEB	Amber Warning	0x04	0x9E	158	16
2long 5short	Motor Temp Hot Cutback (Motor high temperature drop current)	0x25	0x4110	Amber Warning	0x04	0x464	1124	16
2long 6short	Motor Temp Sensor Fault	0x26	0x4311	Amber Warning	0x04	0x464	1124	12
2long 7short	External Relay On Fault (External relay open)	0x27	0x5441	Red Stop	0x10	0xDB3	3507	5
2long 8short	External Relay Off Fault (External relay short)	0x28	0x3211	Red Stop	0x10	0xDB3	3507	6
3long 1short	External Relay Did Not Close	0x31	0x3221	Red Stop	0x10	0xDB3	3507	7
3long 2short	Bus OverCurrent	0x32	0xFFB4	Amber Warning	0x04	0xA13	2579	16
3long 3short	Bus OverCurrent CutOff	0x33	0xFFB4	Red Stop	0x10	0xA13	2579	0
3long 5short	Motor Open	0x35	0x7012	Red Stop	0x10	0x414	1044	5
3long 6short	Throttle Wiper High (High throttle signal voltage)	0x36	0xFFE2	Red Stop	0x10	0xD88	3464	0
3long 7short	Throttle Wiper Low (Low throttle signal voltage)	0x37	0xFFE2	Red Stop	0x10	0xD88	3464	1
3long 8short	EEPROM Failure	0x38	0x3610	Red Stop	0x10	0x7F000	520192	13
4long 1short	HPD/Sequencing Fault	0x41	0xFF4E	Red Stop	0x10	0x7F001	520193	19
4long 2short	Parameter Change Fault	0x42	0x7013	Red Stop	0x10	0x7F002	520194	13
4long 3short	CAN Timeout	0x43	0x8130	Red Stop	0x10	0xB25	2853	8
4long 4short	Stall Detected	0x44	0xFFD3	Red Stop	0x10	0x24D	589	1

Software

ED-EP130 series fault code table (continued)

Lamp Display	Fault Name	Lamp Display Code (Hex)	Fault Code (Hex)	DM1				
				Lamp	Lamp Status	SPN (Hex)	SPN (Dec)	FMI
4long 5short	Over Speed Fault	0x45	0x7014	Red Stop	0x10	0x24D	589	0
4long 6short	Keyswitch Voltage Fault	0x46	0x5114	Red Stop	0x10	0x9E	158	13
4long 7short	Controller Internal Fault14 (Driving voltage fault)	0x47	0xFFE9	Red Stop	0x10	0x7F00F	520207	12
4long 8short	Controller Internal Fault1 (MOSA voltage detection fault)	0x48	0xFFE9	Red Stop	0x10	0x7F003	520195	12
5long 1short	Controller Internal Fault2 (MOSB voltage detection fault)	0x51	0xFFE9	Red Stop	0x10	0x7F004	520196	12
5long 2short	Controller Internal Fault3 (MOSC voltage detection fault)	0x52	0xFFE9	Red Stop	0x10	0x7F005	520197	12
5long 3short	Controller Internal Fault7 (Phase A voltage detection fault)	0x53	0x3201	Red Stop	0x10	0x7F009	520201	12
5long 4short	Controller Internal Fault8 (Phase B voltage detection fault)	0x54	0x3201	Red Stop	0x10	0x7F00A	520202	12
5long 5short	Controller Internal Fault9 (Phase C voltage detection fault)	0x55	0x3201	Red Stop	0x10	0x7F00B	520203	12
5long 6short	Controller Internal Fault10 (Overcurrent detection sensor A fault)	0x56	0x3201	Red Stop	0x10	0x7F00C	520204	12
5long 7short	Controller Internal Fault11 (Overcurrent detection sensor B fault)	0x57	0x3201	Red Stop	0x10	0x7F00D	520205	12
5long 8short	Controller Internal Communication Fault	0x58	0x7015	Red Stop	0x10	0x7F010	520208	2
6long 1short	Controller Internal Fault13 (Parameters synchronization fault)	0x61	0x7016	Red Stop	0x10	0x7F00E	520206	12
6long 3short	Precharge Failed	0x63	0x3130	Red Stop	0x10	0x7F011	520209	12
6long 4short	Controller Internal Fault4 (Phase A upper switch voltage detection fault)	0x64	0xFFE9	Red Stop	0x10	0x7F006	520198	12
6long 5short	Controller Internal Fault5 (Phase B upper switch voltage detection fault)	0x65	0xFFE9	Red Stop	0x10	0x7F007	520199	12
6long 6short	Controller Internal Fault6 (Phase C upper switch voltage detection fault)	0x66	0xFFE9	Red Stop	0x10	0x7F008	520200	12

Software

ED-EP130 series fault code table (continued)

Lamp Display	Fault Name	Lamp Display Code (Hex)	Fault Code (Hex)	DM1				
				Lamp	Lamp Status	SPN (Hex)	SPN (Dec)	FMI
6long 7short	Regen Ansyn Speed Fault (Energy recovery speed fault (Energy recovery increase))	0x67	0xFFA1	Red Stop	0x10	0x7F012	520210	10
7long 1short	Motor Temp Stop Fault (Motor over temp stop fault (Energy recovery increase))	0x71	0xFFB5	Red Stop	0x10	0x464	1124	0
7long 4short	Travel Control Fault	0x74	0x7628	Red Stop	0x10	0x7F013	520211	10
7long 5short	Safety Stop Fault	0x75	0x7629	Red Stop	0x10	0x7F014	520212	10
7long 6short	Cross Check Fault	0x76	0x7630	Red Stop	0x10	0x7F015	520213	19
7long 7short	Software Fault	0x77	0x7631	Red Stop	0x10	0x21A1	8609	13

Fault Code 0xFFA1, which does not occur without energy recovery.

SPN table

SPN table

SPN (Hex)	SPN (Dec)	SPN name	Type
0x9E	158	Battery Voltage	Standard SPN
0x24D	589	Motor Speed	
0x414	1044	Hydraulic Pump Motor	
0x464	1124	Motor Temperature	
0x470	1136	MCU Temperature	
0x703	1795	Motor Current	
0xA13	2579	Bus Current	
0xB25	2853	CAN Communication	
0xD88	3464	Throttle Wiper	
0xDB3	3507	MCU External Relay	
0x21A1	8609	Software	

Software

SPN table (continued)

SPN (Hex)	SPN (Dec)	SPN name	Type
0x7F000	520192	EEPROM Failure	Danfoss Defined SPN
0x7F001	520193	HPD Fault	
0x7F002	520194	MCU Parameter Change Fault	
0x7F003	520195	Controller Internal Fault1 (MOSA voltage detection fault)	
0x7F004	520196	Controller Internal Fault2 (MOSB voltage detection fault)	
0x7F005	520197	Controller Internal Fault3 (MOSC voltage detection fault)	
0x7F006	520198	Controller Internal Fault4 (Phase A upper switch voltage detection fault)	
0x7F007	520199	Controller Internal Fault5 (Phase B upper switch voltage detection fault)	
0x7F008	520200	Controller Internal Fault6 (Phase C upper switch voltage detection fault)	
0x7F009	520201	Controller Internal Fault7 (Phase A voltage detection fault)	
0x7F00A	520202	Controller Internal Fault8 (Phase B voltage detection fault)	
0x7F00B	520203	Controller Internal Fault9 (Phase C voltage detection fault)	
0x7F00C	520204	Controller Internal Fault10 (Overcurrent detection sensor A fault)	
0x7F00D	520205	Controller Internal Fault11 (Overcurrent detection sensor B fault)	
0x7F00E	520206	Controller Internal Fault13 (Parameters synchronization fault)	
0x7F00F	520207	Controller Internal Fault14 (Driving voltage fault)	
0x7F010	520208	Controller Internal Communication	
0x7F011	520209	Precharge	
0x7F012	520210	Regen Ansyn Speed Fault (Energy recovery speed fault (Energy recovery increase))	
0x7F013	520211	Travel Control	
0x7F014	520212	Safety Stop	
0x7F015	520213	Cross Check	

Software

SPN check and fix table

SPN check and fix table

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x703	0	Controller Overcurrent	1. Phase-to-phase short circuit in the motor. 2. Error in parameter adjustment for the controller. 3. The controller itself has malfunctioned.	Fault occurrence condition: The measured phase current of the motor exceeds the set overcurrent value. Method to clear the fault: Restart the controller after eliminating possible causes of the fault.
0x703	12	Current Sensor Fault1	1. The controller itself has malfunctioned. 2. Phase-to-frame short circuit in the motor.	Fault occurrence condition: Incorrect reading of the current sensor offset in the controller. Method to clear the fault: Restart the controller after eliminating possible causes of the fault.
0x703	12	Current Sensor Fault2	1. The controller itself has malfunctioned. 2. Phase-to-frame short circuit in the motor.	Fault occurrence condition: Incorrect reading of the current sensor offset in the controller. Method to clear the fault: Restart the controller after eliminating possible causes of the fault.
0x470	1	Controller Severe Undertemp	1. The controller operates at extreme ambient temperatures. 2. Incorrect temperature detection by the controller.	Fault occurrence condition: The controller temperature is below -40℃. Method to clear the fault: Restart the system using the key switch when the controller temperature rises above -40℃.
0x470	0	Controller Severe Overtemp	1. Operation of the controller at extremely ambient temperatures; 2. Incorrect temperature detection by the controller. 3. Excessive load on the motor. 4. Poor heat dissipation in the controller.	Fault occurrence condition: The controller temperature exceeds +95℃. Method to clear the fault: Restart the safety interlock or key switch when the controller temperature drops below +95℃.
0x9E	1	B+ Severe Undervoltage	1. Improper battery parameters. 2. Non-controller systems draining the battery. 3. Excessive battery resistance. 4. Battery disconnection during operation. 5. Fuse or main contactor failed to close.	Fault occurrence condition: When drive is enabled, the input voltage drops below the severe undervoltage limit. Method to clear the fault: Restart the controller when the input voltage rises above the severely undervoltage limit.
0x9E	0	B+ Severe Overvoltage	1. Improper battery parameters. 2. Excessive battery resistance. 3. Battery disconnection during regenerative braking.	Fault occurrence condition: When drive is enabled, the input voltage exceeds the severe overvoltage limit. Method to clear the fault: Restart the key switch when the input voltage drops below the severely overvoltage limit.

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x470	12	Controller Temp Sensor Fault	1. Internal controller failure.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: Power off and restart the key switch. If the fault persists, return the controller for repair.
0x470	18	Controller Undertemp Cutback (Controller low temperature drop current)	1. Operation of the controller at low ambient temperatures. 2. Incorrect temperature detection by the controller.	Fault occurrence condition: The controller temperature is below -30℃. Device performance is derated from -30℃ to -40℃. Method to clear the fault: The controller temperature must rise above -30℃.
0x470	16	Controller Overtemp Cutback (Controller high temperature drop current)	1. Performance limitation of the controller at this temperature. 2. Operation of the controller at extreme ambient temperatures. 3. Incorrect temperature detection by the controller. 4. Excessive vehicle load. 5. Poor heat dissipation in the controller.	Fault occurrence condition: The controller temperature exceeds +85℃. Method to clear the fault: The controller temperature must drop below +85℃.
0x9E	18	B+ Undervoltage Cutback (B+ undervoltage drop current)	1. Normal operation. The fault indicates that the battery needs charging. Controller performance is limited at this voltage. 2. Improper battery parameters. 3. Non-controller systems draining the battery. 4. Excessive battery resistance. 5. Battery disconnection during operation. 6. Fuse or main contactor failed to close.	Fault occurrence condition: The input voltage drops below the undervoltage limit. Method to clear the fault: The input voltage must rise above the undervoltage limit
0x9E	16	B+ Overvoltage Cutback (B+ overvoltage drop current)	1. Normal operation. The fault indicates that regenerative braking current has increased the battery voltage during regenerative braking. Controller performance is limited at this voltage. 2. Improper battery parameters. 3. Excessive battery resistance. 4. Battery disconnection during regenerative braking.	Fault occurrence condition: The input voltage exceeds the overvoltage limit. Method to clear the fault: The input voltage must drop below the overvoltage limit

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x464	16	Motor Temp Hot Cutback (Motor high temperature drop current)	1. The motor temperature has exceeded the set motor high-temperature derating threshold, and the motor current output is limited. 2. Incorrect adjustment of motor temperature control parameters. 3. If the application does not use a motor thermistor, the temperature compensation function should be disabled.	Fault occurrence condition: The motor temperature exceeds the set motor high-temperature derating threshold. Method to clear the fault: The motor temperature must drop to within the set range.
0x464	12	Motor Temp Sensor Fault	1. The motor temperature sensor is not properly connected. 2. The motor temperature sensor detection function has not been disabled when no temperature sensor is used.	Fault occurrence condition: The voltage at the motor temperature sensor input port is outside the normal operating range corresponding to the temperature sensor type. Method to clear the fault: The input voltage of the motor temperature sensor must return to within the specified range.
0xDB3	5	External Relay On Fault (External relay open)	1. Open circuit during drive loading. 2. Contaminated connector pins. 3. Poor contact or incorrect wiring.	Fault occurrence condition: The drive connection of the relay is abnormal. Method to clear the fault: Correct the open circuit and restart.
0xDB3	6	External Relay Off Fault (External relay short)	1. Short circuit during drive loading. 2. Contaminated connector pins; 3. Poor contact or incorrect wiring.	Fault occurrence condition: Short circuit in the relay driver. Method to clear the fault: Correct the short circuit and restart.
0xDB3	7	External Relay Did Not Close	1. Open circuit or short circuit during drive loading; 2. Contaminated connector pins; 3. Poor contact or incorrect wiring.	Fault occurrence conditions: The relay fails to close. The relay contacts are oxidized, burnt, or not making proper contact. An external load preventing internal DC-link capacitor charging is connected to the B+ terminal. Method to clear the fault: Correct the possible causes and restart the controller.
0xA13	16	Bus OverCurrent	1. Excessive external load; 2. Low battery voltage; 3. Improper setting of the maximum busbar drive current.	Fault occurrence condition: If the currently estimated bus current exceeds the shutdown bus current by 20 amperes for 5 consecutive seconds, an alarm will be triggered. Method to clear the fault: Stop the pump motor to allow automatic recovery.

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0xA13	0	Bus OverCurrent CutOff	1. Excessive external load. 2. Low battery voltage. 3. Improper setting of the maximum busbar drive current.	Fault occurrence condition: An alarm is triggered when the currently estimated bus current continuously exceeds the shutdown bus current. Method to clear the fault: Stop the pump motor to allow automatic recovery.
0x414	5	Motor Open	1. Motor phase open circuit. 2. Poor or incorrect wiring.	Fault occurrence condition: When the U, V, or W phase of the motor is detected as an open circuit. Method to clear the fault: 1. Correctly reconnect the motor phase wires. 2. Restart the key switch.
0xD88	0	Throttle Wiper High (High throttle signal voltage)	1. The throttle signal voltage is too high. 2. Improper adjustment of throttle parameters.	Fault occurrence condition: The throttle signal voltage exceeds the set high threshold voltage. Method to clear the fault: The throttle signal voltage must drop below the set high threshold voltage.
0xD88	1	Throttle Wiper Low (Low throttle signal voltage)	1. The throttle signal voltage is too low. 2. Improper adjustment of throttle parameters.	Fault occurrence condition: The throttle signal voltage is below the set low threshold voltage. Method to clear the fault: The throttle signal voltage must rise above the set low threshold voltage.
0x7F000	13	EEPROM Failure	1. Failure to read EEPROM data during power-on: a. EEPROM data error or loss. b. EEPROM data structure does not match the program's data structure. c. EEPROM data exceeds the allowable limit range. 2. Three consecutive failures in writing parameters to EEPROM after power-on. The fault is triggered if either of the above conditions is met.	Fault occurrence condition: The controller software failed to write to the EEPROM. Method to clear the fault: 1. Power off and restart the controller. 2. If the fault persists, contact after-sales service for repair.
0x7F001	19	HPD/Sequencing Fault	Incorrect inputs from the key switch, enable signal, gear direction, or throttle resulting in a high pedal inhibit or sequence fault.	Fault occurrence condition: Incorrect inputs from the key switch, interlock, gear direction, or throttle result in a high pedal inhibit or sequence fault. Method to clear the fault: Re-enter the inputs in the correct sequence.

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x7F002	13	Parameter Change Fault	This is a safety fault triggered by changes to certain parameter settings. The vehicle will be disabled until the key switch (KSI) is restarted. For example, if the user changes the throttle type, this fault will occur and require a KSI restart before the vehicle can operate again.	Fault occurrence condition: Parameters that require a key switch restart have been adjusted. Method to clear the fault: Restart the key switch.
0xB25	8	CAN Timeout	1. PDO message reception timeout. 2. CAN link abnormality.	Fault occurrence condition: PDO message reception timeout. Method to clear the fault: Restore operation after troubleshooting possible causes.
0x24D	1	Stall Detected	1. Motor stall. 2. Motor encoder failure. 3. Poor wiring or incorrect connections. 4. Motor encoder power supply issue.	Fault occurrence condition: When the detected phase current is greater than or equal to the stall current (set value) for a duration longer than or equal to the stall time (set value), and the speed is lower than the stall speed (set value). Method to clear the fault: Troubleshoot possible causes of the fault and restart the controller.
0x24D	0	Over Speed Fault	1. Unreasonable operating parameter settings. 2. Loss of control in the controller's control loop.	Fault occurrence condition: The motor speed is detected to exceed the overspeed threshold. Method to clear the fault: Power off, verify configuration parameters (such as maximum speed limit, regenerative braking current, motor magnetic offset angle, etc.), and restart the key switch.
0x9E	13	Keyswitch Voltage Fault	1. Poor wiring of the key switch. 2. Non-controller systems draining the voltage of the low-power circuit. 3. Excessive resistance in the low-power circuit. 4. Disconnection of the low-power circuit power supply during operation.	Fault occurrence condition: The key switch voltage is out of range. Method to clear the fault: Eliminate possible causes and restart the key switch.
0x7F00F	12	Controller Internal Fault14 (Driving voltage fault)	1. Internal controller failure.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: Restart the key switch.

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x7F003	12	Controller Internal Fault1 (MOSA voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F004	12	Controller Internal Fault2 (MOSB voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F005	12	Controller Internal Fault3 (MOSC voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F009	12	Controller Internal Fault7 (Phase A voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F00A	12	Controller Internal Fault8 (Phase B voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F00B	12	Controller Internal Fault9 (Phase C voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x7F00C	12	Controller Internal Fault10 (Overcurrent detection sensor A fault)	1. Internal controller failure.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: Restart the key switch.
0x7F00D	12	Controller Internal Fault11 (Overcurrent detection sensor B fault)	1. Internal controller failure.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: Restart the key switch.
0x7F010	2	Controller Internal Communication Fault	1. Internal controller communication fault.	1.Internal controller failure. 2.Abnormal power supply at controller B+ and B- terminals.
0x7F00E	12	Controller Internal Fault13 (Parameters synchronization fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: A parameter synchronization fault is detected. Method to clear the fault: Restart the key switch.
0x7F011	12	Precharge Failed	1. Power battery is not connected. 2. There is a short circuit or significant load on the capacitor output side.	Fault occurrence condition: Low input voltage is detected after the key switch is powered on. Method to clear the fault: Restart the key switch after eliminating possible causes.
0x7F006	12	Controller Internal Fault4 (Phase A upper switch voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F007	12	Controller Internal Fault5 (Phase B upper switch voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.
0x7F008	12	Controller Internal Fault6 (Phase C upper switch voltage detection fault)	1. Internal controller failure. 2. Abnormal power supply at controller B+ and B- terminals.	Fault occurrence condition: An internal controller fault is detected. Method to clear the fault: After confirming that the B+ and B- voltage is normal, restart the key switch. If the fault persists, contact after-sales service for repair.

Software

SPN check and fix table (continued)

SPN (Hex)	SPN (Dec)	SPN Name	Fault Cause	How to Repair/Fix
0x7F012	10	Regen Ansyn Speed Fault (Energy recovery speed fault (Energy recovery increase))	1. Dry running occurs. (Pump is facing dry running) 2. The set energy recovery current is unreasonable.	Fault occurrence condition: Abnormal speed is detected. Fault clearance method: After troubleshooting, re-enable the energy recovery request.
0x464	0	Motor Temp Stop Fault (Motor over temp stop fault (Energy recovery increase))	1. The motor operates under heavy load for prolonged periods. 2. The motor operates in a high-temperature environment for extended durations.	Fault occurrence condition: The motor overheats. Fault clearance method: The motor temperature must drop below the overtemperature threshold.
0x7F013	10	Travel Control Fault	1. The actual motor speed exceeds the maximum speed ratio threshold. 2. The actual motor speed is higher than the permissible threshold of the requested speed.	Fault occurrence condition: The current motor speed exceeds the allowed set value. Fault clearance method: Restart the key switch.
0x7F014	10	Safety Stop Fault	1. The motor's speed curve exceeds the planned stopping speed range after the Interlock is set to 0.	Fault occurrence condition: The current motor speed exceeds the permitted set value. Fault clearance method: Restart the key switch.
0x7F015	19	Cross Check Fault	1. Cross-verification failed between Enable Pin 4 and CAN communication Interlock signal. 2. Voltage cross-verification failed for Pot wipe Pin 3. 3. Internal controller hardware malfunction.	Fault occurrence condition: Internal controller cross-verification fails. Fault clearance method: Ensure normal external inputs and restart the key switch.
0x21A1	13	Software Fault	1. Software verification failed.	Fault occurrence condition: Internal controller cross-verification fails. Fault clearance method: Ensure all external wiring is correct and restart the key switch. If the fault persists, the controller must be returned for repair.

Debugging

Danfoss PLUS+1 Service Tool can be used to communicate with ePowerpack products via a computer.

The Service Tool software allows the operator to perform the following functions:
- Adjust system parameters
- Display system and process data
- Record data in real time
- Update and upload parameters in batches

Software

Service tool hardware connection procedure

1. Refer to the schematic diagram to ensure that the ePowerpack power unit is properly powered by 24 V_{DC}.
2. Connect the USB port of CG150 (part number: 11153051, ordered directly from Danfoss) to the USB port of the computer.
3. Port definition

   Definition of the CAN communication port corresponding to the D-Sub interface on the CG150:

Pin	Function
1	-
2	CAN Low (-)
3	CAN Shield/Ground
4	-
5	-
6	-
7	CAN High (+)
8	-
9	-
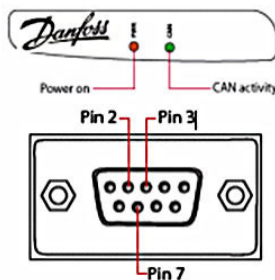
   Definition of CAN interface on ePowerpack:

4. By referring to the port definition in the previous step, connect the CAN interfaces (pin 2 & 7) of the CG150's D-Sub connector to the CAN interfaces of the corresponding ePowerpack product using twisted-pair wires (pin 7 & 6) and ensure that the terminal resistance (120 Ω) at both ends of the CAN bus are wired properly.
   - Drives for all software are included in the Service Tool installation files.
   - The CAN interface for the ePowerPack power unit is on the 8-pin AMPSEAL connector.

Service tool software connection procedure

1. After connecting the USB port of CG150 to the computer for the first time, the computer will automatically install the corresponding driver.
2. Open the Danfoss PLUS+1 Service Tool software.
3. Make sure the default gateway of Service Tool software is CG150, the baud rate is 250 kbit/s and the communication protocol is UDS, specifically as follows:
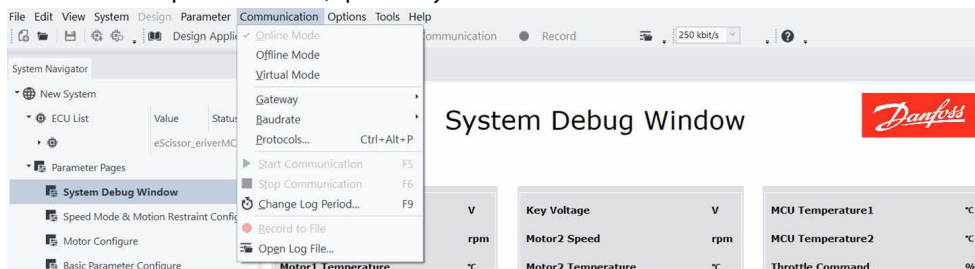
Gateway Settings -> Select Gateway
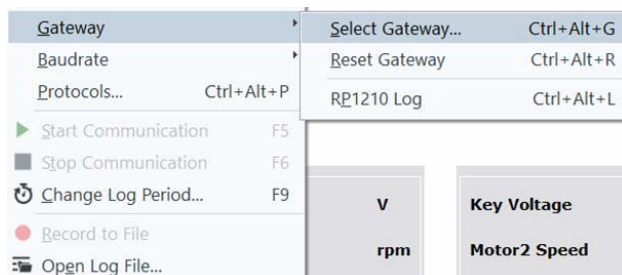
Select CG150, then select "OK".

Software
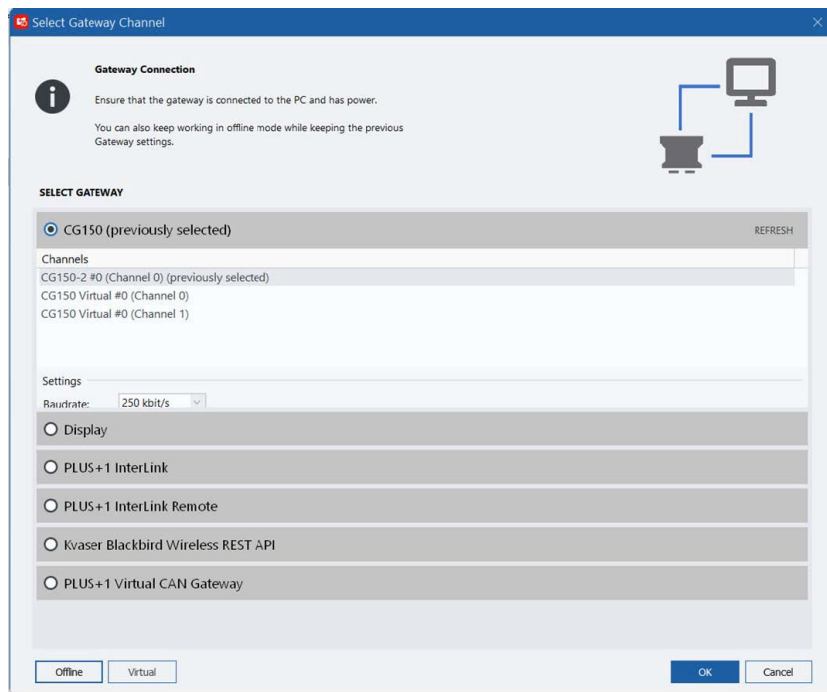
Baud Rate Setting

Select the CAN communication baud rate used by the system, which is generally 250 kbit/s.

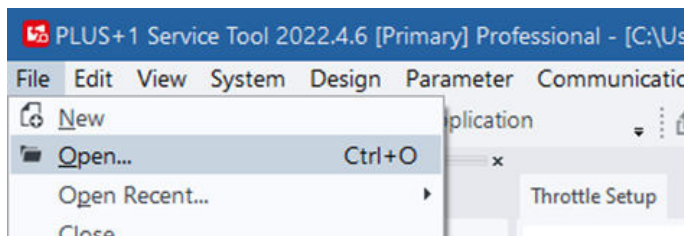

UDS Communication protocol

Check UDS communication protocol

Select and Load "EC-C24-D180 Debug Tool V1.06.p1d",

4. Select and load the ePowerpack diagnostic application (p1d file)

Open the diagnostic application with the menu File\Open.. button or directly by double-clicking on the corresponding p1d file.

Software

5. Make sure that the Service Tool software and the ePowerpack power unit are online. If not, select Online Mode by clicking on Online Mode under Communication or select Online by clicking on the drop-down menu in the lower left corner of the Service Tool software.

6. Start and stop communication:

Start or stop communication with the ePowerpack by clicking on the Start Communication and Stop Communication buttons under the menu Communication.
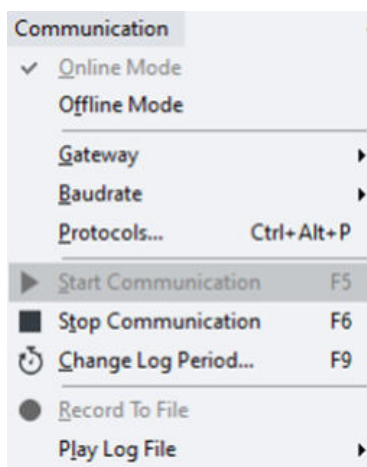

7. Read and modify parameters

Click the Read button under the Parameter menu to read the value of the corresponding parameter in the Service Tool page, or click the Write button under the Parameter menu after modifying the parameter to write the modified parameter into the ePowerpack power unit.
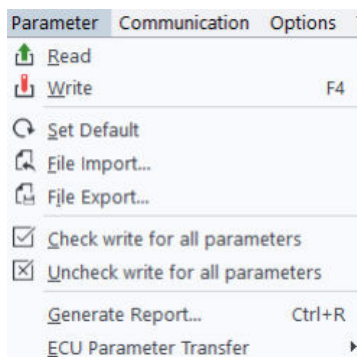
8. Batch export of all parameters of the ePowerpack power unit:

Software

    a. Select all the parameters in the Download Parameter page, and click the Read button to read all the parameters of the ePowerpack power unit.

    b. Click on the File Export button under the Parameter menu to batch export all parameters of the ePowerpack power unit and save them in an xml file.
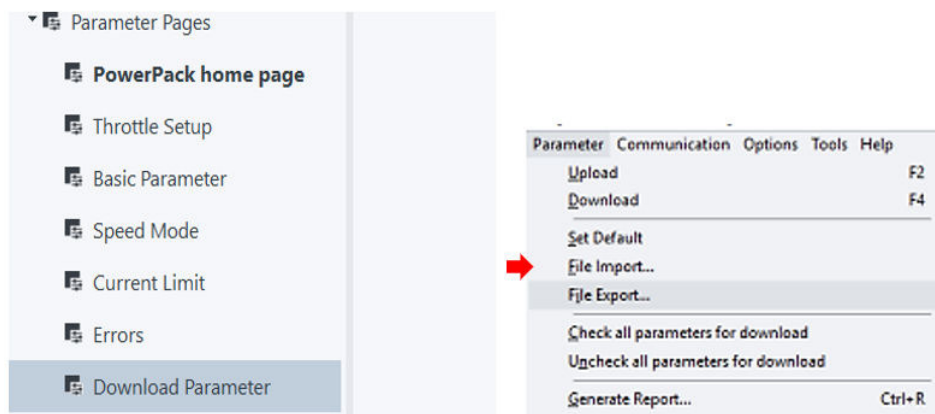
9. Batch import of parameters to ePowerpack power unit:

    a. Select the Download Parameter page, and click the File Import button under the Parameter menu to import parameters in the xml file into Service Tool.

    b. Select all parameters, and click the Write button to batch write the parameters to the ePowerpack power unit.

!	**For complete instructions on how to use the Service Tool software, please refer to the user manual within the Service Tool software.**

Explanation of parameters

For parameter details, refer to the following sections in this user guide.

Software

Fault Diagnosis

When the system is faulty, the Errors page corresponding to the fault is displayed in red.

Fault name	Description
Controller OverCurrent	Controller overcurrent
Current Sensor Fault1	Current sensor fault 1
Current Sensor Fault2	Current sensor fault 2
Controller Severe Undertemp	Serious undertemperature of the controller
Controller Severe Overtemp	Serious overtemperature of controller
B+Severe Undervoltage	Serious undervoltage
B-Severe Overvoltage	Serious overvoltage
Controller Temp Sensor Fault	Controller temperature sensor abnormality
Controller UnderTemp Cutback	Controller low temperature cutback
Controller OverTemp Cutback	Controller thermal cutback
B+ Undervoltage Cutback	Undervoltage cutback
B+ Undervoltage Cutback	Overvoltage cutback
Motor Temp Hot cutback	Motor thermal cutback
Motor Temp Sensor fault	Motor temperature sensor fault
External Relay on fault	External relay open-circuit fault
External Relay off fault	External relay short-circuit fault
External Relay did not close	External contactor not-closed fault
Bus Over Current	Bus overcurrent alarm fault
Bus Over Current CutOff	Bus overcurrent shut-off fault
Motor Open	Motor open circuit
Throttle Wiper High	High throttle signal voltage
Throttle Wiper Low	Low throttle signal voltage
EEPROM Failure	EEPROM fault
HPD/Sequencing Fault	High pedal/start sequence fault

Software

Fault name	Description
Parameter Change Fault	Parameter change fault
Can Timeout	CAN communication fault
Stall detected	Motor stall fault
Over Speed fault	Motor overspeed fault
Keyswitch Voltage Fault	Key switch voltage abnormality
Controller internal fault 4	Controller fault 4 (drive voltage abnormality)
Controller internal fault 1	Controller fault 1 (Detection abnormality of MOSA voltage)
Controller internal fault 2	Controller fault 2 (Detection abnormality of MOSB voltage)
Controller internal fault 3	Controller fault 3 (Detection abnormality of MOSC voltage)
Controller internal fault 7	Controller fault 7 (Detection abnormality of A-phase voltage)
Controller internal fault 8	Controller fault 8 (Detection abnormality of B-phase voltage)
Controller internal fault 9	Controller fault 9 (Detection abnormality of C-phase voltage)
Controller internal fault 10	Controller fault 10 (Abnormality of overcurrent detection sensor A)
Controller internal fault 11	Controller fault 11 (Abnormality of overcurrent detection sensor B)
Internal communication	Controller internal communication fault
Controller internal fault 13	Parameter synchronization fault
Precharge failed	Precharge fault
Controller internal fault 4	Controller fault 4 (Detection abnormality of voltage of A-phase upper switch)
Controller internal fault 5	Controller fault 5 (Detection abnormality of voltage of B-phase upper switch)
Controller internal fault 6	Controller fault 6 (Detection abnormality of voltage of C-phase upper switch)

Dismounting

⚠	**Make sure that the mating structure is not damaged. Do not pluck any bores or use headed bolts or rods for pushing the product out of the mating structure.**

For dismounting, follow the steps below.

1. Disconnect the connectors and cables.
2. Remove the mounting bolts and prepare the product for lifting.
3. Lift the product off while supporting it.

Aftersales

The product does not have any serviceable parts.

Service policy

Maintenance and service of the product is limited to the procedures described in this user guide.

For further information, go to *https://danfosseditron.zendesk.com/hc/en-gb* or send email to editron.service@danfoss.com.

Disposal

Dispose of the product and any of its parts by appropriate means in accordance with local laws and regulations.

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