

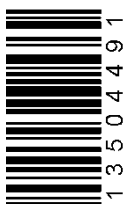


Emotron VS10 / VS30 AC drive

0.25 ... 2.2 kW



Mounting and switch on instruction



Diese Seite wurde absichtlich leer gelassen.

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1 General information

First read, then start



1 General information

1.1 First read, then start

WARNING!

Read this documentation thoroughly before carrying out the installation and commissioning.

- ▶ Please observe the safety instructions!



Information and tools with regard to the Emotron products can be found on the Internet:

<http://www.emotron.com/services-support/file-archive/>

1.2 Notations and conventions

1.2.1 Product code, examples:

VS10-23-1P7-20-CM

VS10-40-1P7-20-CM

VS	10	23	1P7	20	CM
Series	1-phase	230V	Rated current 1.7A	IP20	CANopen & Modbus
VS	30	40	1P7	20	CM
Series	3-phase	400V	Rated current 1.7A	IP20	CANopen & Modbus



2 Safety instructions

2.1 Basic safety measures

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets!

The product

- must only be used as directed.
- must never be commissioned if they display signs of damage.
- must never be technically modified.
- must never be commissioned if they are not fully mounted.
- must never be operated without required covers.

Connect/disconnect all pluggable terminals only in deenergised condition.

Only remove the product from the installation in the deenergised state.

Insulation resistance tests between 24V control potential and PE: According to EN 61800-5-1, the maximum test voltage must not exceed 110 VDC.

Observe all specifications of the corresponding documentation supplied. This is the precondition for safe and trouble-free operation and for obtaining the product features specified.

The procedural notes and circuit details described in this document are only proposals. It is up to the user to check whether they can be adapted to the particular applications. Emotron does not take any responsibility for the suitability of the procedures and circuit proposals described.

The product must only be used by qualified personnel. IEC 60364 or CENELEC HD 384 define the skills of these persons:

- They are familiar with installing, mounting, commissioning, and operating the product.
- They have the corresponding qualifications for their work.
- They know and can apply all regulations for the prevention of accidents, directives, and laws applicable at the place of use.

Observe the specific notes in the other chapters!







2.2 Residual hazards

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this can lead to severe injuries to persons and damage to material assets!

Product

Observe the warning labels on the product!

Icon	Description
	Electrostatic sensitive devices: Before working on the inverter, the staff must ensure to be free of electrostatic charge!
	Dangerous electrical voltage Before working on the inverter, check whether all power connections are dead! After mains OFF, power connections X100 and X105 carry a dangerous electrical voltage for the time specified on the inverter!
	High leakage current: Carry out fixed installation and PE connection in compliance with EN 61800-5-1 or EN 60204-1 !
	Hot surface: Use personal protective equipment or wait until devices have cooled down!

Motor

If there is a short circuit of two power transistors, a residual movement of up to 180° /number of pole pairs can occur at the motor! (For 4-pole motor: residual movement max. $180^\circ/2 = 90^\circ$).

This residual movement must be taken into consideration by the user for his/her risk assessment.

2.3 Application as directed

The product

- must only be operated under the operating conditions prescribed in this documentation.
- meets the protection requirements of 2014/35/EU: Low-Voltage Directive.
- is not a machine in terms of 2006/42/EC: Machinery Directive.
- is not a household appliance, but is only designed as component for commercial or professional use in terms of EN 61000-3-2.



3 Product description

Earth/ground connection (PE)

Relay output X9

Network X2xx
CANopen/Modbus(Optional)

Shield connection
CANopen/Modbus

Toggle switch
CANopen/Modbus

Shield connection
Control connection

Motor connection X105

Mains voltage connection X100

IT screw

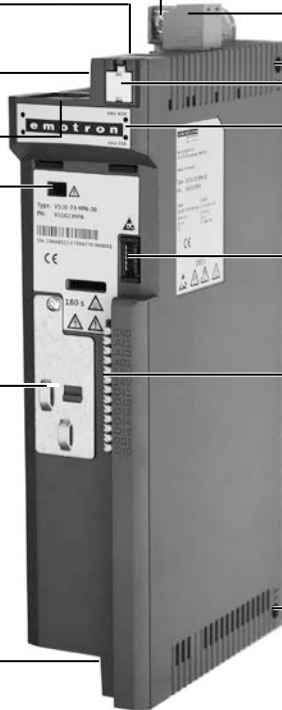
Memory module X20

Inverter status LEDs

Interface X16
Diagnostic Module

Control terminals X3
Basic I/O

IT screw



4 Mounting

Important notes



4 Mounting

4.1 Important notes

DANGER!

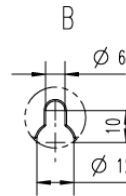
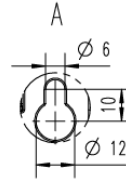
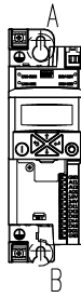
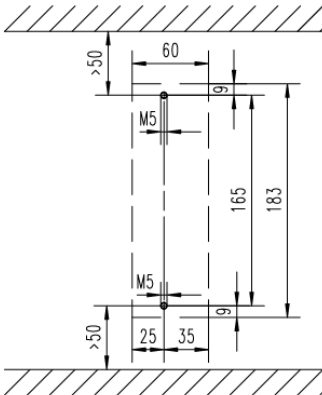
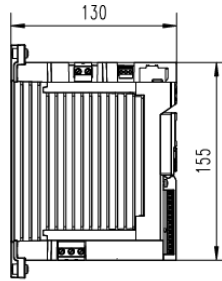
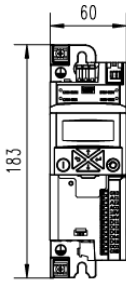
Dangerous electrical voltage

Possible consequence: death or severe injuries

- ▶ All works on the inverter must only be carried out in the deenergised state.
 - ▶ After switching off the mains voltage, wait for at least 3 minutes before you start working.
-



4.2 Mechanical installation Dimensions
VS10/VS30 - 0.25 kW ... 0.37 kW



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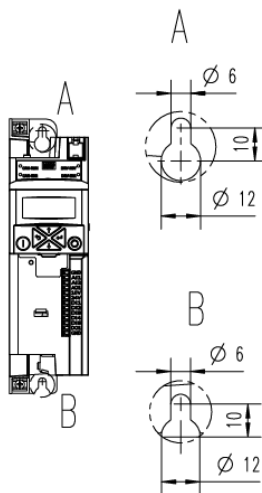
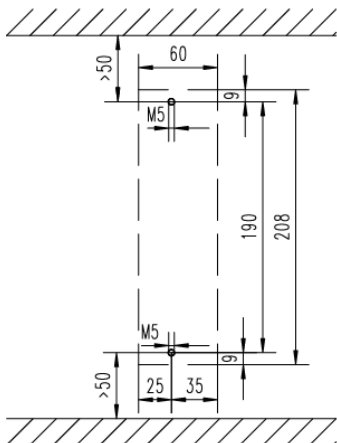
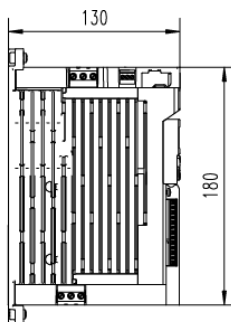
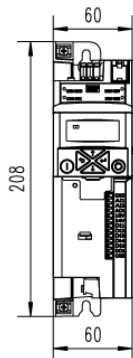
All dimensions in mm

4 Mounting

Mechanical installation



Dimensions VS10/VS30 - 0.55 kW ... 0.75 kW

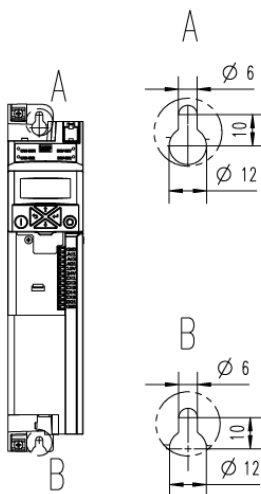
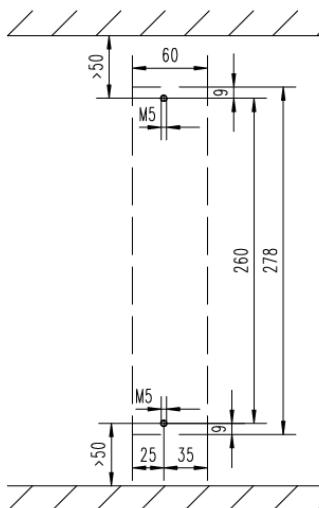
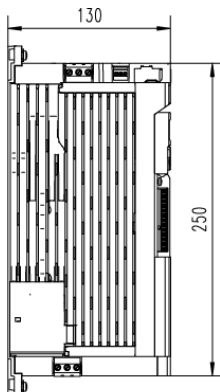
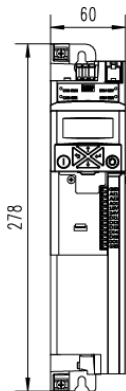


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All dimensions in mm



Dimensions VS30 - 1.1 kW ... 2.2 kW



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All dimensions in mm

4 Mounting

Electrical installation
Connection to the 230 V system



4.3 Electrical installation

4.3.1 Connection to the 230 V system

4.3.1.1 Connection plan

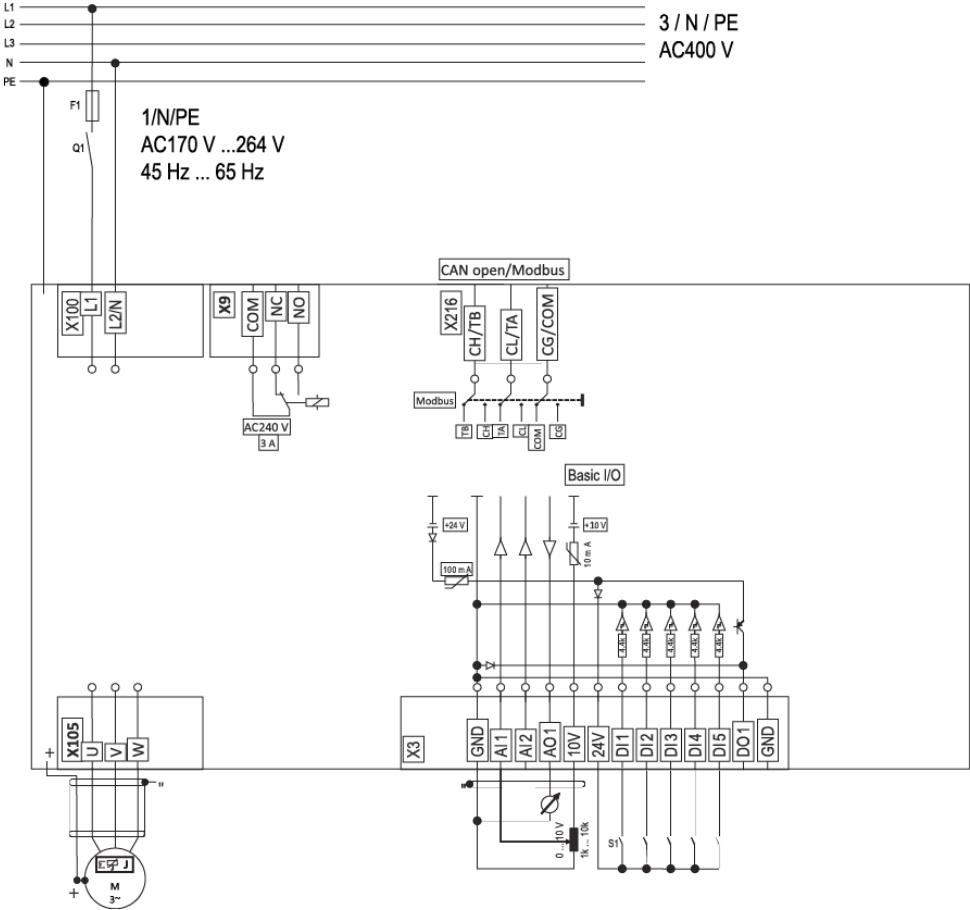


Fig. 1: Wiring example

S1 Run/Stop

F1 Fuse

Q1 Mains contactor

--- Dashed line = options



4.3.1.2 Fuses and cable cross-sections

Operation without mains choke

Cable installation in compliance with EN 60204-1

Laying system B2

Inverter		VS10231P7	VS10232P4	VS10233P2	VS10234P2	VS10236P0	VS10237P0	VS10239P6
Rated power	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2
Rated mains current								
without mains choke	A	4	5.7	7.6	10	14.3	16.7	22.5
Fuse								
Fusing characteristics		gG/gL or gRL						
Max. rated fuse current	A	10	10	16	16	25	25	25
Cable cross-section	mm ²	1.5	1.5	2.5	2.5	6	6	6
Circuit breaker								
Fusing characteristics		B						
Max. rated fuse current	A	10	10	16	16	25	25	25
Cable cross-section	mm ²	1.5	1.5	2.5	2.5	6	6	6
Earth-leakage circuit breaker		≥ 30 mA, type A or B						

**4.3.1.3 Terminal data****Mains connection**

Inverter		VS10231P7	VS10232P4	VS10233P2	VS10234P2	VS10236P0	VS10237P0	VS10239P6	
Rated power	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2	
Connection		X100							
Connection type		Screw terminal							
Min. cable cross-section	mm ²	1							
Max. cable cross-section	mm ²	2.5				6			
Stripping length	mm	8							
Tightening torque	Nm	0.5				0.7			
Required tool		0.5 x 3.0				0.6 x 3.5			

Motor connection

Inverter		VS10231P7	VS10232P4	VS10233P2	VS10234P2	VS10236P0	VS10237P0	VS10239P6
Rated power	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2
Connection		X105						
Connection type		Screw terminal						
Min. cable cross-section	mm ²	1						
Max. cable cross-section	mm ²	2.5						
Stripping length	mm	8						
Tightening torque	Nm	0.5						
Required tool		0.5 x 3.0						

PE conductor connection

Inverter		VS10231P7	VS10232P4	VS10233P2	VS10234P2	VS10236P0	VS10237P0	VS10239P6
Rated power	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2
Connection		PE						
Connection type		PE screw						
Min. cable cross-section	mm ²	1						
Max. cable cross-section	mm ²	6						
Stripping length	mm	10						
Tightening torque	Nm	1.2						
Required tool		0.8 x 5.5						

Control connections

Terminal description		Relay output			Control terminals		
Connection		X9			X3		
Connection type		Screw terminal			Spring terminal		
Min. cable cross-section	mm ²	0.5			0.5		
Max. cable cross-section	mm ²	1.5			1.5		
Stripping length	mm	6			9		
Tightening torque	Nm	0.2			-		
Required tool		0.4 x 2.5			0.4 x 2.5		



4.3.2 Connection to the 400 V system

4.3.2.1 Connection plan

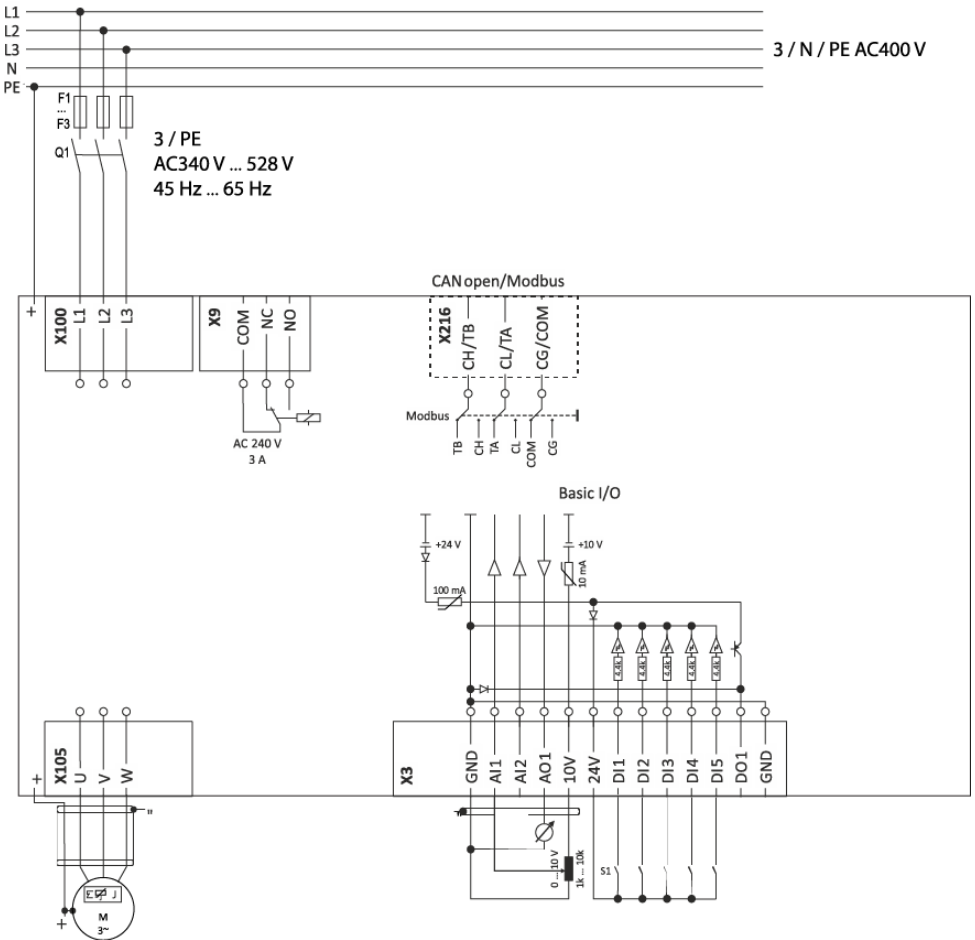


Fig. 2: Wiring example

S1 Run/Stop
F1 ... Fuses
F3

Q1 Mains contactor
--- Dashed line = options

4 Mounting
 Electrical installation
 Connection to the 400 V system



4.3.2.2 Fuses and cable cross-sections

Operation without mains choke

Cable installation in compliance with EN 60204-1

Laying system B2

Inverter		VS30401P3	VS30401P8	VS30402P4	VS30403P2	VS30403P9	VS30405P6
Rated power	kW	0.37	0.55	0.75	1.1	1.5	2.2
Rated mains current							
without mains choke	A	1.8	2.5	3.3	4.4	5.4	7.8
Fuse							
Fusing characteristics		gG/gL or gRL					
Max. rated fuse current	A	10	10	10	16	16	16
Cable cross-section	mm ²	1.5	1.5	1.5	2.5	2.5	2.5
Circuit breaker							
Fusing characteristics		B					
Max. rated fuse current	A	10	10	10	16	16	16
Cable cross-section	mm ²	1.5	1.5	1.5	2.5	2.5	2.5
Earth-leakage circuit breaker		≥ 30 mA, type B					



4.3.2.3 Terminal data

Mains connection

Inverter		VS30401P3	VS30401P8	VS30402P4	VS30403P2	VS30403P9	VS30405P6
Rated power	kW	0.37	0.55	0.75	1.1	1.5	2.2
Connection		X100					
Connection type		Screw terminal					
Min. cable cross-section	mm ²	1					
Max. cable cross-section	mm ²	2.5					
Stripping length	mm	8					
Tightening torque	Nm	0.5					
Required tool		0.5 x 3.0					

Motor connection

Inverter		VS30401P3	VS30401P8	VS30402P4	VS30403P2	VS30403P9	VS30405P6
Rated power	kW	0.37	0.55	0.75	1.1	1.5	2.2
Connection		X105					
Connection type		Screw terminal					
Min. cable cross-section	mm ²	1					
Max. cable cross-section	mm ²	2.5					
Stripping length	mm	8					
Tightening torque	Nm	0.5					
Required tool		0.5 x 3.0					

PE conductor connection

Inverter		VS30401P3	VS30401P8	VS30402P4	VS30403P2	VS30403P9	VS30405P6
Rated power	kW	0.37	0.55	0.75	1.1	1.5	2.2
Connection		PE					
Connection type		PE screw					
Min. cable cross-section	mm ²	1					
Max. cable cross-section	mm ²	6					
Stripping length	mm	10					
Tightening torque	Nm	1.2					
Required tool		0.8 x 5.5					

Control connections

Terminal description		Relay output			Control terminals		
Connection		X9			X3		
Connection type		Screw terminal			Spring terminal		
Min. cable cross-section	mm ²	0.5			0.5		
Max. cable cross-section	mm ²	1.5			1.5		
Stripping length	mm	6			9		
Tightening torque	Nm	0.2			-		
Required tool		0.4 x 2.5			0.4 x 2.5		



4.3.3 **Connection to the IT system**

i NOTICE!

Internal components have earth/ground potential if the IT screws are not removed.
 Consequence: the monitoring functions of the IT system respond.

- ▶ Before connection to an IT system be absolutely sure to remove the IT screws.

VS10231P7, VS10232P4, VS30401P3,	VS10233P2, VS10234P2, VS10236P0, VS10237P0, VS10239P6, VS30401P8, VS30402P4, VS30403P2, VS30403P9, VS30405P6,
<p style="text-align: right;">TX10</p>	<p style="text-align: right;">TX10</p> <p style="text-align: right;">TX10</p>



4.3.4 CANopen/Modbus connection

4.3.4.1 Connection plan

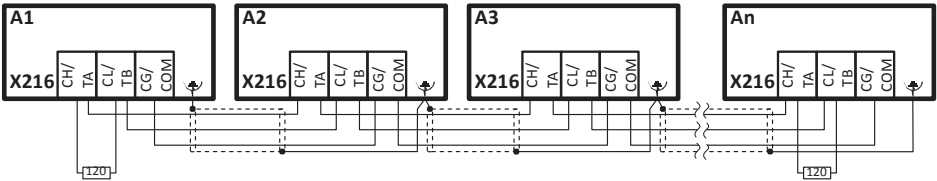


Fig. 3: Wiring example: CANopen or Modbus network

4.3.4.2 Terminal data

Terminal description		CANopen/Modbus
Connection		X216
Connection type		Spring terminal
Min. cable cross-section	mm ²	0.5
Max. cable cross-section	mm ²	1.5
Stripping length	mm	10
Tightening torque	Nm	-
Required tool		0.4 x 2.5

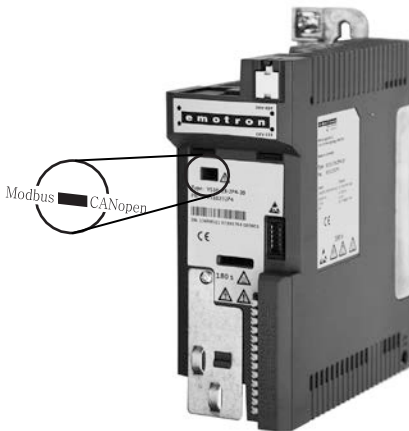
4.3.4.3 Basic network settings



The network must be terminated with a 120 Ω resistor at the physically first and last node. Connect resistor to terminals CH/TA and CL/TB.

Configuring network basic settings

1. Use toggle switch on front of the inverter to select CANopen or Modbus network.



2. Set node address and baud rate via corresponding parameters.

5 Commissioning

Important notes



5 Commissioning

5.1 Important notes

WARNING!

Incorrect settings during commissioning may cause unexpected and dangerous motor and system movements.

Possible consequence: death, severe injuries or damage to property

- ▶ Clear hazardous area.
- ▶ Observe safety instructions and safety clearances.

5.2 Before initial switch-on

Prevent injury to persons and damage to property. Check the following before switching on the mains voltage:

- Is the wiring complete and correct?
- Are there no short circuits and earth faults?
- Is the motor circuit configuration (star/delta) adapted to the output voltage of the inverter?
- Is the motor connected in-phase (direction of rotation)?
- Does the "emergency stop" function of the entire plant operate correctly?



5.3 Initial switch-on / functional test with terminal control

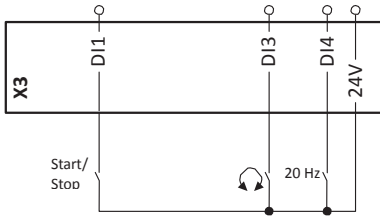
Target: achieve rotation of the motor connected to the inverter as quickly as possible.

Requirements:

- The connected motor matches the inverter in terms of power.
- The parameter settings comply with the delivery status (Emotron setting).

1. Preparation:

1. Wiring of power terminals. (Chapter 4.3 *Electrical installation*)
2. Wire digital inputs X3/DI1 (start/stop), X3/DI3 (reversal of rotation direction), and X3/DI4 (preset frequency setpoint 20 Hz).
3. Do not connect terminal X3/AI1 (analog setpoint selection) or connect it to GND.



2. Switch on mains and check readiness for operation:

1. Switch on mains voltage.
2. Observe LED status displays "RDY" and "ERR" on the front of the inverter:
 - a) If the blue "RDY" LED is blinking and the red "ERR" LED is off, the inverter is ready for operation. The controller is inhibited.
You can now start the drive.
 - b) If the red "ERR" LED is lit permanently, a fault is pending.
Eliminate the fault before you carry on with the functional test.

LED status displays

"RDY" LED (blue)	"ERR" LED (red)	Status/meaning
off	off	No supply voltage.
blinking (2 Hz)	off	Inverter inhibited.
	lit every 1.5 s for a short time	Inverter inhibited, no DC-bus voltage.
	blinking fast (4 Hz)	Inverter inhibited, warning active.
	on	Inverter inhibited, fault active.
on	off	Inverter enabled.
	blinking fast (4 Hz)	Inverter enabled, warning active.
	blinking (1 Hz)	Inverter enabled, quick stop as response to a fault active.



Carrying out the functional test

1. **Start drive:**

1. Start inverter: X3/DI1 = HIGH.
2. Activate preset frequency setpoint 1 (20 Hz) as speed setpoint: X3/DI4 = HIGH.

The drive rotates with 20 Hz.

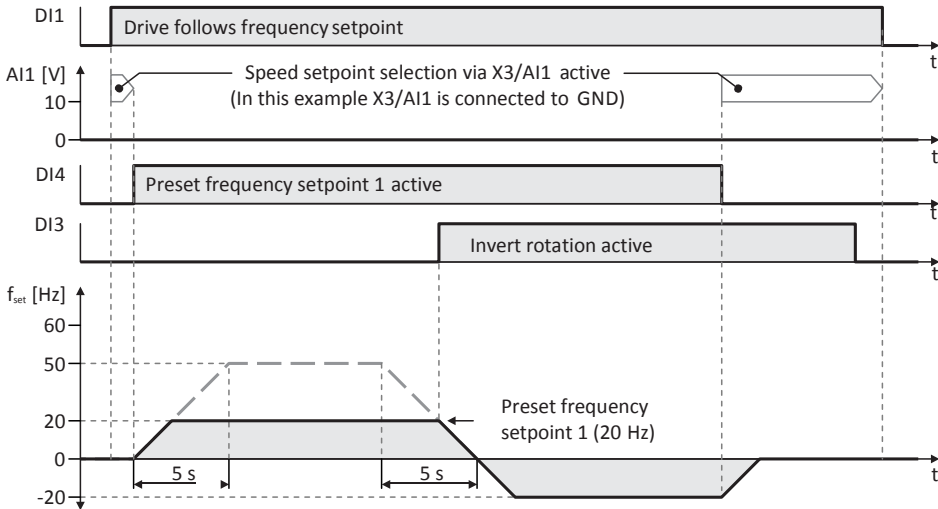
3. Optional: activate the function for the reversal of rotation direction.

a) X3/DI3 = HIGH.

The drive rotates with 20 Hz in the opposite direction.

b) Deactivate the function for the reversal of rotation direction again: X3/DI3 = LOW.

Speed characteristic (example)



2. **Stop drive:**

1. Deactivate preset frequency setpoint 1 again: X3/DI4 = LOW.
2. Stop inverter again: X3/DI1 = LOW.

The functional test is completed.



The commissioning process of the drive solution is described in a separate commissioning instruction which can be found on the Internet in our download area:

<http://www.emotron.com/services-support/file-archive/>



6 Technical data

6.1 Standards and operating conditions

Conformities		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
EAC	TR TC 004/2011	Eurasian conformity: Safety of low voltage equipment
	TP TC 020/2011	Eurasian conformity: Electromagnetic compatibility of technical means
RoHS 2	2011/65/EU	Restrictions for the use of specific hazardous materials in electric and electronic devices
Approvals		
UL	UL 61800-5-1	for USA and Canada (requirements of CSA 22.2 No. 274)
Energy efficiency		
Class IE2	EN 50598-2	
Type of protection		
IP20	EN 60529	
Type 1	NEMA 250	Protection against contact
Open type		only for UL approved systems
Insulation resistance		
Overvoltage category III	EN 61800-5-1	0 ... 2000 m a.m.s.l.
Overvoltage category II		above 2000 m a.m.s.l.
Control circuit isolation		
Safe mains isolation by double/reinforced insulation	EN 61800-5-1	
Protective measures against		
Short circuit		
Earth fault		Earth fault strength depends on the operating status
Overvoltage		
Motor stalling		
Motor overtemperature		I ² t monitoring
Leakage current		
> 3.5 mA AC, > 10 mA DC	EN 61800-5-1	Observe regulations and safety instructions!
Mains switching		
3-time mains switching in 1 min		cyclic, without restrictions
Starting current		
≤ 3 x rated mains current		
Mains systems		
TT		Voltage to earth/ground: max. 300V
TN		
IT		Apply the measures described for IT systems!
		IT systems not relevant for UL approved systems
Operation on public supply systems		
Implement measures to limit the radio interference to be expected:		The compliance with the requirements for the machine/plant is the responsibility of the manufacturer of the machine or plant!
< 0.5 kW: with mains choke	EN 61000-3-2	
0.5 ... 1 kW: With active filter		
> 1 kW at mains current ≤ 16 A: without additional measures		
Mains current > 16 A: with mains choke or mains filter, with	EN 61000-3-12	RSCE: Short-circuit power ratio at the connection point of the machine/plant to the public network.



dimensioning for rated power. $R_{sce} \geq 120$ is to be met.		
Requirements to the shielded motor cable		
Capacitance per unit length		
C-core-core/C-core-shield < 75/150 pF/m		$\leq 2,5 \text{ mm}^2 / \text{AWG } 14$
C-core-core/C-core-shield < 150/300 pF/m		$\geq 4 \text{ mm}^2 / \text{AWG } 12$
Electric strength		
$U_0/U = 0,6/1,0 \text{ kV}$		U = r.m.s. value external conductor/external conductor
		U_0 = r.m.s. value external conductor to PE
$U \geq 600 \text{ V}$	UL	U = r.m.s. value external conductor/external conductor
Climate		
1K3 (-25 ... +60 °C)	EN 60721-3-1	Storage
2K3 (-25 ... +70 °C)	EN 60721-3-2	Transport
3K3 (-10 ... +55 °C)	EN 60721-3-3	Operation
		Operation at a switching frequency of 8 or 16 kHz: above +40°C, reduce rated output current by 2.5%/°C
Site altitude		
0 ... 1000 m a.m.s.l.		
1000 ... 4000 m a.m.s.l.		Reduce rated output current by 5%/1000 m
Pollution		
Degree of pollution 2	EN 61800-5-1	
Vibration resistance		
Transport		
2M2 (sine, shock)	EN 60721-3-2	
Operation		
Amplitude 1 mm	Germanischer Lloyd	5 ... 13.2 Hz
acceleration resistant up to 0.7 g		13.2 ... 100 Hz
Amplitude 0.075 mm	EN 61800-5-1	10 ... 57 Hz
acceleration resistant up to 1 g		57 ... 150 Hz
Noise emission		
Category C2	EN 61800-3	type-dependent, for motor cable lengths see rated data
Noise immunity		
Meets requirement in compliance with	EN 61800-3	



6.2 Rated data

6.2.1 Connection to the 230 V system

Inverter		VS10231P7	VS10232P4	VS10233P2	VS10234P2	VS10236P0	VS10237P0	VS10239P6
Rated power	kW	0.25	0.37	0.55	0.75	1.1	1.5	2.2
Mains voltage range		1/N/PE AC 170 V ... 264 V, 45 Hz ... 55 Hz						
Operating mode		S1						
Max. surrounding air	°C	40						
Switching frequency	kHz	4						
Rated mains current								
without mains choke	A	4	5.7	7.6	10	14.3	16.7	22.5
with mains choke	A	3.6	4.8	7.1	8.8	11.9	13.9	16.9
Rated output current	A	1.7	2.4	3.2	4.2	6	7	9.6
Motor cable length								
C2 residential area / industrial	m	15			20			
Weight	kg	0.75		0.95		1.35		

6.2.2 Connection to the 400 V system

Inverter		VS30401P3	VS30401P8	VS30402P4	VS30403P2	VS30403P9	VS30405P6
Rated power	kW	0.37	0.55	0.75	1.1	1.5	2.2
Mains voltage range		3/N/PE AC 340 V ... 528 V, 45 Hz ... 55 Hz					
Operating mode		S1					
Max. surrounding air	°C	40					
Switching frequency	kHz	4					
Rated mains current							
without mains choke	A	1.8	2.5	3.3	4.4	5.4	7.8
with mains choke	A	1.4	2	2.6	3	3.7	5.3
Rated output current	A	1.3	1.8	2.4	3.2	3.9	5.6
Motor cable length							
C2 residential area / industrial	m	15			20		
Weight	kg	0.75	0.95		1.35		

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