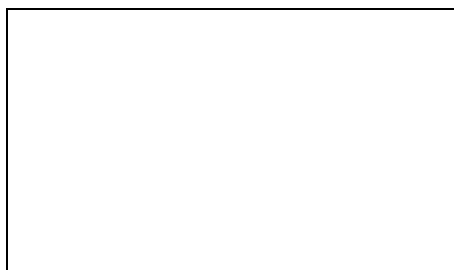


Valid for the following model:
EMS-VVX 1



EMS-VVX™ -1
DRIVE SYSTEM
INSTRUCTION MANUAL

Document number: 605-11030

Document version: r4a

Date of release: 1996-01-15

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SAFETY MEASURES

During installation

- Read the operating instructions thoroughly before installing and running the unit.
- Installation must be carried out by qualified personnel.
- The appropriate rules and regulations governing the installation and operation of electrical equipment should be closely followed (e.g., VDE 0100).
- Measures to protect against personal injury and machine damage should be carried out according to local rules and regulations.
- EMS-VVX is designed for fixed installation.
- Cables should not be connected or disconnected while the mains voltage is being supplied to the unit.
- Check that the equipment is correctly installed before operating it. Refer to the instructions given under section Installation.
- Faults caused by incorrect installation or operation are not covered by the guarantee.

During operation

- Measurements must not be taken inside the motor and the control unit while the equipment is running or mains voltage is being supplied.
- The units must not be opened or dismantled while in operation.

During dismantling and disposal

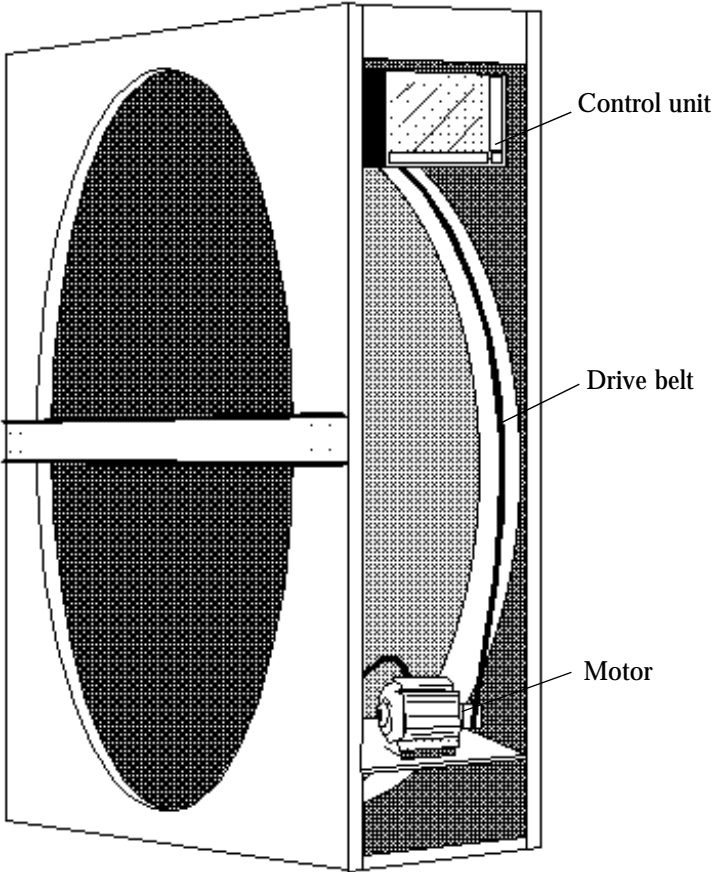
The following materials should be handled and recycled according to appropriate local rules and regulations:

- The plastic housing of VVX-1.
- Small amounts of tin and lead in the circuit boards.
- Copper, plastic, aluminium and steel components of the motor.

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Typical installation in a rotor casing



1. INSTALLATION

1.1 Components

The EMS-VVX-1 speed-controlled drive system is specially designed for driving rotary heat exchangers. The system comprises a control unit, a special motor unit (without gear) and a connecting cable 1.5 m long. The control unit operates from a single-phase power supply of 220-240 \pm 10% VAC, 50-60 Hz.

The EMS-VVX-1 is designed for use with heat-exchanger rotors up to 1000 mm in diameter. Three other sizes of drive system are available for regulating the speed of rotors up to 5500 mm diameter. For more detailed information, please refer to the separate documentation for those systems.

1.2 Installation procedure

Basic installation

The motor unit (motor without gears) should be installed on the shelf inside the heat exchanger. The control unit should be fitted in a suitable position inside the heat exchanger cabinet or in the equipment room. Rubber bushes or the like fitted between the motor and motor shelf can be used to dampen vibration.

Cable

The motor is equipped with a 1.5 m long cable for connection to control units (see section Connection). Cable of the following specification is used: Seven 0.75 mm² conductors.

Connecting

The wiring diagram in section Connection shows how the control signal leads should be connected and the DIP-switches set.

An external fuse must always be fitted a 10 A delay fuse for EMS-VVX-1.

No adjustment needs to be made to the control unit.



Warning! The control unit is neither protected against shortcircuiting between conductors in the motor cable nor against defective earthing between the motor leads and earth. Either of these occurrences will immediately result in irreversible damage to the control unit. Always use an ohmmeter to check for short-circuiting before the power supply is switched on.

A safety isolating switch should be installed in the mains supply to the control unit. Note that if the mains power is switched off, this will trigger an alarm for low voltage.

No switches must be fitted in the circuit between the motor and control unit.

Always isolate the mains power before altering the setting of a DIP-switch.

Fitting the rotor sensor

The magnet for the pulse sensor (rotor monitor) is screwed into the periphery of the heat exchanger. If the casing surrounding the rotor is magnetic, the magnet must be insulated from the casing. The pulse sensor must be fitted provide a gap of 5-8 mm between the pulse sensor and the passing magnet (see below). A flashing dot on the display indicates when the magnet passes the pulse generator.

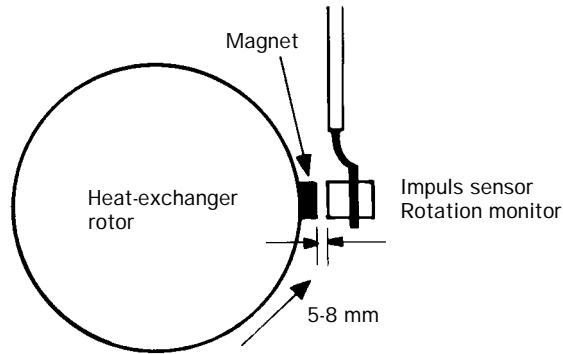


Figure 1 Impuls sensor

Accessories

The following items can be ordered separately:

Pulley, 19 mm and 22 mm

Cable nipple kit

Rotor sensor and magnet

Installation kit for motor, which includes bolts, nuts, washers and rubber vibration dampers

Table of drive-belt data for the EMS-VVX-1

VVX rotor Ø [mm]	PULLEY, diameter								
	Ø = 19mm Max. speed, [rpm]			Ø = 22mm Max. speed, [rpm]			Ø = 50mm Max. speed, [rpm]		
	40%	70%	100%	40%	70%	100%	40%	70%	100%
300	10.1	17.7	-	11.7	-	-	-	-	-
400	7.6	13.3	19.0	8.8	15.4	-	20.0	-	-
500	-	10.6	15.2	7.0	12.3	17.6	16.0	-	-
600	-	8.9	12.7	-	10.3	14.7	13.3	-	-
700	-	7.6	10.9	-	8.8	12.6	11.4	20.0	-
800	-	-	9.5	-	7.7	11.0	10.0	17.5	-
900	-	-	8.4	-	-	9.8	8.9	15.6	-
1000	-	-	7.6	-	-	8.8	8.0	14.0	20.0

2. CONNECTION

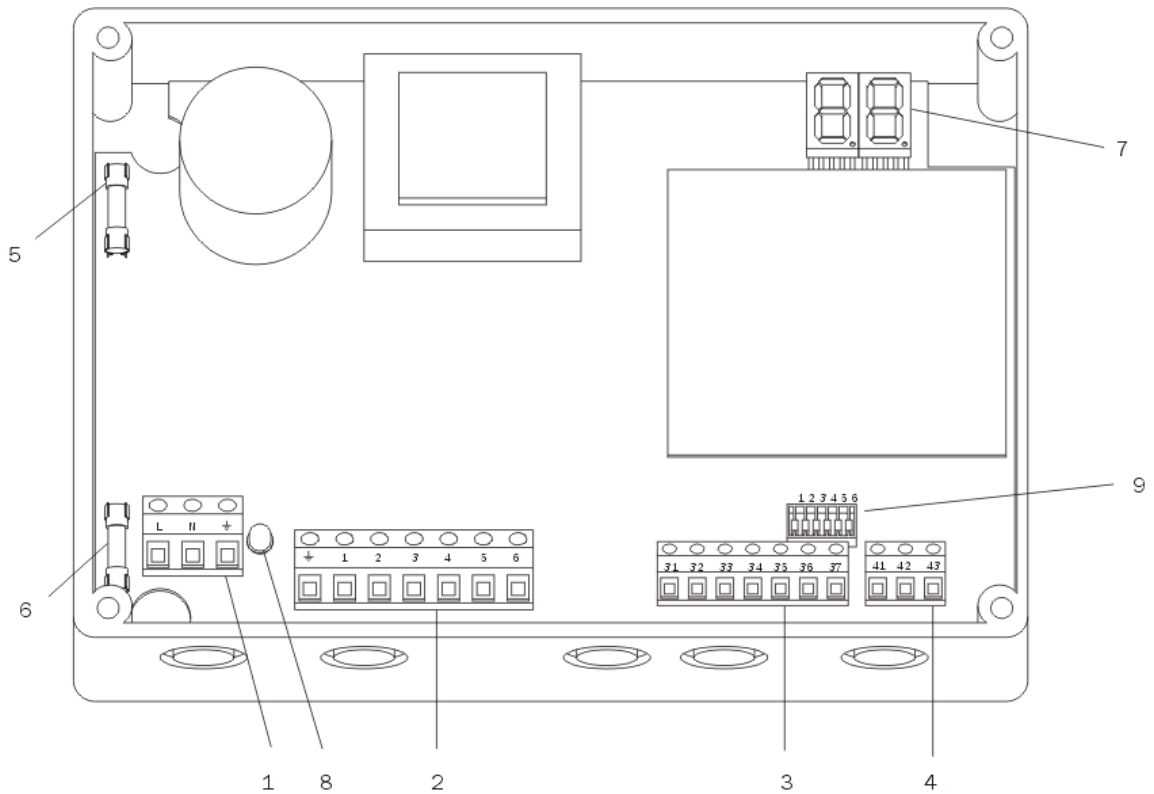


Figure 2 EMS-VVX-1 with cover removed

1. Mains power terminal block
2. Motor terminal block
3. Control terminal block
4. Alarm terminal block
5. Fuse, power supply control logic, 63 mAT
6. Fuse, power supply motor electronic, 2 AT
7. Display
8. LED, residual voltage
9. DIP-switches

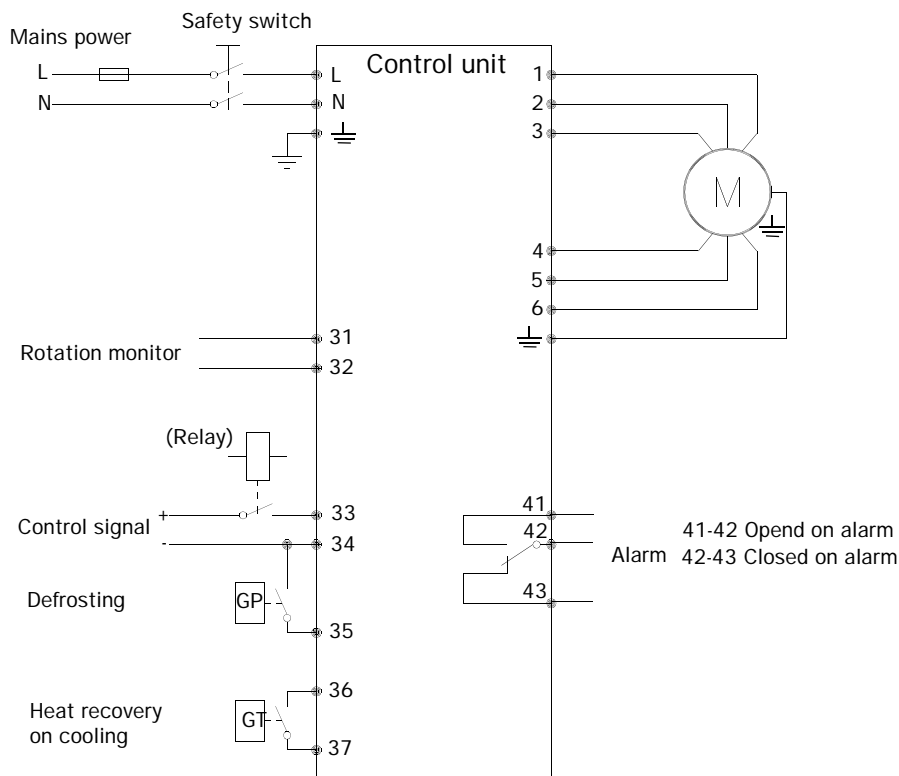
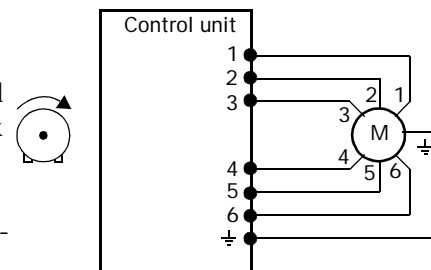


Figure 3 Wiring diagram

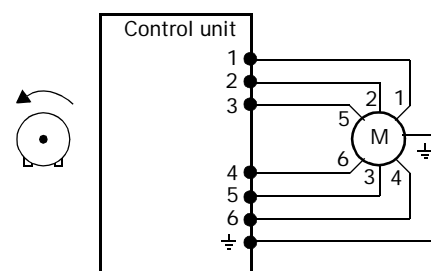
Direction of rotation

The motor unit can be connected for either clockwise or anticlockwise rotation. For clockwise rotation motor cable 1, 2, 3, 4, 5 and 6 should be connected to respectively terminal number 1, 2, 3, 4, 5 and 6 on the motor terminal block in the control unit.

For anticlockwise rotation motor cable 1 should be connected to terminal 1, 2 to terminal 2, 3 to terminal 5, 4 to terminal 6, 5 to terminal 3 and 6 to terminal 4 on the motor terminal block in the control unit.



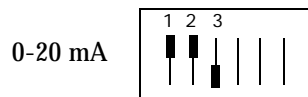
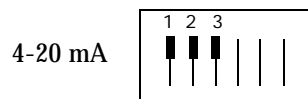
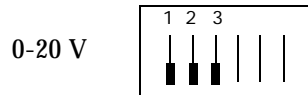
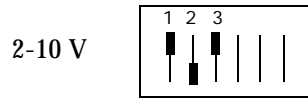
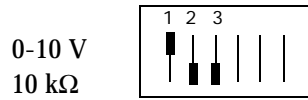
Clockwise rotation



Anticlockwise rotation

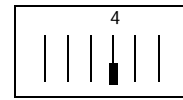
DIP-switch settings

Control signal

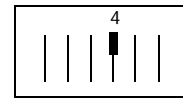


Rotor sensor

YES

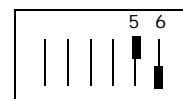


NO

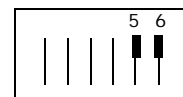


Maximum rotation speed

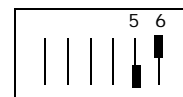
100%



70%



40%



Manual control using 10 k Ω potentiometer

The drive system can be easily controlled manually with the help of a 10 k Ω potentiometer which is connected in the following manner:

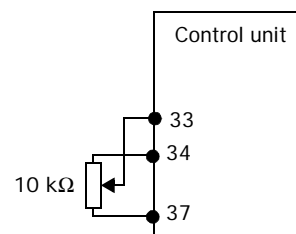


Figure 4 10 k Ω potentiometer

Switching off

When the heat-exchanger rotor needs to be switched off, for example, during the night, this can be achieved by disconnecting the control signal by means of a relay, see Fig. 3. The same result is achieved by setting the control signal to its minimum value.

Heat recovery on cooling

The differential thermostat switch for heat recovery on cooling (max. rotor speed) can be connected between terminals 36-37, see Fig. 3.

Defrosting

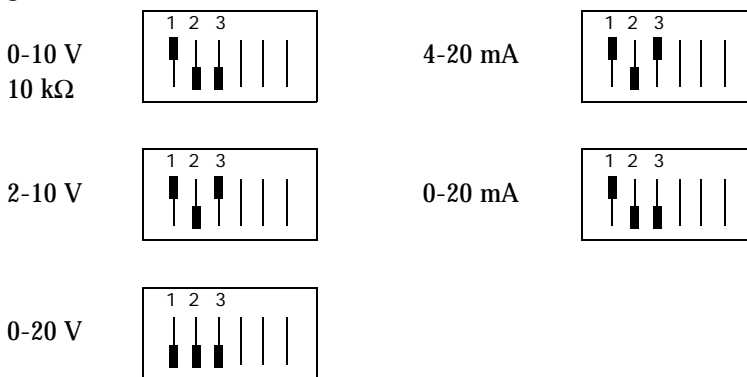
The differential pressure switch for defrosting (2.5% of max. rotor speed) can be connected between terminals 34-35, see Fig. 3.

2.1 Parallel operation

For parallel operation of several heat exchangers by a control signal, each heat exchanger must be equipped with its own control and motor unit. Normally up to 10 control units can be linked to the same control signal

Control signal

The control signal is connected to the first drive unit according to the instructions given. Additional drive units are integrated by linking terminal block connections 33 and 34 to the respective 33 and 34 connections of the first drive system. DIP-switches in the first drive unit are set according to the instructions given, and in additional drive units as follows:



Heat recovery on cooling using a differential thermostat

First connect the control signal according to Fig. 3. The differential thermostat is then connected to the first control system in the usual way. Additional control units are linked in parallel by connecting terminals 36 and 37 to the respective 36 and 37 terminals of the first control unit.

Defrosting using a differential pressure switch

First connect the control signal according to Fig.3. The differential pressure switch is then connected to the first control unit in the usual way. Additional control units are linked in parallel by connecting terminal 35 of a control unit to terminal 35 of the first control unit.

Alarm relay

The control systems are individually wired for alarm signals. The alarm outputs terminals can be linked in parallel, or in series to receive a common alarm.

3. GENERAL DESCRIPTION

The EMS-VVX-1 is a speed-controlled drive system that has been specially adapted to drive rotary heat exchangers with diameters of up to 1000 mm.

The drive system comprises a sealed control unit and a motor unit without gears. The two units are interconnected by means of a cable preconnected to the motor. The control unit operates from a single-phase power supply of 220-240 \pm 10% VAC.

The system incorporates a number of standard functions to make it ideally suited to its application:

- An integral electronic tachometer function ensures that the motor always maintains the speed determined by the control signal.
- Constant torque throughout the speed range.
- Rotor sensor which also operates during the purging mode.
- Heat-exchanger purging mode (automatic)- the rotor advances 30° (approx.) every six minutes.
- Control ratio, 1:1200 (int).
- Soft starting takes approximately 30 seconds to reach full speed.
- Electronic motor-overload protection.
- Suitable for the majority of control signals on the market.
- Easy-to-read front panel giving all necessary wiring information.
- All control input ports galvanically isolated.
- No initial trimming is necessary.
- Compact size for easy installation.
- Display indicates status of system.

3.1 Build-in functions

Control unit protection

The control unit is equipped with both overvoltage and undervoltage protection. If the voltage moves outside the permitted power-supply limits, the control unit is isolated and the motor stopped. As soon as the power supply voltage has returned to the nominal value, the motor is restarted automatically.

The control unit incorporates motor-overload protection so there is no need for any external motor protection. In the event of motor overload, the power supply to the motor will be broken. The power supply to the control unit must then be interrupted for about five seconds before the drive system can be restarted.

Rotor sensor (DIP-switch 4)

The rotor sensor monitors whether the heat-exchanger rotor is rotating.

A magnet on the periphery of the rotor acts on a pulse sensor once every revolution. If the drive belt should fail, causing the heat exchanger to stop, no pulses will be generated and an alarm will therefore be activated. The magnet and sensor must be ordered separately.

The rotor sensor also operates when the system is in the purging mode, although the period before the alarm is activated is then longer.

Automatic purging

When the control signal falls below a given value, the heat-exchanger rotor advances about 30° every six minutes. With the rotor turning at such a slow speed, no additional heat will be delivered by the system but the rotor will be kept clean (purging).

Exact control-signal values for initiation of the purging mode are given in section, Technical Data.

Soft starting

The control system is equipped with a soft-starting function. The ramp time is about 30 seconds.

Radio interference suppression

To the relevant standards.

Accurate speed display

An accurate reading for the rotor speed is shown on the display when the rotor sensor is connected.

Reversed direction of rotation

The direction of motor rotation can be reversed.

Indication of residual voltage

A yellow LED will be illuminated when residual voltage is present in the control unit. Residual voltage remains for about one minute after the mains supply is switched off.

Selection of maximum speed (DIP-switch 5 and 6)

The max. motor speed can be set to 100%, 70% or 40%. A maximum speed of 70% or 40% should be selected for the smallest rotors and/or when a larger pulley is used.

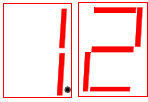
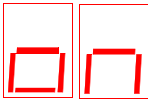
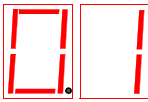
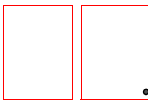
Alarm relay

A built-in relay with changeover switch gives alarms for:

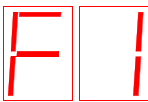
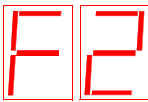
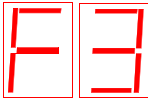
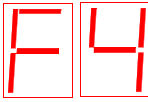
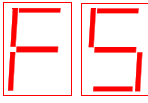
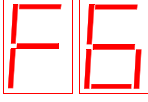
- Overvoltage supply
- Undervoltage supply
- Broken power supply
- Motor overload
- The rotor monitor not receiving a signal from the magnet, for example, when a fan belt snaps

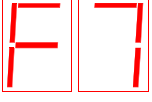
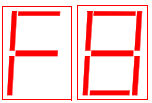
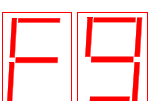
3.2 Data displayed

Normal operation

	Rotor speed in rpm. Value updated every 0.3 seconds. Default ratio = 40:1; the correct rotor speed is shown after two sensor signals have been received. Range: 0.1-64.
	Indicates rotor sensor DIP-switch setting when rotor sensor not connected.
	Purging mode. Control signal low.
	This dot flashes each time the magnet on the heat-exchanger passes the rotor sensor. It remains on whenever contacts are closed but for at least 1 second.

Alarm indication: (F in the left display segment flashes)

	Malfunction indicated	Alarm
	Power supply-voltage high	Immediately
	Power supply-voltage low	Immediately
	Rotor alarm	After 24 seconds - 8 hours, depending on speed of rotor.
	Power supply-no voltage	Immediately
	Motor/overload protection	Immediately
	Overload	Immediately

	Malfunciton indicated	Alarm
	Internal fault in drive system	Immediately
	Internal fault in drive system	Immediately
	Internal fault in drive system	Immediately

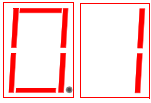
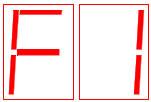
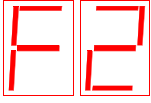
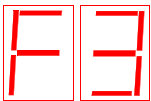
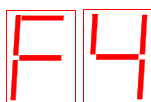
4. MAINTENANCE AND FAULT-FINDING

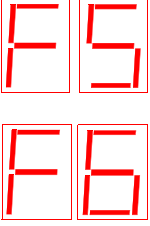
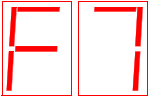
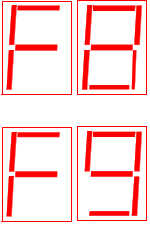
4.1 Maintenance

The motor and control unit usually require no maintenance. All that is needed is to check the wiring and tightness of screws, and to ensure that the units are securely installed.

4.2 Fault-finding EMS-VVX-1

Check that the equipment has been correctly installed, e.g. terminal screws correctly tightened, no loose wiring, etc., and that the DIP-switches are set correctly.

Fault indication		Malfunction indication/Action
	Purging mode/ control signal low	Check the EMS system by connecting a jumper across terminals 36 and 37. The motor should now gradually increase speed up to maximum revs. Vary the control signal between the minimum and maximum values. Check that 0-10 V (2-10V) can be measured across terminals 33 (+) and 34 (-). Is + or- changed?
	Power supply- voltage high	Voltage exceeds 264 V a.c. A distorted power supply voltage can occur in certain industrial environments.
	Power supply- voltage low	Voltage below 198 V a.c. Power supply is weak, a voltage stabilizer should be installed.
	Rotation super- vision	Heat-exchanger rotor not rotating. Check the drive belt. Heat exchanger rotor rotating. Check that the right display dot lights up when the magnet passes the rotor sensor. If not, check that the gap between the magnet and sensor is 5-8 mm and measure sensor resistance (ohm) after disconnection from the EMS unit. The sensor is short-circuited when energized by the magnet and open circuit when de-energized. Connect a jumper across terminals 31 and 32. The right display dot should now light up. If not, replace the control unit.
 Display off Yellow LED illuminated	Power supply- no voltage	If the display and LED are not illuminated, start by checking the external fuse and that the power supply at the terminal block is 220-240 ±10% VAC. If F4 is displayed but the LED is not illuminated, check the 2 A internal fuse. If the fuse has blown, fit a new 2AT fuse. If it blows again, check the motor. If the motor is faultless, fit a new control unit. If the motor is faulty, fit a new motor and control unit. If the display is off but the LED is illuminated, check the 63 mA internal fuse.

Faultindication		Malfunction indication/Action
 <p>F5 F6</p>	Motor-overload protection	<p>The motor-overload protection has tripped due to high load. Check that the motor cables are connected according to chapter "Connection", if not reconnect the motor cables and restart the system. If the drivsystem is running for longer periods, the load can be too high, check also that the heat-exchanger rotor is rotating freely, that it is not too large and that the pulley does not have too large diameter. If the fault cannot be traced, the motor still stops and F5/F6 is displayed each time a restart is attempted, fit a new control unit.</p>
 <p>F7</p>	Internal fault in drive system	<p>Check the motor with a meter (see below*). If the insulation is defective or the motor resistance is too low, fit a new motor and control unit. If the motor resistance is too high, check the control unit by connection the power supply with the motor disconnected. F9 should now be displayed. Fit a new motor. If the motor is faultless, fit a new control unit.</p>
 <p>F8 F9</p>	Internal fault in drive system	<p>Open the power supply circuit. Check that the motor cable is connected properly and that the motor has the right specification. Try to restart the system. If F8/F9 is displayed again, isolate the power supply and check the motor with a meter (see below*). If the motor is faultless, fit a new control unit. If the motor is faulty, fit a new motor and a new control unit.</p>

* Testing the motor

Open the power supply circuit. Disconnect the motor cable from the control unit. Measure the resistance across terminals 1- 2, 3 - 4 and 5 - 6. All readings should be between 30 and 90 ohm. Check the insulation between terminals 1-3, 1-5, 3-5, earth-1, earth-3 and earth-5.

DIP-switches

If the motor will not reach maximum rpm or fails to respond to the control signal, check DIP-switches 1-3, 5 and 6.

If ON is displayed instead of the rotor speed, change the setting of DIP-switch 4.

Direction of rotation

The direction of rotation can be changed by shifting the motor cables, see chapter "Connection".

5. TECHNICAL DATA: EMS-VVX-1

Outputs

Output torque:	0.7 Nm
Speed range:	20-400 rpm, intermittent operation: 0.33-20 rpm
Purging mode:	Integral function
Soft starting:	Integral function
Motor-overload protection:	Integral function
Alarm output:	Changeover switch, 5 A, 250 V a.c. maximum

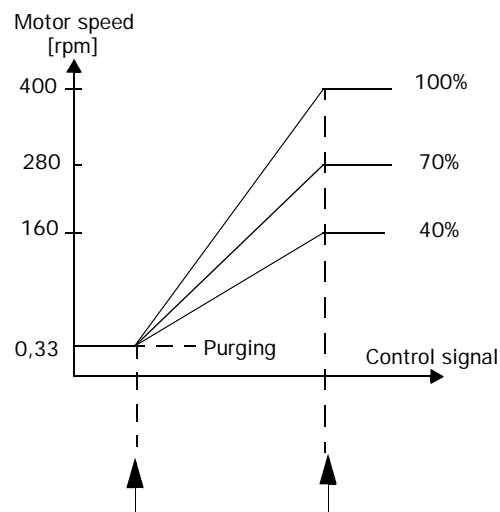
Inputs

Power supply:	220-240 VAC $\pm 10\%$, 50-60 Hz
Control signal:	0-10 V, 2-10 V, 0-20 V (phase cut); 0-20 mA, 4-20 mA, or 0-10 k Ω potentiometer
Rotation monitor:	Pulse sensor should be connected
Radio-interference suppression:	Yes

General

Protection class	IP54
Ambient temperature	-30 to +40°C
Tachometer	Integral function

Drive system operating conditions at different control signals



Control signal	Purging	Max.speed
0-10 V	0.4 V	9.7 V
10 k Ω	0.4 V	9.7 V
2-10 V	2.3 V	9.7 V
0-20 V	0.8 V	19.4 V
4-20 mA	4.6 mA	19.4 mA
0-20 mA	0.8 mA	19.4 mA

Dimensions and weights

Control unit 1.1 kg

Motor 3.8 kg

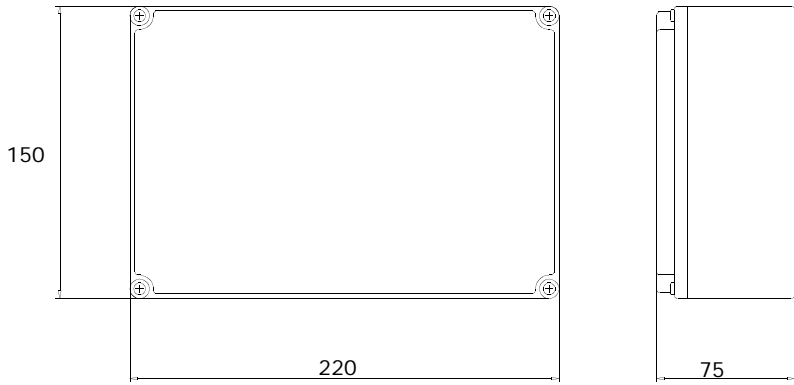


Figure 5 Dimensions, control unit

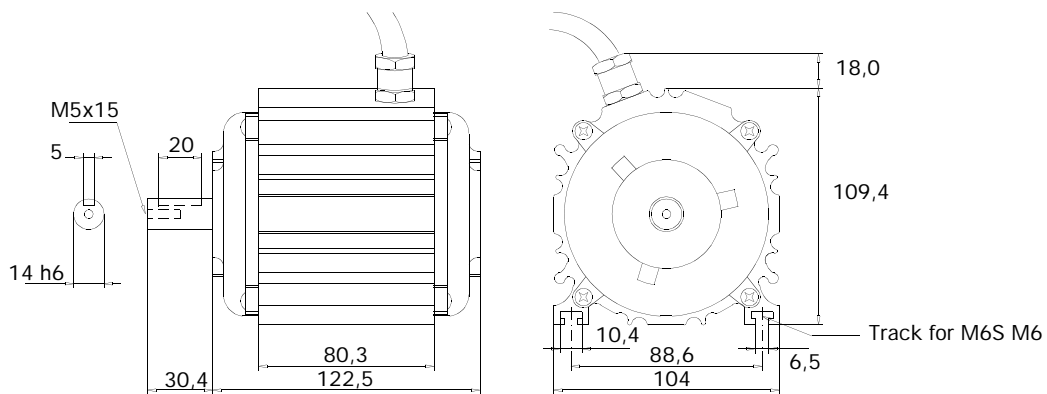


Figure 6 Dimensions, motor