Instructions heat exchanger control system, 14 Nm SILVER C RX, RECOnomic, sizes 100/120, RECOsorptic, sizes 80-120

1. General

The heat exchanger control system is a system for motors of 14 Nm. It is designed for precise and quiet control of rotary heat exchangers in SILVER C RX ventilation units with standard rotor (RECOnomic) in sizes 100/120, and with sorption rotor (RECOsorptic) in sizes 80-120.

The control system consists of a motor control system with an integrated rotation monitor and a motor. The rotation monitor is used for monitoring the rotor movement to ensure that the rotor rotates as intended.

The heat exchanger control system is designed for precise control of the rotor's rotation speed, which enables energy-optimum heat recovery.

The heat exchanger control system is located inside the centre section of the air handling unit. For access, open the inspection door.

Forbidden to start operation

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

The heat exchanger control system must not be powered up until the entire installation conforms to the provisions in ALL relevant EU Directives.

If the heat exchanger control system has been damaged, for instance during transport, it must be inspected and repaired by qualified personnel before it is voltage fed.

Built-in protection

If the temperature in the heat exchanger control system exceeds 95 °C, the heat exchanger control system will attempt to reduce the heat development by reducing the amount of current fed to the motor.

The heat exchanger control system has a built-in current limiter to protect the motor and cables, which means it cannot deliver more current than it is set to.

The heat exchanger control system is short-circuit protected against phase-phase-short-circuiting on the unit's motor connector (U, V, W).

2. Technical data

Control

	Unit	Heat exchanger control system
Torque	Nm	14.0
Size based on capacity	W	790
Efficiency	%	> 94%
Power supply		
Voltage	VAC	1 x 230 V AC 50/60 Hz -15%/+15%
Supply current at maximum load	A	3.4
Power factor (cos-phi) at maximum load		>90%
Motor output		
Nominal motor output (on the shaft)	kW	790
Motor speed	rpm	0 - 400
Nominal torque, motor	Nm	14.0
Torque, motor boost	Nm	17.5
Frequency	Hz	0 - 400
Max. voltage out	Vrms	3 x 0 - 230 V AC
Protection		
Max. fuse protection	A	10
Output, motor		Short-circuit protected between phases
Motor		Current limitation protection
Impulse protection		Transient protection of VDR
Surge protection		400 V (PTC)
overload protection		Overload protection, current and temperature
Environment		
Temperature, operation	°C	-40 to +40
Temperature, start	°C	-40 to +40
Temperature, storage	°C	-40 to +70
Dimensions	mm	185 x 265 x 125
Degree of protection	IP	54
Enclosure material		Aluminium
Front cover		Plastic
Weight	kg	3.6
Relative humidity	% rh	10-95% RH, non-condensing
Cooling		Self-cooling
Interface		
RS-485 interface protocol		RS-485 interface (Baud rate: 9.6, 19.2, 38.4, 57.6, 115.2 kbaud) Preset: 38.4 kbaud, 2 stop bits, non-parity
RS-485 interface connection		2 x RJ12 & 3 x spring-type terminals
RS-485 interface cable		Max. 100 m
Analogue In1		0–10 VDC, 100% @ 9.5 V DC +/-2%
Analogue Out1		+10 V DC
Digital In1 (internal Pull up)		Alarm resetting
Digital In2 (internal Pull up)		Activation of external rotation monitor
Alarm relay		SPDT-relay 1 A 30 V DC/24 V AC
Green LED		On: Power connected | Flashing: Active Modbus communication
Red LED		Flashing: Alarm, but still operating | Lit constantly: Serious alarm - stop the motor
Rotary switch		Yes
Functions		
Technology		Sinusoidal back-EMF signal controlled via FOC (Field Oriented Control)
Ramp up time	sec.	60
Ramp down time	sec.	60
Alarm		Yes
Alarm resetting		Via digital input, Modbus or by powering down the unit for more than 60 seconds
Air purging	sec.	Yes
Service data log		In-operation hours, alarm, load, program version, max. temp., max. motor voltage, max. motor current, max. ripple voltage, max. ripple current
Updating the software		Yes. via serial interface
Short-circuit protection		Yes
EMC filter		Integrated
Approvals		
EMC		EN 61800-3 (C1 & C2)
LVD		EN 61800-5-1
Product standard		EN 61800 Part 2
The RoHS Directive		Yes
Product approvals		CE
PBS: Data applies at: nominal supply voltage and at +25 °C ambient temperature		

Drive motor

	Unit	Drive motor 790 W, 14 Nm
Size SILVER C RX, standard rotor Size SILVER C RX, sorption rotor		100/120 80-120
Torque	Nm	14.0
Output	W	790
Weight	kg	≈ 13.2
Enclosure class	IP	54
Temperature, operation	°C	-40 to +40
Temperature, storage	°C	-40 to +70
Dimensions	mm	134 x 134 x 170

3. Function

General

The motor's linear torque curve permits very exact control of the rotor speed over a very large range. This results in energy efficient heat recovery and exact temperature control.

The heat exchanger control system is controlled with 0 – 10 V signals or via Modbus communication.

The combination of the motor's high torque and FOC technology (Field Oriented Controls) produces a unique innovative solution and increased efficiency. The unit uses the feedback signal from the motor to ensure that the motor receives exactly the right amount of current to reach the set speed and torque.

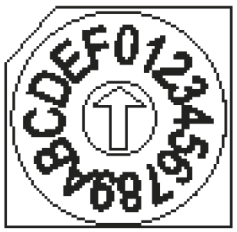
Rotation speed monitor

The heat exchanger control system is equipped with advanced software to monitor the rotor's rotation, which means that no physical or optical rotor protection is necessary.

4. Functions and settings

Function selector switch

The heat exchanger control system is equipped with a function selector switch for setting the min./max. motor speed, see figure to the right and the table below.



On delivery the function selector switch is set at the factory as per the table below:

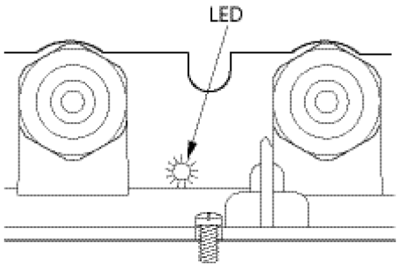
	Mode function selector switch
Rotor, standard	
SILVER C	
RX 100/120	4
Rotor, sorption	
SILVER C	
RX 080	6
RX 100/120	7

Incorrect setting of the maximum motor speed can result in inferior performance or overloading of the motor, with the risk of overheating and permanent damage to the motor and drive unit.

LED indicator

The heat exchanger control system is equipped with a LED indicator, see the diagram to the right.

LED is placed on the underside of the heat exchanger control system, next to the inlet for the mains cable, see the figure to the right.



LED indicator codes, see the table below.

LED Status	**Status**
OFF	No voltage
Green ON	Powered up
Flashing green	Valid Modbus communication
Red ON	Rotor stopped due to a critical alarm
Flashing red	Operational with reduced capacity
Orange ON	Test function enabled
Flashing orange	Purging function enabled

0 - 10 V control

The heat exchanger control system is set at the factory for 0-10 V control.

This can be changed to a constant Modbus control via the equivalent Modbus register, see separate Modbus protocol.

The motor starts when there is a control signal above 1.1 V
(see the diagram to the right).

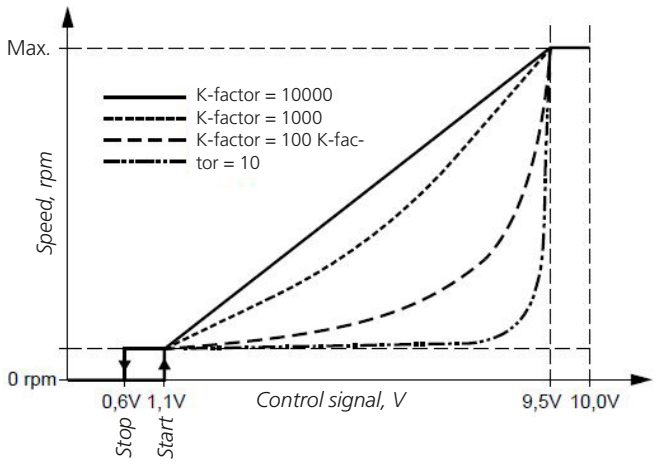
The motor stops when the control signal is lower than 0.6 V (see the diagram to the right).

The motor runs at maximum speed when there is a control signal above 9.5 V (see the diagram to the right).

Compensation for non-linear heat transfer on the rotor can be achieved by configuring a K-factor. It is thus possible to achieve a significantly more optimal heat transfer and an improved setting (see the diagram to the right).

The K-factor is configured via the Modbus register.

The default K-factor is configured by the manufacturer to 50.



Rotation monitoring

When the motor and rotor are mechanically connected via a drive belt, it is necessary to monitor whether the rotor rotates.

The heat exchanger control system is equipped with internal rotor monitoring.

If the motor no longer drives the rotor due to a slack or defective belt, the heat exchanger control system will trip an alarm for "rotor protection".

Internal rotor protection

The internal rotor protection monitors the correct direction of rotation of the rotor by measuring the motor current and motor speed.

The rotation control software checks every 10 seconds changes in the motor speed after a brief change of the motor current. In the event of six unsuccessful checks, a restart is tripped.

The default setting in the heat exchanger control system is one restart attempt. After approximately two minutes, a rotor protection alarm sounds.

The internal rotor protection works automatically at a speed over 25 rpm. At motor speeds below 25 rpm, typically the connected control unit (AHU control unit) assists. If the rotor does not provide the required heat recovery, the connected control unit will request a higher speed to enable higher heat recovery.

Boost function

The heat exchanger control system has an integrated "Start function" that automatically makes a higher current intensity to the motor during start possible.

The heat exchanger control system can deliver up to 150% of the nominal current (stated in mA) to the motor during start (max. 100 sec.)

The heat exchanger control system stops the start function when the set "start time" on the timer elapses or when the motor has reached 50% of the maximum set speed.

Purging

When the heat exchanger control system is set to "RS-485 interface" purging is controlled from the air handling unit's control system.

When the heat exchanger control system is controlled via the 0–10 V-signal, purging starts automatically when the motor has been switched off for 10 minutes.

The motor will run a number of revs at low speed, after which the motor stops again.

The function is repeated every 10 minutes when the motor is switched off.

The function thereby prevents mechanical faults and soiling of the rotor.

Built-in protection

If the temperature in the heat exchanger control system exceeds 95 °C, the heat exchanger control system will attempt to reduce the heat development by reducing the amount of current fed to the motor.

The heat exchanger control system has a built-in current limiter to protect the motor and cables, which means the heat exchanger control system cannot deliver more current than it is set to.

The heat exchanger control system is short-circuit protected against phase-phase-short-circuiting on the unit's motor connector (U, V, W).

The heat exchanger control system's control inputs are protected against short-circuiting.

Blocked rotor detection

If the rotor load is higher than the nominal maximum torque for the heat exchanger control system and the motor, the heat exchanger control system will trip an alarm for blocked rotor.

This detection depends on the belt tension and the friction between the belt and belt pulley.

A significantly lower belt tension will be perceived as a failed belt and trip the alarm for the internal rotor protection, which results in the heat exchanger control system stopping the motor.

A lower belt tension can reduce the friction between the belt and belt pulley and can cause a lower rotor speed than required if the belt slips on the belt pulley.

Depending on the motor's speed and friction between the belt and belt pulley, the heat exchanger control system will detect this failure through monitoring the motor's creep speed and system vibrations.

High creep values and vibrations will typically be detected at higher motor speeds.

5. Electrical connections

Electrical connections must be carried out by a qualified electrician.

Open the heat exchanger control system

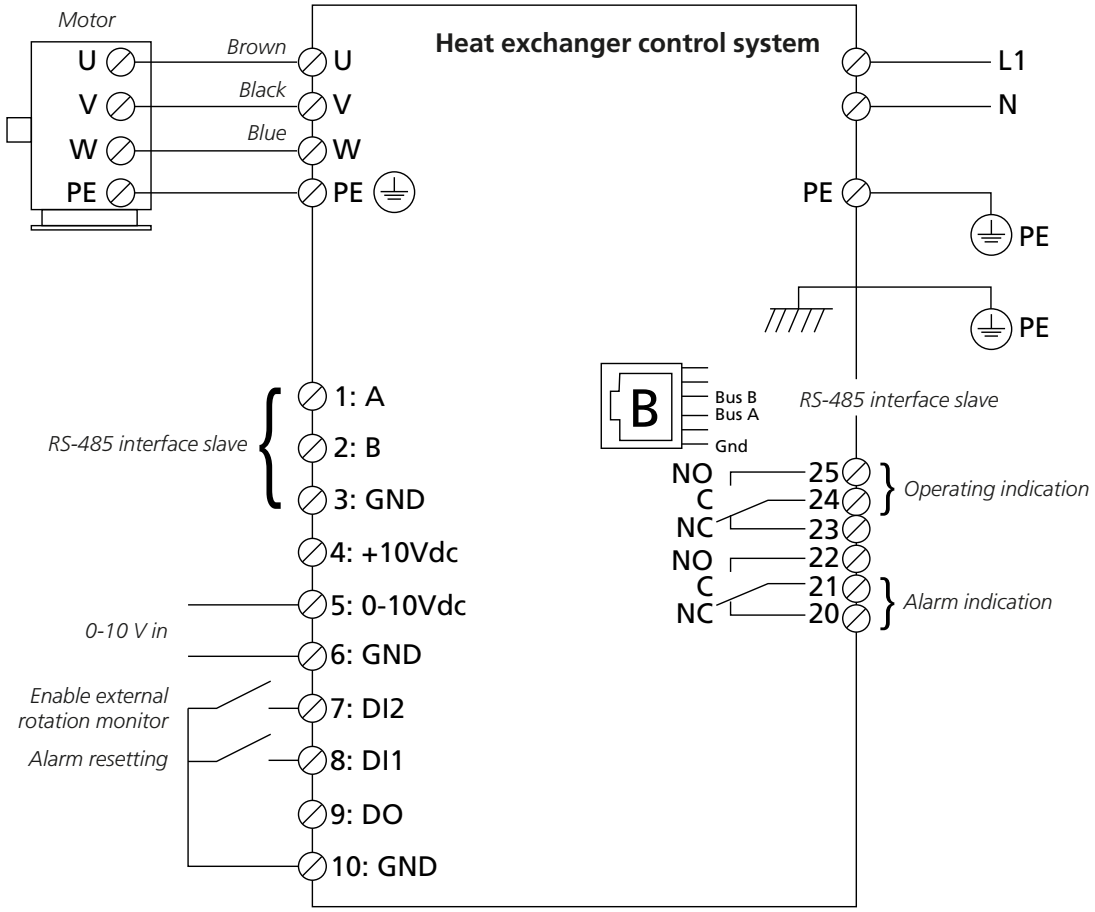
Make sure the supply voltage is disconnected before opening the plastic casing.

Wait about 3 minutes after disconnecting the mains voltage before opening the plastic casing.

The heat exchanger control system is opened by loosening the six Torx 20 screws that hold the cover in place.

Carefully remove the loosened plastic cover.

Overview, terminals and connectors



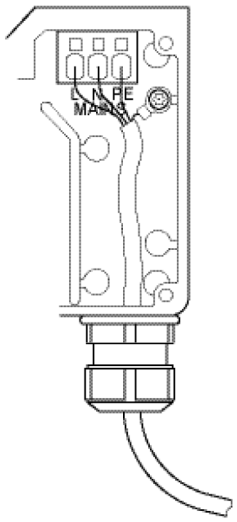
Supply connection

Power supply 230 V AC, +/-15%.

The power cable is connected to the heat exchanger control system on terminals "L", "N" and "PE", see the figure to the right.

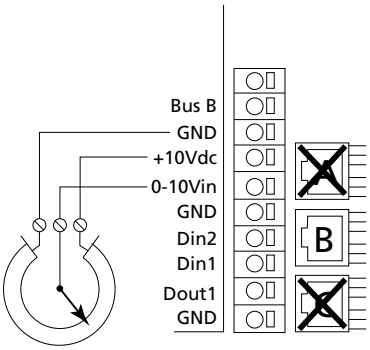
It is recommended that the PE wire is 20 mm longer than the other wires in the cable.

Remember to tighten the cable glands to ensure moisture cannot enter the heat exchanger control system and to provide strain relief.



Control 0 - 10 V

Analogue 0-10 V input control signal for speed control via external 0-10 V control signal, see the figure to the right.

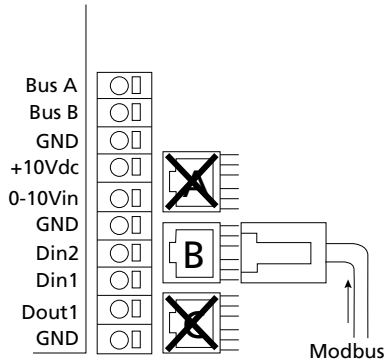


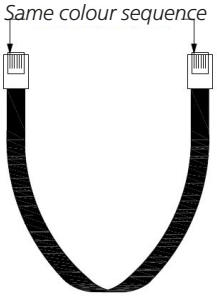
Control via Modbus

The RS-485 Interface can be connected to the heat exchanger control system via the RJ12 connector marked B or via the spring terminals in the terminal block. RJ12 Modbus connectors marked with A and C must not be used.

If RJ12 connectors are used a telecom cable, 6-wires, unshielded, 30 AWG/0.066 mm² (flat/telecom cable) is recommended.

When fitting the RJ12 connectors, note that the connectors must be directed so that the colour sequence in the connectors are the same at both ends, see the figure to the right.





6. Modbus

On delivery the heat exchanger control system is set at the factory as per the table below:

	Setting range	Unit	Factory setting
Address	1-247		79 dec.
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2 kBaud		38.4
Parity	None, even, odd		None
Stop bit(s)	0, 1, 2		2
Communication, timeout	0-240	Sec.	10

The heat exchanger control system supports commands according to the table below:

Function code	Description
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Force Single Coil
6	Preset Single Registers
8	Diagnostics. Sub-function 00 Only – Return Query Data (loop back)
15	Force Multiple Coils
16	Preset Multiple Registers

Detection of enabled Modbus

The heat exchanger control system automatically detects valid Modbus communication on Modbus inputs (RJ12 connector "B" on the terminal block).

The heat exchanger control system will first detect the communication parameters: ID 79, 38.4 – 8 – N – 2

Alternative communication parameters can be set with the help of the Modbus register.

After 10 seconds without a valid Modbus request being received with standard parameters, the heat exchanger control system will attempt to detect a Modbus request with the alternative parameters.

Modbus protocol

The current Modbus protocol can be downloaded from www.swegon.com

7. Trouble shooting

Control 0 - 10 V

Symptoms	Cause	Action
The motor doesn't run	There is no power supply	Check the supply voltage (230 V AC) to the heat exchanger control system terminals "L" and "N" (nominal supply voltage is specified on the rating plate). The LED lights with a constant green light.
		Check if the short-circuit protection is activated.
		Check that other components have not disconnected the supply voltage to the heat exchanger control system.
	Bad electrical connections	Check the electrical connections.
	Incorrect motor to the heat exchanger control system	Check that the function selector switch is set correctly for the selected motor size and speed.
	Control signal 0-10 V DC missing.	Check that the heat exchanger control system receives a signal >1.1 V on 0-10 V In.
	Active alarm	Read active alarms Modbus register and remove the cause of the alarm.
	The motor has been stopped by the built-in motor protection due to an overload or other alarm	Reset the alarm by short-circuiting the "Alarm reset" input. The alarm can also be reset by switching off the supply voltage to the heat exchanger control system and switching it back on after about 60 seconds.
	Defective heat exchanger control system	Replace the heat exchanger control system. Never attempt to repair a defective heat exchanger control system. Contact your supplier for replacement/repair.
	Defective motor	Replace the motor
The motor runs in the wrong direction	Incorrect phase sequence in motor cable	Switch the 2 phase wires on the motor or heat exchanger control system's motor terminals.
	RS-485 interface register set incorrectly	The direction of rotation can also be inverted via an RS-485 interface command.
The heat exchanger control system stops due to an alarm	At least one active alarm	See the alarm via Modbus to establish which alarm has stopped the motor.
		Reset the alarm by short-circuiting the "Alarm reset" input. The alarm can also be reset by switching off the supply voltage to the heat exchanger control system and switching it back on after about 60 seconds.
	The alarm is shown again after resetting	Rectify the cause of the alarm reactivation.

Control via RS-485 interface

Symptoms	Cause	Action
The motor doesn't run.	There is no power supply	Check the supply voltage to the heat exchanger control system terminals "L" and "N" (230 V AC)
		Check if the short-circuit protection is activated.
		Check that other components have not disconnected the supply voltage to the heat exchanger control system.
	Bad electrical connections	Check the electrical connections.
	Incorrect motor to the heat exchanger control system	Check that the function selector switch is set correctly for the selected motor size and speed.
	There is no in-operation signal	Check that the heat exchanger control system can receive operation signals. Coil Stat Bits Register 0X0001: Start/stop for motor (1=on)
	No %-control signal from Modbus drive unit	Check the Modbus-control signal on the Modbus address: Holding registers; Register 3X0001: PrcSet 0-10000 (0-100%)
	The motor has been stopped by the built-in motor protection due to an overload	Reset the alarm: Coil Stat Bits Register 0X0002: Reset (1 pulse = resetting). The alarm can also be reset by switching off the supply voltage to the heat exchanger control system and switching it back on after about 60 seconds.
	Defective heat exchanger control system	Replace the heat exchanger control system Never attempt to repair a defective heat exchanger control system. Contact your supplier for replacement/repair.
	Defective motor	Replace the motor
The motor runs in the wrong direction	Incorrect phase sequence in motor cable	Switch the 2 phase wires on the motor or heat exchanger control system's motor terminals.
	Motor rotation is configured incorrectly	The direction of rotation can be checked and changed with the help of the Modbus-register.
The heat exchanger control system stops due to an alarm	At least one active alarm	Use the hand-held terminal to show the alarm and to determine which alarm has stopped the motor.
		Reset the alarm by short-circuiting the "Alarm reset" input, digital input Din1 or Din2 depending on the setting. The alarm can also be reset by switching off the supply voltage to the heat exchanger control system and switching it back on after about 60 seconds.
	The alarm is shown again after resetting	Read the alarm via Modbus register to establish which alarm has stopped the motor.
		Rectify the cause of the alarm reactivation.

8. Alarms and error codes

The heat exchanger control system has built-in alarm monitoring that monitors optimal problem-free operations and trips an alarm for operating or performance problems.

The alarm is either a "critical" alarm or "non-critical" alarm.

"Critical" alarms stop the motor.

"Non-critical" alarms reduce the motor's performance.

The built-in alarm monitoring stops the heat exchanger control system.

If the alarm situation passes, the alarm is reset automatically and the heat exchanger control system restarts.

The alarm can be reset with a Modbus command.

The alarm is reset automatically when the power is disconnected for longer than 60 seconds.

Alarms can be read via Modbus, see Modbus protocol.

Overview of alarms/error codes, see the table below:

Error code	Alarm overview	Alarm overview	Activity
E01	Rotation monitor alarm	**"C"**	**"SA5"**
E02	Supply voltage too high	**"C"**	**"SA5"**
E03	Supply voltage too low	**"C"**	**"S"**
E04	The current to the motor critically increased, e.g. short-circuit in cable, connectors or motor	**"C"**	**"SA5"**
E05	Internal temperature in the heat exchanger control system too high (> 95 °C)	**"NC"**	**"RP"**
E06	Blocked motor	**"C"**	**"SA5"**
E07	No valid Modbus communication >10 sec.	**"C"**	**"S"**
E08	Phase error on motor's power supply (U, V, W)	**"C"**	**"SA5"**
E09	Internal hardware failure	**"C"**	**"S"**

Alarm codes can be read on the display.

Notes:
"C" = critical alarm **"NC"** = non-critical
"RP" = reduced performance
"SA5" = the motor stops after a restart caused by the same error within 60 minutes
"S" = the motor stops immediately

9. Maintenance

Under normal operating conditions and load profiles, the heat exchanger control system is maintenance-free.

10. Approvals and certificates

CE marking

Swegon hereby declares under sole responsibility that the product complies with the following directives from the European Parliament:

LVD – low voltage: 2014/35/EU

EMC – electromagnetic compatibility: 2014/30/EU

RoHS – restriction of the use of certain hazardous substances in electrical and electronic equipment: 2011/65/EU

Product standard

In accordance with EN 61800-2 – Adjustable speed electrical power drive systems, general requirements.

Safety

In accordance with EN 61800-5-1 – Adjustable speed electrical power drive systems: Safety requirements – electrical, thermal and energy.

EMC – electromagnetic compatibility

In accordance with EN 61800-3 (C1 and C2) - adjustable speed electrical power drive systems. Part 3. EMC requirements and special testing methods.

RoHS compliant

Contains no hazardous substances in accordance with the RoHS directive.