REGENERATIV-WÄRMERÜCKGEWINNER

rotorsysteme®

Instruction Manual
rotortronic VVX 15, 25 and 35

BV1

rotortronic VVX

Types 15, 25 und 35

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Instruction Manual
rotortronic VVX 15, 25 and 35 BV1

Contents

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rotortronic VVX 15, 25 and 35

BV1

Valid fort he following models:

rotortronic VVX 15
rotortronic VVX 25
rotortronic VVX 35

This product is protected as follows:
Patent: US 4 868 478; EP 0 285 637; SE 8604308-0
US 5 315 224; EP 0 507 835; SE 9002217-9
US 6 628 100; SE 9902821-9
SE 0100814-3
Registered design: US 462 937; DE 400 05 393.4; SE 66 630

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Safety instructions

During installation

- Read the instruction manual completely before installation and commissioning.
- The installation must be carried out by qualified personnel.
- General conditions and regulations for the installation and operation of electrical machinery must be observed.
- Measures to protect personal injury and damage to the machine must be taken following local rules and regulations.
- The drive system rotortronic VVX is intended for permanent installation.
- Cables may not be connected or disconnected while the supply voltage is on.
- Check that the equipment is correctly connected before it is taken into use, see the instructions in the chapter on Mounting/Connection.
- Faults that araise due to faulty installation or operation are not covered by the guarantee.

During operation

- Measurement in the control unit, during operation, must only be carried out on the terminals and only by authorized personnel. NOTE: Great care must be taken.
- The units may not be opened or disassembled during operation.

During disassembly and scrapping

- The housing of the control unit is made from aluminium and steel. The material must be handled and recycled following the relevant laws.
- The cricuit board contains small amounts of tin and lead, which must be handled and recycled in accordance with the relevant laws.
- The motor is made from copper, plastic, aluminium and iron. These materials must be handled and recycled in accordance with the relevant laws.

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1. Description

1.1 Introduction

Rotortronic VVX 15-35 is a series of speed controlled drive systems specially designed for driving Rotary Heat Exchangers / Rotorsystems. The drive system consist of a motor and ist associated control unit.

The new drive system is also based on the SR (switched reluctance) motor technologie.

These motors make it possible to drive Rotorsystems up to 3.5 metres in diameter without gears.

Important Note:

Connect rotortronic VVX control system directly with the motor cable !

Do not change the length of the motor cable !

Do run motor wires and pilot wires always shielded !

1.2 Product range

Rotortronic VVX is available in three sizes for rotors up to around 3.5 m. They come in three sizes for diametres up to 3,5 m: rotortronic VVX 15, 25 und 35.

Built-in functions of rotortronic VVX are:

- Automatic purging operation
- Rotation monitor - integrated electronics or with external rotation sensor
- Alarm relay
- Test switch
- Prioriry switch / defrosting
- Heat recovery on cooling with extemal differential thermostat
- Display of the rotor speed in rpm when the external rotation sensor is connected.
- analog output signal proportional to motor rotation speed
- Input for potentiometer with low resistance, 100 Ω bis 5 kΩ
- prepared for serial data transmission

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1.3 Operating indicators / build in functions

Operating status:

0,1	Purging mode to support self cleaning effect of the rotorsystem. Low control signal
2,5	Actual speed of Rotorsystem in rpm (0,2-99 rpm). After two pulses from the rotation monitor, the correct speed of rotation of thr rotor is displayed.
on	Shortly displayed when starting. If not, DIP-switch should be checked.
.	Lit for two seconds when the magnet passes the rotation sensor.
S	Summer operation/heat recovery on cooling: Displayed, if the exhaust air temperature is lower than outside air temperature (the potention between connector 51 and 53 is higher than the potention between connector 51 and 52)
F8	An alarm is indicated by the letter F followed by a number. See also the chapter troubleshooting.
No display	Check power supply

Table 1: Operating indication rotortronic VVX 15-35

1.3.1 Automatic purging mode / holding torque

When the control signal is low, <1.5 V at 0-10 V the drive system switches to purging mode. In purging mode the motor shaft turns two revolutions every 10 minutes, which is equivalent to around 30 degrees of rotation by the heat exchanger rotor. This slow rotation does not provide any significant heat transfer, but simply serves to keep the rotor clean.

Most of the time the rotor seals keep the rotor stationary, but if the rotor seals are not touching the rotor and the air flow is not perpendicular to the rotor, the air flow may cause the rotor to rotate. To prevent unintentional heat recovery in this situation the motor is used to provide a holding torque to keep the rotor stationary.

The first time the drive system goes into purging mode after the power is switched on this holding torque is not activated, since many rotors do not require an active holding torque to keep them stationary.

A rotor that does requine a holding torque will then begin to turn slowly. The drive system immediately brakes this motion, reducing the speed to zero, and then applies a constant holding torque to keep the rotor stationary. The drive system has now learned which rotors require a holding torque, and which do not. The holding torque is at least 50% higher than the torque required for operation just before is should stand still.

If a holding torque has been applied and you grasp the drive belt and try to turn the rotor by hand, the torque will progressively increase.

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The holding torque is generated by passing a current through one of the motor phases. The higher the torque that is required, the higher the current. This current produces a noise that gets louder as the current increases. Integrated in the control unit are three motor protection breakers, one for each motor phase. The motor protection also protects the motor when the holding torque is activated.

1.3.2 Rotation monitor (DIP-switch 4)

The rotation monitor is using an external rotation sensor.

The rotation monitor is equipped with a magnet, that is installed at circumference sheet metal of the rotor. The magnet activates the sensor once every revolution. Should, for example, a belt break and the rotor stops, the pulses cease and an alarm is actuated. The time until the alarm is given is speed dependent and is 24 seconds at max. speed, 20 minutes at min. speed and about 8 hours in purge mode.

The rotation monitor activates the alarm through operating indicator and alarm relay, nevertheless the motor will not stop if an alarm is activated.

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1.3.3 Protection of the control unit

The control unit is protected by monitoring for both over-voltage and under-voltage. If the supply voltage goes over or under the allowed limits, the control unit is disconnected and the motor stops. The motor starts again automatically when the supply voltage returns to its normal value.

The control unit has built-in motor protection that protects against overloading, and external motor protection is not required. Power supply to the motor is cut in the event of overload. In order to restart the drive system, the supply voltage to the control unit should be temporarily disconnected for at least 5 seconds.

Built-in short circuit protection protects against short circuits between the phases of the motor and between the phases and earth.

<table>
<tr><th>Protective Function</th><th>External alarm</th><th>Restart</th><th>Alarm reset</th></tr>
<tr><td>Supply fault, overvoltage</td><td rowspan="2">Yes, immediately</td><td rowspan="2">Automatic</td><td rowspan="4">Automatic</td></tr>
<tr><td>Supply fault, undervoltage</td></tr>
<tr><td>Pre-alarm, rotation monitor</td><td>No</td><td rowspan="2">Motor not stopped</td></tr>
<tr><td>Rotation monitor</td><td>Yes</td></tr>
<tr><td>Pre-alarm, motor protection/overload</td><td>No</td><td>The system tries to reset three times</td><td>Automatic</td></tr>
<tr><td>Motor protection/ Overload</td><td rowspan="2">Yes, immediately</td><td rowspan="2">Manual, disconnect and reconnect power supply</td><td rowspan="2">Manual, disconnect and reconnect power supply</td></tr>
<tr><td>Short circuit</td></tr>
</table>

Table 2: Protection and alarm functions

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2. Mounting / connection

2.1 Mounting

Both the motor and the control unit are usually mounted in the housing of the rotorsystem. In this way, they do not occupy any space outside of the rotorsystem housing and are well protected during transport. Furthermore, it is often advantageous from the point of view of interference (EMC) to place the motor and control unit in the rotor housing. The motor is usually mounted on a sprung motor support when a V-belt is used. In this way, problems arising if non-circular rotors are used can be prevented. Vibration dampers should be mounted between the motor and the motor support so that any vibration from the motor is not transmitted to the rotor housing.

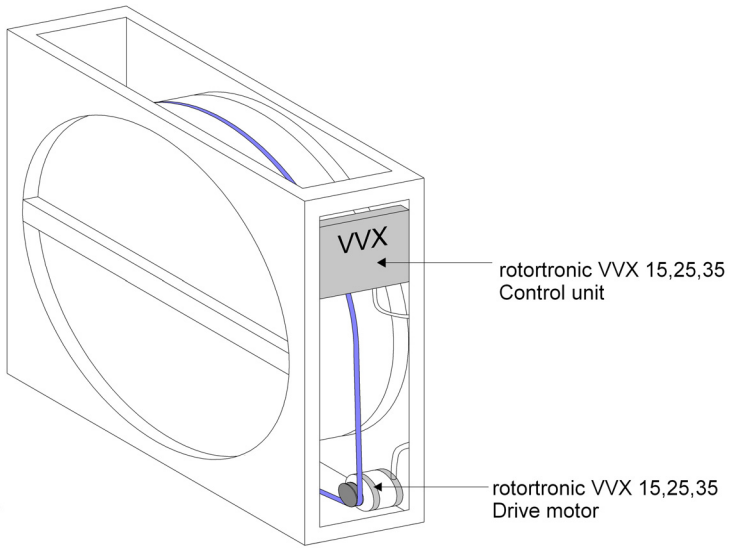

Figure 1: Motor and Control unit

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2.1.1 Sensor of rotation monitor

The magnet for the rotation sensor is screwed onto the circumference sheet metal of the rotorsystem. If the sheet metal is magnetic, the magnet must be insulated from this cover. The rotation sensor is mounted such that the magnet passes at a distance of 5-8 mm, see figure 2.

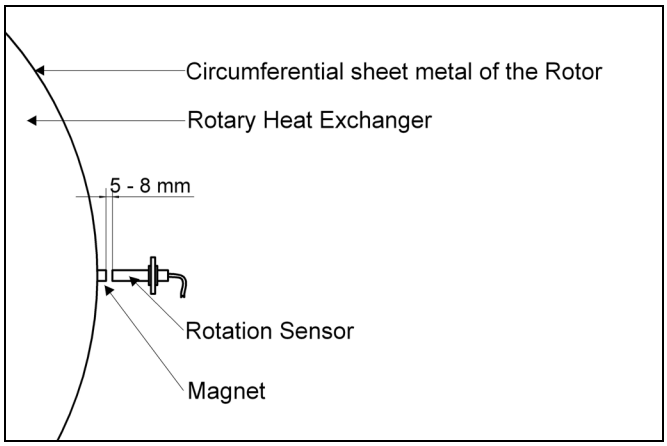

Figure: Sensor of rotation monitor

2.2 Connection

WARNING! Residual voltage remains up to 1 minute after disconnection of the supply voltage.

The motor is delivered with a fixed connected motor cable to simplify installation of the drive system. The length of the cables are:

rotortronic VVX 15: 2,0 m
rotortronic VVX 25: 2,5 m
rotortronic VVX 35: 2,5 m

The motor cable cannot be extended because this could interfere with the electronic tachometer that is built into the system.
An external slow-blow fuse at 10 A must always be installed. The drive system does not contain a fuse.
Electronic motor protection is built into the control unit, and monitors the motor at all times. The control unit is protected from short circuit within the motor.
A safety switch is to be installed between the mains supply and the control unit. An alarm for loss of power is given if the main supply is disconnected.

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WARNING! No switch is allowed between the motor and the control unit

2.2.1 When switching off

When it is desired to switch off the rotorsystem, for example at night, this can be done using a relay connected in series with the control signal. This relay interrupts the signal to control signal terminal number 33. In this way, no alarm about interruption of power supply is given. The control signal can of course also be reduced to its minimum value, in order to achieve the same result. If the control signal is low or absent the drive system switches to purging mode.

2.2.2 Recommendations with respect to EMC

In order to fulfil the European EMC Directive 8913361ECC regarding electro-magnetic compatibility, the following precautions must be taken:
The motor cable must be mounted as close to the heat exchanger housing as possible. If the cable is too long, the excess should be collected together in the form of, for example, a figure "8". The area enclosed by the cable should be as small as possible. Electrical tape or cable ties can be used to achieve this.

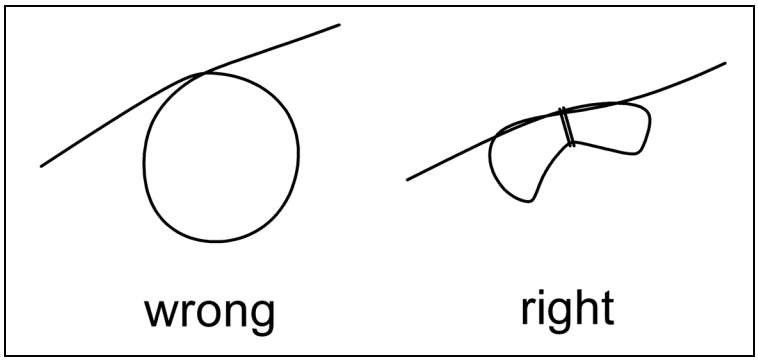

Figure 3: Exess motor cable should be arranged such that the area enclosed is as small as possible

Special EMC couplings/glands are not necessary.
An EMC filter is built into all rotortronic VVX models.

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2.2.3 Priority switch / defrosting / manual control

A preselected speed of rotation can be specified by a potential-free connection between the priority inputs 34-35. When terminal 34 is connected to terminal 35, the speed of rotation is determined by the priority potentiometer, which is located next to the DIP switches in the control unit. The priority, switch has higher priority than the summer/winter switch and the control signal.
The switch can be used, for example, when cleaning the rotor, defrosting using an external differential pressostat or for manual control of the speed of rotation.

2.2.4 Manual control using a 10 kOhm potentiometer

It is simple to control the drive system manually using a 10 kOhm potentiometer connected as shown in the figure.

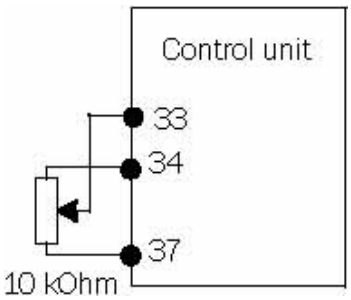

Figure 4: Installation 10 kOhm potentiometer

Important Note:

Connect rotortronic VVX control system directly with the motor cable !

Do not change the length of the motor cable !

Do run motor- and pilot wires always shielded !

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2.2.5 Test switch

The control unit is equipped with a test switch, placed under the cover between terminals 37 and 41. When this switch is in the "ON" Position, the motor soft-starts and the speed increases to the maximum, independently of other signal sources. In the "OFF" Position (down), the test switch is not operational.

The test switch can also be used to tun the motor at maximum speed if, for example, an external control signal is available.

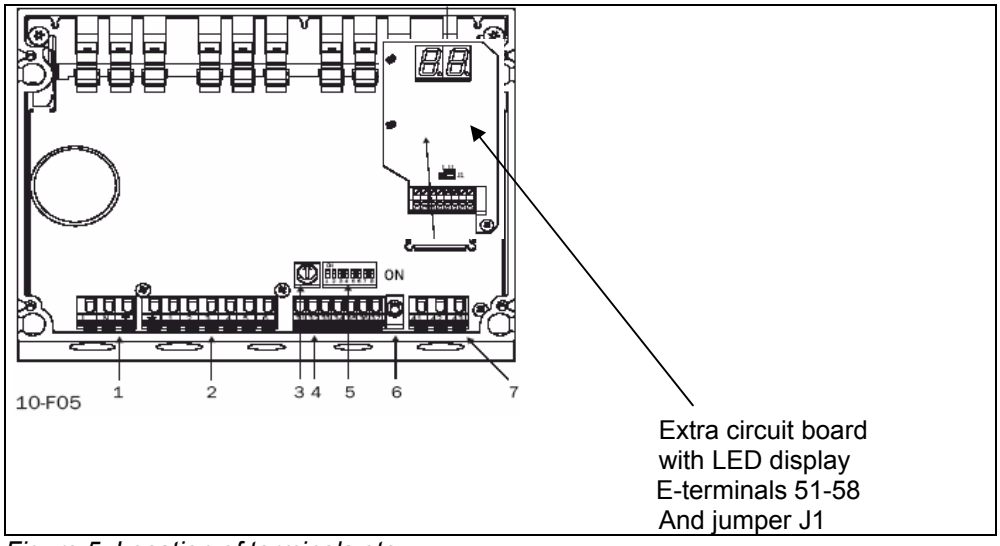

Figure 5: Location of terminals etc.

No.	designation
1	Supply terminal
2	Motor terminal
3	Priority potentiometer
4	Control signal terminal
5	DIP-switch
6	Test-switch
7	Alarm terminal

table 3, Location of terminals

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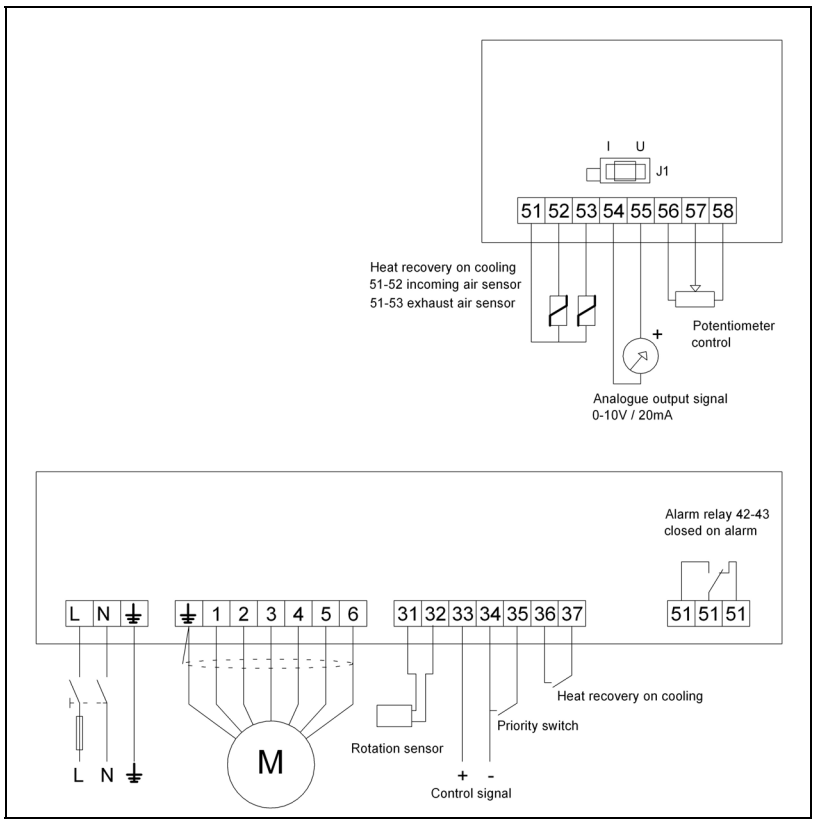

Figure 6: Wiring diagram

2.2.6 Choice of maximum speed

The maximum speed can be limited to 80% (200 rpm) or 60% (150 rpm). This function is primarily intended for use with rotors smaller than 1,3 m, when it is desired to limit the speed of rotation and/or when using larger belt pulleys.

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2.2.7 Setting DIP-switches

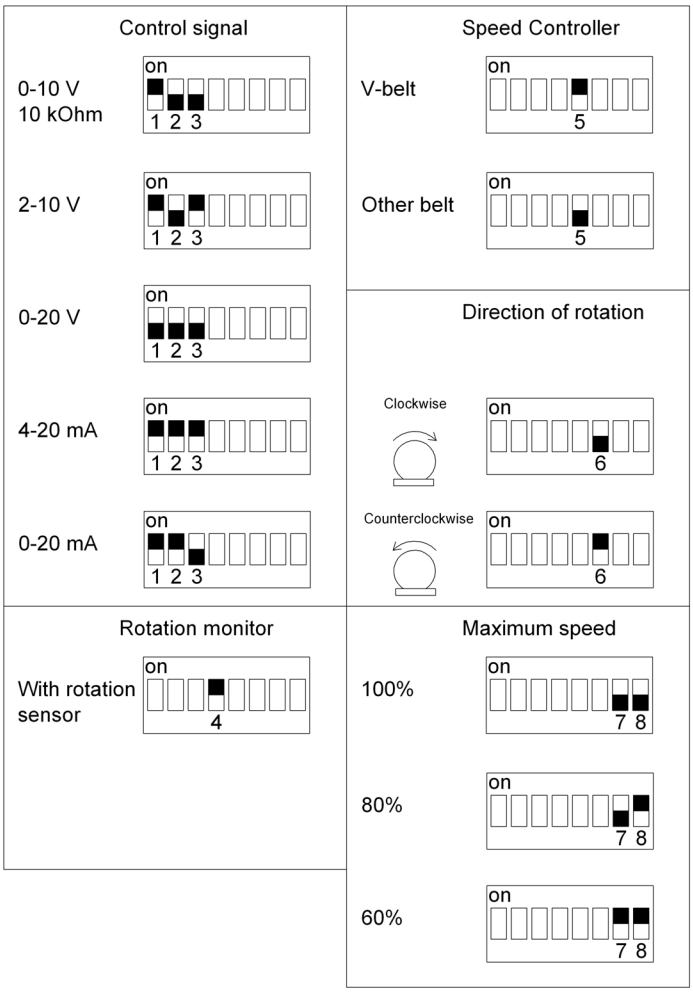

Figure 7: Setting Dip-switches

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WARNING! Disconnect the voltage supply before changing the DIP-switch settings.

2.2.8 Speed controller

DIP switch 5 on the control unit can be used to select between two speed controllers. One controller provides gentler operation and is used if resilient belts such as round belts, flat belts and resilient V-belts are fitted. In this case DIP-switch 5 should be set "OFF". The other controller is faster and stiffer, and is intended for use with stiff belts. In this case DIP switch 5 should be set "ON".

If the stiffer controller is not adequate for smooth operation when the max. speed is set to 100%, an even stiffer and faster controller can be selected by setting DIP-switches 5 and 7 "ON" and setting DIP switch 8 "OFF", see figure 8.

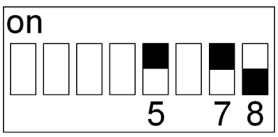

Figure 8: Selection of a very stiff and fast controller

2.2.9 Parallel connection

If several rotorsystems are to be used in parallel using one control signal or sensor, each rotorsystem must be equipped with its own drive system (motor and control unit).

The control signal is connected to the first drive System according to the instructions for connection. The other control units are connected by connecting terminals 33 and 34 of the other control units to terminals 33 and 34, respectively, on the first control unit.

The DIP-switches on the first control unit are set as described in "Setting DIP switches". DIP-switch 1 and DIP switch 3 on the other control units are set as described in "Setting DIP-switches", while DIP-switch 2 is always set as described below:

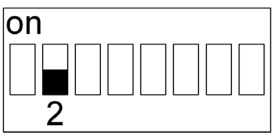

Figure 9: Dip-switch parallel connection

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The control units give individual alarms. The alarm outputs can be connected in parallel or in series in order to obtain a collective alarm.
Rotortronic VVX drive units can also use the analogue output signal in order to control other drive Systems. Terminals 54(-) and 55(+) are connected to rerminals 34(-) and 33(+), respectively. The DIP-switches on all control units are set as described in "Setting DIP-switches".

2.2.10 Heat recovery on cooling - summer/winter switch

Heat recovery on cooling refers to the mode of operation when the incoming air temperature exceeds the exhaust air temperature. By driving the rotorsystem at maximum speed, a cooling effect is achieved on the incoming air.

The heat recovery on cooling function is most simply obtained by using an external regulator which has this function built-in. Rotortronic VVX is then controlled by a control signal, e.g. 0-10 V.

If for example, an external regulator is already installed, you can obtain the heat recovery on cooling function by directly connecting a separate differential thermostat to rotortronic VVX, terminals 36-37.

Rotortronic VVX has a built-in differential thermostat. This makes it possible to connect two NTC sensors of resistance 2000 Ohm (for example EGL 511), one in the incoming air duct and one in the exhaust air duct, directly to Rotortronic VVX, terminals 51-53. If the exhaust air is colder than the incoming air, the rotor rotates at its maximum speed, and cooling is recovered. If the exhaust air is warmer than the incoming air (as is normally the case) the speed is controlled by the control signal, and heat is recovered.

2.2.11 Analogue output signal

The output signal, 0-20 mA or 0-10 V is proportional to the speed of the motor. Maximum value, 20 mA or 10 V is always obtained at the selected max. speed (60, 80 or 100% of the motor's maximum rpm). The choice between the 0-20 mA output signal and the 0-10 V output signal is made with jumper J1 positioned behind the control terminals 51-58.

2.2.12 Potentiometer with low resistance,100 Ohm to 5 kOhm

When control is provided by a potentiometer with a total resistance value between 100 Ohm and 5 kOhm, the three leads are connected to terminals 56-58. DIP-switches 1-3 are set in the same way as for a control signal of 0-10 V.

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3. Maintenance/troubleshooting

WARNING! Residual voltage remains for up to 1 minute after disconnection of the supply voltage. The test-switch and the DIP switches may only be adjusted when the supply voltage has been disconnected.

3.1 Maintenance

The motor and the controller do not normally require any maintenance. However, it should be regularly checked that the cabling is not damaged and that all fixing screws are securely tightened.

3.2 Motor diagnosis

Disconnect the supply voltage. Disconnect the motor cables from the control unit. Measure the motor resistance between 1-2, 3-4 and 5-6. The values should be:

Rotortronic VVX15: 30-90 Ω
Rotortronic VVX25: 5-15 Ω
Rotortronic VVX35: 5-15 Ω

The resistance should not differ by more than 5 Ohm between the phases for rotortronic VVX 15, and by no more than 2 Ohm for rotortronic VVX 25 and 35. Also check the insulation resistance between 1-3, 1-5, 3-5, 1-earth, 3-earth and 5-earth.

3.3 Troubleshooting

Check that the equipment has been correctly installed, i.e. that the cables are properly stripped, that there are no loose cables, etc., and check that the DIP switches are correctly set.

It is always possible to test run the drive system using the TEST switch located under the cover next to terminal 37, see Fig. 4. The switch has two fixed positions, when it is in the up position, the motor accelerates to its maximum speed independent of the control signal, and when it is in the down position the rotation speed is controlled by the control signal.

If the motor does not reach maximum speed or respond to the control signal, check DIP-switches 1-3 and 7 and 8. If the rotorsystem rotates in the wrong direction, change the setting of DIP-switch 6. Reset, vibration, noise and built-in protection are described in the chapters Description and Mounting/Connection.

If the control unit is to be exchanged, the complete covered box containing the circuit boards must be exchanged.

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Alarm indication	Fault	Fault condition/Action required
0,1	Purging/ low control signal	Check the rotortronic VVX by running the drive system with the test switch located next to terminal 37. The motor should accelerate to its maximum speed.nIf the motor does accelerate to the maximum speed when the test switch is activated, the fault is external. Can 0-10V (2-10V) be measured between 33(+) and 34(-)? Have + and – been swapped?
P3	Pre-alarm Rotation monitor	The drive system has switched to a softer speed controller because the motr shaft is jerking sharply. Check that the drive belt is not slipping on the pulley.
F3	Rotation monitor	Rotorsystem does not rotate, check the drive belt. The rotorsystem rotates, check the indication is given when the magnet passes the rotation sensor, see the section Operating indicators, if not replace the rotation sensor.
P5	Pre-alarm, overload/ motor protection	The motor protection has been activated due to excessive load. After a cool-down period of 10 minutes the system restarts automatically. If the overload protection trips three times within 120 minutes the drive system will be shut down, see also overload (F5)

Table 4/1: Troubleshooting

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Alarm indication	Fault	Fault condition/Action required
F5	Overload/motor protection	The motor protection has been activated due to excessive load. Check that the motor cables are connected correctly, see the chapter on mounting / Connection. Check also that the rotor runs freely and that the rotor and pulleys are not to large. If the fault remains, carry out motor diagnosis. Replace the motor if it is faulty. If the fault does not lie within the motor, replace the control unit.
-	Supply voltage missing	Check that the 230 VAC +/- 15% is connected to the supply terminal.
F1	Overvoltage	The supply voltage exceeds 264 VAC
F2	Undervoltage	The supply voltage lies below 196 VAC
F6	Earth fault in the motor	Disconnect the supply voltage, check the connection of the motor cable and check that the correct motor is connected. If the fault remains, carry out motor diagnosis. If the motor is faulty, replace it. If the fault does not lie with the motor, replace the control unit.
F7	Short circuit in the motor	
F8	Circuit break in the motor	
F9		

Table 4/2: Troubleshooting

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Instruction Manual
rotortronic VVX 15, 25 and 35 BV1

4. Technical data

Function		rotortronic VVX		
		15	25	35
Output data	Rotation speed (rpm)	5-250		
	Torque* (Nm)	1,5	4	6
	Power (W)	40	100	160
	Direction of rotation	Selectable		
	Purging mode	Built-in function		
	Motor protection	Built-in function		
	Soft start and Stopp (s)	15/15	25/25	35/35
	Alarm output	Alternating contact, max. 5A 230 VAC		
Input data	Supply voltage	230 VAC +/- 15%, 50/60 Hz		
	Current (A)	0,7	1,3	1,7
	Control signal	0-10V, 2-10V, 0-20V phase cut, 0-20mA, 4-20 mA, 10 kOhm potentiometer		
General	Protection class	IP 54		
	Weight, control unit (kg)	1.7		
	Weight, motor (kg)	5	8	11
	Terminals	1 pc M12 and 4 pc M16 (glands)		
	Ambient temperature	-30 - + 40°C		
	Tachometer	Electronic tachometer, tachometer cable is not needed		
	EMC, emission	EN 50081-1		
	EMC, immunity	EN 50082-2		
*) Torque is constant over entire speed range.				

Table 5: Technical data

4.1 The drive system's operation using different control signals

The drive system has a built-in linearity function that gives a linear relationship between the control signal and the efficiency of the rotorsystem, rather than having the speed of rotation proportional to the control signal. This provides good conditions for stable temperature control.

Control signal	Purging	Max. speed
0-10 V	1,5 V	9,7 V
2-10 V	3 V	9,7 V
0-20 V	3V	19,4 V
4-20 mA	6 mA	19,4 mA
0-20 mA	3 mA	19,4 mA

Table 6: Technical data

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4.2 Motor and control unit dimensions

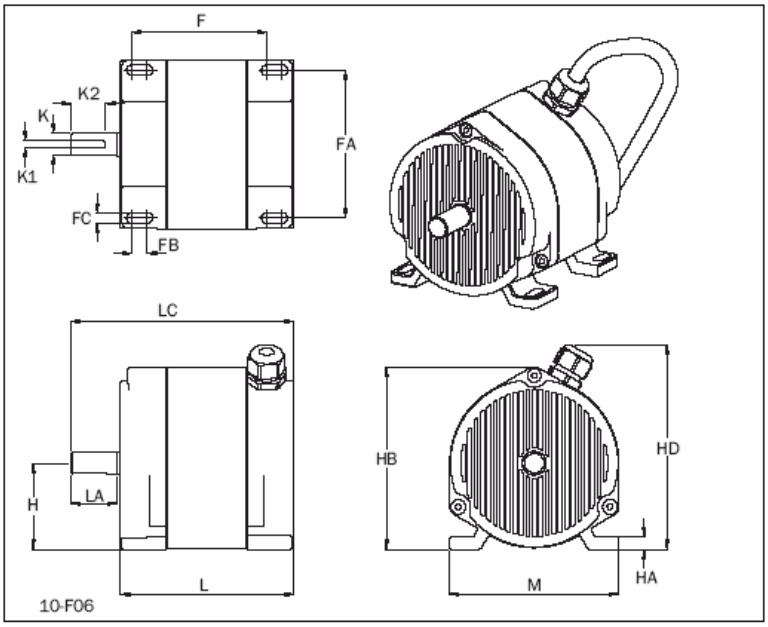

Figure 10: Motor dimensions

	F	FA	FB	FC	H	HA	HB	HD
15	88	96	10	7	56	8	119	134
25	82	140	12	7	81	10	173	180
35	109	140	12	7	81	10	173	180
	K	K1	K2	L	LA	LC	M	
15	14j6	5h9	20	113	30	145	110	
25	14j6	5h9	20	114	35	152	160	
35	14j6	5h9	20	141	35	179	160	

Table 7: Motor dimensions (mm)

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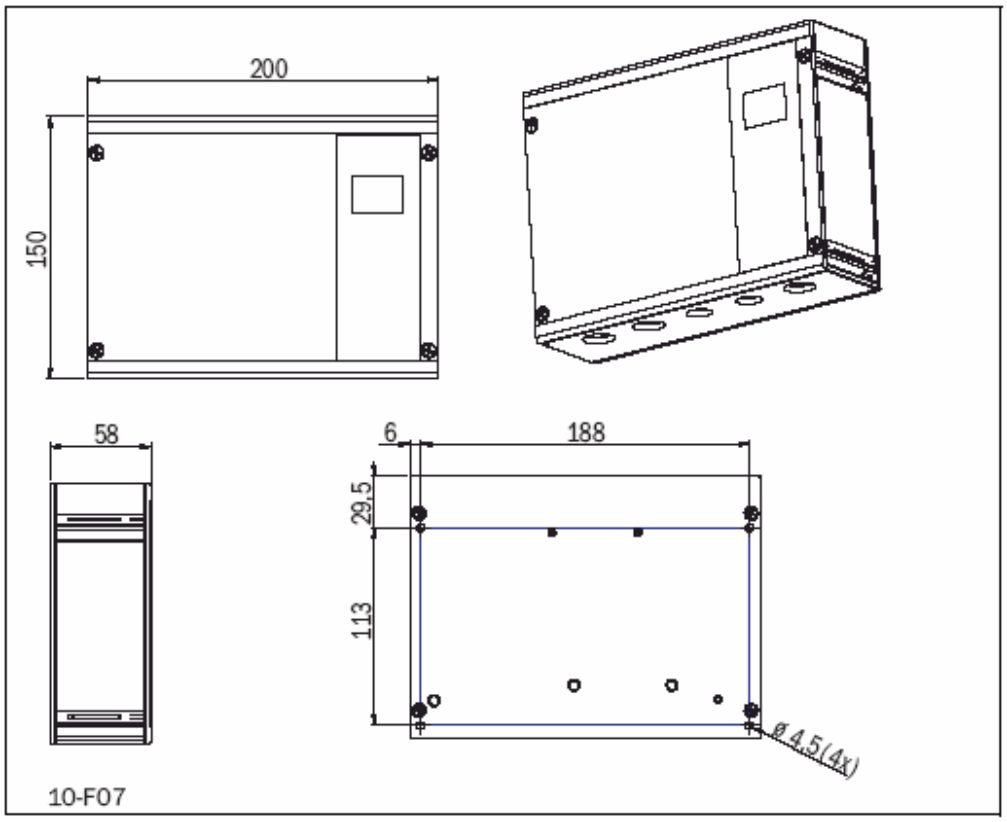

Figure 11,Control unit dimensions (mm)

Version 5.6
Technical specifications subject to change

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