

Instructions for the fan motor control system with integrated wiring terminals

SILVER

1. General

The motor control system is used for controlling the type EC, 0.41 - 10 kW fan motors in the SILVER units. The motor control system is mounted on the respective fan mounting frame.

Integrated functions:

- 0 - 10 V DC analogue input for controlling the speed.
- Control with an external hand-held micro terminal.
- Flying start, in both directions.
- Alarm for overloading, over-voltage and under-voltage.
- Protective motor switch with integrated current limiting function.
- Short-circuit protected inputs and outputs.
- Digital input for start/stop.
- Digital input for operation in fire mode.
- Digital input for alarm resetting.
- Integrated EMC filter.
- In-operation indication, 0-10 V output.
- Operation relay, free-closing relay output
- Alarm relay, free-closing relay output

Forbidden to start operation

It is forbidden to start operation until the entire air handling unit, where the above-mentioned fan motor control system is integrated, has been declared to conform to relevant regulations in Machinery Directive 98/37/EEC and to existing national legislation, if applicable.

The motor control system must not be energized until the entire installation conforms to the provisions in ALL relevant EU Directives. The motor control system is covered by the factory warranty provided it is installed according to these installation instructions and applicable installation regulations. If the motor control system has been damaged, for instance during transport, it must be inspected and repaired by qualified personnel before the voltage is connected.

Safety functions

The motor control system is protected against phase-to-phase short-circuiting, and has integrated current limiting function for protection of the motor.

The electrician is accountable for ensuring correct earthing as well as protection according to local standards and regulations. An earth fault circuit breaker, multiple protective earthing or ordinary earthing can be used as extra protection, provided that the local regulations are complied with. The earth leakage currents exceed 3.5 mA. Therefore a fixed, permanent installation and heavy-duty protective earthing are required.

NOTE! If an earth fault occurs, there can be a direct current component in the leakage current. Earth fault circuit breakers should therefore be designed to be able to detect this and be installed according to applicable national and international regulations, where they are used.

2. Technical data

Motor shaft power

The respective size of SILVER is available in two capacity variants (does not apply to size 04). The lower specified capacity on the respective size in the table below applies to capacity variant 1 and the higher capacity applies to capacity variant 2. Sizes 04-50 have one fan per airflow direction, sizes 60-100 have two fans per airflow direction and the size 120 has three fans per airflow direction.

Size	Motor shaft power
04:	1.15 kW (0.41 kW)*
05:	1.15 kW (0.8 kW* cap.var. 1 alt. 1.15 kW cap.var. 2)
07:	1.15 kW (0.8 kW* cap.var. 1 alt. 1.15 kW cap.var. 2)
08:	1.15 kW (cap. var. 1) alt. 1.6 kW (cap. var. 2)
11:	1.15 kW (cap. var. 1) alt. 1.6 kW (cap. var. 2)
12:	2.4 kW (1.6 kW* cap.var. 1 alt. 2.4 kW cap.var. 2)
14:	2.4 kW (1.6 kW* cap.var. 1 alt. 2.4 kW cap.var. 2)
20:	2.4 kW (cap. var. 1) alt. 3.4 kW (cap. var. 2)
25:	2.4 kW (cap. var. 1) alt. 3.4 kW (cap. var. 2)
30:	4.0 kW (cap. var. 1) alt. 5.0 kW (cap. var. 2)
35:	4.0 kW (cap. var. 1) alt. 5.0 kW (cap. var. 2)
40:	6.5 kW (cap. var. 1) alt. 10 kW (cap. var. 2)
50:	6.5 kW (cap. var. 1) alt. 10 kW (cap. var. 2)
60:	2 x 4.0 kW (cap. var. 1) alt. 2 x 6.5 kW (cap. var. 2)
70:	2 x 4.0 kW (cap. var. 1) alt. 2 x 6.5 kW (cap. var. 2)
80:	2 x 6.5 kW (cap. var. 1) alt. 2 x 10 kW (cap. var. 2)
100:	2 x 6.5 kW (cap. var. 1) alt. 2 x 10 kW (cap. var. 2)
120:	3 x 6.5 kW (cap. var. 1) alt. 3 x 10 kW (cap. var. 2)

*) The motor control system limits the output power to the value specified.

Power supply

Each fan has one motor control system. The motor control system should be supplied with power according to the table below.

Specified voltage -10% – +15%.

Size	Electrical data per fan	Number of motor control systems per airflow direction
04:	1 x 230 V, 50 Hz, rated 2,1 A	1
05, cap.var. 1:	1 x 230 V, 50 Hz, rated 4,0 A	1
05, cap.var. 2:	1 x 230 V, 50 Hz, rated 5,2 A	1
07, cap.var. 1:	1 x 230 V, 50 Hz, rated 4,0 A	1
07, cap.var. 2:	1 x 230 V, 50 Hz, rated 5,2 A	1
08, cap.var. 1:	1 x 230 V, 50 Hz, rated 5,5 A	1
08, cap.var. 2:	3 x 400 V, 50 Hz, rated 2,6 A	1
11, cap.var. 1:	1 x 230 V, 50 Hz, rated 5,5 A	1
11, cap.var. 2:	3 x 400 V, 50 Hz, rated 2,6 A	1
12, cap.var. 1:	3 x 400 V, 50 Hz, rated 2,9 A	1
12, cap.var. 2:	3 x 400 V, 50 Hz, rated 3,7 A	1
14, cap.var. 1:	3 x 400 V, 50 Hz, rated 2,9 A	1
14, cap.var. 2:	3 x 400 V, 50 Hz, rated 3,7 A	1
20, cap.var. 1:	3 x 400 V, 50 Hz, rated 4,3 A	1
20, cap.var. 2:	3 x 400 V, 50 Hz, rated 5,8 A	1
25, cap.var. 1:	3 x 400 V, 50 Hz, rated 4,3 A	1
25, cap.var. 2:	3 x 400 V, 50 Hz, rated 5,8 A	1
30, cap.var. 1:	3 x 400 V, 50 Hz, rated 6,7 A	1
30, cap.var. 2:	3 x 400 V, 50 Hz, rated 8,0 A	1
35, cap.var. 1:	3 x 400 V, 50 Hz, rated 6,7 A	1
35, cap.var. 2:	3 x 400 V, 50 Hz, rated 8,0 A	1
40, cap.var. 1:	3 x 400 V, 50 Hz, rated 10,6 A	1
40, cap.var. 2:	3 x 400 V, 50 Hz, rated 15,0 A	1
50, cap.var. 1:	3 x 400 V, 50 Hz, rated 10,6 A	1
50, cap.var. 2:	3 x 400 V, 50 Hz, rated 15,0 A	1
60, cap.var. 1:	3 x 400 V, 50 Hz, rated 6,55 A	2
60, cap.var. 2:	3 x 400 V, 50 Hz, rated 10,3 A	2
70, cap.var. 1:	3 x 400 V, 50 Hz, rated 6,55 A	2
70, cap.var. 2:	3 x 400 V, 50 Hz, rated 10,3 A	2
80, cap.var. 1:	3 x 400 V, 50 Hz, rated 10,6 A	2
80, cap.var. 2:	3 x 400 V, 50 Hz, rated 15,0 A	2
100, cap.var. 1:	3 x 400 V, 50 Hz, rated 10,6 A	2
100, cap.var. 2:	3 x 400 V, 50 Hz, rated 15,0 A	2
120, cap.var. 1:	3 x 400 V, 50 Hz, rated 10,6 A	3
120, cap.var. 2:	3 x 400 V, 50 Hz, rated 15,0 A	3

TECHNICAL DATA OF THE MOTOR CONTROL SYSTEM								
Description	kW	The size of the control system						
		0.41/0.8 kW*	1.15 kW	1.6 kW*	2.4 kW	4.0 kW	6.5 kW	10.0 kW
Dimensions	mm	185 x 220 x 90		185 x 250 x 100		220 x 295 x 110		
Weight	kg	2.0		3.0		3.9		
POWER SUPPLY								
Voltage	VAC	1 x 230 VAC 50/60 Hz +/-10 %		3 x 400 VAC 50/60 Hz +/-10				
Current at max. load	A	4.4	6.5	3.5	5.0	8.4	13.6	16
Power factor COS φ for max. load		>0.99 (Active PFC)		>0.9				
MOTOR OUTPUT								
Frequency	Hz	0 - 120						
Max. output voltage	Vrms	3 x 0 - 0,9 Vin						
Max. output current	Arms	3.2	4.5	4.5	6.4	11.7	19	22
PROTECTION								
Max. fuse	A	16						
Motor output		Short-circuit protected between phases						
Motor		To be protected by current limitation						
Impulse protection		Transient protected with varistors						
Surge protection		Yes, 400 V (PTC)		Yes, 565 V				
Overload protection		Overload protected for current and temperature						
ENVIRONMENTAL SPECIFICATIONS								
Operating temperature	°C	-40 °C to + 40 °C						
Start temperature	°C	-40 °C to + 50 °C						
Storage temperature	°C	-40 °C to + 70 °C						
Enclosure class	IP	65				54		
Enclosure material		Aluminium						
Front access panel		Plastic						
Humidity	% rh	10 – 95 % rh – non-condensing						
Vibrations		Stationary: IEC 60721-3-3 Class 3M6 2.0 kg Non-stationary: IEC 60721-3-3 Class 3M6 25.0 kg						
INTERFACES								
Digital communication	Slave	2 x RJ12 & 2 x spring-type wiring terminals						
Digital communication	Master	1 x RJ12						
Analogue In 1		0 - 10 VDC, 100% vid 9.5 V DC +/-2%						
Analogue Out 1		+10 V DC						
Digital In 1		Start/stop with internal pull-up						
Digital In 2		Alarm reset						
Green LED		Shines constantly: Voltage connected. Flashing: Active communication						
Red LED		Flashing: Alarm, but still operating. Shines constantly: Critical alarm - stop the motor						
FUNCTION								
Technology		Sinusoidal Back EMF controlled by signals via FOC (Field Oriented Control)						
Flying start		Yes, typically < 30 % of max. speed, depending on the load and the weight of the fan						
Ramp up	Sec.	15 - 300						
Ramp down	Sec.	15 - 300						
Alarm		Yes						
Alarm reset		Via digital input, or dead for more than 60 seconds.						
Fan stop	Sec.	The braking function stops the fan as fast as possible. The braking time depends on the live force of the fan.						
Service data log		In-operation hours, alarm, load, program version, max. temperature, max. motor voltage, max. motor current, max. ripple voltage, max. ripple current.						
Program update		Yes. via serial interface.						
Motor parameters		Programmable by Swegon.						
Fire mode		Rated output for 1 hour at 70 °C						
Field weakening		Yes						
Short-circuit protection		Yes						
EMC filter		Integrated						
APPROVALS								
EMC		EMC EN 61800-3 (C1 and C2)						
LVD		EN 61800-5-1						
Product standard		EN 61800 Part 2						
The RoHS Directive		Yes						
Product approvals		CE						

* SILVER, size 04. The motor control system limits the output power to 0.41 kW.

3. Function

Control

The motor control system can control via the following:

- 0 - 10 V DC (100 % for 9.5 V, +/-2 %)
- local control with hand-held terminal (Accessory TBLZ-4-75)
- potentiometer

Control with 0 – 10 V DC

The motor control system regulates the speed linearly between 0 % and 100 %, however it is limited to the regulation range between the preset lowest and highest speeds of rotation (See Fig. 2 and 3). Set the lowest and highest speed of rotation via the hand-held terminal. 100 % speed is defined as an input voltage of "0-10 V in".

In order to be able to control the motor control system via 0 – 10 V DC, select "Control = 0 – 10 V DC" in the "User settings"/"Control type" menu of the hand-held terminal, which is also the factory setting. External stop and stop from the hand-held micro terminal have higher priority than start from the hand-held terminal.

If the fire mode function is not switched off, the motor control system will control the fan without the alarm and safety functions being activated. See the "Firemode" Section.

Control with hand-held terminal

In order to be able to control the motor control system with the hand-held terminal, select "Control = Modbus" in the "User settings"/"Control type" menu of the hand-held terminal. For other particulars, see the instructions for the hand-held terminal.

Control with a potentiometer

The motor control system can be controlled via a potentiometer. The potentiometer should have a resistance of at least 4.7 k Ω (recommended) and not higher than 47 k Ω .

For other particulars, refer to the "Control with 0 – 10 V DC" Section.

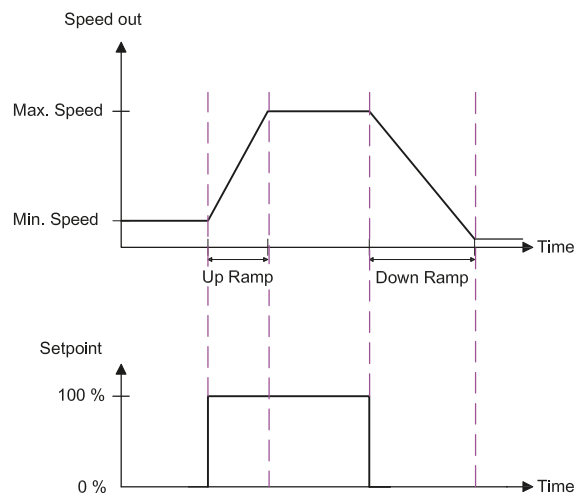


Fig. 2. The ratio between the speed and the ramp up and ramp down times

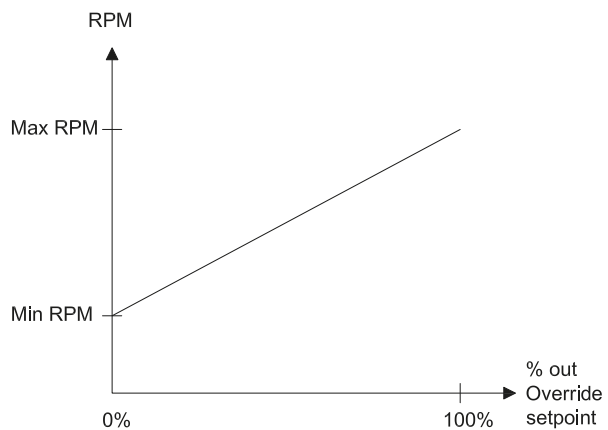


Fig. 3. The ratio between the speed and the min./max. speed setting

Firemode function [Fire mode]

The motor control system is supplied with the "Firemode" function switched off by means of a pre-fitted short-circuit jumper. The short-circuit jumper must be removed if the fire mode signal e.g. comes from a common fire alarm installation (ABA).

The Firemode function is the designation of a condition in the motor control system when the system is running an emergency program without monitoring of alarms. For example, the internal excess temperature protection in the motor control system is switched off and the motor does not stop when an interruption in communication arises. The function can e.g. be used for smoke extraction in connection with a fire in a building. An extract air fan will e.g. be able to continue extracting smoke from the building as long as it is at all possible when "Firemode" is activated. This occurs as well without the fan stopping due to a fault and other alarms from both the fan and from the motor control system. The speed is the preset speed, which either comes from an external 0 – 10 V control signal or a potentiometer.

The motor control system will continue to operate for at least one hour, even if the motor control system and the fan motor are overheated.

In this situation, the motor control system has priority to continue to operate, regardless of which alarm is active.

Observe the following: If the temperature in the motor control system is over 75 °C, the voltage supplied to the hand-held terminal is interrupted. The hand-held terminal can therefore not be used when the temperature exceeds 75 °C.

Automatic restart after alarm

The motor control system automatically attempts to start again following an alarm, such as over voltage. This automatic restart is carried out maximally 5 times. After that, the motor control system will remain in the error mode, and must be restarted by resetting the alarm.

Alarm resetting: See Section on "Alarm resetting".

In-operation indication

The motor control system is equipped with an 0 - 10 V analogue output for in-operation indication. 0% speed corresponds to a 0V output signal, 100% speed corresponds to a 10V output signal.

Operation relay

The motor control system is equipped with an operation relay that can transmit an in-operation signal to an external item of equipment. The signal output is a changeover relay that normally is closed between Terminals 20 and 21. When the motor control system receives a start signal, the relay changes position and closes between Terminals 21 and 22.

Alarm relay/output

The motor control system is equipped with an alarm output in the form of an alarm relay. The alarm relay is activated if an alarm arises in the motor control system or if an alarm is discovered in the motor or fan. The alarm output is a changeover relay that normally is closed between Terminals 24 and 25. When the motor control system receives an alarm signal, the relay changes position and closes between Terminals 23 and 24.

Alarm resetting

The motor control system is equipped with a digital input for resetting alarms. The alarm output is reset by short-circuiting Terminals 06 (GND) and 07 (Din2) (See Fig. 1). The alarm output can also be reset by switching off the supply voltage to the motor control system for more than 60 seconds.

Switching frequency

The motor's switching frequency (SwitchMode) can be set in the hand-held terminal to the following values.

0 = Auto

1 = Low = 4 kHz

2 = High = 8 kHz

If the switching frequency increases, the level of audible noise from the motor control system will decrease, but this will simultaneously increase the losses in the motor. The motor will consequently run at lower efficiency and this will impair its operating economy.

In position 0 = Auto, the motor control system's switching frequency changes automatically. When an increase in speed of rotation is required, the motor control system switches from 2 = High = 8 kHz to 1 = Low = 4 kHz, if the speed exceeds 60 % of the rated maximum speed. When a decrease in speed of rotation is required, the motor control system switches from 1 = Low (4 kHz) to 2 = High = (8 kHz), if the speed drops below 50 % of the rated maximum speed.

In mode 1 = Low = 4 kHz the motor control system always runs with a low switching frequency while the air handling unit is operating.

In mode 2 = High = 8 kHz the motor control system always runs with a high switching frequency while the air handling unit is operating.

LED indications

The motor control system has a two-colour, built-in LED, which is located on the underside of the motor control system by the cable grommets for supply voltage.

The LED shines constantly green when the supply voltage is connected.

It flashes green when the Modbus communication is active.

It shines constantly red when at least one critical alarm is active.

It flashes red when at least one non-critical alarm is active.

Warning The chassis on the motor control system can become very warm!



Warning! Do not repair the motor control system at the site. Never attempt to repair a defective control system unit.

Contact Swegon to obtain a replacement unit.

Important! Contact the supplier if you want further technical particulars.

4. Electrical connections

The fan mounting frame is equipped with one motor control system. For access, open the inspection covers of the fans and unscrew the bolts that secure the blue cover of the motor control system casing.

I/O module SILVER

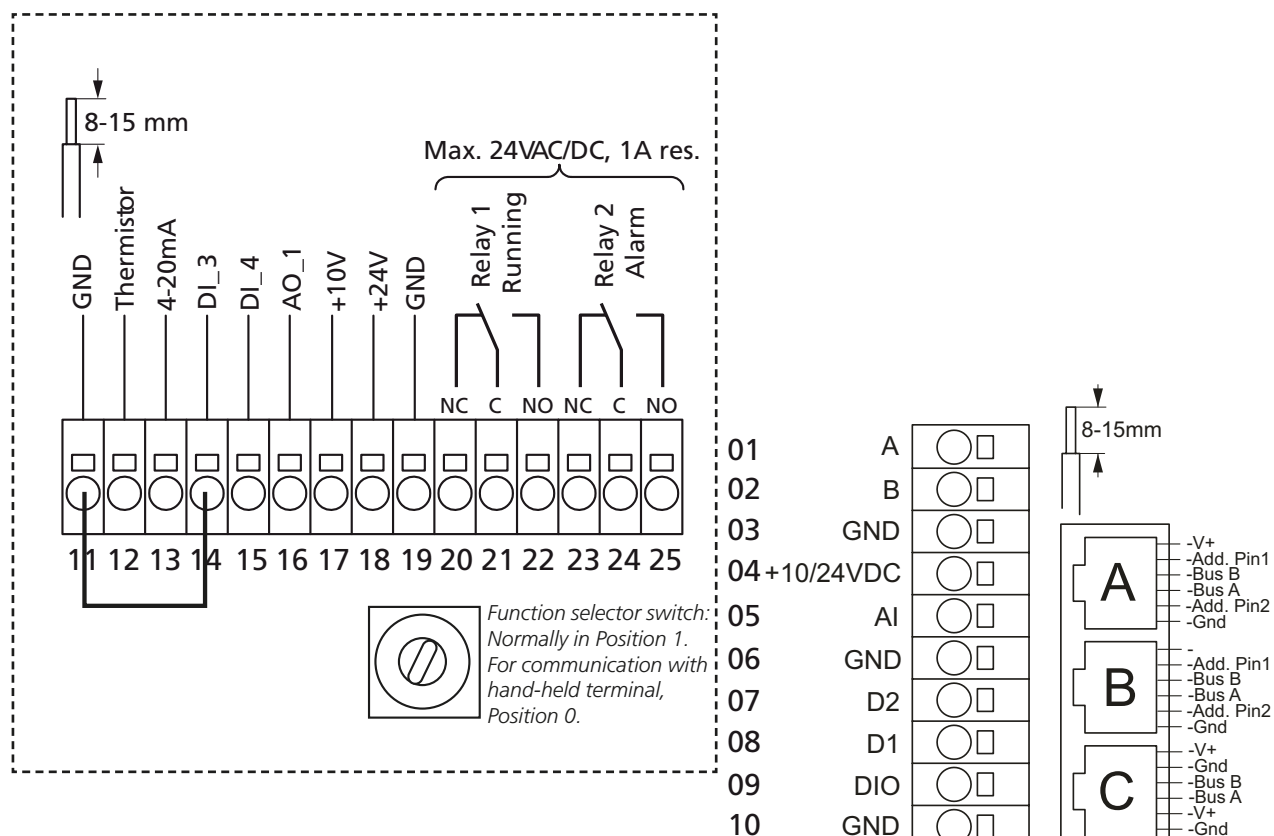


Fig. 1. Wiring terminals in the motor control system

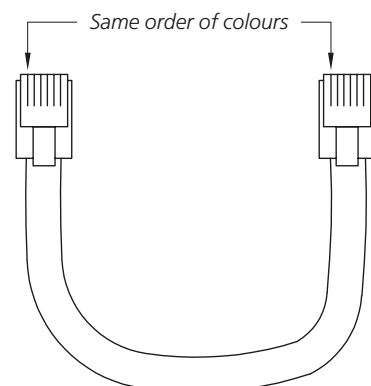
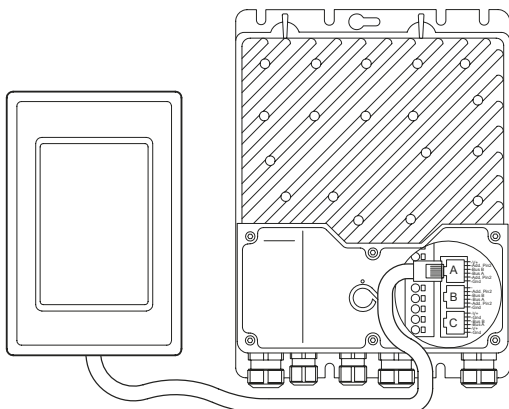
D1	Start/Stop
D2	Alarm Reset
DIO	Not used
Dig. in3	Firemode
Dig. in4	Not used

To connect control signal wiring

- Remove the pre-fitted sealing plug on the underside of the motor control system and install a cable fitting.
- Connect the 0 – 10 V DC control signal cable leads from an external regulator to Terminals 05 (0 - 10 V in) and 03 (GND) (See Fig. 1).
- Connect the control potentiometer cable leads to Terminals 04 (+10 Vdc), 05 (0 - 10 V in) and 03 (GND) (See Fig. 1 and 4).
- Connect the start and stop signal cable leads to Terminals 10 (GND) and 08 (Din1) (See Fig. 1). This should be a potential-free digital contact.
- Connect the firemode signal cable leads to the motor control system on Terminals 11 (GND) and 14 (Dig. in3) (See Fig. 1). This should be a potential-free digital contact.
- Connect the Alarm Reset signal cable leads to the motor control system on Terminals 06 (GND) and 07 (Din2) (See Fig. 1). This should be a potential-free digital contact.
- Connect the in-operation indication cable leads to Terminals 16 (0-10V out) and 19 (GND) (See Fig. 1).
- The in-operation signal cable is labelled "R1", and should be connected to Terminals 20 (NC), 21 (C) and 22 (NO) (See Fig. 1).
- The alarm signal cable is labelled "R2", and should be connected to Terminals 23 (NC), 24 (C) and 25 (NO) (See Fig. 1).

Electric wiring of the hand-held micro terminal

Connect the hand-held micro terminal to the motor control system's integrated wiring terminals, in Port "A". Use a bus cable, (type 6-core, unshielded, 30 AWG/0.066 mm² telecommunication cable or a similar flat cable) with RJ12/6 connectors in both ends, see the figures below.



Electric Power Connections

The cables for connecting power to the motor control system are located in the respective fan compartment.

For appropriate connection, see Fig. 7 and 8 below.

For electrical data, see Section 2.

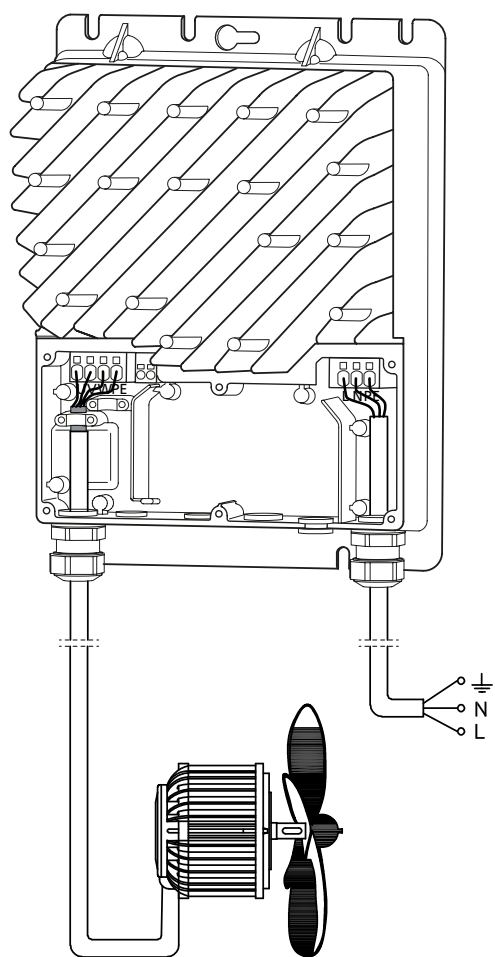


Fig. 7. Power connection of the motor control system: 0.8 - 1.15 kW.

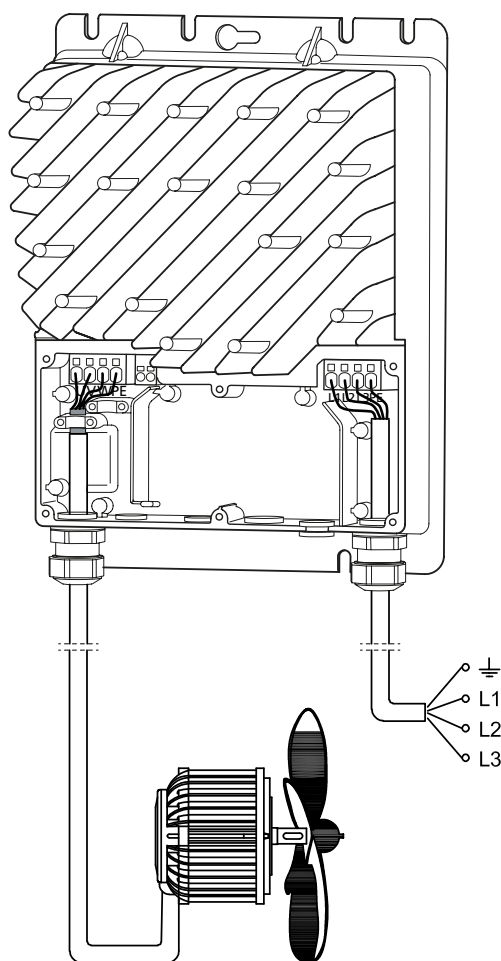


Fig. 8. Power connection of the motor control system: 1.6 - 10.0 kW.

5. Trouble shooting

To open the motor control system

Before you open the motor control system, isolate the line voltage and wait at least 3 minutes. Failure to do so will expose you to the risk of coming into contact with harmful residual voltage inside the unit. If natural draught in the duct system causes the fan impeller to rotate, but no in-operation signal has been received, there is risk that the motor will induce voltage on the motor control terminals, making them dangerous to touch.

Troubleshooting when the motor control system is controlled with external (A/D) signals:

Symptoms	Cause	Action
The motor is not rotating	There is no power supply	Check whether there is voltage on the motor control system's "L" and "N" Terminals on the models for 230 V or on the "L1", "L2" and "L3" Terminals on the models for 3 x 400 V. (The operating voltage is specified on the rating plate, affixed to the side of the motor control system.)
		Check that all the short-circuit protections have been activated.
		Check that the incoming power supply to the motor control system has not been interrupted by some other component.
	Poor electrical connections	Check the connectors and other electrical connections
	Wrong motor the motor control system	Check that correct motor settings have been entered and saved in the motor control system set up.
	There is no in-operation signal	Check that the motor control system can receive in-operation signals. The motor control system must have a connected signal to the Start/Stop input, digital input Terminal 08 (Din1).
	There is no 0 – 10 V DC control signal	Check that the 0 - 10 V DC control signal cable leads are correctly connected to Terminals 05 (0-10V in) and 06 (GND) in the motor control system.
		For potentiometer operation: Check that the potentiometer's 0 - 10 V DC control signal cable leads are correctly connected to Terminals 04 (+10Vdc), 05 (0-10V in) and 06 (GND) in the motor control system. The potentiometer should have an inner resistance of at least 4.7 kΩ.
	Alarm active	Read the relevant alarm and remedy the cause.
The motor rotates in the wrong direction	Incorrect phase sequence in motor cable	Reset the alarm by short-circuiting Terminals 06 (GND) and 07 (Din2) in the motor control system. You can also reset the alarm by switching off the supply voltage to the motor control system and switching it back on after 60 seconds.
		Replace the motor control system.
		Replace the motor
The motor control system is noisier than the acceptable level.	Too low switching frequency	Increase the switching frequency. 0 = Auto 1 = Low = 4 kHz 2 = High = 8 kHz When the switching frequency increases, the losses in the motor will also increase, which will lower the efficiency and impair its operating economy. It is possible to change the switching frequency in the motor control system with the hand-held micro terminal.
The motor control system switches off. due to an alarm	At least one alarm active	Read the alarm in the hand-held micro terminal to determine which alarm has stopped the motor control system/motor. Reset the alarm by short-circuiting Terminals 06 (GND) and 07 (Din2) in the motor control system. You can also reset the alarm by switching off the supply voltage to the motor control system and switching it back on after roughly 60 seconds.
	The alarm will be reactivated after resetting	Read the alarm in the hand-held micro terminal to determine which alarm has stopped the motor control system/motor. Remedy the reason why the alarm was reactivated.

6. Service and maintenance

No particular maintenance is required. Contact Swegon if any problem arises.

To troubleshoot the unit: See Section 5. Troubleshooting.

7. Alarms

The integrated alarm relay in the motor control system has changeover contacts and is marked "Alarm Relay". The motor control system stops and an alarm indicating LED is lit. If the fault ceases to exist, the alarm is reset automatically and the motor control system starts up.

The motor control system tries to automatically start again. If the maximum number of restarts (5) is exceeded, the alarm must be reset.

When the motor control system is controlled with 0 – 10 V DC and digital signals, the alarm can be reset by short-circuiting Terminals 06 (GND) and 07 (Din2).

If the line voltage is switched off for more than 60 seconds, the alarm will be automatically reset.

8. Environment and waste disposal

Help to protect the environment by ensuring correct disposal of the packaging and use the products in accordance with applicable environmental regulations.

Disposal of the product

The product must not be disposed of as ordinary household refuse. They must be collected in separate containers according to applicable local rules.

9. Applicable standards.

GB-61800-2 "Electric motor operation with variable speed, General Requirements"

EN-61800-3 "General electromagnetic compatibility"

EN-61800-5 "Electric motor operating modes with variable speed, Safety Requirements"

10. CE marking

Swegon AB certifies under its own sole responsibility that this product conforms to the Commission's Directive 92/31 with subsequent modifications concerning electric compatibility as well as the Commission's Directive 73/23 dealing with electric material for use within certain voltage limitations.

APPROVALS	
EMC	EN 61800-3 (C1 AND C2)
LVD	EN 61800-5-1
PRODUCT STANDARD	EN 61800 PART 2
THE ROHS DIRECTIVE	YES
PRODUCT APPROVALS	CE