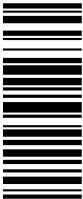




Emotron VS30 AC drive

3 ... 7.5 kW



13518389

Mounting and switch on instruction

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1 General information

First read, then start

1 General information

1.1 First read, then start



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 Emotron, examples:

VS30-40-7P3-20-C

VS30-40-016-20-M

VS	30	40	7P3	20	C
Series	3-phase	400V	Rated current 7.3A	IP20	CANopen + STD I/O
VS	30	40	016	20	M
Series	3-phase	400V	Rated current 16A	IP20	MODBUS + STD I/O

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 deenergisedstate.

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!

I	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
	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. $180^\circ/2 = 90^\circ$).

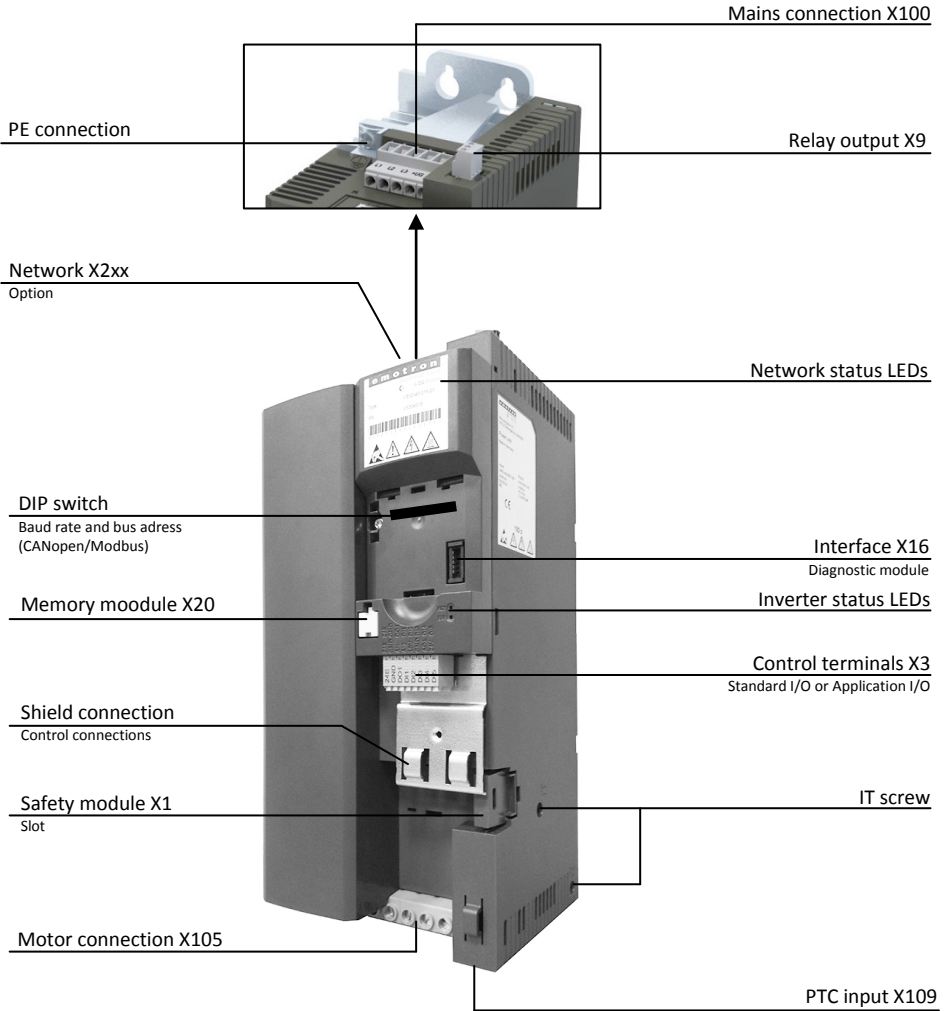
This residual movement must be taken into consideration by the user for his/her risk assessment.

2.3 Application as directed

The product

- must only be actuated 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



4 Mounting

4.1 Important notes

DANGER!

Dangerous electrical voltage

Possible consequence: death or severe injuries

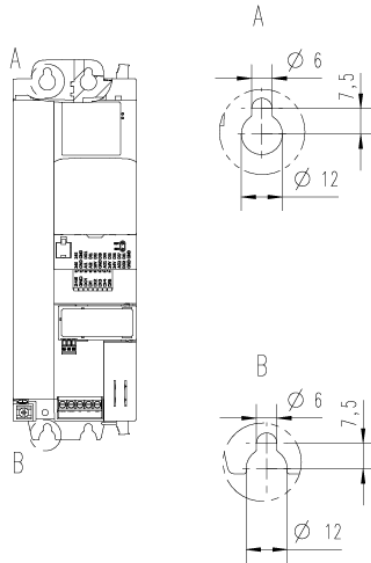
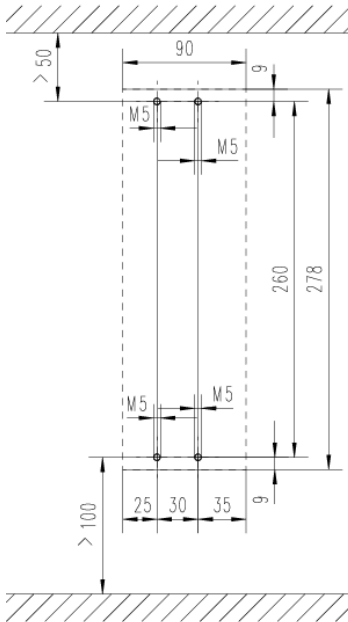
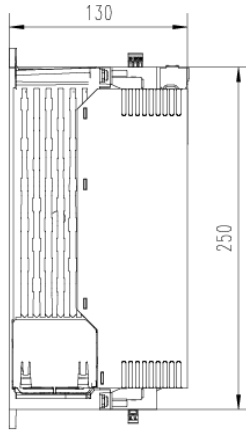
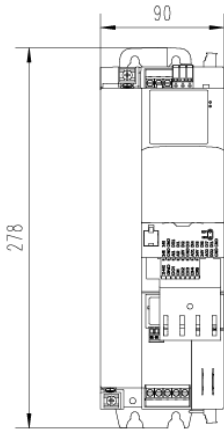
- ▶ All works on the inverter must only be carried out in the deenergised state.
 - ▶ After switching off the mains voltage, wait for at least 3 minutes before you start working.
-

4 Mounting

Important notes

4.2 Mechanical installation

Dimensions 3 kW ... 5,5 kW

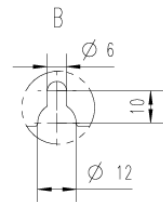
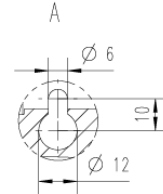
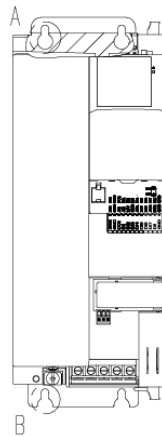
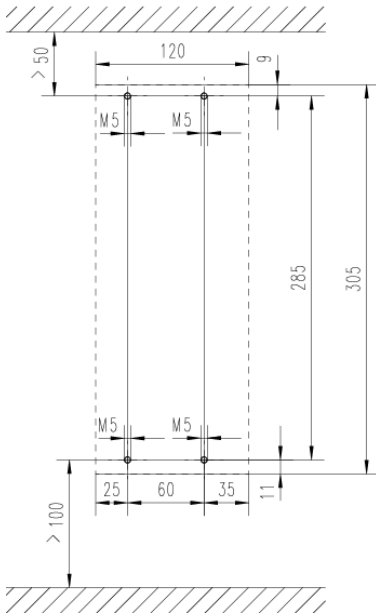
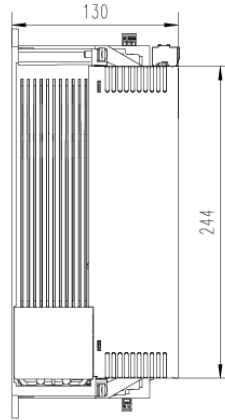
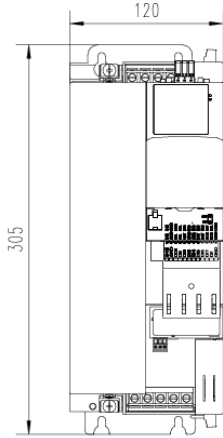


All Dimensions in mm

8800288

Mechanical installation

Dimensions 7,5 kW



All Dimensions in mm

8800296

4 Mounting

Electrical installation
Connection to the 400 V system

4.3 Electrical installation

4.3.1 Connection to the 400 V system

4.3.1.1 Connection plan

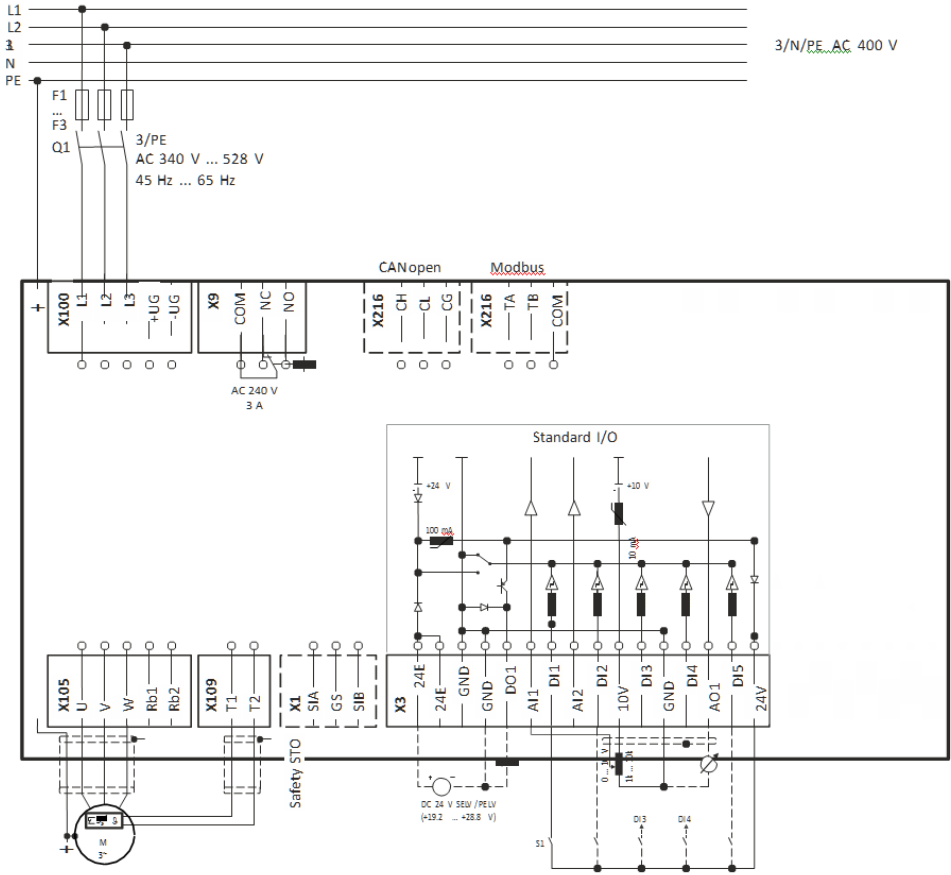


Fig. 1: Wiring example

S1 Start enable

--- 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		VS30407P3	VS30409P5	VS3040013	VS3040016
Rated power	kW	3	4	5,5	7,5
Rated mains current					
without mains choke	A	9,6	12,5	17,2	20
Fuse					
Characteristics		gG/gL or gRL			
Max. rated current	A	25	25	25	32
Cable cross-section	mm ²	6	6	6	10
Circuit breaker					
Characteristics		B			
Max. rated current	A	25	25	25	32
Cable cross-section	mm ²	6	6	6	10

4.3.1.3 Terminal data Mains

connection

Inverter		VS30407P3	VS30409P5	VS3040013	VS3040016
Rated power	kW	3	4	5,5	7,5
Connection		X100			
Connection type		Screw terminal			
Min. cable cross-section	mm ²	1,5			
Max. cable cross-section	mm ²	6		16	35
Stripping length	mm	9		11	18
Tightening torque	Nm	0,5		1,2	3.8
Required screwdriver		0.6 x 3.5		0.8 x 4.0	

Motor connection

Inverter		VS30407P3	VS30409P5	VS3040013	VS3040016
Rated power	kW	3	4	5,5	7,5
Connection		X105			
Connection type		Screw terminal			
Min. cable cross-section	mm ²	1,5			
Max. cable cross-section	mm ²	6		16	35
Stripping length	mm	9		11	18
Tightening torque	Nm	0,5		1,2	3.8
Required screwdriver		0.6 x 3.5		0.8 x 4.0	

Mounting

Electrical installation
Connection to the 400 V system

PE conductor connection

Inverter		VS30407P3	VS30409P5	VS3040013	VS3040016
Rated power	kW	3	4	5,5	7,5
Connection		PE			
Connection type		PE screw			
Min. cable cross-section	mm ²	1,5			
Max. cable cross-section	mm ²	6			16
Stripping length	mm	10			11
Tightening torque	Nm	1,2			3,4
Required screwdriver		0.8 x 5.5			PZ2

Control connections

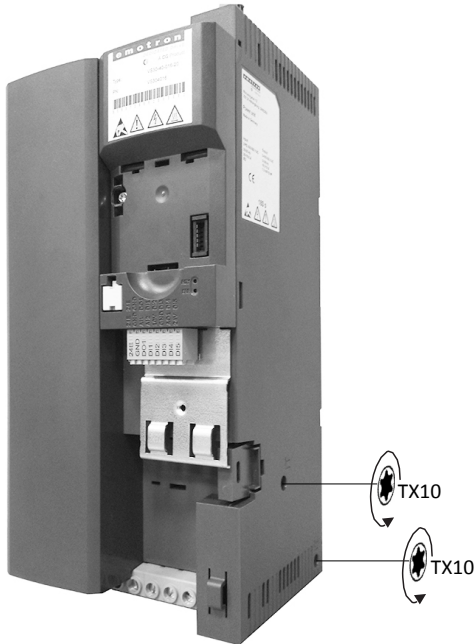
Terminal description		Relay output	PTC input	Control terminals
Connection		X9	X109	X3
Connection type		Screw terminal	Screw terminal	Spring terminal
Min. cable cross-section	mm ²	0,5	0,5	0,5
Max. cable cross-section	mm ²	1,5	1,5	1,5
Stripping length	mm	6	6	9
Tightening torque	Nm	0,2	0,2	-
Required screwdriver		0.4 x 2.5	0.4 x 2.5	0.4 x 2.5

4.3.2 Connection to the IT system

i NOTICE!

Internal components have earth 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.



4.3.3 CANopen connection

4.3.3.1 Connection plan

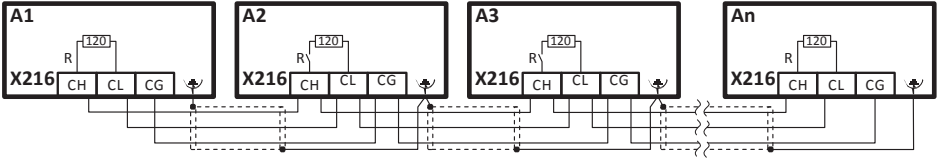


Fig. 2: Wiring example: CANopen network

4.3.3.2 Terminal data

Terminal description	CANopen	
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 screwdriver	0.4 x 2.5	

4.3.3.3 Basic network settings



The network must be terminated with a 120 Ω resistor at the physically first and last node.
Set the "R" switch to ON at these nodes.

Use the DIP switch to set the node address and baud rate and to activate the integrated bus terminating resistor.

R

d

c

b

a

64

32

16

8

4

2

1

ON
↑

Baud
CAN Address

B	Baud rate					CAN node address						
R	d	c	b	a		64	32	16	8	4	2	1
OFF	OFF	ON	OFF	ON	20 kbps	OF	OFF	OFF	OFF	OFF	OFF	OFF
inaktiv	OFF	OFF	ON	ON	50 kbps	Value from parameter						
ON	OFF	OFF	ON	OFF	125 kbps	Node address - example:						
aktiv	OFF	OFF	OFF	ON	250 kbps	OF	OFF	ON	OFF	ON	ON	ON
	OFF	OFF	OFF	OFF	Value from parameter (500 kbps)	Node address = 16 + 4 + 2 + 1 = 23						
	OFF	ON	OFF	OFF	1 Mbps							
	All other combinations				Value from parameter (500 kbps)							

Printed in bold = Emotron setting

4.3.4 Modbus connection

4.3.4.1 Connection plan

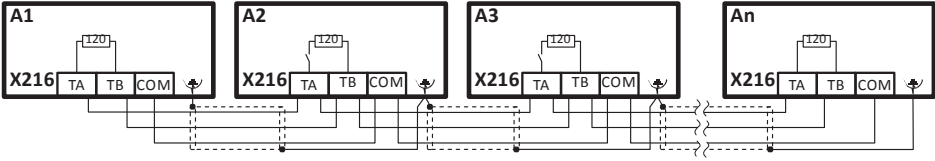


Fig. 3: Wiring example: Modbus network

4.3.4.2 Terminal data

Terminal description		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 screwdriver		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.
Set the "R" switch to ON at these nodes.

Use the DIP switch to set the node address and baud rate and to activate the integrated bus terminating resistor.

R c b a

Mode

128 64 32 16 8 4 2 1

Address

ON

↑

Bus termina- tion	Baud rate		Parity	Modbus node address									
	R	c		b	a	128	64	32	16	8	4	2	1
OFF	n.c.	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inactive		Automatic detection	Automatic	Value from parameter									
ON		ON	ON	Node address - example:									
Active		Value from parameter	Value from parameter	OFF	OFF	OFF	ON	OFF	ON	ON	ON	ON	
				Node address = 16 + 4 + 2 + 1 = 23									
				Node address > 247: value from parameter									

Printed in bold = Emotron setting

4.3.5 Connection of the safety module**4.3.5.1 Important notes**** DANGER!**

Improper installation of the safety engineering system can cause an uncontrolled starting action of the drives.

Possible consequences: Death or severe injuries

- ▶ Safety engineering systems may only be installed and commissioned by qualified and skilled personnel.
- ▶ All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of the EN ISO 13849-1 and the EN ISO 13849-2.
- ▶ Switches, relays with at least IP54 enclosure.
- ▶ Control cabinet with at least IP54 enclosure.
- ▶ It is essential to use insulated wire end ferrules for wiring.
- ▶ All safety relevant cables outside the control cabinet must be protected, e.g. by means of a cable duct
- ▶ Ensure that no short circuits can occur according to the specifications of the EN ISO 13849-2.
- ▶ All further requirements and measures can be obtained from the EN ISO 13849-1 and the EN ISO 13849-2.
- ▶ If an external force acts upon the drive axes, additional brakes are required. Please observe that hanging loads are subject to the force of gravity!
- ▶ The user has to ensure that the inverter will only be used in its intended application within the specified environmental conditions. This is the only way to comply with the declared safety-related characteristics.

 DANGER!

With the "Safe torque off" (STO) function, no "emergency stop" in terms -EN 60204-1 can be executed without additional measures. There is no isolation between the motor and inverter, no service switch or maintenance switch!

Possible consequence: death or severe injuries

- ▶ "Emergency stop" requires electrical isolation, e.g. by a central mains contactor.

 DANGER!

Automatic restart if the request of the safety function is deactivated. Possible consequences: Death or severe injuries

- ▶ You must provide external measures according to EN ISO 13849-1 which ensure that the drive only restarts after a confirmation.

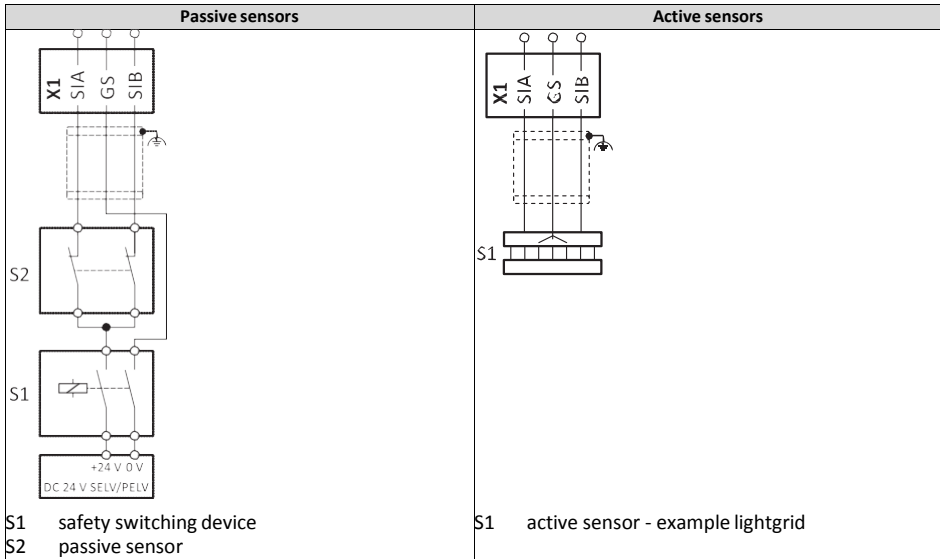
 NOTICE!

Overvoltage

Destruction of the safety component

- ▶ The maximum voltage (maximum rated) at the safety inputs is 32 V DC. The user must make provisions to avoid that this voltage is exceeded.

4.3.5.2 Connection plan



4.3.5.3 Terminal data

Terminal description		Safety STO
Connection		X1
Connection type		Screw terminal
Min. cable cross-section	mm ²	0,5
Max. cable cross-section	mm ²	1,5
Stripping length	mm	6
Tightening torque	Nm	0,2
Required screwdriver		0.4 x 2.5

X1	Specification	Unit	min.	typ.	max.
S/A, S/B	LOW signal	V	-3	0	+5
	HIGH signal	V	+15	+24	+30
	Running time	ms		3	
	Input current S/A	mA		10	14
	Input current S/B	mA		7	12
	Input peak current	mA		100	
	Tolerated test pulse	ms			1
	Switch-off time	ms		50	
	Permissible distance of the test pulses	ms	10		
GS	Reference potential for S/A and S/B				

4 **Mounting**

Electrical installation
Connection of the safety module

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 material assets

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

5.2 **Before initial switch-on**

Prevent injury to persons and damage to material assets. 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

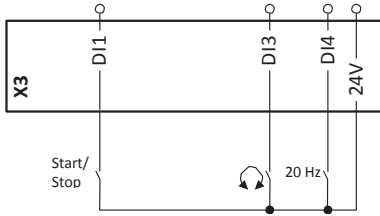
Target: achieve rotation of the motor connected to the inverter as quickly as possible.

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 enable), X3/DI3 (reversal of rotation direction), and X3/DI4 (preset 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 (1 Hz)	off	Safe torque off (STO) active.
	blinking fast (4 Hz)	Safe torque off (STO) active. Warning active.
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. Enable inverter: X3/DI1 = HIGH.
 - a) If the inverter is equipped with an integrated safety system: X1/SIA = HIGH and X1/SIB = HIGH.
2. Activate preset setpoint 1 (20 Hz) as speed setpoint: X3/DI4 = HIGH.

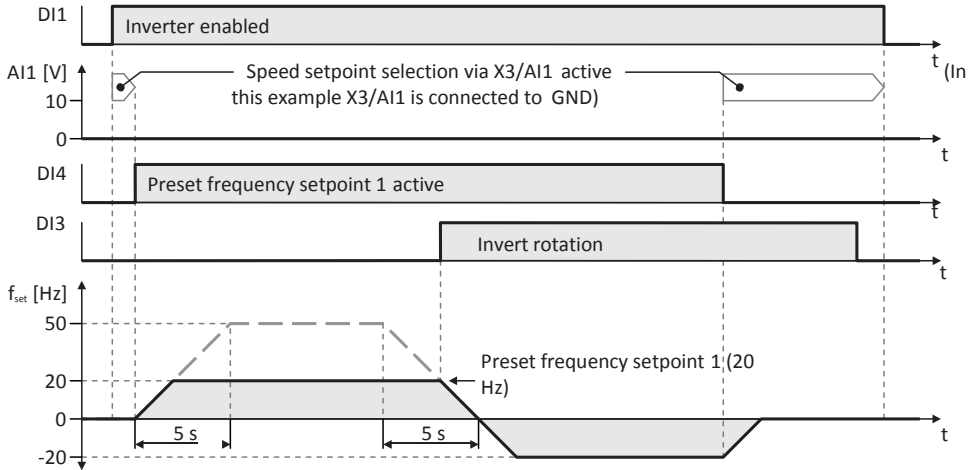
The drive rotates with 20 Hz.

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 setpoint 1 again: X3/DI4 = LOW.
2. Inhibit 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	in preparation
CSA	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
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		PTC or thermal contact, 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		
TN		
IT		Apply the measures described for IT 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 dimensioning for rated power. R _{sc} ≥ 120 is to be met.	EN 61000-3-12	RSCE: Short-circuit power ratio at the connection point of the machine/plant to the public network.

Requirements to the shielded motor cable		
Capacitance per unit length		
C-core-core/C-core-shield < 75/150 pF/m		≤ 2,5 mm ² / AWG 14
C-core-core/C-core-shield < 150/300 pF/m		≥ 4 mm ² / AWG 12
Electric strength		
U ₀ /U = 0,6/1,0 kV		U ₀ = r.m.s. value external conductor to PE
U ≥ 600 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 2 or 4 kHz: above +45°C, reduce rated output current by 2.5%/°C
		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	EN 60721-3-2	
Operation		
Amplitude 1 mm acceleration resistant up to 0.7 g	Germanischer Lloyd	5 ... 13.2 Hz 13.2 ... 100 Hz
Amplitude 0.075 mm acceleration resistant up to 1 g	EN 61800-5-1	10 ... 57 Hz 57 ... 150 Hz
Noise emission		
Category C1	EN 61800-3	type-dependent, for motor cable lengths see rated data
Category C2		Motor cable lengths see rated data
Noise immunity		
Meets requirement in compliance with	EN 61800-3	

Rated data
 Connection to the 400 V system

6.2 Rated data

6.2.1 Connection to the 400 V system

Inverter		VS30407P3	VS30409P5	VS3040013	VS3040016
Rated power	kW	3	4	5,5	7,5
Mains voltage range	V	3/N/PE AC 360 V ... 440 V, 45 Hz ... 55 Hz			
Operating mode		S1			
Max. ambient temperature	°C	45			
Switching frequency	kHz	4			
Rated mains current					
without mains choke	A	9,6	12,5	17,2	20
with mains choke	A	6,9	9	12,4	15,7
Rated output current	A	7,3	9,5	13	16,5
Motor cable length					
C2 residential area / industrial premises	m	20			
Weight	kg	2,3			3,7

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