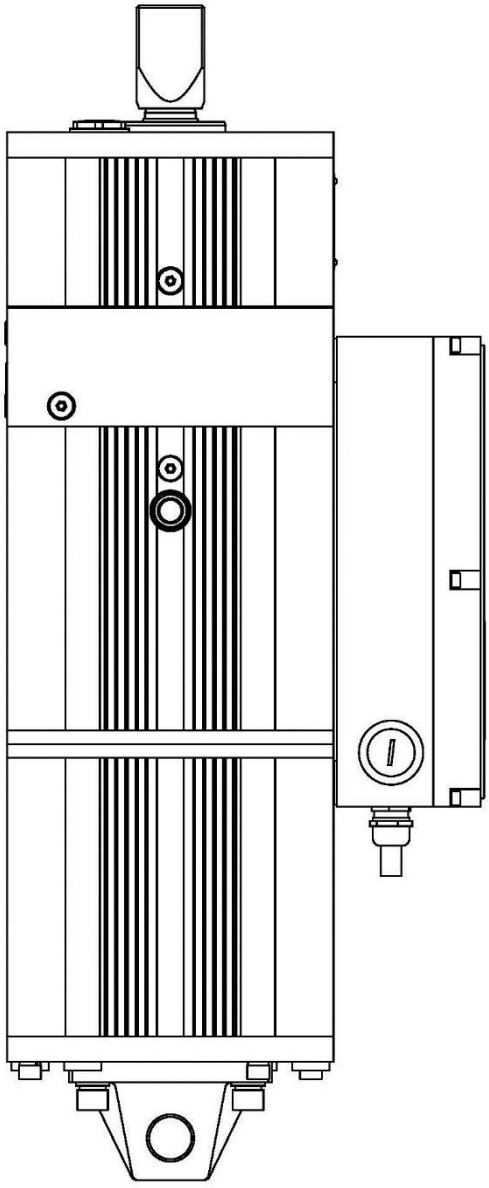
Furka® F-HED Series Thruster



The Furka® F-HED thruster is a very compact dive control system that integrates electrical motor, gear pump, hydraulic valves and cylinder. It is used as drive mechanism working as a brake thruster, e.g. in drum and disk brakes, drive control of industrial valves, steering mechanism, industrial valves, gates, swaying/rotating devices, clamping devices or boom latch thruster.

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1. Safety regulations

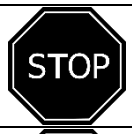
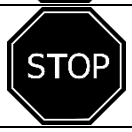
1.1 General advise

The safety of your thruster depends on proper and regular inspection and maintenance. Study the manual before starting the installation. If in doubt, please don't hesitate to contact our service-department or your local retailer.

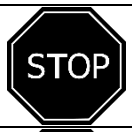
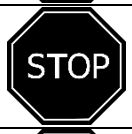
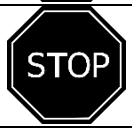
1.2 Safety and warning symbols

	Warning of personal injury	This signal indicates a threat of danger. If this danger is not avoided, this will result in death or serious injuries.
	Warning of product damages	This symbol indicates a warning which may contribute to prevent material or machine damage.
	General advice	This symbol indicates information that helps to avoid adverse results and conditions.

1.3 General hazard warnings

	The lifting rod must be protected while handling the thruster. It must be neither damaged nor be subjected to shearing forces. It should be kept clean. Colour residues and (welding) splashes should be avoided.
	A sudden start-up of the installation endangers the life of the maintenance personnel! Secure the drive and the installation against any accidental movement before starting any work! **Reading the operating instructions is indispensable.**
	When operating the HPU, strong electro-magnetic radiation may occur, which is why persons with pacemakers are advised not to stay in the vicinity.

- The following applies to all work and operations with the thruster: **Safety first**
- Don't use any mechanical devices to block the brake.
- Ensure, that **the drive** is disconnected from the electrical power supply.
- Ensure, that **the brake (thruster)** is disconnected from the electrical power supply.
- Any electrical work is only to be done by a trained electrician.
- Only use original Furka® spare parts
- The thruster must not be disassembled.
- **Never open the thruster or the screw plug when it is hot! Escaping hot oil may cause burns!**
- **Before repair or refilling, let the unit cool down to room temperature!**
- Furka® thrusters are fully factory tested prior to delivery and are supplied in a perfect condition.

	Caution: Hydraulic fluid can be hazardous to health, contact with skin and eyes can cause serious damage. Follow the instructions in the safety data sheets of the hydraulic fluid manufacturer with regard to the protection of personnel and safety.
	Caution: Hydraulic fluid may be harmful to the environment. It is therefore recommended that the unit is installed incl. a catch pan to prevent environmentally harmful fluid escaping through leaks what can lead to contamination.
	Caution: Intentional or unintentional tampering with valves, accessories or components is not permitted. Opening a throttle valve can e.g. cause a load to fall freely.
	Attention: All installation, maintenance, dismantling and replacement work on the hydraulic unit and its components may only be carried out in compliance with the the safety instructions. During this work the hydraulic system must be depressurised (pressure 0) and the drives driven by the unit must be unloaded (load 0).

1.4 Warranty

The warranty and its duration depends on the contract. For details on the supplier's warranty please refer to the terms of the contract. Any warranty- or liability claims are excluded in case they occur because of one or more of the following conditions:

- Non-designated use of the thruster.
- Improper handling, setup, operation and maintenance of the thruster by the operating company.
- Neglection of the regulations and notes in this manual concerning transport, setting up, operation and maintenance of the thruster.
- Improper maintenance and repairs of the thruster.
- Improper monitoring of components, which are prone to wear.
- Catastrophes, external objects and forces and force majeure.
- Changes at the thruster without approval of Furka®.
- The information in this manual has been checked thoroughly. Nevertheless we can't accept liability for errors.

1.5 Non-designated use

Only the use described in this document is permitted. The risks associated with improper use lie solely with the user and Furka Antriebstechnik GmbH accepts no liability.

Unintended use is defined as

Disregard

- of the operating pressure level in the installation drawing,

- of the specifications regarding the pressure fluid,

- the correspondingly deviating operating and environmental conditions.

2. Valve controlled electro-hydraulic thruster

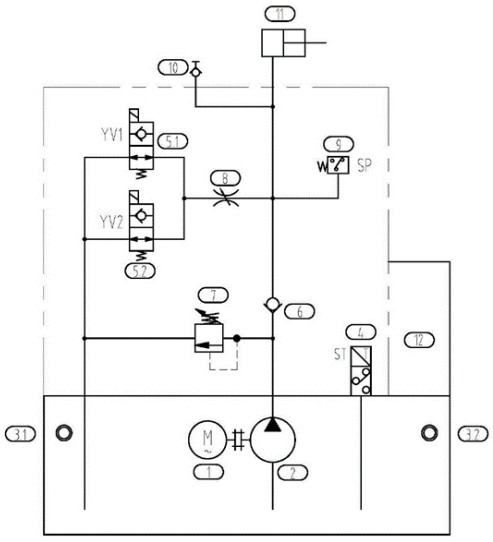


Fig. 1: Hydraulic diagram

Table for the operation order of electric elements

("+" means the element is energized)

Operation \ Element		YV	SP	M	T	BMS
Brake release (remote)		+		+		+
Brake hold		+	+ Upper limit	-		+
System pressure compensation		+	+ Lower limit	+		+
Brake close (remote)		-		-		-
warning	Motor continuously operates over 1s					+
	During the retaining of brake, motor is started over 1 time within 5min					+
	Oil temperature reaches 70℃				+	

Power supply of electric elements: M: 380V; SP, YV: 240VDC

2.1 Basic function

The FHED thruster is an independent unit that consists of motor, gear pump, valves, piston rod and protective casing completed by a CMU integrated control device. Typical applications are drum and disc brakes, actuator for industrial valves, gates, as well as rotating, pivoting and clamping devices. For basic functionality please refer to figure 1.

The control and monitoring unit controls the motor and the relay and monitors the hydraulic functions. Braking times, error types and times as well as information about the motor status can be read out via a LED display.

2.2 Storage, transport and packaging

The thruster is shipped ready to mount.

- Thrusters are shipped ready to use complete with hydraulic fluid.
- Store and transport the thruster dust- and waterproof.
- Protect the thruster during the whole storage- and transport time against damage.

In case of additional painting, do NOT contaminate:

- Rod of the thruster
- Electrical components

- Signs and plates

If the thruster isn't installed directly after delivery heed the following instructions:

Store and / or transport the thrusters dust- and waterproof with drying agent until installation. Protect the brake against external damages during the complete storage- / transport-period.

	**Note!** **Depending on the type, the F-HED thruster has a weight of up to 56kg.** **Always use a proper lifting device to transport the thruster! Danger of injury.**

2.3 Technical parameters

2.3.1 Suitable operating environment

1) Ambient temperature -30 °C - +60 °C
2) Indoor, outdoor, sea side
3) Rain-, rust-, wind-, sand-, and vibration-proof

2.3.2 Motor duty / Load cycles

1) Rating is S1 or S3
2) Unlimited working cycles
3) Electrical motor is S3 rated, continuous operating time is normally ≤ 0.5s
4) The motor is switched off when the thrust has reached the target value, the force is always kept over the minimum value.
5) Maximum operating frequency is 1000c/h

2.3.3 Supply voltage and IP protection classes

1) IP protection class of thruster is IP66
2) IP protection class of the control box is IP67
3) Supply voltage: 340…420V, 50/60Hz
4) Power: 1.5kW

Voltage fluctuations should not exceed ±10% of the rated voltage.
It is not permissible to operate the thruster with a supply voltage and frequency other than those specified on the nameplate.

2.3.4 Safety and maintenance rules

1) The operator is responsible for the cleanliness of the thruster and brake.
2) Do not make any changes (type and size) on electrical or hydraulic components.
3) The hydraulic flow valve may only be adjusted by trained personal.
4) The hydraulic safety valve and the overflow valve may only be adjusted by trained personal.
5) Changes in the CMU software may be only implemented by qualified personal.
6) When wiring the motor, make sure that the direction of rotation of the motor is correct.
7) The thruster must not be operated in case the oil level is too low.
8) Only use oil that is specified in this manual.
9) Before disassembling the thruster make sure that supply and control voltage have been switched off and that there are no constraining forces on the thruster.

2.3.5 Interface requirements

1) Mounting bore piston rod head Ø 25×40

2) Mounting bore base plate Ø 25×40

3) Power supply AC380/50Hz, water-proof cable gland M25×1.5, cable diameter 13～18mm

4) Water-proof cable gland of control cable M20×1.5, cable diameter Ø 6～12mm (optional)

2.4 Nameplate

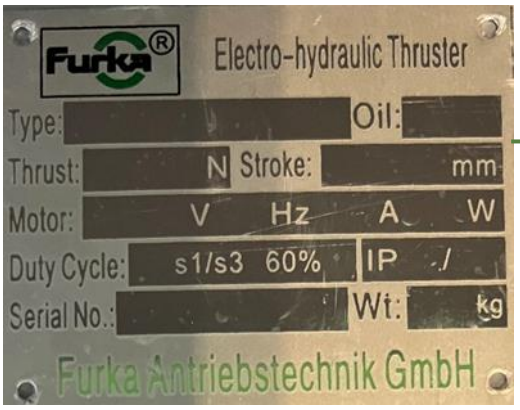
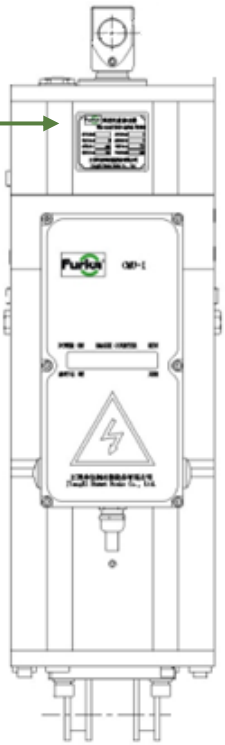


Fig. 1: Thruster nameplate



3. Structure, installation and operation of thruster

3.1 Thruster structure

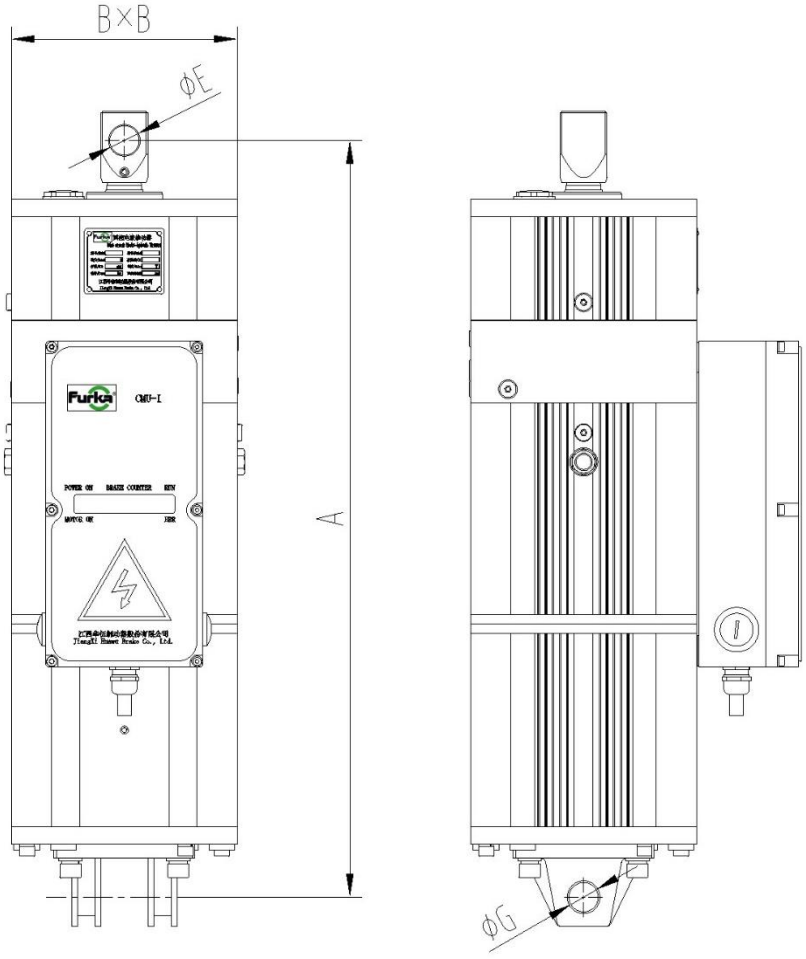


Fig. 2: Design F-HED thruster

Size	*Power consump-tion kW*	*Current consump-tion A*	*A mm*	*B mm*	*E mm*	*G mm*	*Weight kg*	*Power cable*	*Control cable*
F-HED500-60	0.45	1.2	435	173	20	20	21	M25x1.5 Cable diameter: 13 – 18mm	M20x1.5 Cable diameter: 6 – 12mm
F-HED800-60	0.65	1.6	450	173	20	20	23		
F-HED2000-60	0.65	1.6	450	173	20	20	23		
F-HED3000-60	1.1	2.56	645	193	25	25	41		
F-HED4000-80	1.1	2.56	645	193	25	25	41		
F-HED5000-80	1.1	2.56	645	193	25	25	41		
F-HED6000-80	1.5	3.5	645	193	25	25	56		
F-HED7000-80	1.5	3.5	645	193	25	25	56		
F-HED8000-80	1.5	3.5	645	193	25	25	56		

Table 1: Thruster data

The electrohydraulic thruster (F-HED) described in figure 4 is a compact lifting device consisting of motor-pump unit, valve group, hydraulic cylinder and electric control device.

1. Motor pump unit: The motor (1) drives the gear pump (2) that provides the required pressure for the thruster.
2. Hydraulic cylinder (11): The hydraulic cylinder is the working cylinder converting energy from the pump into a linear movement. It is providing the required stroke to open the brake. When the motor is energized the piston extends. When the motor is switched off the piston is pushed back by the brake spring.
3. Pressure relief valve (7): Limits the max. working pressure (don't change settings without consulting Furka)
4. Pressure monitoring: The H-HED thruster monitors the upper and lower pressure limits via the pressure switch (9). The pressure switch activates the switching output signal when the pressure exceeds the upper value and causes the pump to stop. If the pressure drops below the minimum value (reset point) after the pump has stopped, the switching output is deactivated again and the pump restarted.

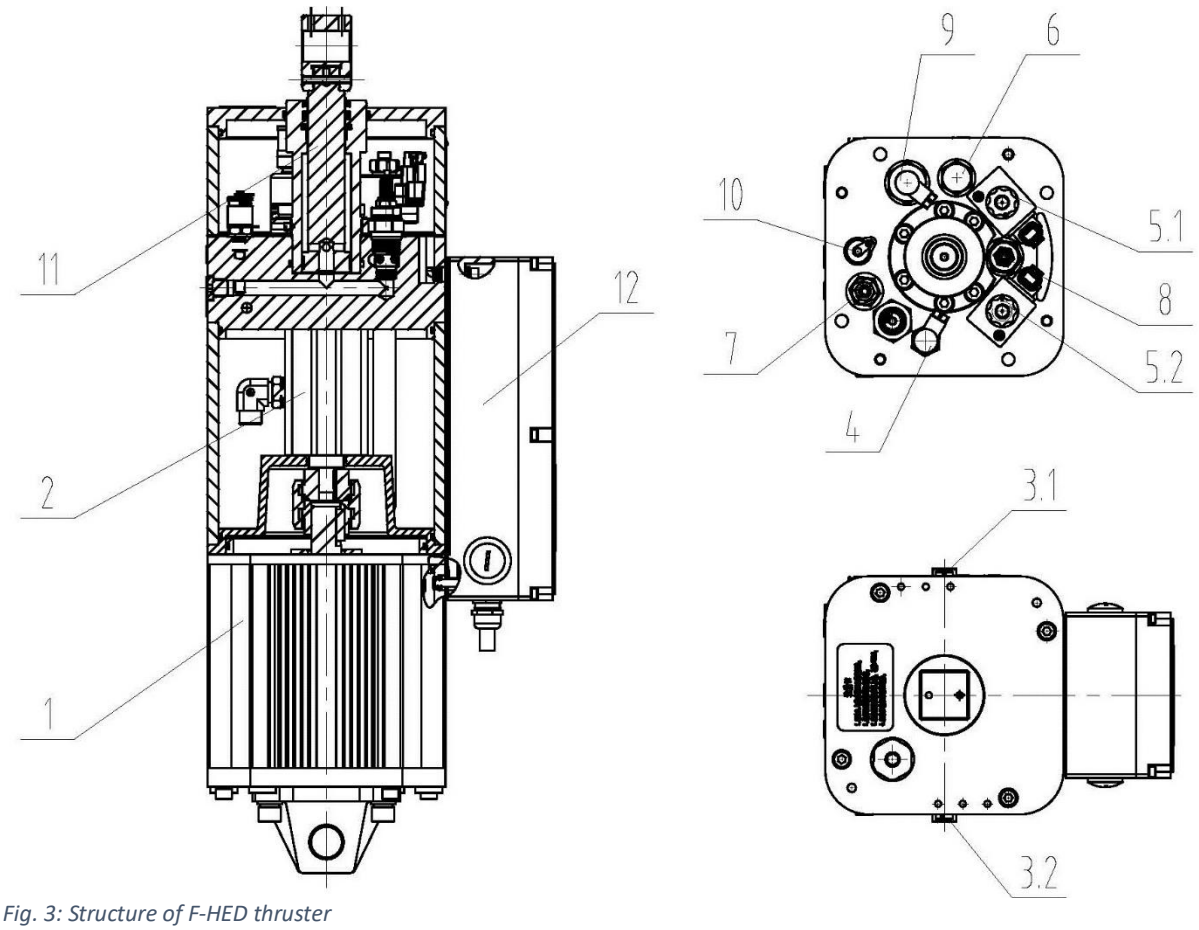


Fig. 3: Structure of F-HED thruster

1. motor **2**.gear pump **3.1**, **3.2** Sight glass **4**. Temperature switch **5.1**, **5.2** directional poppet valve **6**. check valve **7**. pressure relief valve **8**. Speed control valve **9**. Pressure switch **10**. Plug-in coupling **11**. Piston rod **12**. Control unit

5. Oil temperature switch (4): The thruster monitors the oil temperature in real time via the temperature switch. When the pre-set temperature of 75°C is reached a switch contact is sending a signal to the master control.
6. Solenoid valve (5.1, 5.2): When the motor is switched on, the solenoid valves are energised so that the cylinder can be pressurised (piston will extend: Brake released). In the de-energised state the oil flows back into the tank (brake closed). The solenoid valves are arranged redundantly so that in the event of failure of one of the valves, the backflow of the oil is still guaranteed and the brake can close safely (fail safe function).
7. Speed control valve (8): The thruster release speed can be adjusted. Therefore the cover has to be removed. Loosen the lock nut on speed control valve (8) counter-clockwise (CCW). The flow control valve can be adjusted with the help of a special 4mm socket wrench as per fig. 5.

Fig. 4: Socket-wrench with T-handle (wrench size 4mm)

The opening time is set faster by turning the socket-wrench counter-clockwise (CCW). If it is turned clockwise (CW), the thruster opens more slowly. Don't forget to tighten the lock-nut after the adjustment has been done.

8. Displacement sensor mounting screw:
   The position and travel of the piston rod can be queried with the aid of a displacement sensor. The cover is secured with three M6 screw extinguishers (depth 11mm).

3.2 Thruster Installation

3.2.1 Installation position (ref. to fig. 6)

If the thruster is installed at an angle, make sure that the electrical control box always faces upwards. This also applies to horizontal installation.

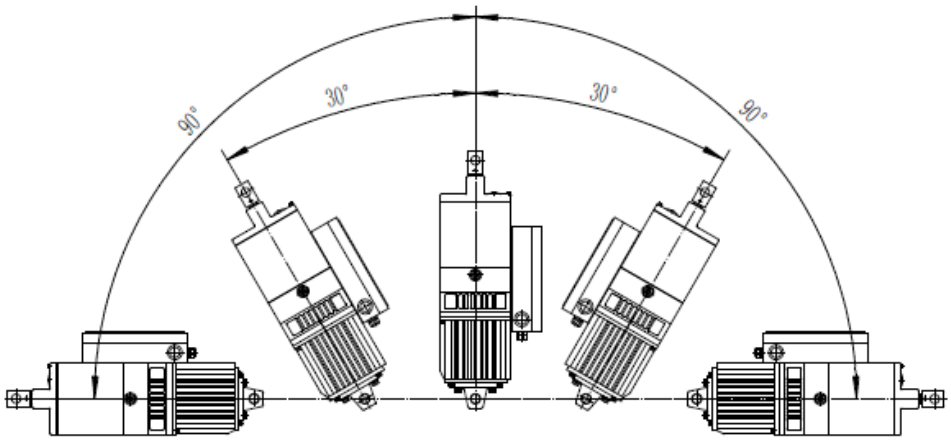


Fig. 5: Mounting options

3.3 Thruster operation

3.3.1 Working principle

The HED thruster is an independent drive unit, with integrated mechanical, electrical and hydraulic functions. Opening, closing and pressure holding is controlled by the main PLC.

3.3.1.1 Command mode

Power supply command: The supply voltage to the thruster is provided by the main power supply.
Control power command: The thruster is switched on and off via the control line.

3.3.1.2 Working principle

Brake open: The thruster receives the “Open” command from the main PLC. The motor is energised and drives the pump. The solenoid valves are energised and the piston rod extends (brake is released/opened). As soon as a pressure of 110 bar is reached, the pressure switch switches off the motor.
Brake kept open/released:
The use of poppet valves hermetically seals off the volume flow for a certain time keeping the brake in released condition (motor is still shut off!). As soon as the pressure drops below 90 bar, the pressure switch gives a signal to start the motor so that the pressure can be built up again.
Brake closed/set:
The command "Close brake" is given by the main PLC. The motor and the solenoid valves are de-energised so that the oil can flow back into the tank and the brake closes.

3.3.2 Electrical connection

STOP	**Danger!** The applied electrical voltages are dangerous to life! The electrical connection and all other electrical tasks must only be done by a **trained electrician**!

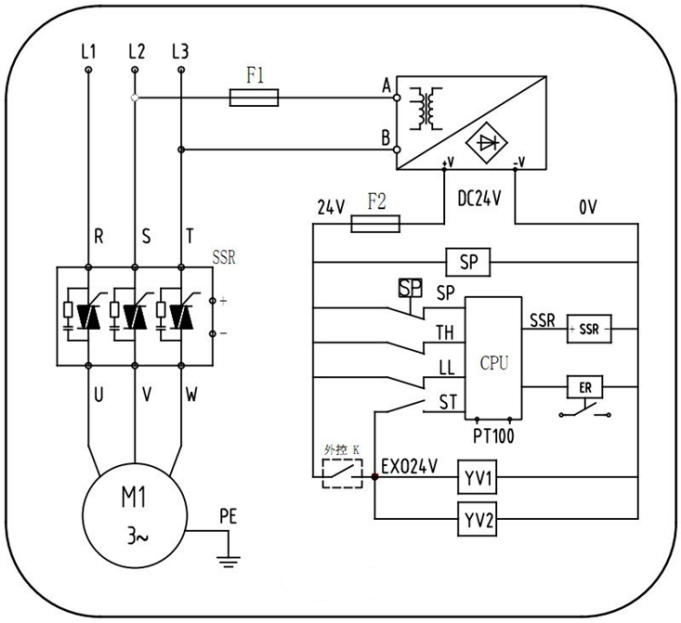


Fig. 6: Electrical connection

F1: high speed fuse

SSR: three phase solid state relay (max. recommended power 3kW) incl. overcurrent and overheat protection

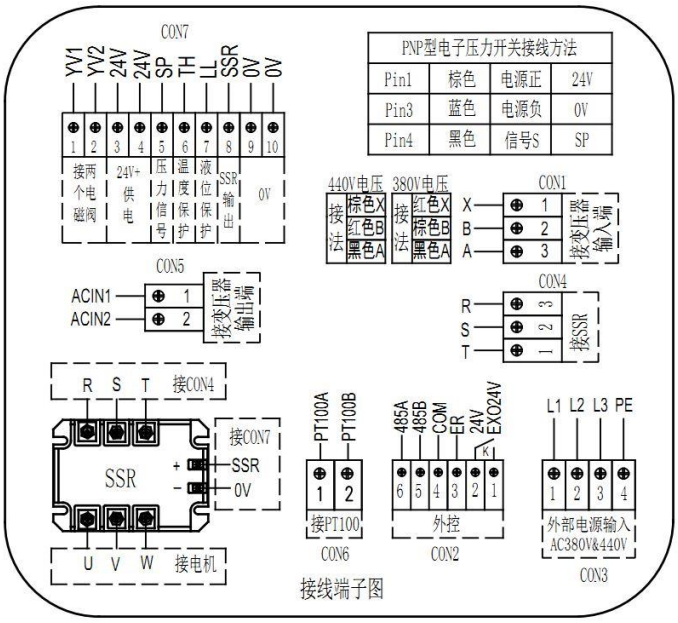


Fig. 7: Junction box, wiring

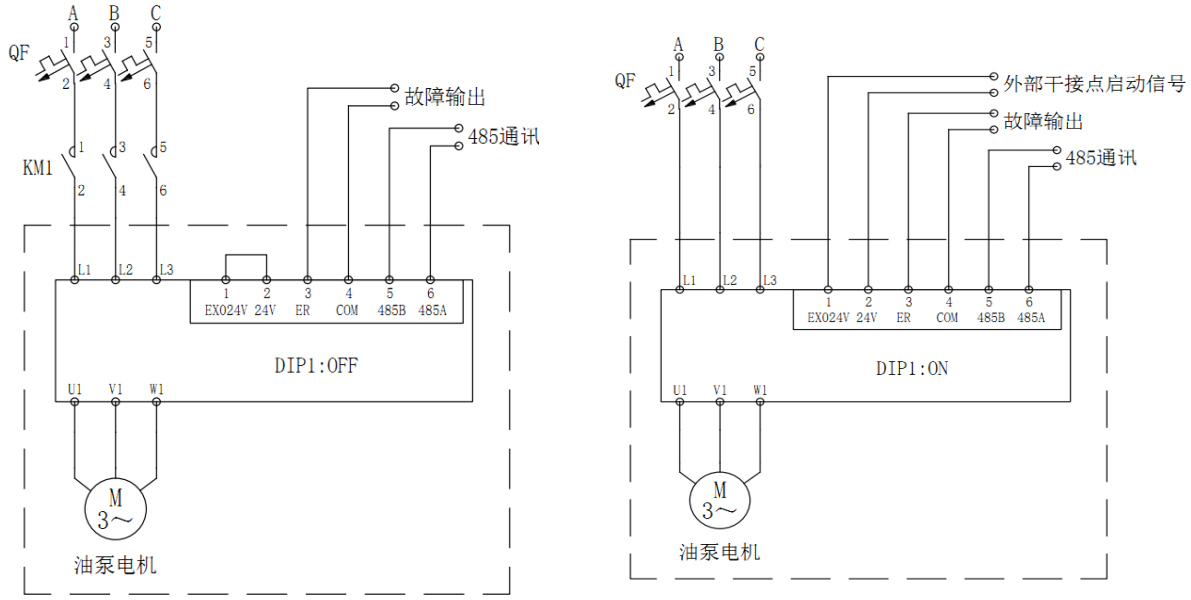


Fig. 8: Control board power supply settings

Note:

- F is a fast fuse

- SSR is a three phase solid state relay

- DIP switch settings:

    - Single wire system: Motor and controller are supplied with power at the same time: Pin1 → OFF

    - Two-wire system: Motor and controller are supplied with power separately: Pin1 → ON

    - Fieldbus (Modbus) function <u>on</u>: Pin 2 → ON

    - Fieldbus (Modbus) function <u>off</u>: Pin 2 → OFF

    - Selector switch F-HED or F-HPU function: <u>F-HED</u> function: Pin 3 → OFF

      <u>F-HPU</u> function: Pin 3 → ON

    - Motor function controlled by <u>pressure sensor</u>: Pin 4 → OFF

    - Motor function controlled by <u>travel sensor</u>: Pin 4 → ON

Note 3.2, 3.3, 3.4 Factory settings. Don't change any settings without consulting Furka.

Error messages:

Fault	*LED display*
Motor runs for too long. Continuous operating time of the motor of more than 3s is detected	**Err** (red) flickering; display period 1s
Motor starts frequently: Motor starts more than 3 times within 5min	**Err** (yellow) flickering; display period 1s
Low oil level warning	**Err** (yellow) flickering; display period 1s
Oil temperature warning: when the oil temperature of the hydraulic system is detected to be too high	**Err** (yellow) flickering; display period 1s

Table 2: Errormessages

4. Operation and maintenance

4.1 Pre-operation

The thruster has been run for about 2500 open/close cycles before delivery (Factory tested).

4.2 Check

4.2.1 Mechanical

- Before installing check thruster for oil leakages
- Check whether the piston rod is free of any damages
- Oil level check (oil sight glass): If the oil level is too low, top up to the specified level.

Note: Overflow valve and pressure switch have been set correctly before delivery, which cannot be adjusted at will. In case certain parameters need to be changed, please contact Furka®.

4.2.2 Electrical

Determination of the phase sequence: Check if the pump is running in the right direction by repeatedly switching the motor on and off quickly (inching operation) without reaching full speed until it is evident that the pump is working properly. Faultless operation, which can be seen from the noise level of the pressure gauge, should be reached after 30 seconds at the longest.

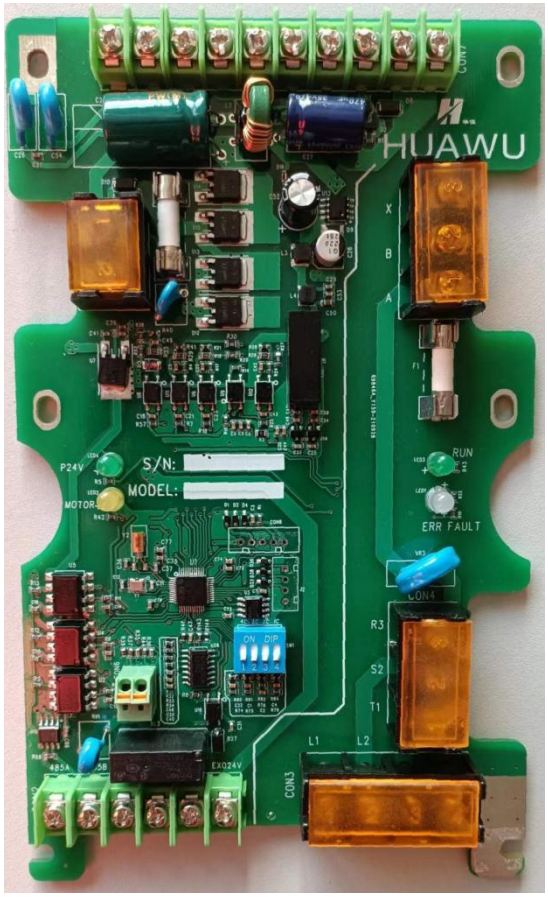


Fig. 9: Control board

Status reading

Terminals 485A and 485B can be connected to the PC and the main control system, and through the standard protocol MODBUS version number, production information, braking times, alarms and other information can be queried.

Terminals 485A and 485B can be also connected to the company's LCD screen to query and display the information described above.

LED lights

P24V:Power indicator

MOTOR: Motor operation indicator

RUN: Operation indicator

ERR FAULT: Fault indicator

Note: The HDMU01 electrical section applies to hardware versions prior to HDMU01_HV3.0.

5. Trouble shooting

5.1 Motor cannot be started

- Check oil level and temperature

- Check electrical power supply (incl. control power supply) and wiring

- Check wiring of pressure switch (9) (Contact)

- Check if the motor is damaged

5.2 Thruster does not lift, brake cannot be released

- check if the motor is running (phase sequence ok?)

- check for correct installation (no jamming)

- check oil level

- check setting of pressure regulating valve (7) and pressure switch (9)

- check if the solenoid valves are energized

- Check whether the oil filter is dirty

- check for damaged seals

5.3 Motor starts frequently

- check if the solenoid valves (10) are energized (stable power supply wiring of the coils)

- Check for leakages

5.4 Motor starts continuously

Thrust is too low:

- Check pressure switch (9)

- Check control board

5.5 Troubleshooting

Nr.	*Fault*	*Troubleshooting*
1	Err light (yello or red)	1. Check for leakages
		2. Check cables and cable connection
		3. Replace pressure switch and temperature switch
		4. Replace HDMU01 board
2	Motor cannot be started	1. Check cable and cable connection
		2. Check motor protection switch for blown fuses
		3. Replace pressure switch, temperature switch and solid state relay
		4. Replace HDMU01 board
		5. Replace motor

Table 3: Troubleshooting

6. Disposal

The disposal of the individual materials must be carried out in accordance with the legal and national regulations of your country or your company's internal specifications. If the thruster is to be decommissioned and scrapped, the remaining hydraulic fluid must first be carefully drained from all parts of the unit.
Special attention must be paid to the disposal of the pressure fluid and to components with residual pressure fluid. When disposing of the pressure fluids, observe the instructions in the safety data sheet.

The thruster to be scrapped should be dismantled into its individual parts and disposed of separately according to the various materials in accordance with the applicable regulations.
Dismantling should be carried out by competent personnel. There are no special dangers as long as suitable tools and equipment are used.

Furka Antriebstechnik GmbH
IHW Park, Gebäude T/EG
Eiserfelder Str. 316
57080 Siegen

T +49 271 338894 70

www.furka-antriebstechnik.de