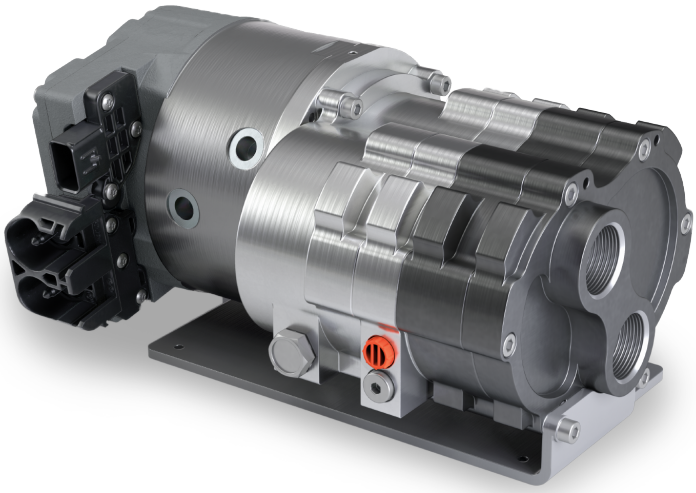
VACUUM SOLUTIONS

# MINK Hydrogen

Hydrogen Recirculation Blower
MH 0040 A

## Instruction Manual



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VACUUM APP

CE UKCA

0870242128 | A0004_en-US | Original instructions

1/22/2024

# Table of Contents

# 1 Safety

Prior to handling the machine, this instruction manual should be read and understood. If anything needs to be clarified, please contact your Busch representative.

Read this manual carefully before use and keep for future reference.

This instruction manual remains valid as long as the customer does not change anything on the product.

The machine is intended for industrial use. It must be handled only by technically trained personnel.

The machine is intended for use under monitored laboratory conditions. It must be handled only by technically trained personnel.

Always wear appropriate personal protective equipment in accordance with the local regulations.

The machine has been designed and manufactured in accordance with the state-of-the-art methods. Nevertheless, residual risks may remain, as described in the following chapters and in accordance with the chapter *Intended Use* [➔ 5].

This instruction manual highlights potential hazards where appropriate. Safety notes and warning messages are tagged with one of the keywords DANGER, WARNING, CAUTION, NOTICE and NOTE as follows:

**DANGER**

**... indicates an imminent dangerous situation that will result in death or serious injuries if not prevented.**

**WARNING**

**... indicates a potentially dangerous situation that could result in death or serious injuries.**

**CAUTION**

**... indicates a potentially dangerous situation that could result in minor injuries.**

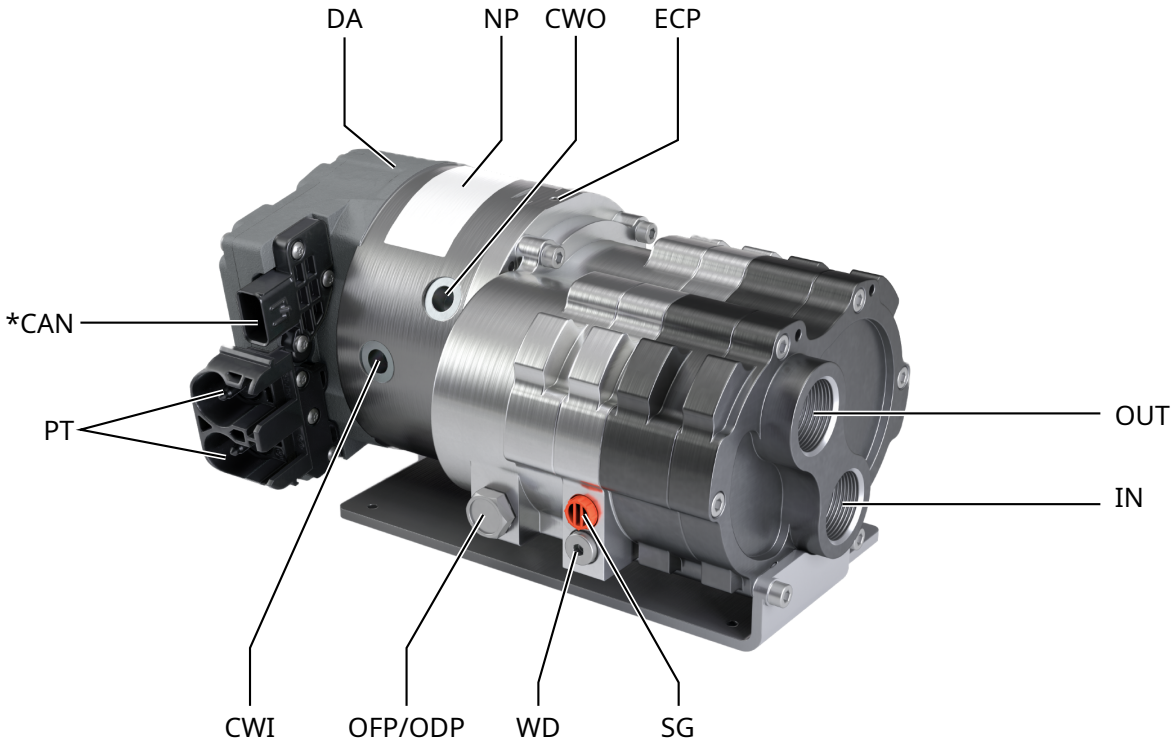
**NOTICE**

**... indicates a potentially dangerous situation that could result in damage to property.**

**NOTE**

**... indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.**

# 2 Product Description




*Incl. USB-Drive with CAN database

| Description | | | |
|---|---|---|---|
| IN | Inlet connection (connected to fuel cell inlet, 20 Nm) | OUT | Pressure connection (connected to fuel cell outlet, 20 Nm) |
| OFP/ODP | Oil fill/drain plug | ECP | Machine earth connection (M5, 8 Nm) |
| CWI | Cooling water inlet (<1 lpm, G1/4", 10 Nm) | CWO | Cooling water outlet (G1/4", 10 Nm) |
| SG | Sealing gas (G1/8", 8 Nm) | WD | Water drainage (G1/8", 8 Nm) |
| *CAN | CAN connector (Tyco) | PT | Power terminals (M6, 8 Nm) |
| DA | Directional arrow | NP | Nameplate |

## NOTE

**Technical term.**

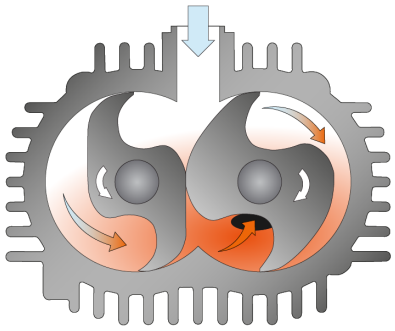
**In this instruction manual, we consider that the term ‘machine’ refers to the ‘compressor’.**

## NOTE

**Illustrations.**

**In this instruction manual, the illustrations may differ from the appearance of the machine.**

## 2.1 Operating Principle



The machine works on the claw principle.

## 2.2 Intended Use

**WARNING**

**In case of foreseeable misuse outside the intended use of the machine.**

**Risk of injuries!**

**Risk of damage to the machine!**

**Risk of damage to the environment!**

- Make sure to follow all instructions described in this manual.

The machine is intended for the recirculation of hydrogen gases or gas mixtures of nitrogen/humid hydrogen.

The machine is intended to be used with a water separator upstream of the suction connection. Liquid water permanently flowing through the process chamber will reduce its lifetime in a proportion linked to the amount of that liquid water.

The machine is intended for the compression of air and other dry, non-aggressive, non-toxic, non-ignitable and non-explosive gases.

Conveying of other media leads to an increased thermal and/or mechanical load on the machine and is permissible only after a consultation with Busch.

The machine is intended for the placement in a non-potentially explosive environment.

The machine is suitable for continuous operation.

Permitted environmental conditions, see *Technical Data* [➔ 37].

## 2.3 Water Cooling

Liquid cooling for the electronic components of the control. The electronics cuts off at 110°C. This temperature will be reached according to the overpressure, inlet- and ambient temperatures. The cooling is therefore mandatory in some operating points ranges (see the mapping performed with air at different temperatures).

## 2.4 Sealing Gas System

The sealing gas is **necessary** to improve the sealing efficiency and to protect the gearbox from water from the system. Connect the sealing gas port to a **dry gas source** ($N_2$, $H_2$, other compatible with process gas).

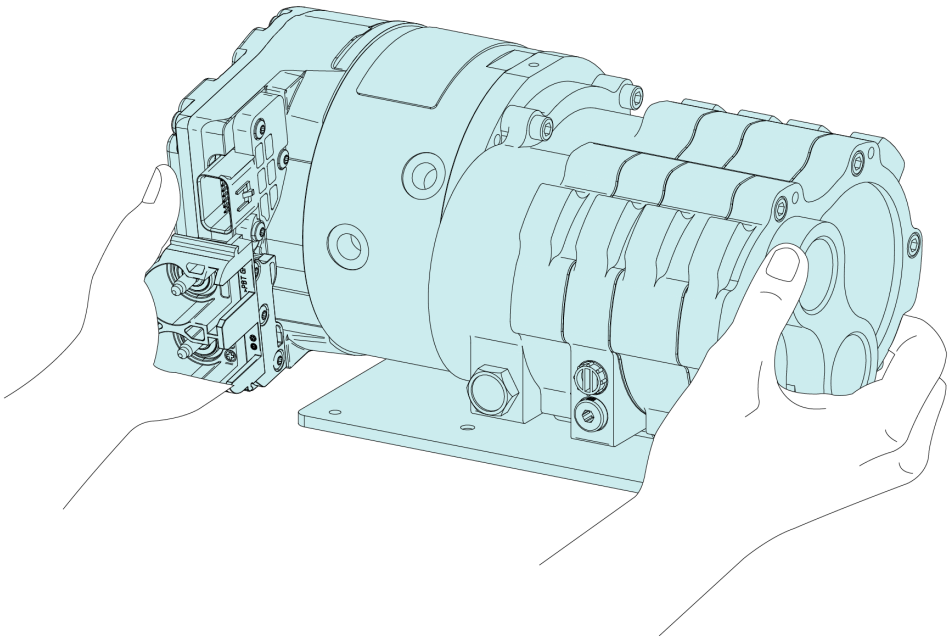
## 2.5 Water Drainage

Water from the recirculation circuit, which collects on the suction side of the machine, can be drained through the drainage connection.

- Protects the sealing system
- Protect the machine from frozen water at low temperatures

# 3 Transport

- To find out the weight of the machine, refer to the chapter *Technical Data* [➔ 37] or the nameplate (NP).



- Check the machine for transport damage.

If the machine is secured to a base plate:

- Remove the machine from the base plate.

# 4 Storage

- Seal all apertures with adhesive tape or reuse provided caps, if not connected to a system.

If the machine is to be stored for more than 2 months:

- Make sure that the inside of the process chamber will be kept dry and dust free at ambient temperature.
- Make sure the machine is stored in a horizontal position..
- Before restarting the machine after a long period of machine shutdown, it is recommended to maintain as described in chapter *Oil Draining* [➔ 22].
- After storage for more than 2 years, check the machine for oil leaks - visual inspection.

# 5 Installation

## 5.1 Installation Conditions

**WARNING**

**Hydrogen leaks.**

**Risk of severe injury!**

**Risk of explosion!**

- Perform a hydrogen leak test of the entire system in order to fulfill a maximum leak rate of 10 $Ncm^3/h$.
- Please refer to the Commission Regulation (EU) No 406/2010 and the Regulation (EU) No 79/2009.
- Make sure the machine is vented enough or monitored by a hydrogen sensor.
- Make sure that no excess pressure of more than 3.0 bar(a) reaches the machine inlet.

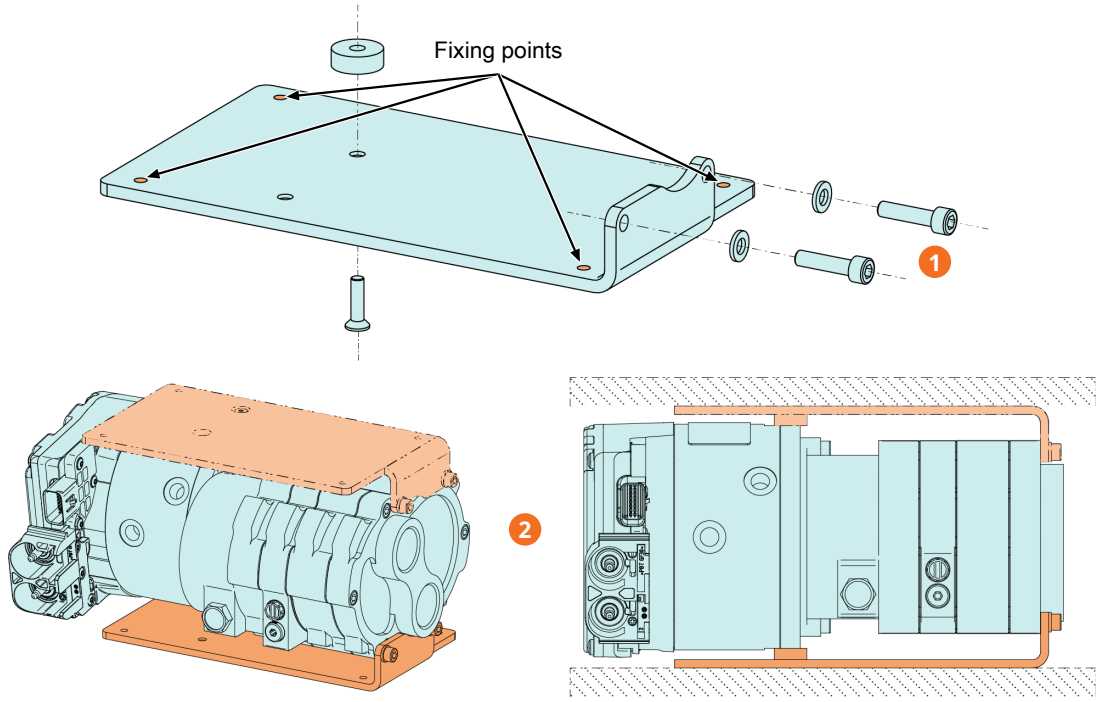
**NOTICE**

**Use of the machine outside of the permitted installation conditions.**

**Risk of premature failure!**

**Loss of efficiency!**

- Make sure that the installation conditions are fully respected.




| Description | | | |
|---|---|---|---|
| 1 | Installation on top or bottom M6 (8 Nm) | 2 | Horizontal installation with 2 possible configuration |

- Make sure that the environment of the machine is not potentially explosive.
- Make sure that the ambient conditions comply with the *Technical Data* [➔ 37].
- Make sure that the environmental conditions comply with the protection class of the motor and the electrical elements.
- Make sure that the installation space or location is protected from weather and lightning.
- We strongly recommend to install the product at the top level of the fluid circuit to avoid the stagnation of condensates inside the compression stage.
- Make sure that enough space remains for maintenance work.
- Make sure that the machine is placed or mounted horizontally on a flat surface.
- Make sure that all provided covers, guards, hoods, etc. are mounted.

**WARNING**

**Vibration level.**

**Risk of premature failure!**

- Make sure the product is protected from external shocks. Regarding vibration level, please contact your Busch representative to discuss the corresponding levels.

## 5.2 Connecting Lines / Pipes

**WARNING**

**Unprotected connection.**

**Risk of severe injury!**

- Do not put hand or fingers in the connection.

- Remove all protective covers before installation.
- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines on the suction and discharge connections.
- Make sure that the diameter of the connection lines over the entire length is at least as large as the connections of the machine.
- Make sure that no dust or other particles can enter into the machine.

In case of long connection lines, it is recommended to use larger diameters in order to avoid a loss of efficiency. In case, contact your Busch representative.

- Make sure that the connections are “face sealed” and not “thread sealed” to ensure tightness.

## 5.2.1 Suction Connection

**WARNING**

**Unprotected connection.**

**Risk of severe injury!**

- Do not put hand or fingers in the connection.

**NOTICE**

**Inlet gas particle size.**

**Risk of damage to the machine!**

- Make sure that the inlet gas complies with ISO 12103-1, A.2 fine test dust.

**NOTICE**

**Ingress of foreign objects or liquids.**

**Risk of damage to the machine!**

If the inlet gas contains dust or other foreign solid particles:

- Install a suitable filter (5 micron or less) upstream from the machine.
- Make sure that the filter is suitable to the pumping speed of the machine, see *Technical Data* [➔ 37].
- Make sure that the filter material is suitable for hydrogen applications.

Connection size(s):

– G1”

Depending on the specific configuration ordered, other connection dimensions may apply.

- Make sure that the gas is drawn without obstruction.
- Provide a water separator upstream of the suction connection. Liquid water permanently flowing through the process chamber will reduce its lifetime in a proportion linked to the amount of that liquid water.
- Make sure that the water separator is suitable to the pumping speed of the machine, see *Technical Data* [➔ 37].
- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines on the suction and discharge connections.

## 5.2.2 Discharge Connection

**WARNING**

**Unprotected connection.**

**Risk of severe injury!**

- Do not put hand or fingers in the connection.

**NOTICE**

**Discharge gas flow obstructed.**

**Risk of damage to the machine!**

- Make sure that the discharged gas will flow without obstruction. Do not shut off or throttle the discharge line.

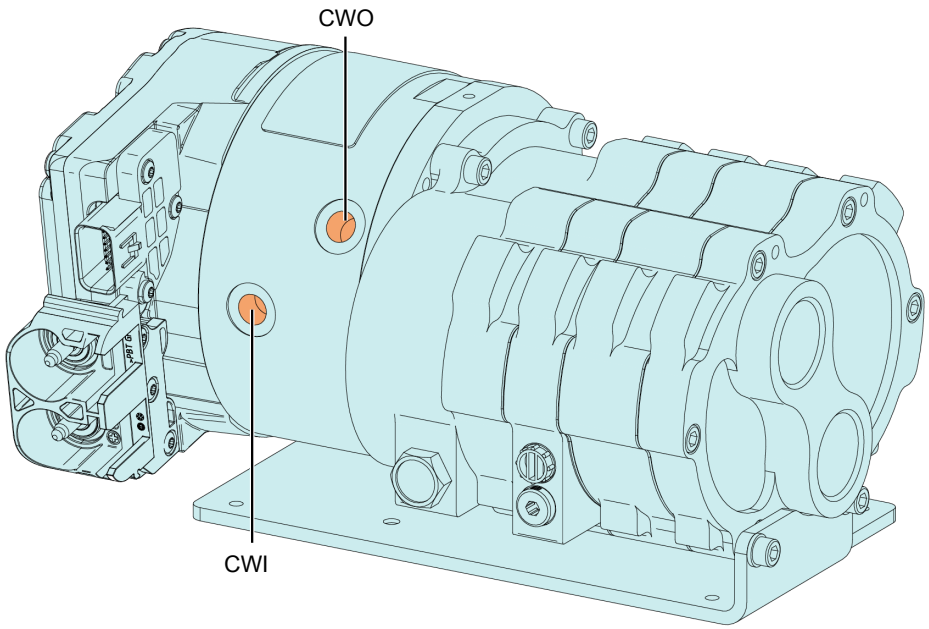
Connection size(s):

– G1”

Depending on the specific configuration ordered, other connection dimensions may apply.

- Make sure that the connection lines cause no stress on the connections of the machine. Therefore, we recommend installing flexible lines on the suction and discharge connections.

## 5.2.3 Cooling Water Connection




| Description | | | |
|---|---|---|---|
| CWO | Cooling water outlet G1/4" (10 Nm) | CWI | Cooling water inlet G1/4" (10 Nm) |

- Connect the cooling water connections (CWI / CWO) to the water supply.

Connection size:

– G ¼" (CWC)

- Materials in contact with the cooling water: Aluminum (EN-AW 5083)
- Make sure that the cooling water complies with the following requirements:

| | | |
|---|---|---|
| Supply capacity | l/min | min. 0.5 |
| Water pressure | bar | 1 ... 4 |
| Supply temperature | °C | +5 ... +80 |
| Required pressure differential across supply and return | bar | 0.05 |

- To reduce the maintenance effort and ensure a long product lifetime, we recommend the following cooling water quality:

| | | |
|---|---|---|
| Hardness | mg/l (ppm) | < 90 |
| Properties | Clean & clear | |
| PH value | | |
| Particle size | µm | < 200 |
| Chloride | mg/l | < 100 |
| Electrical conductivity | µS/cm | ≤ 100 |
| Free chloride | mg/l | < 0.3 |
| Materials in contact with the cooling water | | |

**NOTE**

**Water hardness unit conversion.**

**1 mg/l (ppm) = 0.056 °dh (german degree) = 0.07 °e (english degree) = 0.1 °fH (french degree)**

## 5.2.4 Barrier Gas System Connection

- Connect the barrier gas connection (BGC) to the gas supply.

Connection size:

– G1/8”

- Make sure that the gas complies with the following requirements:

| | | |
|---|---|---|
| Gas type | Dry nitrogen, hydrogen, other compatible with process gas | |
| Gas temperature | °C | 0 ... 95 |
| Maximum gas pressure | bar (g) | System pressure at IN (tolerance 0 ... +0.4 bar(g)) |
| Recommended pressure setting at the pressure safety valve | bar (g) | 2.7 |
| Filtration | µm | 5 |
| Recommended flow rate | SLM (standard liter per minute) | - |

## 5.2.5 Drainage Connection

**WARNING**

**Hydrogen leaks.**

**Risk of severe injury!**

**Risk of explosion!**

- Perform a hydrogen leak test of the entire system in order to fulfill a maximum leak rate of 10 $Ncm^3/h$.
- Please refer to the Commission Regulation (EU) No 406/2010 and the Regulation (EU) No 79/2009.
- Make sure the machine is vented enough or monitored by a hydrogen sensor.
- Make sure that no excess pressure of more than 3.0 bar(a) reaches the machine inlet.

Connection size:

– G1/8”

- Use the option of draining the machine if more than 0,2l/h water flow through the compressor chamber. Maximum water capacity of the machine = 2.5 l/h.
- Consider that the drainage system is pressurized with the pressure of the recirculation circuit.
- Connect the Drainage to the inlet connection (IN) if there is no drainage circuit.
- In case of a leak (hydrogen), escape.

# 6 Electrical Connection

**DANGER**

**Live wires.**

**Risk of electrical shock.**

- Electrical installation work must only be executed by qualified personnel.

**NOTICE**

**Electromagnetic compatibility.**

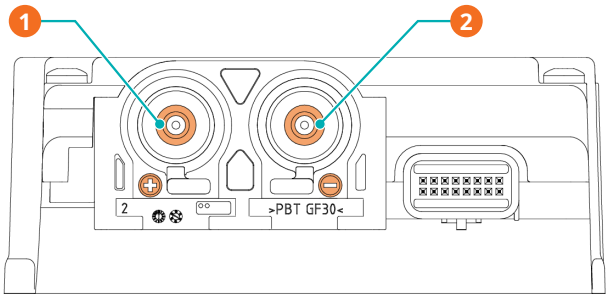
- Make sure that the motor of the machine will not be affected by electric or electromagnetic disturbance from the mains, if necessary, seek advice from Busch.
- Make sure that the EMC of the machine is compliant with the requirements of your supply network system, if necessary, provide further interference suppression (EMC of the machine, see *EU Declaration of Conformity* [➔ 39] or *UK Declaration of Conformity* [➔ 40]).

- Make sure that the motor of the machine will not be affected by electric or electromagnetic disturbance from the mains, if necessary seek advice from Busch.
- Electrically connect the machine
- Due to current level, recommended cable diameter min. 16 $mm^2$.

## 6.1 Machine delivered with a Variable Speed Drive

- If the variable speed drive is not equipped with a lockable disconnect switch, provide it on the power line so that the machine is completely secured during maintenance tasks.
- Provide an overload protection according to EN 60204-1.
- Connect the protective earth conductor.

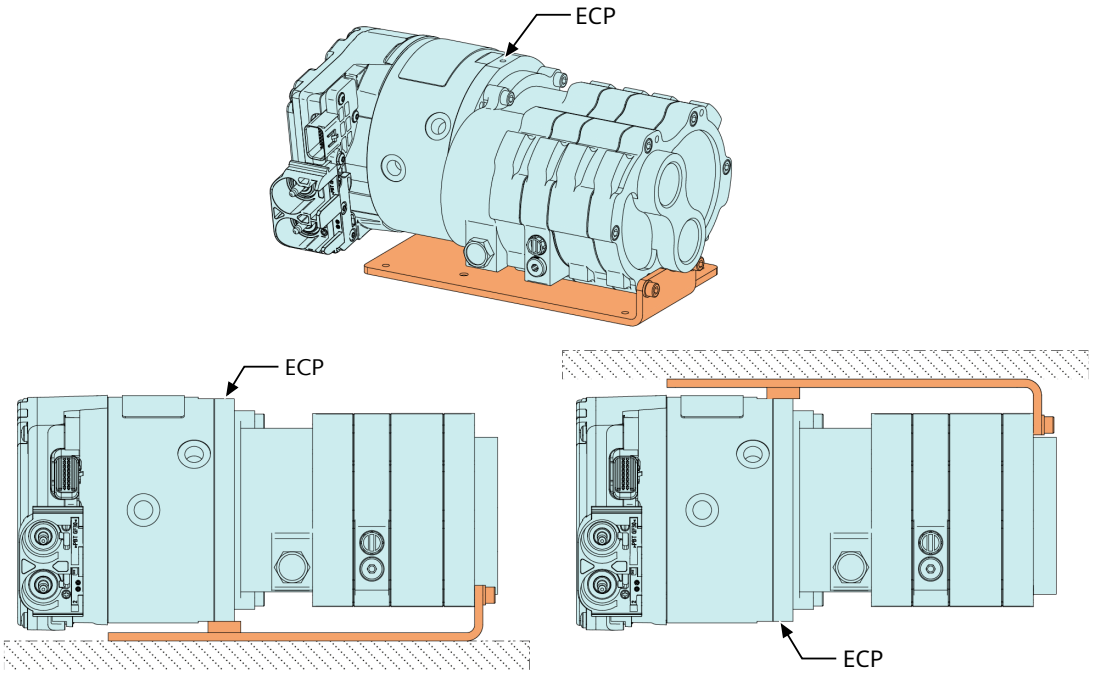
## 6.2 Terminal Connection




| Description | | | |
|---|---|---|---|
| 1 | Battery power connection<br>Terminal supply "+"<br>Bolt M6x12 (8 Nm) | 2 | Battery power connection<br>Terminal supply "-"<br>Bolt M6x12 (8 Nm) |

- A visual Poke yoke is defining the “+” (red) and “–“ (black)
- Coating bolts: Zn/Ni
- Ensure a good contact with his cable lungs for the electrical cone
- In case of harsh environment foreseen the protection of this area against corrosive mist

### 6.2.1 Earth Connection

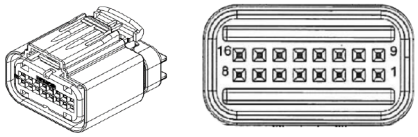



| Description | | | |
|---|---|---|---|
| ECP | Equipotential connection M6 (8 Nm) | | |

# 6.3 Signal Connection

The motor has a 16 pins signal connector.

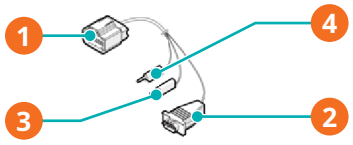
TE Socket 1488345 for plug TE GET.64 / 5-1419168-8




According to TE specification unused pins shall be closed in order to ensure IP6K9K protection.

| PIN Number | Assignment | Comment |
|---|---|---|
| 1 | CAN_L | CAN Low |
| 2 | D_IO_1 | Not used |
| 3 | CAN_H | CAN High |
| 4 | DGND | Not used |
| 5 | Wake up | Not used |
| 6 | 5V_IO | 5V supply for Killswitch |
| 7 | Killswitch | Enable Power stage |
| 8 | 5V_1 | Not used |
| 9 | AN_1 | Not used |
| 10 | A_GND_1 | Not used |
| 11 | 5V_2 | Not used |
| 12 | AN_2 | Not used |
| 13 | A_GND_2 | Not used |
| 14 | 5V_3 | Not used |
| 15 | AN_3 | Not used |
| 16 | A_GND_3 | Not used |

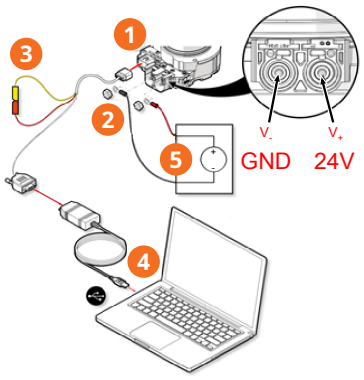
## Signal cable




| Description | | | |
|---|---|---|---|
| 1 | Plug TE GET.64 / 5-1419168-8 | 2 | SUB-D 9 male (for CAN communication) |
| 3 | Killswitch (yellow cable) | 4 | 5V_IO (red cable) |

1. Connect the signal cable
2. Use M6 nuts to connect the two cables (V- and V+)
3. “Killswitch” (yellow) cable to the “5V_IO” (red) cable

   *If required, install an emergency stop switch between the red- and yellow connector.*
4. Connect the PCAN USB (not in scope) interface to your computer / system
5. Power on the machine with an external power supply or battery



# 7 Commissioning

**NOTICE**

**Lubricating a dry running machine (compression chamber).**

**Risk of damage to the machine!**

- Do not lubricate the compression chamber of the machine with oil or grease.

**NOTICE**

**Ambient temperature below 0°C.**

**Risk of damage to the machine!**

- Use a cooling liquid with an antifreeze mixture (ratio 1:1).

**CAUTION**

**During operation the surface of the machine may reach temperatures of more than 70°C.**

**Risk of burns!**

- Avoid contact with the machine during and directly after operation.

**CAUTION**

**Noise of running machine.**

**Risk of damage to hearing!**

If people are present in the vicinity of a machine that is not insulated from noise for extended periods of time:

- Make sure to wear hearing protection.

- Make sure that the *Installation Conditions* [➔ 9] are met.
  - Turn on the water supply.
- Start the machine.
- Make sure that the maximum permissible number of starts does not exceed 12 starts per hour. Those starts should be spread within the hour.
- Make sure that the operating conditions comply with the *Technical Data* [➔ 37].

As soon as the machine is operated under normal operating conditions:

- Measure the motor current and record it as reference for future maintenance and trouble-shooting work.

## NOTICE

**Oil losses through the barrier gas connection**

**Risk of damage to the machine!**

Pressurize and vent the barrier gas system only while the machine is operating, by following this sequence:

- **Switch on** the machine.
- Set the rotation speed between 4000 rpm and 6000 rpm, then pressurize the barrier gas system.
- **Switch off** the machine.
- Set the rotation speed between 4000 rpm and 6000 rpm, then vent the barrier gas system to atmospheric pressure and finally stop the machine.

**CAN Communication Matrix on the USB stick:**

- .dbc file
- .pdf file

| CAN Connector and Voltage data | |
|---|---|
| Nominal voltage | 24 V DC |
| Voltage range | 15 ... 35 V DC |
| Ambient temperature range | -30 ... 95°C |
| Maximum electronic temperature (PCB) | 110°C |
| Rotation speed range | 1200 ... 6000 rpm |
| Maximum power consumption | 50 A |
| Baud rate CAN | 500 kbits/s |
| Overvoltage (switch off / error) | >35 V DC |
| Undervoltage (switch off / error) | <15 V DC |

# 8 Maintenance

**DANGER**

**Live wires.**

**Risk of electrical shock.**

- Electrical installation work must only be executed by qualified personnel.

**WARNING**

**The machine is contaminated with hazardous material.**

**Risk of poisoning!**

**Risk of infection!**

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

**CAUTION**

**Hot surface.**

**Risk of burns!**

- Before doing anything that requires touching the machine, let it cool down first.

**CAUTION**

**Failing to properly maintain the machine.**

**Risk of injuries!**

**Risk of premature failure and loss of efficiency!**

- Maintenance work must only be executed by qualified personnel.
- Respect the maintenance intervals or ask your Busch representative for service.

- Make sure that the system has no high hydrogen concentration.
- Shut down the machine and lock against inadvertent start up.
- Provide a lockable disconnecting switch in the power line to ensure that the machine is completely secured against inadvertent start up during the whole maintenance procedure.
- Disconnect the power supply.

If the machine is equipped with a barrier gas system:

- Close the barrier gas supply.

- Turn off the water supply.
- Vent the connected lines to atmospheric pressure.

If necessary:

- Disconnect all connections.

- Separate special waste from the machine.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the machine as scrap metal.

# 8.1 Maintenance Schedule

The maintenance intervals depend very much on the individual operating conditions. The intervals given below are desired to be considered as starting values which should be shortened or extended as appropriate. Particularly harsh applications such as high liquid water content in the process gas, other contamination or ingress of process material, can make it necessary to shorten the maintenance intervals significantly.

The following maintenance schedule has been defined as information according to internal tests performed at Busch.

**NOTE**

**Final maintenance schedule.**

**The final maintenance schedule must be committed between customers and Busch, based on field test results and analysis.**

| Interval | Maintenance work |
|---|---|
| Every 4000 to 6000 hours<br>or after 6 years | • Replace oil, see *Oil Draining* [➔ 22]. |

# 8.2 Oil Draining

## 8.2.1 Draining Procedure

### Draining the oil

**NOTICE**

**Use of an inappropriate oil.**

**Risk of premature failure!**

**Loss of efficiency!**

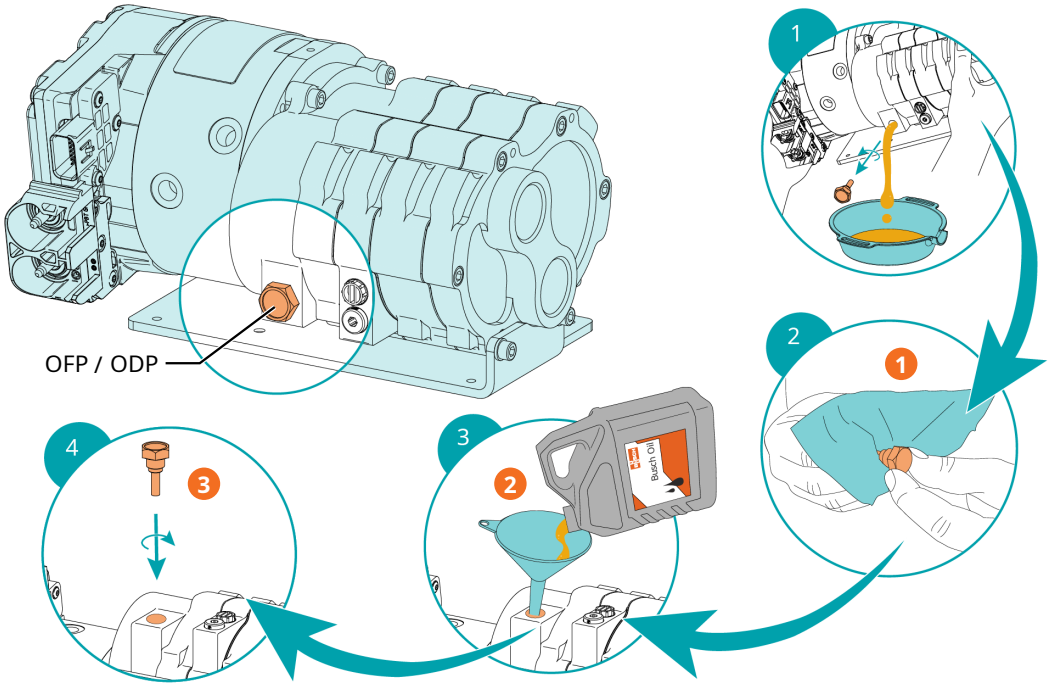
- Only use an oil type which has previously been approved and recommended by Busch.

**NOTE**

**Oil draining.**

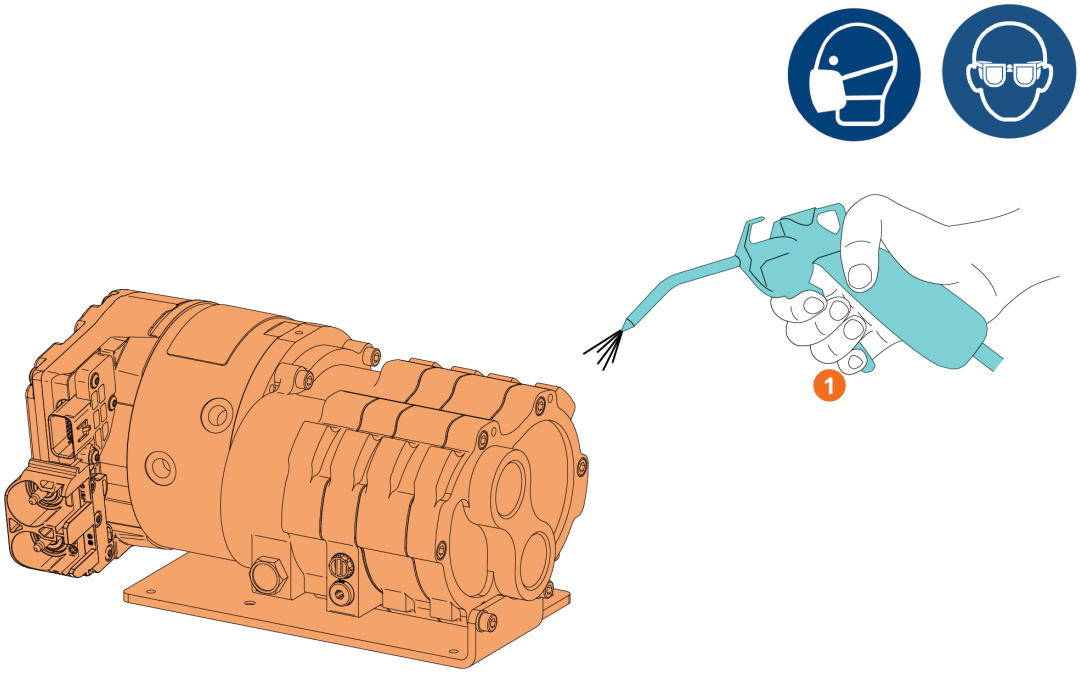
**Recommendation.**

- There is no ideal angle to put the gear for oil draining. We would recommend to move the gear-box several times from standard “vertical position” to a 90° position. The remaining oil must be the lowest possible.




| Description | | | |
|---|---|---|---|
| OFP | Oil fill plug | ODP | Oil drain plug |
| 1 | Clean or if neccessary replace the plug | 2 | Fill till reaching close to the lower edge of the filling hole (approx. 90 ml) |
| 3 | Tighten the plug with 7 Nm torque | | |

## 8.3 Cleaning from Dust and Dirt




| Description | | | |
|---|---|---|---|
| 1 | Clean the surface of the machine and power unit | | |

# 9 Overhaul

**WARNING**

**The machine is contaminated with hazardous material.**

**Risk of poisoning!**

**Risk of infection!**

If the machine is contaminated with hazardous material:

- Wear appropriate personal protective equipment.

**NOTICE**

**Improper assembly.**

**Risk of premature failure!**

**Loss of efficiency!**

- Any dismantling of the machine that goes beyond anything that is described in this manual should be done by Busch authorized technicians.

In case of the machine having conveyed gas that was contaminated with foreign materials which are dangerous to health:

- Decontaminate the machine as much as possible and state the contamination status in a ‘Declaration of Contamination’.

Busch will only accept machine accompanied by a signed, fully completed and legally binding "declaration of contamination", downloadable from the following link: *buschvacuum.com/declaration-of-contamination*.

# 9.1 Replacement Pump-Unit

**DANGER**

**Strong magnetic field**

**For persons with pacemakers there is a danger to life.**

**WARNING**

**Strong magnetic field.**

**Risk of injury due to uncontrolled mutual attraction of magnetic or magnetizable parts!**

- Take into account the magnetic forces occurring during all operations, especially within a radius of 0.5 m around the magnetic coupling.

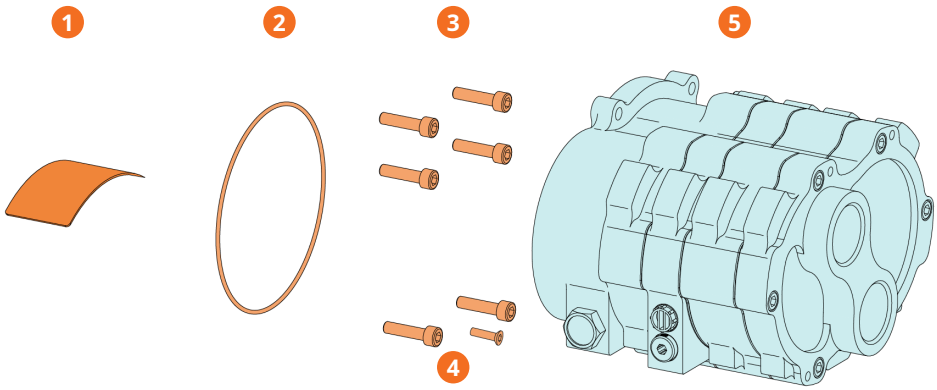
**CAUTION**

**Restriction of the separator vent.**

**Magnetic data carriers (floppy disks, credit cards, etc.) can be damaged or erased by magnetic fields.**

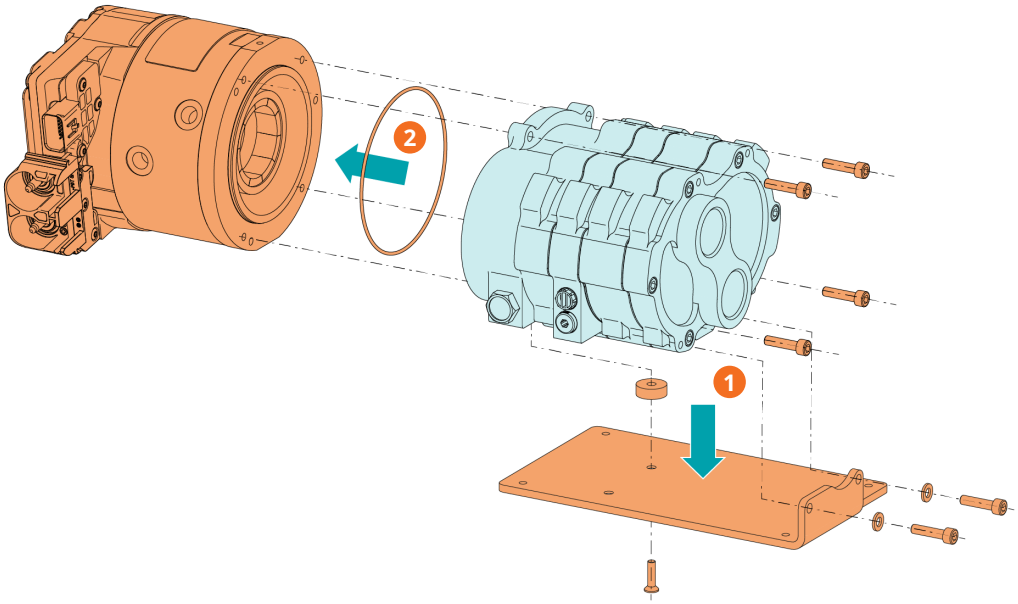
- Keep a minimum distance of 1 m from the magnetic field.

## 9.1.1 Scope of Delivery

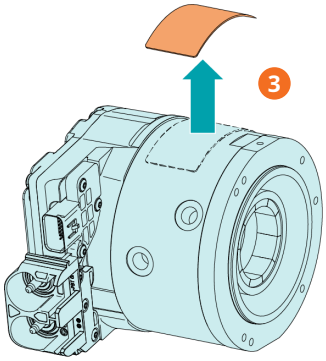


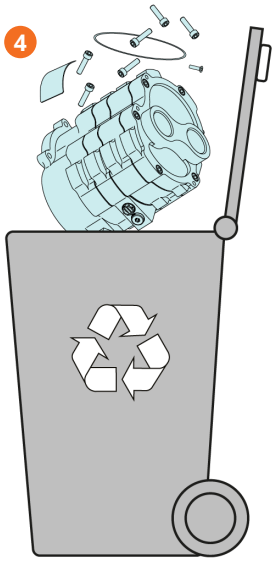

| Description | | | |
|---|---|---|---|
| 1 | Nameplate | 2 | O-ring |
| 3 | 4x screws M6 (installation drive-unit) | 4 | 3x screws M6 (installation base plate) |
| 5 | Pump-unit | | |

## 9.1.2 Removal and Installing the Unit

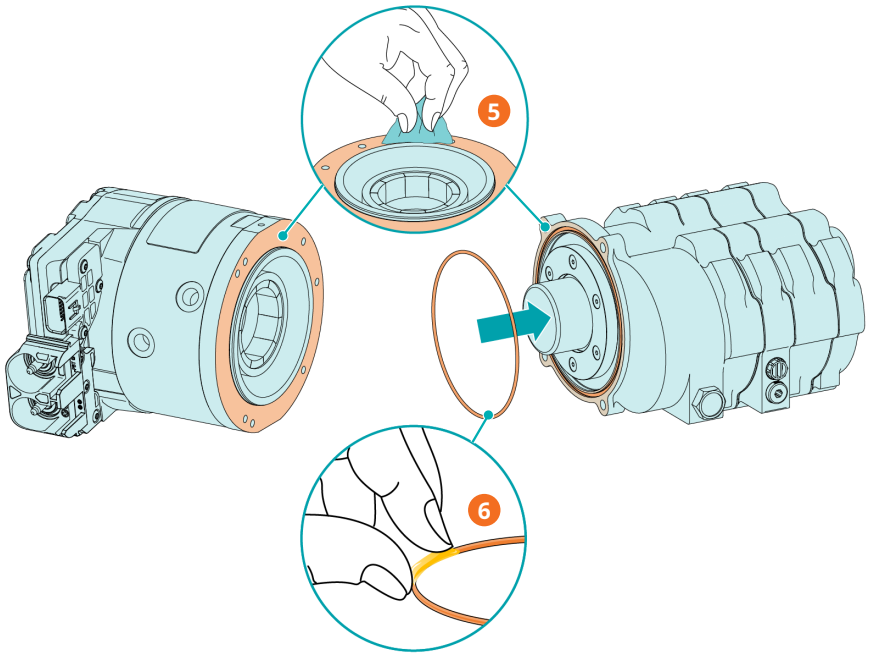



| Description | | | |
|---|---|---|---|
| 1 | Loosen the screws and remove the base plate | 2 | Loosen the screws and remove the motor unit and the o-ring |

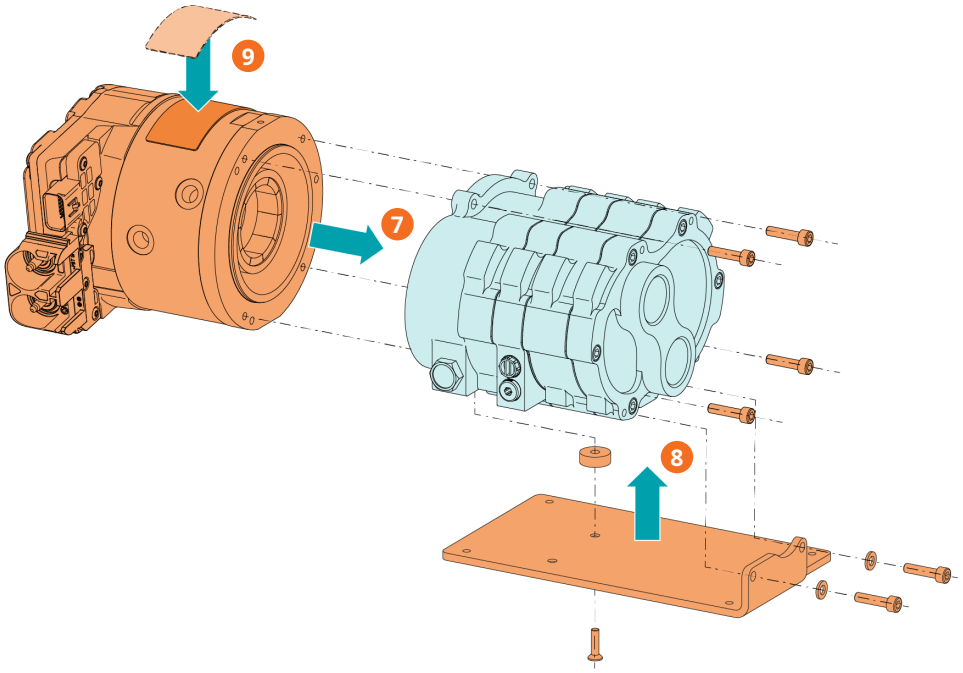



| Description | | | |
|---|---|---|---|
| 3 | Remove the old nameplate from the drive-unit | 4 | Dispose the defective pump-unit and used o-ring, screws and nameplate in compliance with applicable regulations of your country |




| Description | | | |
|---|---|---|---|
| 5 | Clean the contact surfaces from debris and liquids with a cloth | 6 | First lubricate the o-ring with grease, then insert the o-ring into the groove |




| Description | | | |
|---|---|---|---|
| 7 | Install the drive-unit to the new pump-unit with the 4x screws M6 (8 Nm) | 8 | Install the base plate to the pump-unit with the 3x screws M6 (8 Nm) |
| 9 | Reapply the new nameplate on the drive-unit | | |

# 10 Decommissioning

**DANGER**

**Live wires.**

**Risk of electrical shock.**

- Electrical installation work must only be executed by qualified personnel.

**CAUTION**

**Hot surface.**

**Risk of burns!**

- Before doing anything that requires touching the machine, let it cool down first.

- Shut down the machine and lock against inadvertent start up.
- Disconnect the power supply.
- Turn off the water supply.

If the machine is equipped with a barrier gas system:

- Close the barrier gas supply.

- Vent the connected lines to atmospheric pressure.
- Disconnect all connections.

If the machine is to be stored:

- See Storage.

## 10.1 Dismantling and Disposal

- Drain and collect the oil.
- Make sure that no oil drips onto the floor.
- Separate special waste from the machine.
- Dispose of special waste in compliance with applicable regulations.
- Dispose of the machine as scrap metal.

# 11 Spare Parts

**NOTICE**

**Use of non-Busch genuine spare parts.**

**Risk of premature failure!**

**Loss of efficiency!**

- The exclusive use of Busch genuine spare parts and consumables is recommended for the correct functioning of the machine and to validate the warranty.

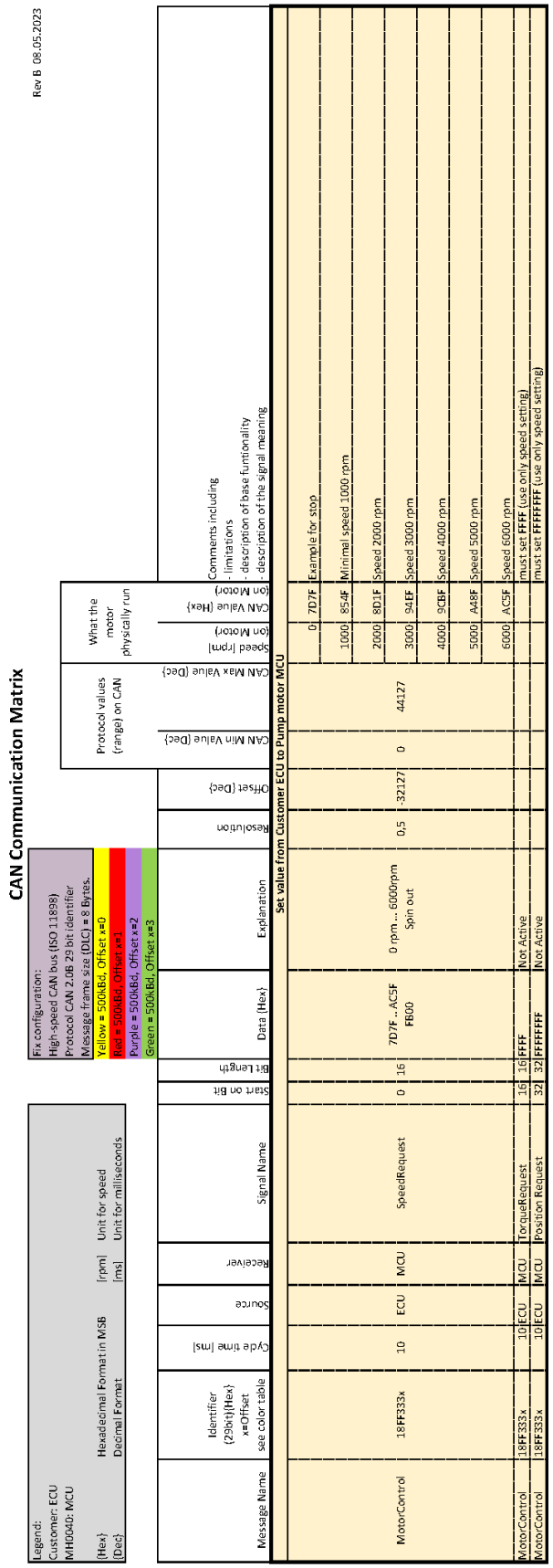
| Spare part | Description | Part no. |
|---|---|---|
| Oil fill/drain plug (OFP/ODP) | | 0415 153 401 |
| Overhaul kit | Replacement stage, seal, screws, nameplate | 2000 096 045 |

If other parts are required:

- Contact your Busch representative.

# 12 CAN Protocol

## 12.1 CAN Matrix



CAN Communication Matrix

Rev B 08.05.2023

Legend:
Customer: ECU
MH0040: MCU
{Hex} Hexadecimal Format in MSB [rpm] Unit for speed
{Dec} Decimal Format [ms] Unit for milliseconds

Fix configuration:
High-speed CAN bus (ISO 11898)
Protocol CAN 2.0B 29 bit identifier
Message frame size (DLC) = 8 Bytes.
Yellow = 500kBd, Offset x=0
Red = 500kBd, Offset x=1
Purple = 500kBd, Offset x=2
Green = 500kBd, Offset x=3

| Message Name | Identifier {29bit}{Hex} x=Offset see color table | Cycle time [ms] | Source | Receiver | Signal Name | Start on Bit | Bit Length | Data {Hex} | Explanation | Resolution | Offset {Dec} | Protocol values (range) on CAN: CAN Min Value {Dec} | Protocol values (range) on CAN: CAN Max Value {Dec} | What the motor physically run: Speed [rpm] (on Motor) | What the motor physically run: CAN Value {Hex} (on Motor) | Comments including<br>- limitations<br>- description of base funtionality<br>- description of the signal meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Set value from Customer ECU to Pump motor MCU | | | | | | | | | | | | | | | | |
| MotorControl | 18FF333x | 10 | ECU | MCU | SpeedRequest | 0 | 16 | 7D7F .. AC5F<br>FB00 | 0 rpm ... 6000rpm<br>Spin out | 0,5 | -32127 | 0 | 44127 | 0 | 7D7F | Example for stop |
| | | | | | | | | | | | | | | 1000 | 854F | Minimal speed 1000 rpm |
| | | | | | | | | | | | | | | 2000 | 8D1F | Speed 2000 rpm |
| | | | | | | | | | | | | | | 3000 | 94EF | Speed 3000 rpm |
| | | | | | | | | | | | | | | 4000 | 9CBF | Speed 4000 rpm |
| | | | | | | | | | | | | | | 5000 | A48F | Speed 5000 rpm |
| | | | | | | | | | | | | | | 6000 | AC5F | Speed 6000 rpm |
| MotorControl | 18FF333x | 10 | ECU | MCU | TorqueRequest | 16 | 16 | FFFF | Not Active | | | | | | | must set FFFF (use only speed setting) |
| MotorControl | 18FF333x | 10 | ECU | MCU | Position Request | 32 | 32 | FFFFFFFF | Not Active | | | | | | | must set FFFFFFFF (use only speed setting) |

| Message Name | Identifier (29bit)(Hex) x=Offset see color table | Cycle time [ms] | Source | Receiver | Signal Name | Start on Bit | Bit Length | Data (Hex) | Explanation | Resolution | Offset (Dec) | Protocol values (range) on CAN: CAN Min Value (Dec) | Protocol values (range) on CAN: CAN Max Value (Dec) | What the motor physically run: Speed [rpm] (on Motor) | What the motor physically run: CAN Value (Hex) (on Motor) | Comments including<br>- limitations<br>- description of base funtionality<br>- description of the signal meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **One time configuration from Customer ECU to Pump motor MCU** | | | | | | | | | | | | | | | | |
| MotorConfig | 18FF343x | Async | ECU | MCU | Max DC current | 0 | 8 | 0...FA<br>FB...FE<br>FF | Values<br>Reserved<br>Not Active | 1 | 0 | 0 | 250 | | | Unit: A Valid input 0..250A. Internally limited to 0...120A<br>Reserved = not used<br>If not Active, defalut value of parameter Ibar_Ctrl.IbatMax is used (Strong recommended!) |
| MotorConfig | 18FF343x | Async | ECU | MCU | Min DC current | 8 | 8 | 0...FA<br>FB...FE<br>FF | Values<br>Reserved<br>Not Active | 1 | 0 | 0 | 250 | | | Unit: A Valid input 0..250A. Internally limited to 0...120A<br>Reserved = not used<br>If not Active, defalut value of parameter Ibar_Ctrl.IbatMin is used (Strong recommended!) |
| MotorConfig | 18FF343x | Async | ECU | MCU | Max Iq current | 16 | 8 | 0...FA<br>FB...FE<br>FF | Values<br>Reserved<br>Not Active | 1 | 0 | 0 | 250 | | | Unit: A Valid input 0..250A. Internally limited to 0...120A<br>Reserved = not used<br>If not Active, defalut value of parameter Customer.IqMax is used (Strong recommended!) |
| MotorConfig | 18FF343x | Async | ECU | MCU | Min Iq current | 24 | 8 | 0...FA<br>FB...FE<br>FF | Values<br>Reserved<br>Not Active | 1 | 0 | 0 | 250 | | | Unit: A Valid input 0..250A. Internally limited to 0...120A<br>Reserved = not used<br>If not Active, defalut value of Customer.IqMin is used (Strong recommended!) |
| MotorConfig | 18FF343x | Async | ECU | MCU | Max speed | 32 | 16 | 0...2EE0<br>2EE1...FFFE<br>FFFF | Values<br>Reserved<br>Not Active | 0,5 | 0 | 0 | 12000 | 6000 | 2EE0 | Unit: rpm/2 Valid input 0..12'000. For Motor possible 0...6000rpm = 0...12'000 (DEC) = 0...2EE0 (Hex)<br>Reserved = not used<br>If not Active, defalut value of parameter customer.Nmax is used |
| **Actual Messages from Pump motor MCU to Customer ECU** | | | | | | | | | | | | | | | | |
| Motor Feedback1 | 18FF312x | 10 | MCU | ECU | Actual speed | 0 | 16 | 7D7F .. AC5F<br>2EE1...FFFE<br>FE00<br>FFFF | Values<br>Reserved<br>Error<br>Not Available | 0,5 | -32127 | 32127 | 44127 | 6000 | AC5F | Unit: rpm/2 Actual speed of the motor output 0..12'000. 0...6000rpm = 0...12'000 (DEC) = 0...2EE0 (Hex)<br>Reserved = not used (except Error)<br>Error will be sent if the MCU cannot provide the motor speed due to failure of speed sensing system.<br>Not Available is sent if MCU is not available, example: running start-up sequence. |
| Motor Feedback1 | 18FF312x | 10 | MCU | ECU | Target speed | 16 | 16 | 0...2EE0<br>2EE1...FFFE<br>FFFF | Values<br>Reserved<br>Not Available | 0,5 | -32127 | 32127 | 44127 | 6000 | 2EE0 | Target speed 0-6000 rpm<br>Reserved = not used<br>Not Available is sent if the motor is not in speed control mode. |
| Motor Feedback1 | 18FF312x | 10 | MCU | ECU | Actual Torque | 32 | 16 | 0...FDFF<br>FE00...FFFE<br>FFFF | Values<br>Error<br>Not Available | 0,015 | -32127 | 0 | 65536 | | | Unit= A. Actual torque building phase current (Iq) between -50A ... +50A<br>Torque in Nm is calculated by 0.56. Example 20A * 0.56Nm/A = 11.2Nm<br>Error<br>Not Available is sent if Enable Pin is low. |
| Motor Feedback1 | 18FF312x | 10 | MCU | ECU | Actual Current | 48 | 8 | 0...FD<br>Fe<br>FF | Values<br>Error<br>Not Available | 2 | -126 | 0 | 250 | | | Unit: A. Estimation of total current consumption of MCU.<br>Total Current over 130A additional Failure Cut Off is set.<br>Not Available is set on start-up. |
| Motor Feedback1 | 18FF312x | 10 | MCU | ECU | Message Counter | 56 | 4 | | | 1 | 0 | 0 | 16 | | | Cyclic Message counter (0-15) that increments with each message transmission. |
| Motor Feedback1 | 18FF312x | 10 | MCU | ECU | Message Checksum | 60 | 4 | | | 1 | 0 | 0 | 16 | | | The 4 bit checksum is the sum of the high nibble and the low nibble of the sum of the identifer, the first 7 data bytes and the 4 bit message counder. It is calculated as follows:<br>Checsum = (Byte1 + Byte2 + Byte3 + Byte4 + Byte5 + Byte6 + Byte7 + message counter&0x0F + message ID low byte + message ID mid low byte + message ID mid high byte + message ID high byte) |

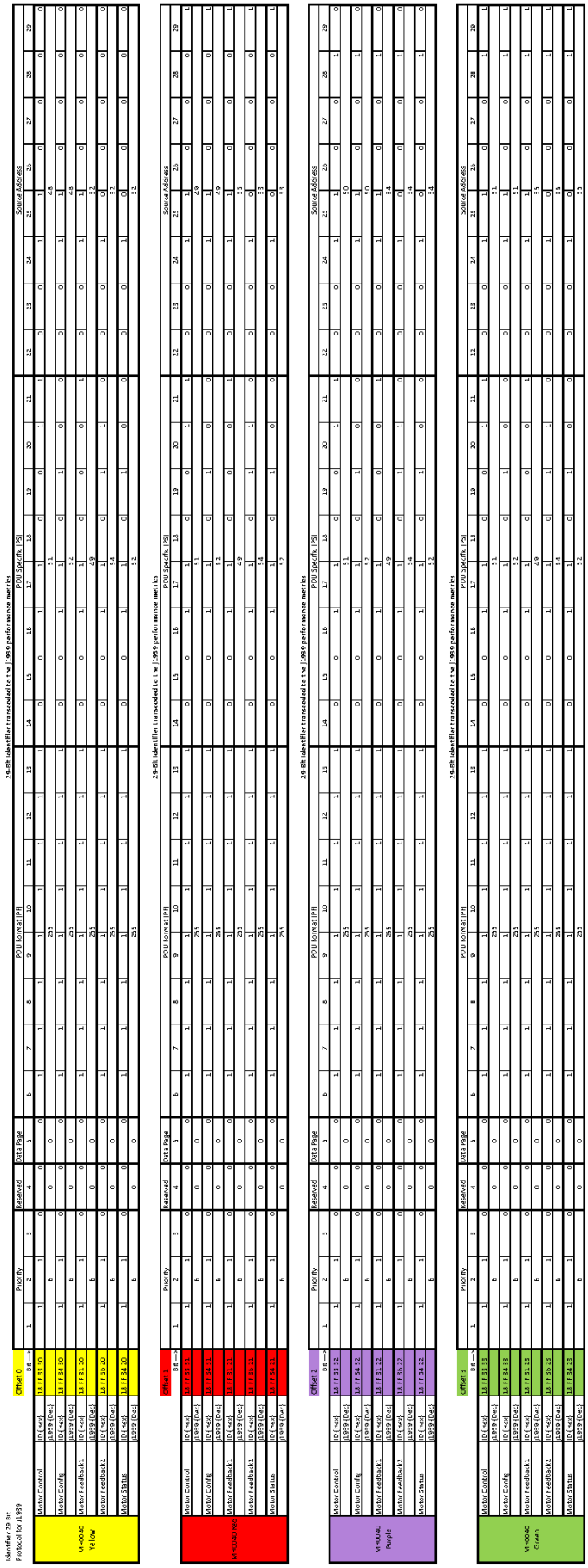
Motor Feedback2 is not needed for the MH0040. The results arriving from identifier 18FF362x can be ignored.

Status Message Part 1

| Message Name | Identifier {29bit}{Hex} x=Offset see color table | Cycle time [ms] | Source | Receiver | Signal Name | Start on Bit | Bit Length | Data {Hex} | Explanation | Resolution | Offset {Dec} | Protocol values (range) on CAN: CAN Min Value {Dec} | Protocol values (range) on CAN: CAN Max Value {Dec} | What the motor physically run: Speed [rpm] on Motor) | What the motor physically run: CAN Value {Hex} on Motor) | Comments including<br>- limitations<br>- description of base funtionality<br>- description of the signal meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Status from Pump motor MCU to Customer ECU** | | | | | | | | | | | | | | | | |
| Motor Status | 18FF342x | 100 | MCU | ECU | Operational State | 0 | 4 | 02..0B | Ready/Normal<br>Motor degraded<br>Reserved<br>Disabled<br>Failure<br>Not Ready | 1 | 0 | 0 | 16 | | | Operational State indicates the state of the motor as additional information during limitations<br>"Normal Operation" no constrains are active<br>"Motor performance degraded"<br>"Reserved" never sent<br>"Motor disabled" will be sent if the Enable or WakeUP input is LOW<br>"Failure" will be sent if the motor is cut-off regardless of the cause<br>"Not Ready" at Startup initialization until MotorControl1 message is received once |
| Motor Status | 18FF342x | 100 | MCU | ECU | Temp Limit Warning | 4 | 2 | 00<br>01<br>02<br>03 | Temperature ok<br>Limits Exceeded<br>Error<br>Not Available | 1 | 0 | 0 | 4 | | | Temperature ok: Sensors on PCB<br>Limits Exceeded: Temperature is critical<br>Error: Not used<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Analog Ctrl Cut Off | 8 | 2 | 00<br>01<br>02<br>03 | Signal ok<br>Motor Cut Off<br>Error<br>Not Available | 1 | 0 | 0 | 4 | | | Analog signal is within allowable range<br>Singal is out of range. (Possible short cut to +Supply or GND)<br>Error: Not used<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Under Voltage Cut Off filtered by 50Hz. | 10 | 2 | 00<br>01<br>02<br>03 | Voltage ok<br>Motor Cut Off<br>Error<br>Not Available | 1 | 0 | 0 | 4 | | | Supply voltage is >16V = ok<br>Supply <16V = Motor stopped.<br>Error: Not used<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Over Voltage Cut Off filtered by 50Hz. | 12 | 2 | 00<br>01<br>02<br>03 | Voltage ok<br>Motor Cut Off<br>Error<br>Not Available | 1 | 0 | 0 | 4 | | | Supply voltage is <32V = ok<br>Supply >32V = Motor stopped.<br>Error: Not used<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Over Temp Cut Off | 14 | 2 | 00<br>01<br>02<br>03 | Temperature ok<br>Motor Cut Off<br>Error<br>Not Available | 1 | 0 | 0 | 4 | | | Temerature of Electronic and motor is ok<br>Electronic temperature too high (>100°C) = Motor stopped.<br>Error on temperature sensor.<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Motor Blocked | 16 | 2 | 00<br>01<br>02<br>03 | Motor ok<br>Motor blocked<br>Reserved<br>Not Available | 1 | 0 | 0 | 4 | | | Motor turn free =ok<br>Rotor blocked. Reset by T_Wakeup.<br>Not used.<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Internal Failure | 18 | 2 | 00<br>01<br>02<br>03 | Normal operation<br>Internal failure<br>Reserved<br>Not Available | 1 | 0 | 0 | 4 | | | Normal operation<br>Internal failure. Reset by T_Wakeup. (Causes see CAN trouble shooting)<br>Not used.<br>Not Available: During start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Actual Control Mode | 20 | 4 | 00<br>01<br>02<br>03<br>04..0D<br>0E<br>0E<br>0F | Not selected<br>Speed control<br>Torque control<br>Position control<br>Reserved<br>Error<br>Not Available | 1 | 0 | 0 | 16 | | | Motor ready for control request<br>Motor in speed control mode<br>Motor in speed torque control mode<br>Motor in position control mode<br>Not used<br>Control mode not correctly specified (See CAN trouble shooting)<br>Not Available: During start-up |

Status Message Part 2

| Message Name | Identifier (29bit)(Hex) xx=Offset see color table | Cycle time [ms] | Source | Receiver | Signal Name | Start on Bit | Bit Length | Data (Hex) | Explanation | Resolution | Offset (Dec) | Protocol values (range) on CAN: CAN Min Value (Dec) | CAN Max Value (Dec) | What the motor physically run: Speed [rpm] (on Motor) | CAN Value (Hex) (on Motor) | Comments including<br>- limitations<br>- description of base funtionality<br>- description of the signal meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motor Status | 18FF342x | 100 | MCU | ECU | Supply Voltage | 26 | 8 | 00..FD<br>FE<br>FF | Voltage value<br>Error<br>Not Available | 0,5 | 0 | 0 | 256 | | | Measured supply Voltage [V/2]<br>Not used<br>Not Available during start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Temp Power Stage | 34 | 8 | 00..FA<br>FB...FD<br>FE<br>FF | Temperature value<br>Reserved<br>Error<br>Not Available | 1 | -40 | 0 | 256 | | | Measured temperature on electronics (-40°C..+210°C)<br>Not used<br>Error on temperature sensor<br>Not Available during start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Kill switch open | 42 | 2 | 01<br>02<br>03 | Kill switch open<br>Reserved<br>Not Available | 1 | 0 | 0 | 4 | | | Kill switch open: Motor enable = low<br>Reserved<br>Not Available |
| Motor Status | 18FF342x | 100 | MCU | ECU | Casing temperature | 44 | 8 | 00..FA<br>FB..FD<br>FE<br>FF | Temperature value<br>Reserved<br>Error<br>Not Available | 1 | -40 | 0 | 256 | | | Measured temperature on housing (-40°C..+210°C)<br>Not used<br>Error on temperature sensor<br>Not Available during start-up |
| Motor Status | 18FF342x | 100 | MCU | ECU | Message Counter | 56 | 4 | | | 1 | 0 | 0 | 16 | | | Cyclic Message counter (0-15) that increments with each message transmission. |
| Motor Status | 18FF342x | 100 | MCU | ECU | Message Checksum | 60 | 4 | | | 1 | 0 | 0 | 16 | | | The 4 bit checksum is the sum of the high nibble and the low nibble of the sum of the identifier, the first 7 data bytes and the 4 bit message counter. It is calculated as follows:<br>Checsum = (Byte1 + Byte2 + Byte3 + Byte4 + Byte5 + Byte6 + Byte7 + message counter&0x0F + message ID low byte + message ID mid low byte + message ID mid high byte + message ID high byte) |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | MCU Identity | | | | |
| Unit Identity | 18FF352x | 1000 | MCU | ECU | Software Version | 0 | 8 | 00..FD<br>FE<br>FF | Software Version<br>Error<br>Not Available | 1 | 0 | 0 | 256 | | | Software Version<br>Not used<br>Not used |
| Unit Identity | 18FF352x | 1000 | MCU | ECU | Hardware Version | 8 | 8 | 00..FD<br>FE<br>FF | Hardware Version<br>Error<br>Not Available | 1 | 0 | 0 | 256 | | | Hardware Version: Hex 0B = 11 -> 1.1; 14 -> 2.0 / make Hex to Dec and div by 10<br>Not used<br>Not used |
| Unit Identity | 18FF352x | 1000 | MCU | ECU | Manufacturing Date | 16 | 32 | 0000..FDFFFFFF<br>FE000000<br>FFFFFFFF | Date<br>Error<br>Not Available | 1 | 0 | 0 | 4211081215 | | | Format: YYYYMMDD as Hex value. Example: 2013-04-11 is Hex 20130411<br>Not used<br>Not used |
| Unit Identity | 18FF352x | 1000 | MCU | ECU | Serial Number | 48 | 16 | 0000..FDFF<br>FE00<br>FFFF | Serial Number<br>Error<br>Not Available | 1 | 0 | 0 | 64255 | | | Format: nnnn as headecimal value. Example: s/n 12 is Hex 0012. Max value is 9999, counting per day.<br>Not used<br>Not used |


Identifier: 29 Bit
Protocol for J1939
29-Bit identifier transcoded to the J1939 performance metrics
PDU format (PF)
PDU Specific (PS)
Source Address
Priority
Reserved
Data Page
Offset 0
Offset 1
Offset 2
Offset 3
MH0040 Yellow
MH0040 Red
MH0040 Purple
MH0040 Green
Motor Control
Motor Config
Motor Feedback1
Motor Feedback2
Motor Status
ID (Hex)
J1939 (Dec)

# 13 Troubleshooting

**DANGER**

**Live wires.**

**Risk of electrical shock.**

- Electrical installation work must only be executed by qualified personnel.

**CAUTION**

**Hot surface.**

**Risk of burns!**

- Before doing anything that requires touching the machine, let it cool down first.

| Problem | Possible Cause | Remedy |
|---|---|---|
| The machine does not start. | The motor is not supplied with the correct voltage. | • Check the power supply. |
| | The motor is defective. | • Replace the motor. |
| | The coupling (CPL) is defective. | • Replace the coupling (CPL). |
| | The rotors are defective. | • Replace the pump-unit, see *Replacement Pump-Unit* [➔ 25]. |
| The machine does not start / rotor clocked at ambient temperatures below 0°C. | At temperatures (ambient; electronics; etc.) below 0 °C, the error **ROTOR BLOCKED** can occur.<br>There is a possibility that the rotor is blocked by frozen water. | Error **ROTOR BLOCKED** is only removeable by a power-reset.<br>• cut off the power supply. (optional: start a heating element to melt the ice)<br>• wait 5 min.<br>• restart the machine and send the starting signal.<br>• if the error still occurs, repeat the steps. |
| The machine does not work, while the motor is running: | The machine is equipped with a magnetic coupling:<br>The magnetic coupling can`t catch the motor on its own. | • Stop the motor, wait until the motor stops turning and start again. |
| The machine does not reach the usual pressure on the discharge connection. | The inlet screen (IS) is partially clogged. | • Clean the inlet screen (IS). |
| | The inlet filter cartridge (optional) is partially clogged. | • Replace the inlet filter cartridge. |
| | The pressure system or pressure line is not leak-tight. | • Check the hose or pipe connection for leakage. |
| | The pressure relief valve/ regulating system (SV) is misadjusted or defective. | • Adjust, repair or replace, respectively. |
| | Internal parts are worn or damaged. | • Repair the machine (contact Busch). |
| | Partial clogging in the discharge or pressure line. | • Remove the clogging. |

| Problem | Possible Cause | Remedy |
|---|---|---|
| The machine runs very noisily. | Worn coupling (CPL). | • Replace the coupling (CPL). |
| | Oil level too low. | • Top up oil. |
| | Defective bearings. | • Repair the machine (contact Busch). |
| The machine runs too hot. | Insufficient cooling. | • Remove dust and dirt from the machine . |
| | The cooling fan's rotation direction is incorrect. | • Check the rotation direction of the cooling fan, see Machine delivered with a Variable Speed Drive. |
| | Ambient temperature too high. | • Observe the permitted ambient temperature, see *Technical Data* [➔ 37]. |
| | Temperature of the process gases at the inlet too high. | • Observe the permitted gas inlet temperature, see *Technical Data* [➔ 37]. |
| | Oil level too low. | • Top up oil. |

For resolution of problems not listed in the troubleshooting table, please contact your Busch representative.

# 14 Technical Data

| | | MINK MH 0040 A |
|---|---|---|
| Nominal pumping speed max. | $m^3/h$ | 40 |
| Differential pressure | bar(g) | max. 0.5 |
| Admissible inlet pressure | bar(a) | Atmospheric pressure − max. 3.0 |
| Nominal motor rating | kW | 1.0 |
| Nominal motor voltage | VDC | 24 |
| Power consumption max. | A | 50 |
| Permitted motor speed range | $min^{-1}$ | 1200 – 6000 |
| Sound pressure level (EN ISO 2151) at 6000 $min^{-1}$; inlet (IN) and outlet (OUT) connected to a system | dB(A) | 67 |
| KpA | dB | 3 |
| Inlet gas temperature range | °C | -30 ... +95 |
| Ambient temperature range | °C | -30 ... +95 |
| Leakage rate (EU 79/2009 & 406/2010) | $Ncm^3/h$ | < 10 |
| Ambient pressure | | Atmospheric pressure |
| Oil capacity | l | 0.09 |
| Protection class | | IP 67 |
| Dimensions (L x W x H) | mm | 293 x 183 x 150 |
| Weight approx. | kg | 11 |

High frequency transient phases (with up and down pressure levels) need to be discussed and validated between customers and Busch on applications themselves.

# 15 Oil

| | VPA 032 |
|---|---|
| ISO-VG | 32 |
| Part number 0.1 L packaging | 0831 253 789 |
| Part number 0.5 L packaging | 0831 253 732 |
| Part number 1 L packaging | 0831 237 294 |

## Oil suitability

**Oil VPA 032:**

- Suitable for fuel cells applications.
- Suitable for harsh thermal applications.
- Advanced anti-corrosion properties for applications with:
  - Potential ingress of hydrogens / water
  - Oxygen content of more than 21%
  - Corrosive chemicals

# 16 EU Declaration of Conformity

This Declaration of Conformity and the CE-markings affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer.

When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the CE-marking.

The manufacturer

**Busch Produktions GmbH**
**Schauinslandstr. 1**
**DE-79689 Maulburg**

declares that the machine: MINK MH 0040 A

fulfill(s) all the relevant provisions from EU directives:

- 'Machinery' 2006/42/EC
- 'Electromagnetic Compatibility' (EMC) 2014/30/EU
- 'RoHS' 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (incl. all related applicable amendments)

and comply(-ies) with the following harmonized standards that have been used to fulfill those provisions:

| Standards | Title of the Standard |
|---|---|
| EN ISO 12100 : 2010 | Safety of machinery - Basic concepts, general principles of design |
| EN ISO 13857 : 2019 | Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs |
| EN 1012-1 : 2010<br>EN 1012-3 : 2013 | Compressors - Safety requirements - Part 1 and Part 3 |
| EN ISO 2151 : 2008 | Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2) |
| EN 60204-1 : 2018 | Safety of machinery - Electrical equipment of machines - Part 1: General requirements |
| EN IEC 61000-6-2 : 2019 | Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments |
| EN IEC 61000-6-4 : 2019 | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments |

Legal person authorized to compile the technical file and authorized representative in the EU (if the manufacturer is not located in the EU):

**Busch Dienste GmbH**
**Schauinslandstr. 1**
**DE-79689 Maulburg**

Maulburg, 02.01.2024

**Dr. Martin Gutmann**

**General Manager**

**Busch Produktions GmbH**

# 17 UK Declaration of Conformity

This Declaration of Conformity and the UKCA-markings affixed to the nameplate are valid for the machine within the Busch scope of delivery. This Declaration of Conformity is issued under the sole responsibility of the manufacturer.

When this machine is integrated into a superordinate machinery the manufacturer of the superordinate machinery (this can be the operating company, too) must conduct the conformity assessment process for the superordinate machine or plant, issue the Declaration of Conformity for it and affix the UKCA-marking.

The manufacturer

**Busch Produktions GmbH**
**Schauinslandstr. 1**
**DE-79689 Maulburg**

declares that the machine: MINK MH 0040 A

fulfill(s) all the relevant provisions from UK legislations:

- Supply of Machinery (Safety) Regulations 2008
- Electromagnetic Compatibility Regulations 2016
- Restriction of the use of certain hazardous substances in Electrical and Electronic Equipment Regulations 2012

and comply(-ies) with the following designated standards that have been used to fulfill those provisions:

| Standards | Title of the Standard |
|---|---|
| EN ISO 12100 : 2010 | Safety of machinery - Basic concepts, general principles of design |
| EN ISO 13857 : 2019 | Safety of machinery - Safety distances to prevent hazard zones being reached by the upper and lower limbs |
| EN 1012-1 : 2010<br>EN 1012-3 : 2013 | Compressors - Safety requirements - Part 1 and Part 3 |
| EN ISO 2151 : 2008 | Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (grade 2) |
| EN 60204-1 : 2018 | Safety of machinery - Electrical equipment of machines - Part 1: General requirements |
| EN IEC 61000-6-2 : 2019 | Electromagnetic compatibility (EMC) - Generic standards. Immunity for industrial environments |
| EN IEC 61000-6-4 : 2019 | Electromagnetic compatibility (EMC) - Generic standards. Emission standard for industrial environments |

Legal person authorized to compile the technical file and importer in the UK (if the manufacturer is not located in the UK):

**Busch (UK) Ltd**
**30 Hortonwood**
**Telford – UK**

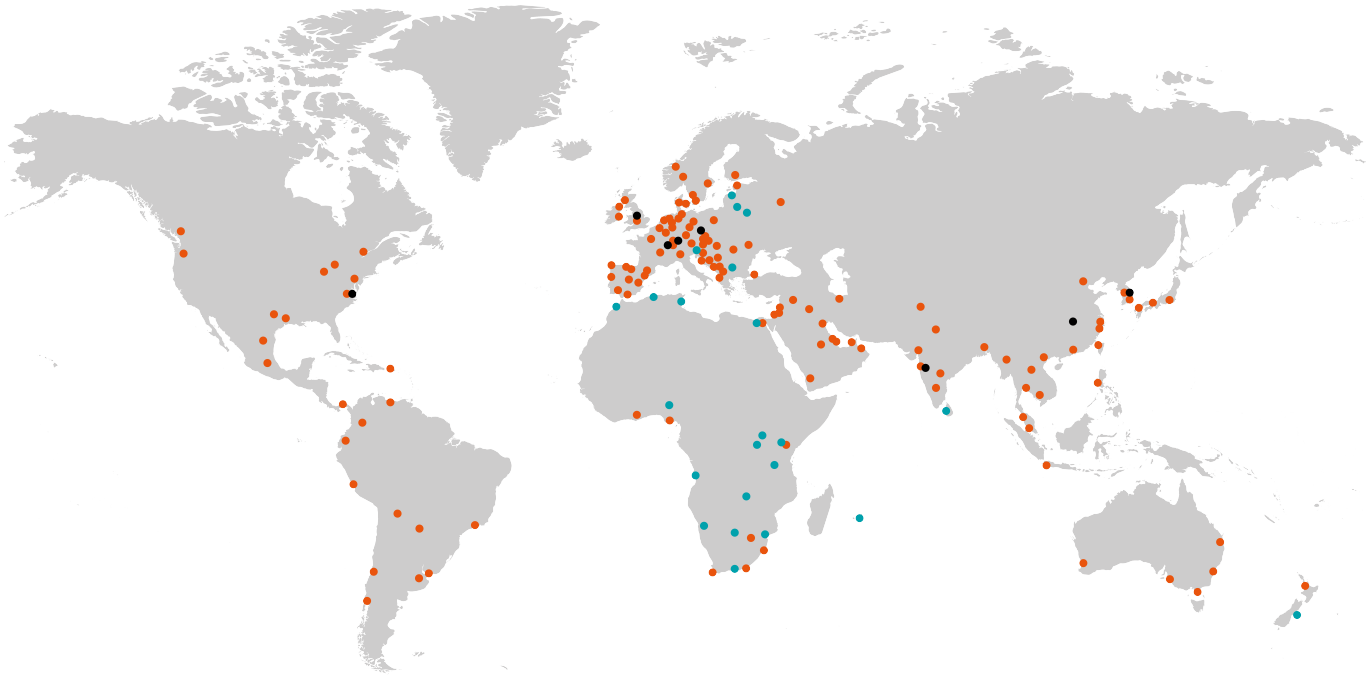
Maulburg, 02.01.2024

**Dr. Martin Gutmann**
**General Manager**
**Busch Produktions GmbH**

# Notes

# Busch
# Vacuum Solutions

With a network of over 60 companies in more than 40 countries and agencies worldwide, Busch has a global presence. In every country, highly competent local personnel delivers custom-tailored support backed by a global network of expertise. Wherever you are. Whatever your business. We are there for you.



Busch companies and Busch employees  Local representatives and distributors  Busch production site

## www.buschvacuum.com

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