• 15P0132B100 •

SINUS S

AC DRIVE 0.37 ... 37 kW / 0.5 ... 50 HP

POWER UNIT

- Mounting and switch-on instructions -

Issued on 31/03/2023
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ENERTRONICA SANTERNO

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Contents

About this document

WARNING !

Read this documentation carefully before starting any work.

► Please observe the safety instructions!

Document description

Further documents

For certain tasks, information is available in further documents.

Document	Contents/topics
15P0132B101 Control Unit	Mounting instruction for Control Unit.
15W0132B100 Diagnostic Modules	Mounting instruction for Diagnostic Modules.
15W0132B101 Accessories Manual	Configuration and selection of the product. Mechanical and electrical installation, product expansions, accessories.
15R0132B100 Programming Manual	Commissioning and parameters settings.

Information and tools with regard to the Santerno products can be found on the Internet:
santerno.com

Notations and conventions

This document uses the following conventions to distinguish different types of information:

Numeric notation			
	Decimal separator	Point	The decimal point is always used. Example: 1 234.56
Text			
	Engineering tools	» «	Software Example: »Remote Sinus«

Layout of the safety instructions

DANGER !

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

WARNING !

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

CAUTION !

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTICE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.

Safety instructions

Disregarding the following basic safety measures and safety information may lead to severe personal injury and damage to property!

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.

Please observe the specific safety information in the other sections!

DANGER !

Electrical voltage

Possible consequences: Death or severe injuries

► Any work on the inverter must only be carried out in the deenergised state.

► After switching off the mains voltage, wait for at least 3 min before you start working.

Basic safety instructions

DANGER !

Dangerous electrical voltage

Death or severe injuries from electric shock.

► Any work on the inverter must only be carried out in a deenergized state.

► After switching off the mains voltage, observe the signs on the product.

Personnel

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.

Process engineering

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

Device protection

- The maximum test voltage for insulation tests between a control potential of 24 V and PE must not exceed 110 V DC (EN 61800−5−1).

Application as directed

- The product must only be operated under the operating conditions prescribed in this documentation.
- The product meets the protection requirements of 2014/35/EU: Low-Voltage Directive.
- The product is not a machine in terms of 2006/42/EU: Machinery Directive.
- Commissioning or starting the operation as directed of a machine with the product is not permitted until it has been ensured that the machine meets the regulations of the EU Directive 2006/42/EU: Machinery Directive; observe EN 60204−1.
- Commissioning or starting operation as directed is only permissible if the EMC Directive 2014/30/EU is complied with.
- The harmonised standard EN 61800−5−1 is applied.
- The product is not a household appliance, but is only designed as a component for commercial or professional use in terms of EN 61000−3−2.
- The product can be used according to the technical data if drive systems have to comply with categories according to EN 61800−3.

  In residential areas, the product may cause EMC interferences. The operator is responsible for taking interference suppression measures.
- The product must only be actuated with motors that are suitable for the operation with inverters.

The user is not allowed to change inverters that come with integrated safety technology.
The safety module must not be removed. If the safety module is defective, the inverter has to be replaced.

Handling

- Never commission the product in the event of visible damage.
- The product must never be technically modified.
- Never commission the product before assembly has been completed.
- The product must never be operated without required covers.
- Establish, separate and change all electrical connections only in deenergised state!

Residual hazards

Even if notes given are taken into consideration and protective measures are implemented, the occurrence of residual risks cannot be fully prevented.

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 property!

Product

Observe the warning labels on the product!

Icon	Description
	**Electrostatic sensitive devices:** Before working on the product, the staff must ensure to be free of electrostatic charge!
	**Dangerous electrical voltage** Before working on the product, make sure there is no voltage applied to the power terminals! After mains disconnection, the power terminals will still carry the hazardous electrical voltage for the time given next to the symbol!
	**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 the device has cooled down!

Motor protection

With some settings of the inverter, the connected motor can be overheated.

- E. g. by longer operation of self-ventilated motors at low speed.
- E. g. by longer operation of the DC-injection brake.

Protection of the machine/system

Drives can reach dangerous overspeeds.

- E. g. by setting high output frequencies in connection with motors and machines not suitable for this purpose.
- The inverters do not provide protection against such operating conditions. For this purpose, use additional components.

Switch contactors in the motor cable only if the controller is inhibited.

- Switching while the inverter is enabled is only permissible if no monitoring functions are activated.

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! (e. g. 4-pole motor: residual movement max. 180°/2 = 90°).

Degree of protection - protection of persons and device protection

- Information applies to the mounted and ready-for-use state.
- Information does not apply to the wire range of the terminals.
  - Terminals that are not wired have low protection against physical contact.
  - Terminals for large cable cross-sections have lower classes of protection, e. g. from 15 kW IP10 only.

Product information

Identification of the products

In tables, the first 15 digits of the corresponding product code are used to identify the products:

Product code:

Product family: **SINUS S**
Model: **0001** to **0034**
Voltage class: **4T**: 400 ÷ 480 Vac / 3-phase
Part: **Power Unit**

Example:

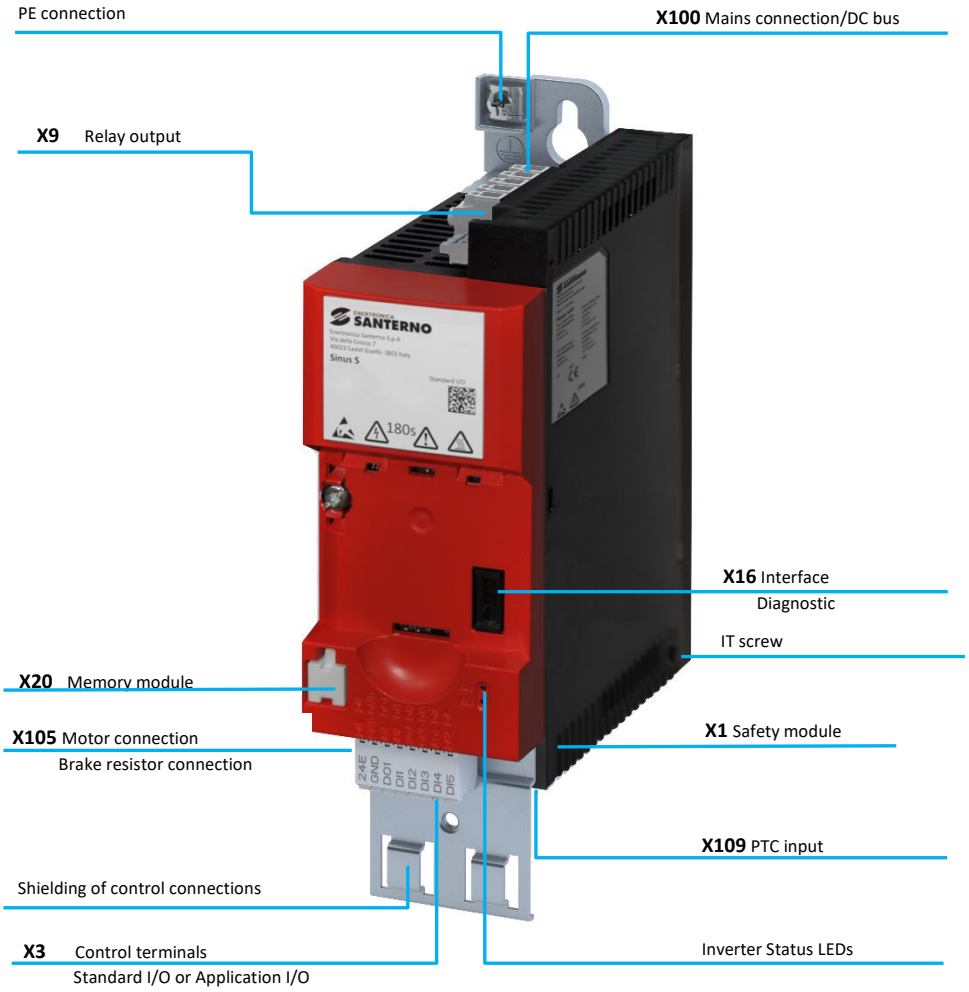
Product code	Meaning
SINUS S 0007 4T POWER UNIT	Inverter of the SINUS S product family Model 0007 Voltage Class 400 ÷ 480 Vac / 3-phase

Example:

Product code	Meaning
SINUS S 0034 4T POWER UNIT	Inverter of the SINUS S product family Model 0034 Voltage Class 400 ÷ 480 Vac / 3-phase

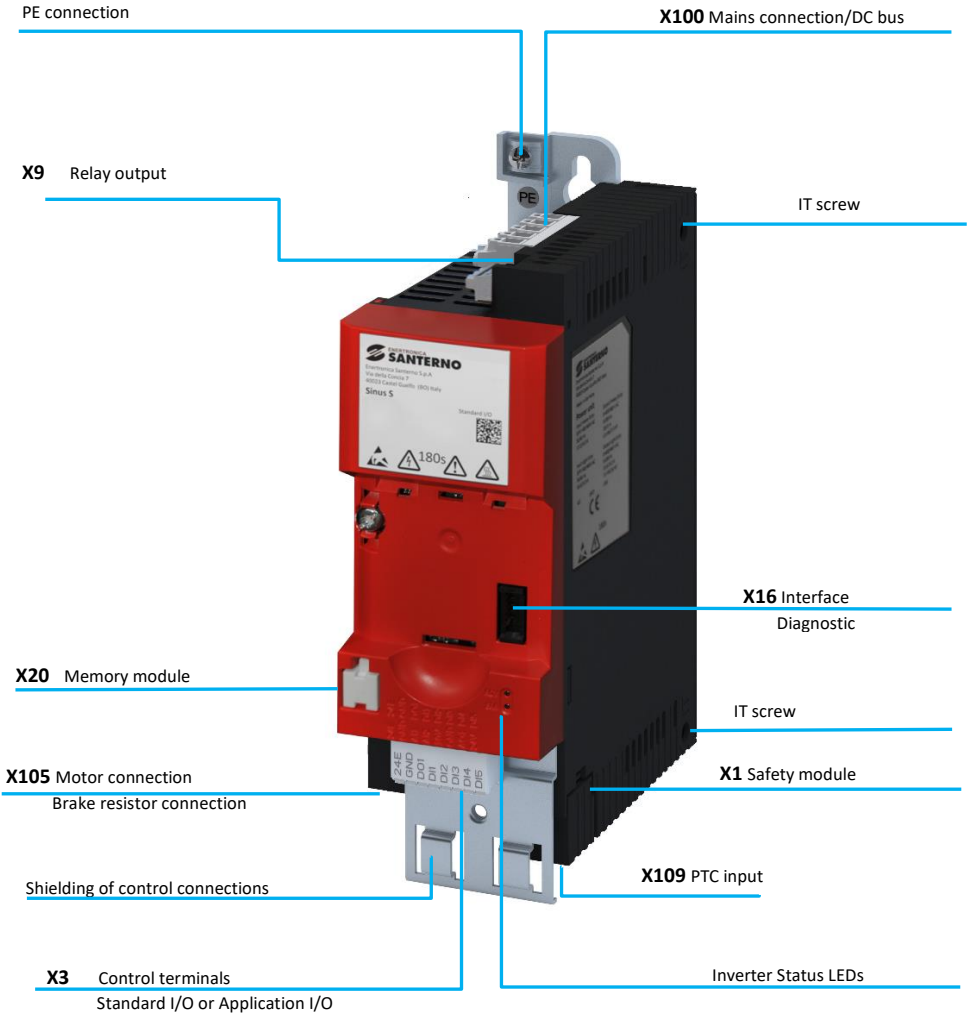
Features

SIZE 1
SINUS 0001 4T POWER UNIT: 0.37 kW

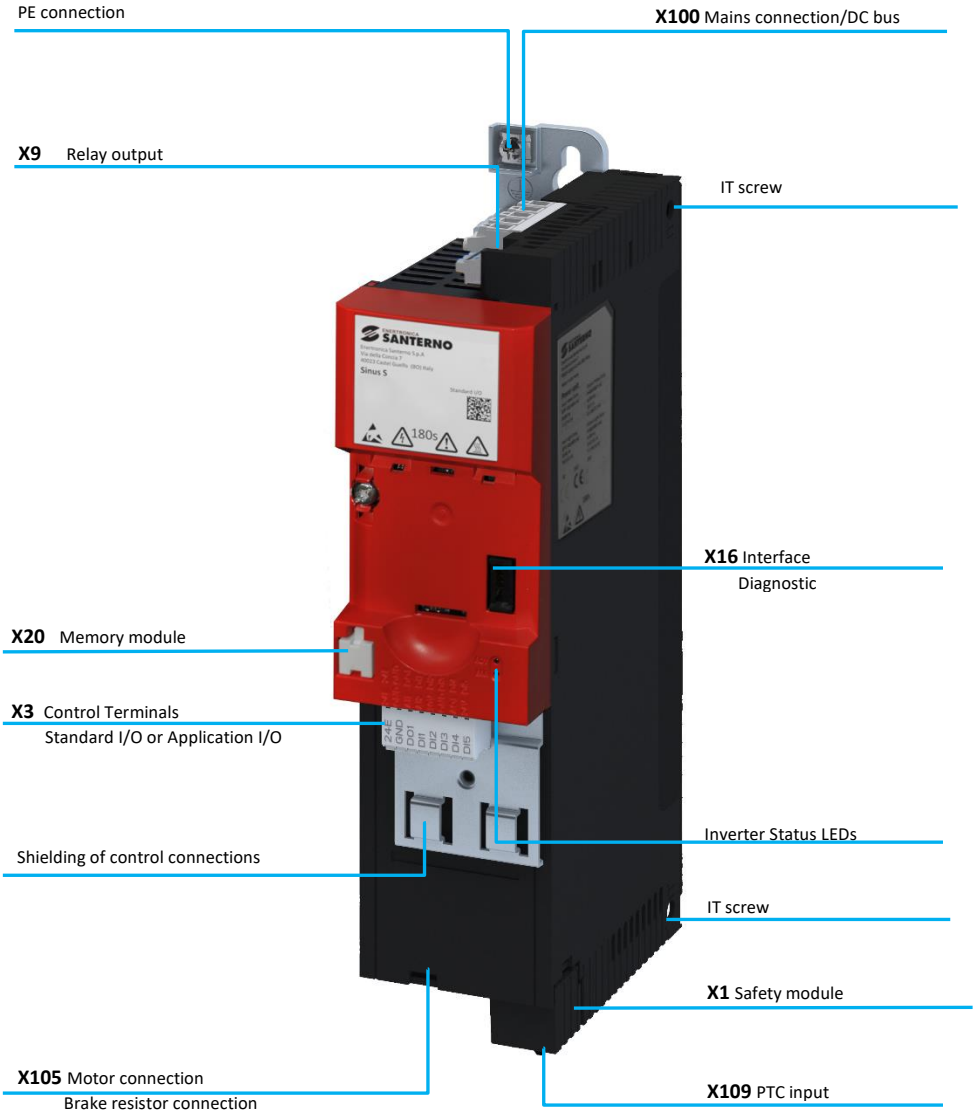


SIZE 2

SINUS 0002 4T POWER UNIT: 0.75 kW



SIZE 3
SINUS 0003 4T POWER UNIT: 1.5 kW
SINUS 0005 4T POWER UNIT: 2.2 kW
SINUS 0006 4T POWER UNIT: 3.0 kW HD
SINUS 0007 4T POWER UNIT: 4.0 kW HD



SIZE 4

SINUS 0011 4T POWER UNIT: 5.5 kW HD

X100 Mains connection/DC bus

PE connection

X9 Relay output

X16 Interface
Diagnostic

X20 Memory module

X3 Control Terminals
Standard I/O or Application I/O

Inverter Status LEDs

IT screw

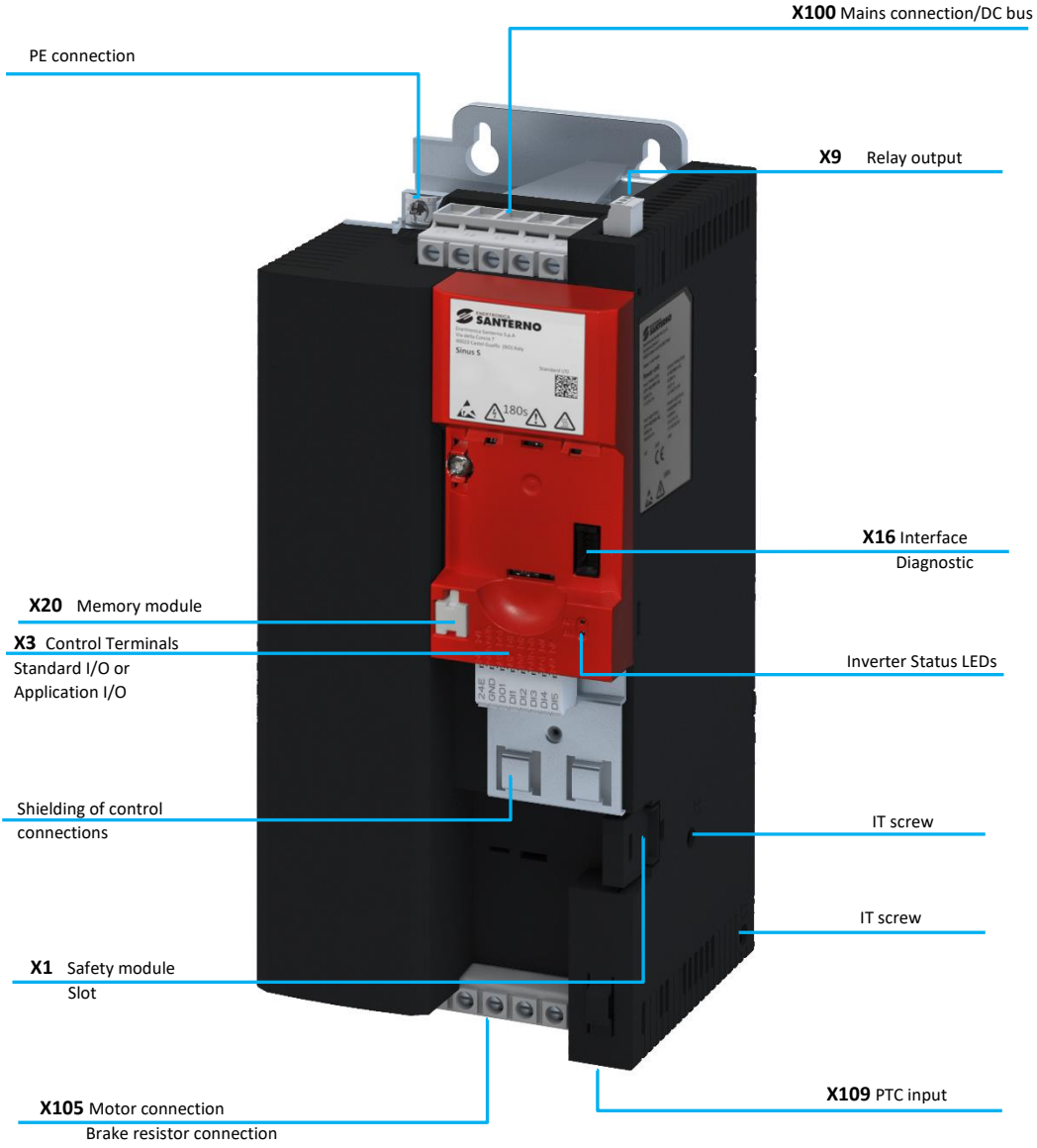
Shielding of control connections

IT screw

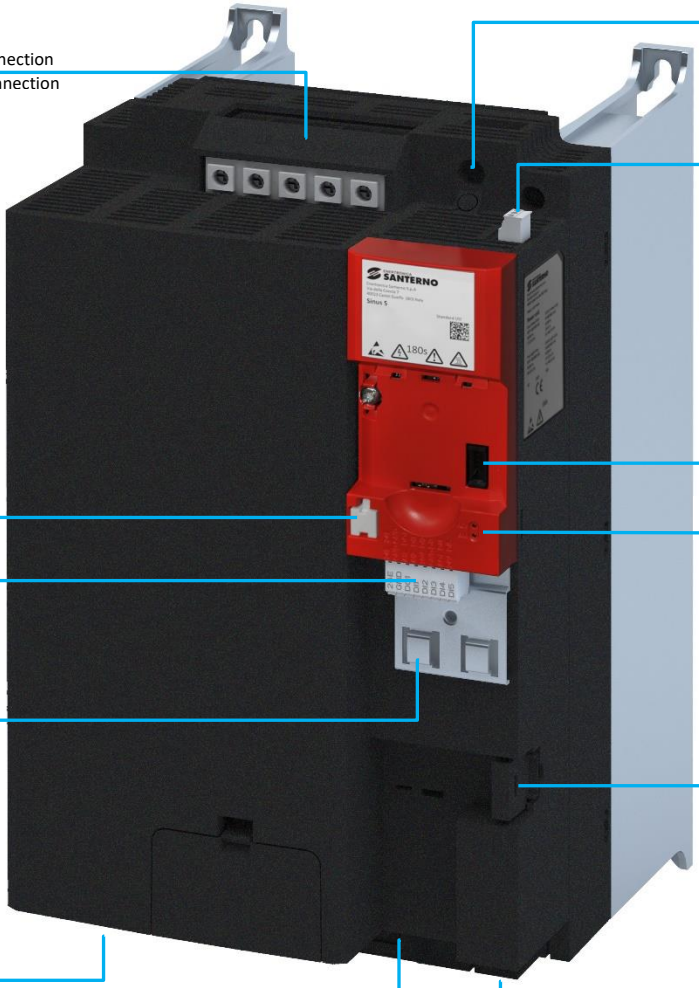
X105 Motor connection
Brake resistor connection

X109 PTC input

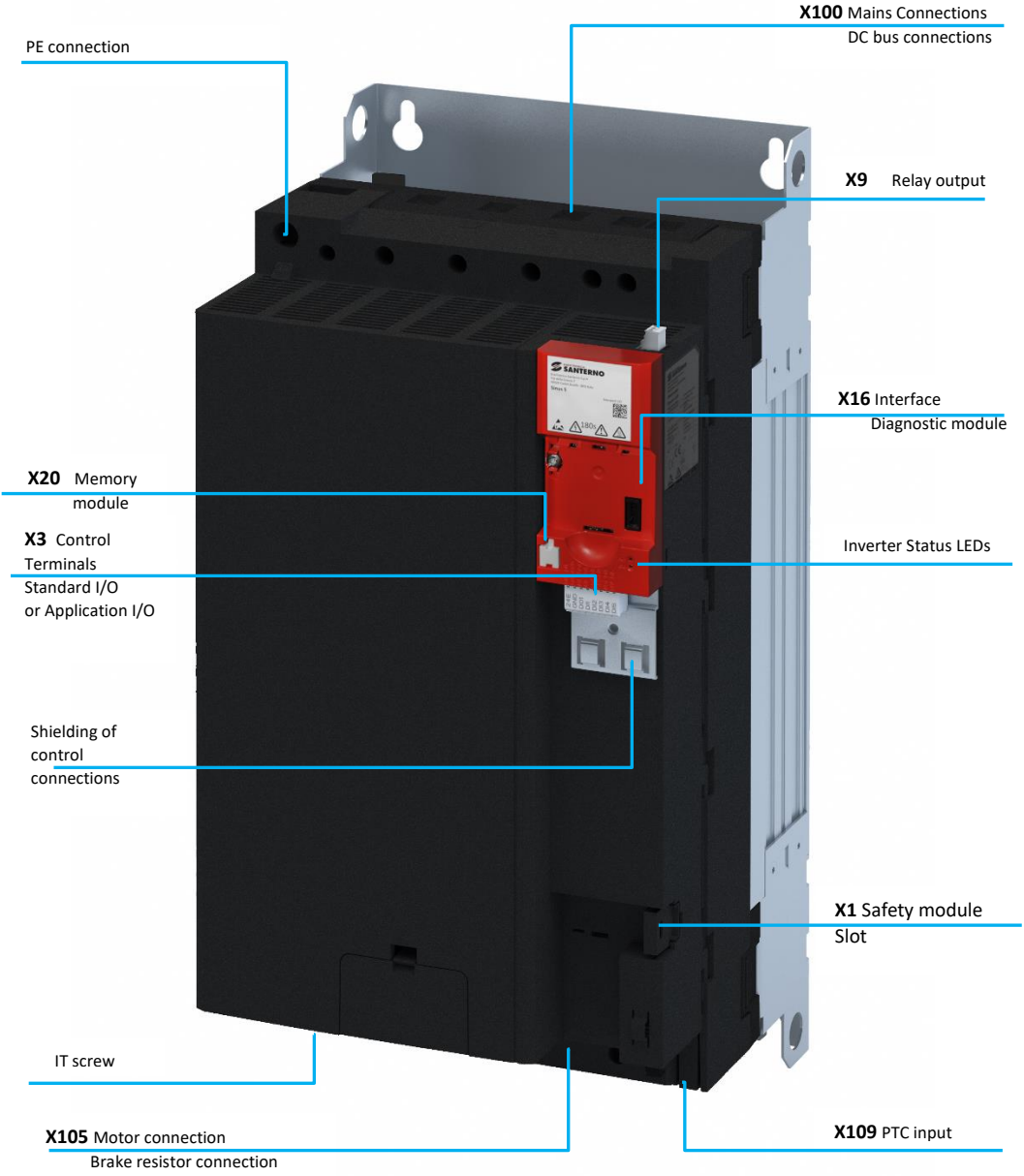
SIZE 5
SINUS 0014 4T POWER UNIT: 7.5 kW HD
SINUS 0017 4T POWER UNIT: 11.0 kW HD



SIZE 6
SINUS 0020 4T POWER UNIT: 15.0 kW HD
SINUS 0025 4T POWER UNIT: 18.5 kW HD
SINUS 0030 4T POWER UNIT: 22.0 kW HD

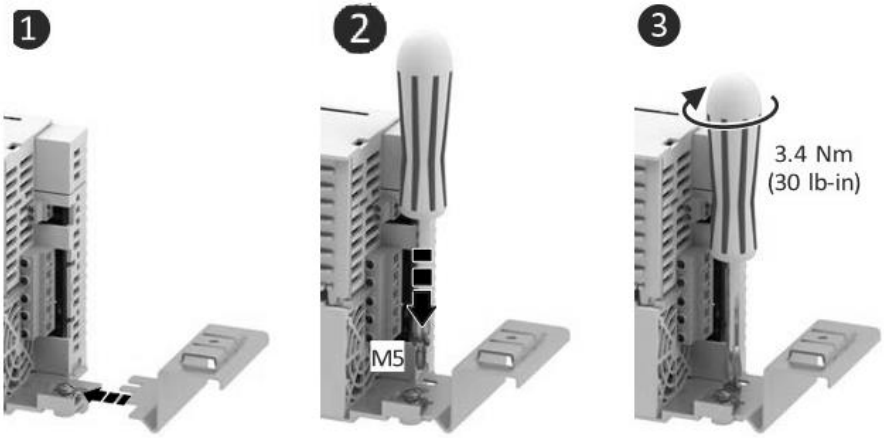


SIZE 7
SINUS 0034 4T POWER UNIT: 30.0 kW HD



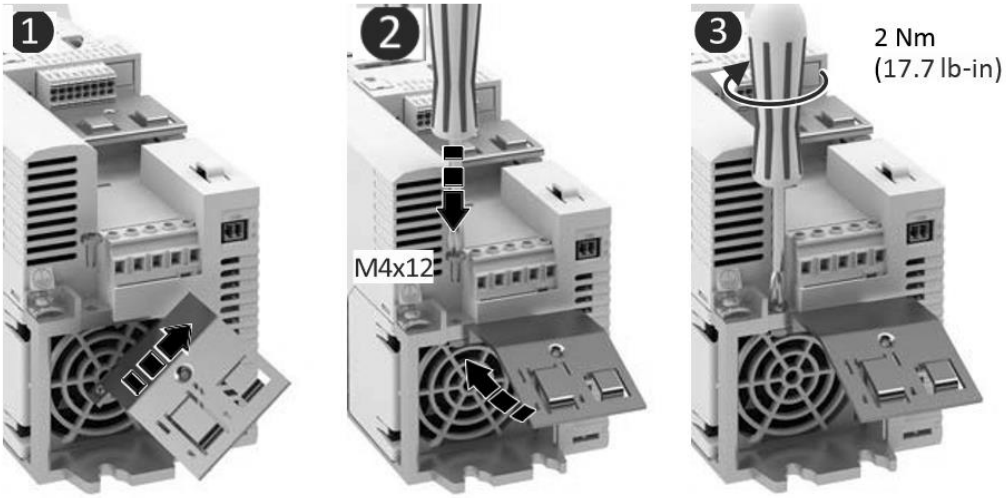
Preparation

Installation of shield connection sheet for motor cable 0.37 kW to 4 kW (optional accessories)

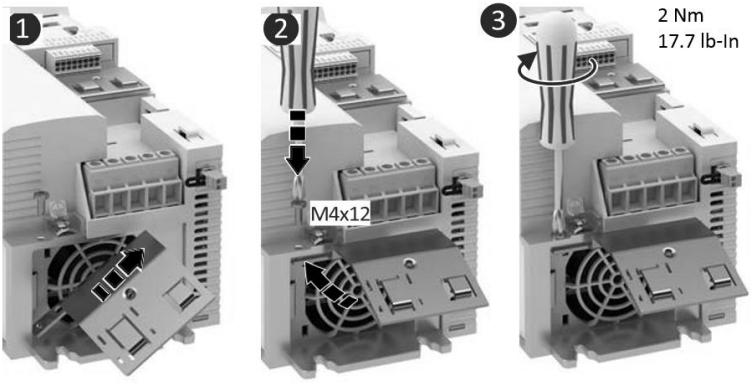


Together with the inverter, the shield connection sheet is screwed onto the mounting plate.

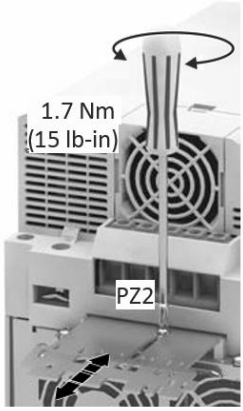
Installation of shield connection sheet for motor cable 5.5 kW (optional accessories)



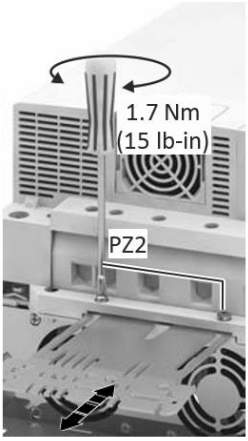
Installation of shield connection sheet for motor cable 7.5 kW to 11 kW (optional accessories)



Installation of shield connection sheet for motor cable 15 kW to 22 kW



Installation of shield connection sheet for motor cable 30 kW

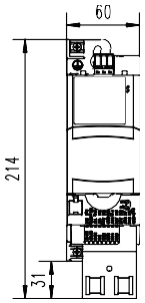


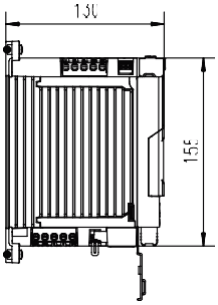
Dimensions

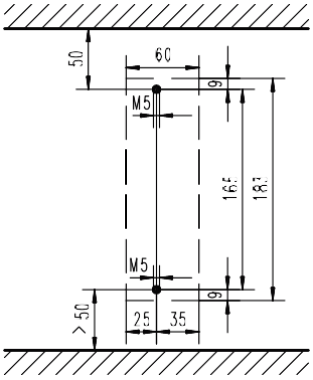
SIZE 1 - 0.37 kW

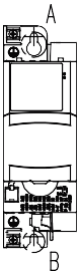
The dimensions in mm apply to:

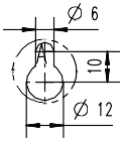
0.37 kW	SINUS S 0001 4T

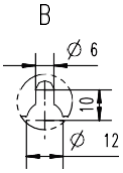










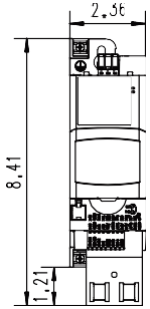


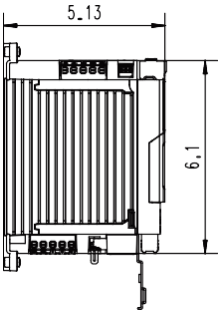
8800263

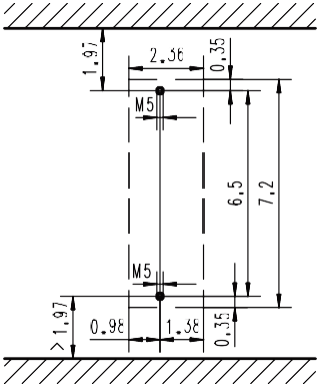
SIZE 1 - 0.5 hp

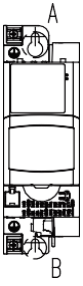
The dimensions in inch apply to:

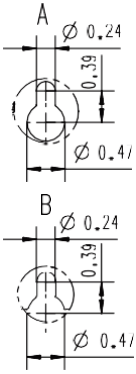
0.5 hp	SINUS S 0001 4T









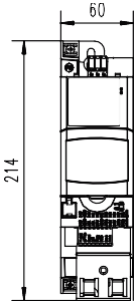


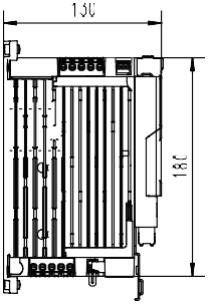
8800298

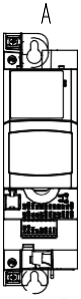
SIZE 2 - 0.75 kW

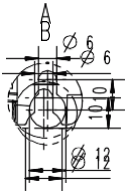
The dimensions in mm apply to:

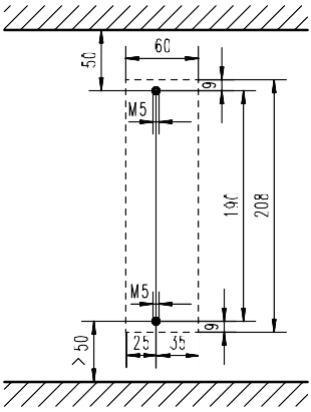
0.75 kW	SINUS S 0002 4T









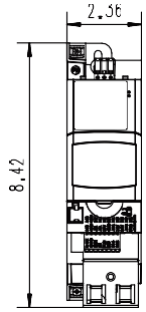


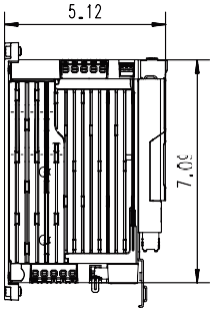
8800264

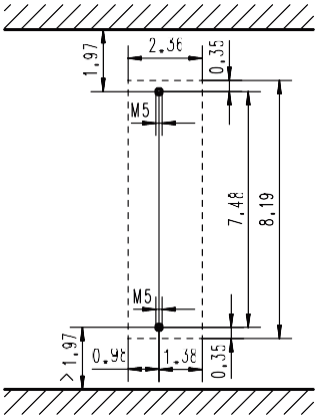
SIZE 2 - 1 hp

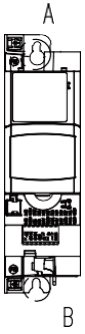
The dimensions in inch apply to:

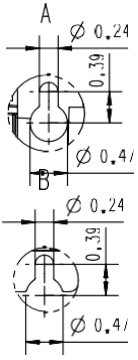
1 hp	SINUS S 0002 4T









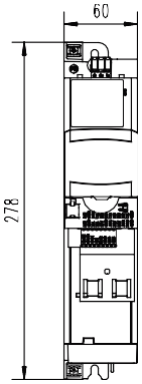


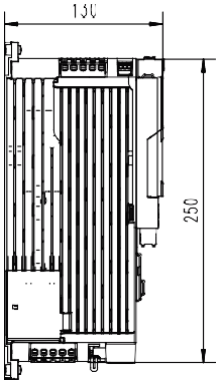
8800299

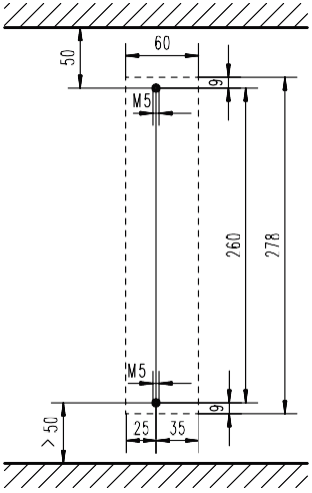
SIZE 3 - 1.5 kW … 4 kW HD

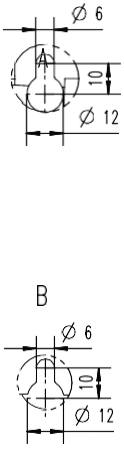
The dimensions in mm apply to:

1.5 kW	SINUS S 0003 4T
2.2 kW	SINUS S 0005 4T
3 kW HD	SINUS S 0006 4T
4 kW HD	SINUS S 0007 4T







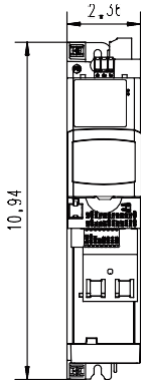


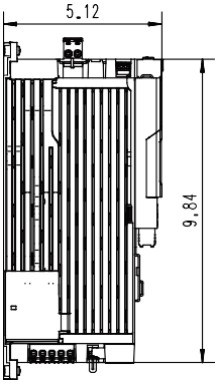
8800265

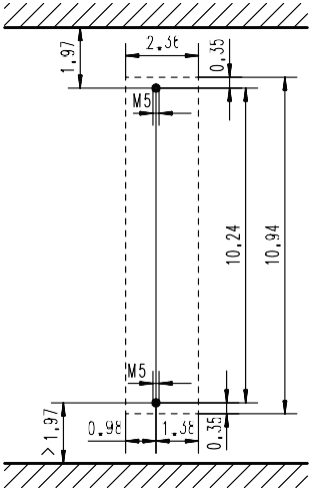
SIZE 3 - 2 hp … 5.5 hp HD

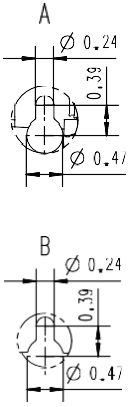
The dimensions in inch apply to:

2 hp	SINUS S 0003 4T
3 hp	SINUS S 0005 4T
4 hp HD	SINUS S 0006 4T
5.5 hp HD	SINUS S 0007 4T







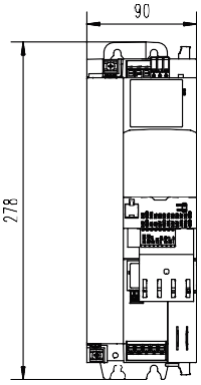


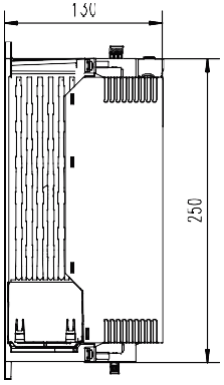
8800300

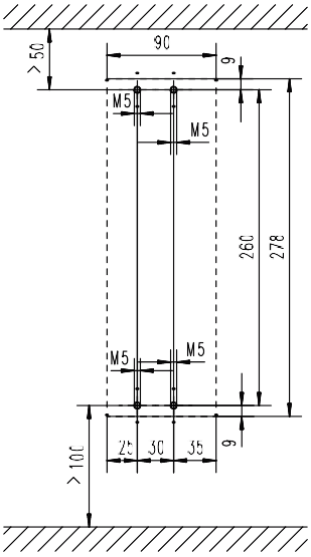
SIZE 4 - 5.5 kW HD

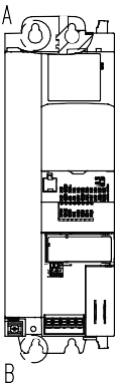
The dimensions in mm apply to:

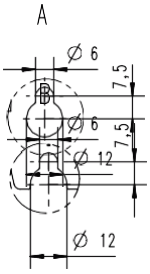
5.5 kW HD	SINUS S 0011 4T









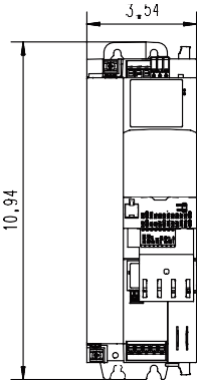


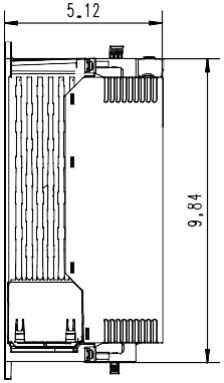
8800288

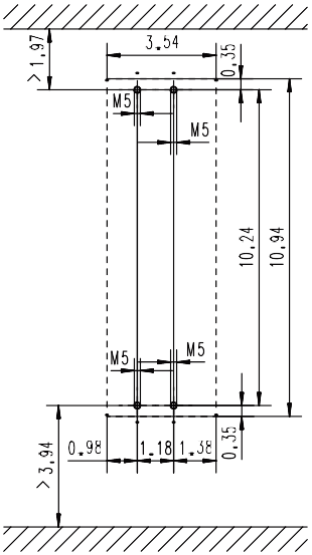
SIZE 4 - 7.5 hp HD

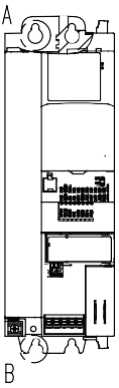
The dimensions in inch apply to:

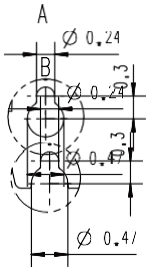
7.5 hp HD	SINUS S 0011 4T









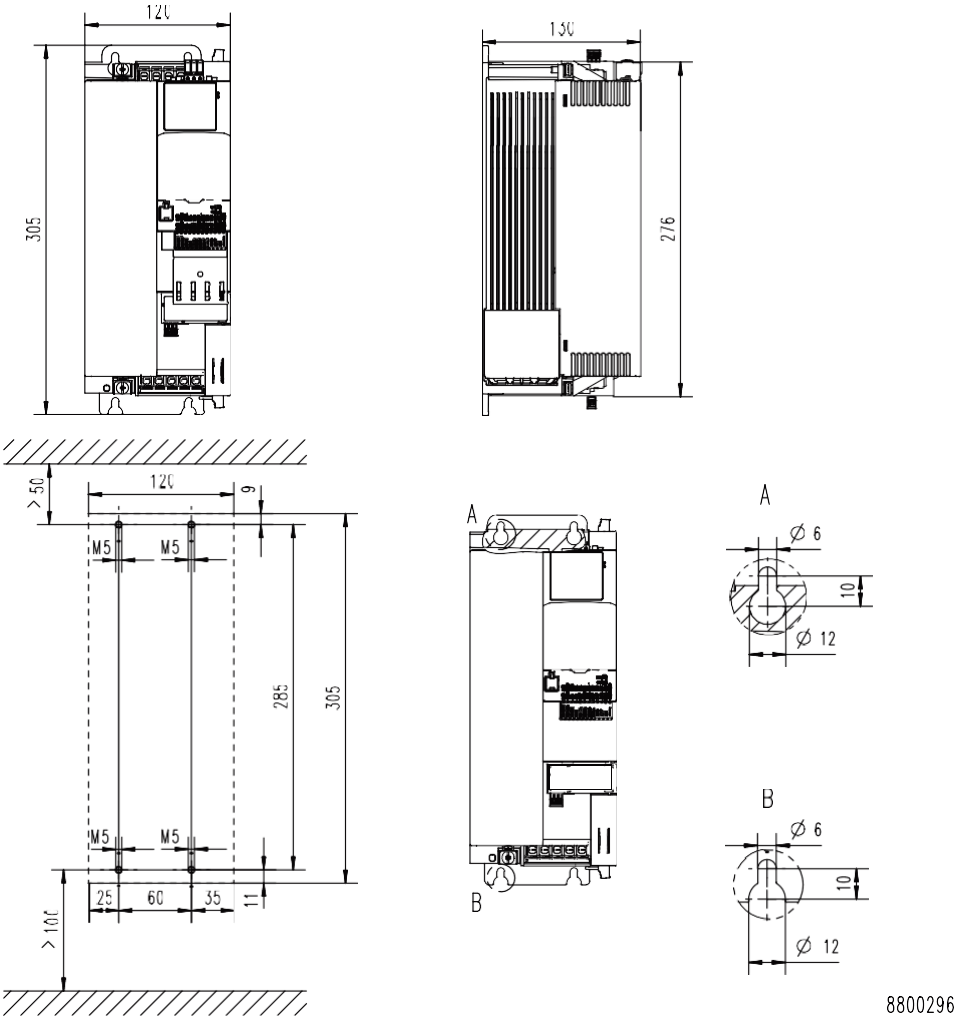


8800302

SIZE 5 - 7.5 kW HD ... 11 kW HD

The dimensions in mm apply to:

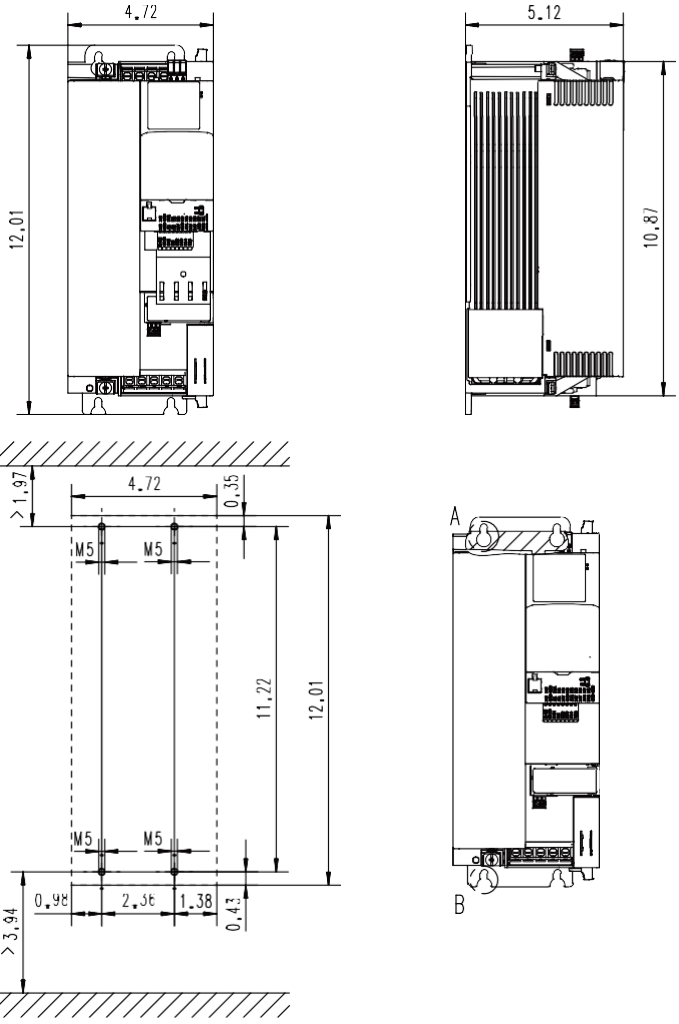
7.5 kW HD	SINUS S 0014 4T
11 kW HD	SINUS S 0017 4T



SIZE 5 - 10 hp HD ... 15 hp HD

The dimensions in inch apply to:

10 hp HD	SINUS S 0014 4T
15 hp HD	SINUS S 0017 4T

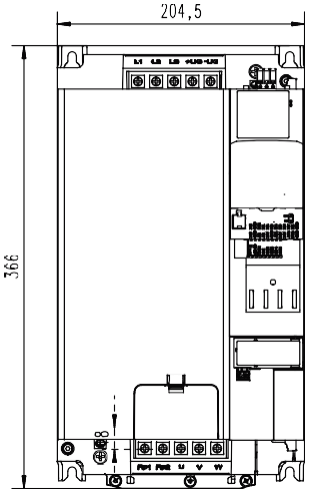


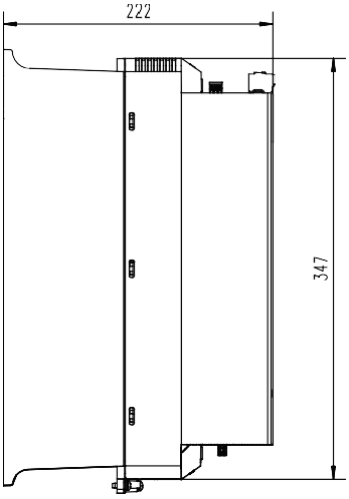
8800303

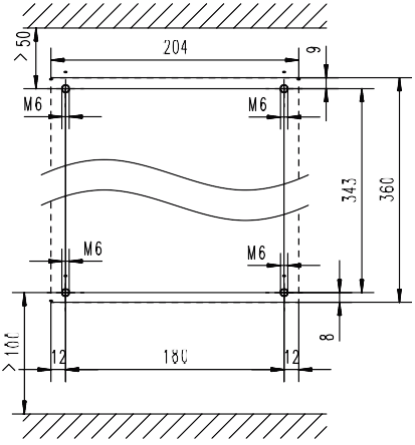
SIZE 6 - 15 kW HD ... 22 kW HD

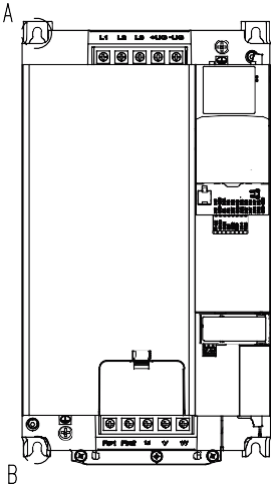
The dimensions in mm apply to:

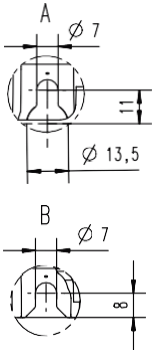
15 kW HD	SINUS S 0020 4T
18.5 kW HD	SINUS S 0025 4T
22 kW HD	SINUS S 0030 4T









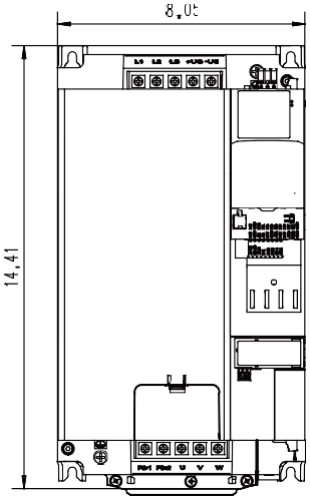


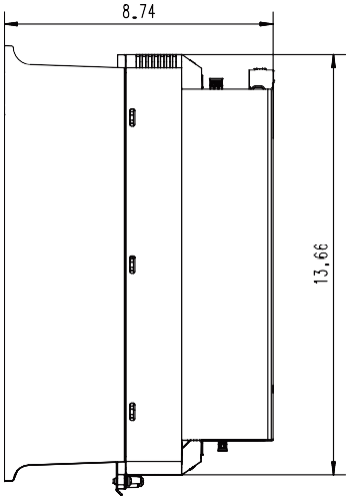
8800297

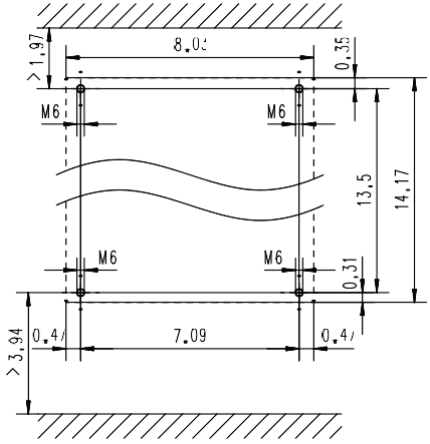
SIZE 6 - 20 hp HD ... 30 hp HD

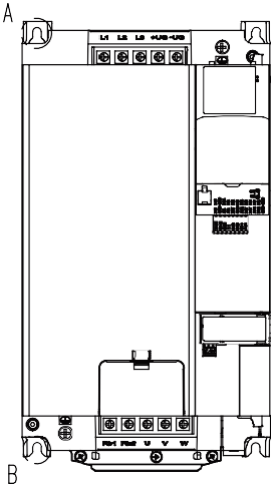
The dimensions in inch apply to:

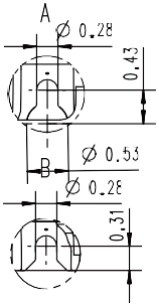
20 hp HD	SINUS S 0020 4T
25 hp HD	SINUS S 0025 4T
30 hp HD	SINUS S 0030 4T









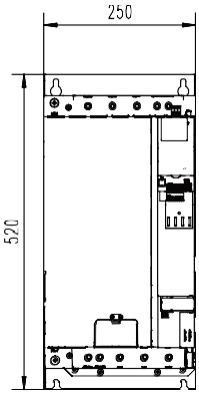


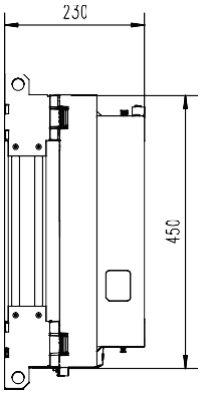
8800304

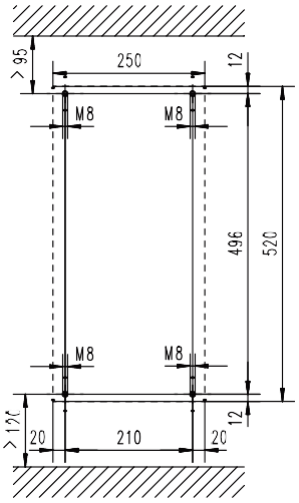
SIZE 7 - 30 kW HD

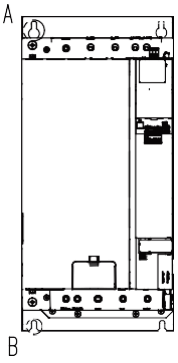
The dimensions in mm apply to:

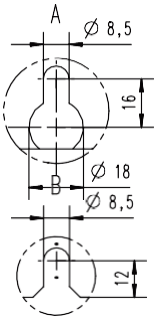
30 kW HD	SINUS S 0034 4T









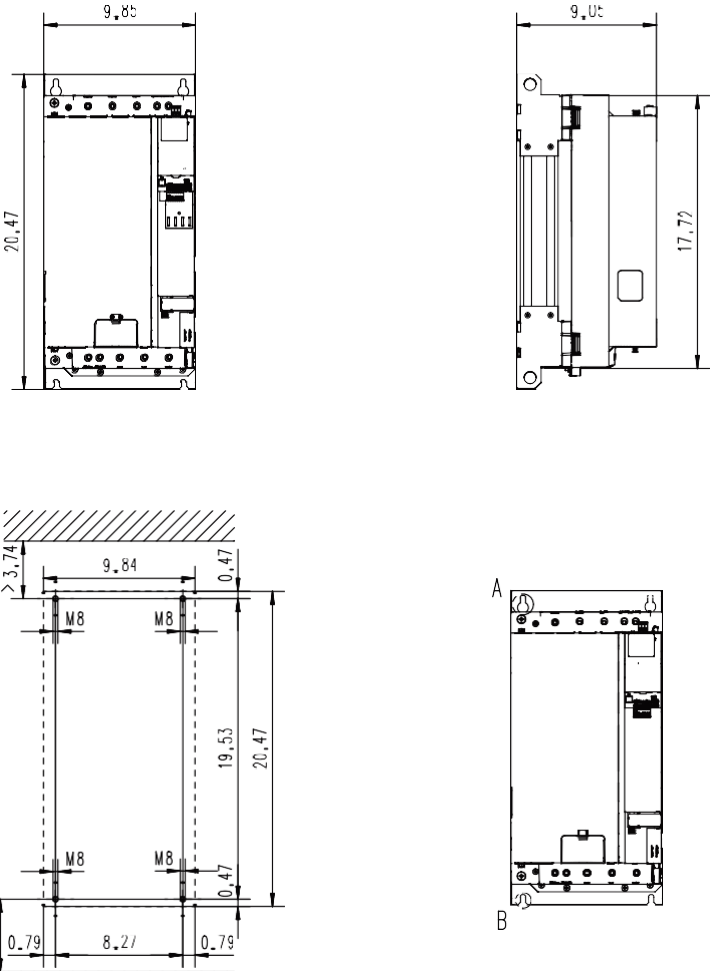


8800313

SIZE 7 - 40 hp HD

The dimensions in inch apply to:

40 hp HD	SINUS S 0034 4T



Electrical installation

Important notes

DANGER !

Electrical voltage

Possible consequences: Death or severe injuries

- ► Any work on the inverter must only be carried out in the de-energised state.
- ► After switching off the mains voltage, wait for at least 3 min before you start working.

DANGER !

Dangerous electrical voltage

The leakage current against earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences: Death or severe injuries when touching the device in the event of an error.

- ► Implement the measures requested in EN 61800−5−1 or EN 60204−1. Especially:
- ► Fixed installation
- ► The PE connection must comply with the standards (PE conductor diameter ≥ 10 mm^2 or use a double PE conductor)

Connection according to UL

⚠ WARNING!

- **UL marking**
- The integral solid state short circuit protection included in the inverter does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code / Canadian Electrical Code and any additional local codes.
- **Marquage UL**
- La protection statique intégrée contre les courts-circuits n'offre pas la même protection que le dispositif de protection du circuit de dérivation. Un tel dispositif doit être fourni, conformément au National Electrical Code / Canadian Electrical Code et aux autres dispositions applicables au niveau local.

⚠ WARNING!

- **UL marking**
- Use 75°C copper wire only, except for control circuits.
- **Marquage UL**
- Utiliser exclusivement des conducteurs en cuivre 75 °C, sauf pour la partie commande.

⚠ WARNING!

- **UL marking**
- Suitable for motor group installation or use on a circuit capable of delivering not more than the rms symmetrical amperes (SCCR) of the drive at its rated voltage.
- Approved fusing is specified in SCCR tables below.
- **Marquage UL**
- Convient pour l'utilisation sur une installation avec un groupe de moteurs ou sur un circuit capable de fournir au maximum une valeur de courant efficace symétrique en ampères à la tension assignée de l'appareil.
- Les dispositifs de protection adaptés sont spécifiés dans les SCCR tableaux suivants.

NOTICE

- **UL marking**
- The opening of the Branch Circuit Protective Device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, current-carring parts and other components of the controller should beexamined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.
- **Marquage UL**
- Le déclenchement du dispositif de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défault. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur et les remplacer s'ils sont endommagés. En cas de grillage de l'élément traversé par le courant dans un relais de surcharge, le relais tout entier doit être remplacé.

NOTICE

- ► **UL marking**
- ► Internal overload protection rated for 125 % of the rated FLA.
- ► **Marquage UL**
- ► Protection contre les surcharges conçue pour se déclencher à 125 % de l'intensité assignée à pleine charge.

(BCP) with Short Circuit Current Ratings (SCCR) with Standard Fuses. (Tested per UL61800-5-1, reference UL file E195081)

These devices are suitable for motor group installation when used with Standard Fuses. For single motor installation, if the fuse value indicated is higher than 400% of the motor current (FLA), the fuse value has to be calculated. If the value of the fuse is below two standard ratings, the nearest standard ratings less than the calculated value shall apply.

Inverter			Standard Fuses (UL248)		
Mains	kW	hp	SCCR	Max. rated current	Class
480 V, 3-ph	0.37	0.50	65 kA	15 A	CC
480 V, 3-ph	0.75	1.00	65 kA	15 A	CC
480 V, 3-ph	1.5	2.0	65 kA	15 A	CC
480 V, 3-ph	2.2	3.0	65 kA	15 A	CC
480 V, 3-ph	3.0	4.0	65 kA	25 A	CC, J, T
480 V, 3-ph	4.0	5.0	65 kA	25 A	CC, J, T
480 V, 3-ph	5.5	7.5	65 kA	25 A	CC, J, T
480 V, 3-ph	7.5	10.0	65 kA	40 A	J, T
480 V, 3-ph	11.0	15.0	65 kA	40 A	J, T
480 V, 3-ph	15.0	20.0	100 kA	70 A	J, T
480 V, 3-ph	18.5	25.0	100 kA	70 A	J, T
480 V, 3-ph	22	30	100 kA	70 A	J, T
480 V, 3-ph	30	40	22 kA	125 A	J, T

Branch Circuit Protection (BCP) with Short Circuit Current Rating (SCCR) for Semiconductor Fuses and Circuit Breaker. (Tested per UL61800-5-1, reference UL file E195081)

These devices are suitable for motor group installation when used with Circuit Breakers. For single motor installation, if the fuse value indicated is higher than 400% of the motor current (FLA), the fuse value has to be calculated. If the value of the fuse is below two standard ratings, the nearest standard ratings less than the calculated value shall apply.

Inverter			Alternate Fuse (Semiconductor Fuse)		Circuit Breaker (UL489)		
Mains	kW	hp	SCCR	Fuse type	SCCR	Max. rated current	Min. cabinet dimensions
480 V, 3-ph	0.37	0.50	100 kA	Mersen A70QS6-14F	65 kA	15 A	
480 V, 3-ph	0.75	1.00	100 kA	Mersen A60Q15-2	65 kA	15 A	0.042 m^3
480 V, 3-ph	1.5	2.0	100 kA	Mersen A60Q15-2	65 kA	15 A	1.48 ft^3
480 V, 3-ph	2.2	3.0	100 kA	Mersen A60Q15-2	65 kA	15 A	
480 V, 3-ph 480 V, 3-ph	3.0 4.0	4.0 5.0	100 kA	Mersen A70QS40-14F Mersen A70QS40-22F Mersen A70QS40-4 Eaton/Bussmann FWP-50A14Fa Eaton/Bussmann FWP-50A22F Eaton/Bussmann FWP-50B Littlefuse L70QS050	65 kA	25 A	0.042 m^3 1.48 ft^3
480 V, 3-ph	5.5	7.5	100 kA	Mersen A70QS40-14F	65 kA	25 A	
480 V, 3-ph	7.5	10.0	100 kA	Mersen A70QS50-22F	65 kA	40 A	0.042 m^3
480 V, 3-ph	11.0	15.0	100 kA	Mersen A70QS50-22F	65 kA	40 A	1.48 ft^3
480 V, 3-ph	15.0	20.0	100 kA	Mersen A70QS80-22F	65 kA	60 A	
480 V, 3-ph	18.5	25.0	100 kA	Mersen A70QS80-22F	65 kA	60 A	0.17 m^3
480 V, 3-ph	22	30	100 kA	Mersen A70QS80-22F	65 kA	60 A	6 ft^3
480 V, 3-ph	30	40	100 kA	Mersen A70QS80-4	35 kA	125 A	0.57 m^3 20 ft^3

3-phase mains connection 400 V “Heavy Duty”

Connection diagram

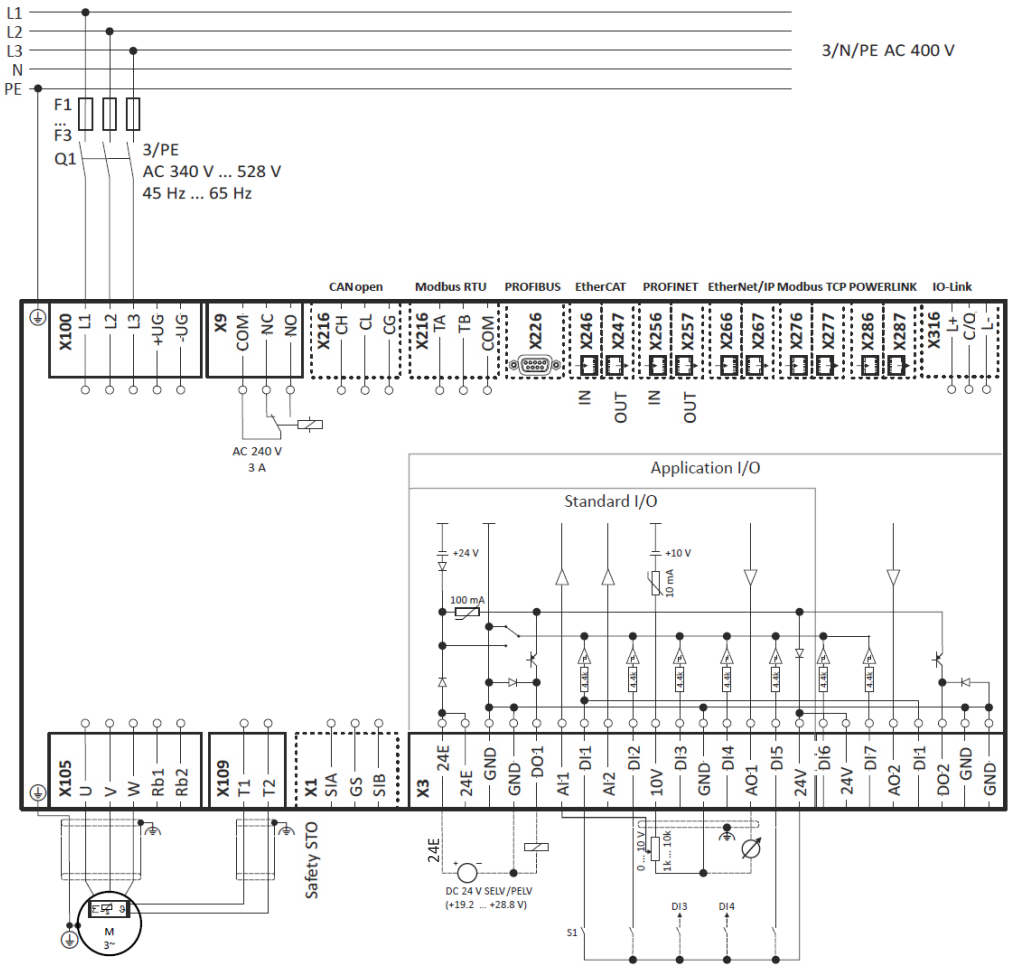


Fig. 13: Wiring example

S1 Start/Stop

F1..3 Fuses

Q1 Mains contactor

--- Dashed line = options

Terminal data

Inverter		SINUS S 0001 SINUS S 0002 SINUS S 0003 SINUS S 0005	SINUS S 0006 SINUS S 0007	SINUS S 0011	SINUS S 0014 SINUS S 0017	SINUS S 0020 SINUS S 0025	SINUS S 0030
Connection		Mains connection X100					
Connection type		Pluggable screw terminal	Screw terminal				
Max. cable cross-section	mm²	2.5	6	6	16	35	50
Stripping length	mm	8	9	9	11	18	19
Tightening torque	Nm	0.5	0.5	0.5	1.2	3.8	4
Required tool		0.5 x 3.0	0.6 x 3.5		0.8 x 4.0	0.8 x 5.5	Hexagon socket 5

Inverter		SINUS S 0001 SINUS S 0002 SINUS S 0003	SINUS S 0006 SINUS S 0007	SINUS S 0011 SINUS S 0014 SINUS S 0017	SINUS S 0020 SINUS S 0025 SINUS S 0030 SINUS S 0034
Connection		PE connection			
Connection type		PE screw			
Max. cable cross-section	mm²	6	6	16	25
Stripping length	mm	10	10	11	16
Tightening torque	Nm	2	2	3.4	4
Required tool		Torx 20		PZ2	

Inverter		SINUS S 0001 SINUS S 0002 SINUS S 0003 SINUS S 0005	SINUS S 0006 SINUS S 0007	SINUS S 0011	SINUS S 0014 SINUS S 0017	SINUS S 0020 SINUS S 0025 SINUS S 0030
Connection		Motor connection X105				
Connection type		Pluggable screw terminal	Screw terminal			
Max. cable cross-section	mm²	2.5	6	6	16	35
Stripping length	mm	8	9	9	11	18
Tightening torque	Nm	0.5	0.5	0.5	1.2	3.8
Required tool		0.5 x 3.0	0.6 x 3.5		0.8 x 4.0	0.8 x 5.5

Inverter	kW	SINUS S 0034
Connection		Motor connection X105
Connection type		Screw terminal
Max. cable cross-section	mm²	50
Stripping length	mm	19
Tightening torque	Nm	4
Required tool		Hexagon socket 5

Fusing data

EN 60204-1

Inverter	Fuse		Circuit breaker		Earth-leakage circuit breaker
	Characteristic	Max. rated current	Characteristic	Max. rated current	
		A		A	
SINUS S 0001	gG/gL or gRL	10	B	10	≥ 30 mA, type B
SINUS S 0002	gG/gL or gRL	10	B	10	≥ 30 mA, type B
SINUS S 0003	gG/gL or gRL	16	B	16	≥ 30 mA, type B
SINUS S 0005	gG/gL or gRL	16	B	16	≥ 30 mA, type B
SINUS S 0006	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0007	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0011	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0014	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0017	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0020	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0025	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0030	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0034	gG/gL or gRL	80	B	80	≥ 300 mA, type B

3-phase mains connection 400 V "Light Duty"

Connection diagram

See "3-phase mains connection 400 V".

Terminal data

See "Terminal data".

Fusing data

EN 60204-1

Inverter	Fuse		Circuit breaker		Earth-leakage circuit breaker
	Characteristic	Max. rated current	Characteristic	Max. rated current	
		A		A	
SINUS S 0006	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0007	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0011	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0014	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0017	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0020	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0025	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0030	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0034	gG/gL or gRL	80	B	80	≥ 300 mA, type B

3-phase mains connection 480 V “Heavy Duty”

Connection diagram

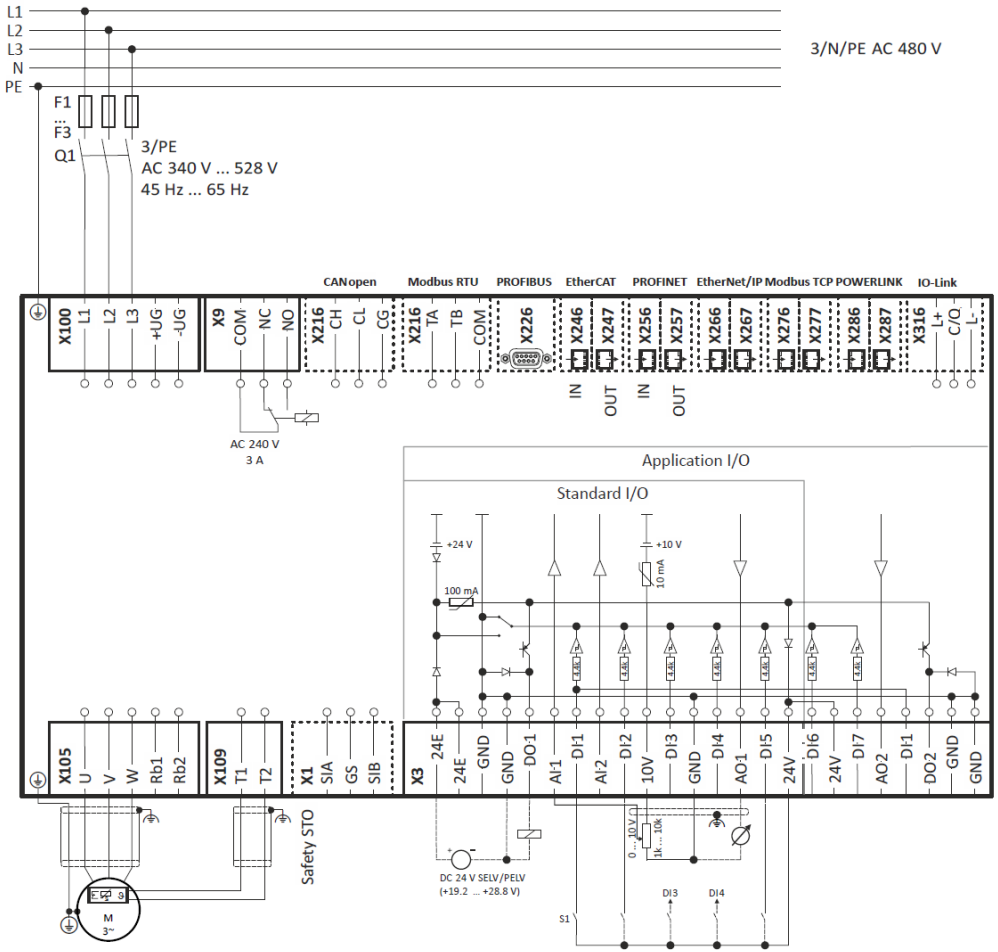


Fig. 14: Wiring example

S1 Start/Stop
F1..3 Fuses
Q1 Mains contactor
--- Dashed line = options

Terminal data

See "Terminal data".

Fusing data

EN 60204-1

Inverter	Fuse		Circuit breaker		Earth-leakage circuit breaker
	Characteristic	Max. rated current	Characteristic	Max. rated current	
		A		A	
SINUS S 0001	gG/gL or gRL	10	B	10	≥ 30 mA, type B
SINUS S 0002	gG/gL or gRL	10	B	10	≥ 30 mA, type B
SINUS S 0003	gG/gL or gRL	16	B	16	≥ 30 mA, type B
SINUS S 0005	gG/gL or gRL	16	B	16	≥ 30 mA, type B
SINUS S 0006	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0007	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0011	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0014	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0017	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0020	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0025	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0030	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0034	gG/gL or gRL	80	B	80	≥ 300 mA, type B

3-phase mains connection 480 V "Light Duty"

Connection diagram

See "3-phase mains connection 480 V".

Terminal data

See "Terminal data".

Fusing data

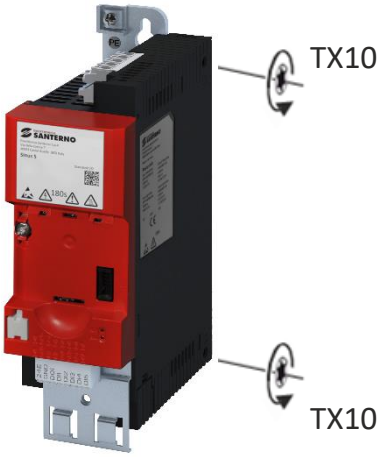
EN 60204-1

Inverter	Fuse		Circuit breaker		Earth-leakage circuit breaker
	Characteristic	Max. rated current	Characteristic	Max. rated current	
		A		A	
SINUS S 0006	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0007	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0011	gG/gL or gRL	25	B	25	≥ 300 mA, type B
SINUS S 0014	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0017	gG/gL or gRL	32	B	32	≥ 300 mA, type B
SINUS S 0020	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0025	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0030	gG/gL or gRL	63	B	63	≥ 300 mA, type B
SINUS S 0034	gG/gL or gRL	80	B	80	≥ 300 mA, type B

Connection to the IT system

For a trouble-free operation on the IT system, observe the following measures:
- Connect an isolating transformer upstream.
- Remove the IT screws. Otherwise the monitoring devices of the IT system will be triggered because internal components are connected to protective earth (PE).

The use of the safety-related function STO is not permissible in the IT system.

SINUS S 0001 4T	SINUS S 0002 4T, SINUS S 0003 4T, SINUS S 0005 4T, SINUS S 0006 4T, SINUS S 0007 4T
	

SINUS S 0011, SINUS S 0014, SINUS S 0017

SINUS S 0020 4T, SINUS S 0025 4T, SINUS S 0030 4T	SINUS S 0034 4T
	

Control connections

Connection description		Control terminals
Connection		X3
Connection type		Pluggable spring terminal
Max. cable cross-section	mm²	1.5
Max. cable cross-section	AWG	16
Stripping length	mm	9
Stripping length	inch	0.35
Tightening torque	Nm	-
Tightening torque	lb-in	-
Required tool		0.4 x 2.5

Data of control connections

Digital inputs

Switching type		PNP, NPN	Parameterisable
PNP switching level			
LOW	V	< +5	IEC 61131−2, type 1
HIGH	V	> +15	
NPN switching level			
LOW	V	> +15	
HIGH	V	< +5	
Input resistance	kΩ	4.6	
Cycle time	ms	1	
Electric strength of external voltage	V	± 30	

Frequency input			
Connection		X3/DI3, X3/DI4	
Frequency range	kHz	0 … 100	
Encoder input			
Type		Incremental HTL encoder	
Two-track connection		X3/DI3 X3/DI4	Track A Track B
Frequency range	kHz	0 … 100	

Digital outputs

Switching level			
LOW	V	< +5	IEC 61131−2, type 1
HIGH	V	> +15	
max. output current	mA	100	Total current for DO1 and 24V
Cycle time	ms	1	
Short-circuit strength		Unlimited period	
Electric strength of external voltage	V	± 30	
Polarity reversal protection		Integrated freewheeling diode for switching the inductive load	
Overload behaviour		Reduced voltage or periodic switch-off/on	
Reset or switch-on behaviour		Output is switched off	LOW

Analog inputs

Cycle time	ms	1	
Resolution of A/D converter	Bit	12	
Operation as voltage input			
Connection designation		X3/AI1, X3/AI2	
Input voltage DC	V	-10 … 10	
Input resistance	kΩ	70	
Accuracy	mV	± 50	Typical
Input voltage in case of open circuit	V	- 0.2 … 0.2	Display "0"
Electric strength of external voltage	V	± 24	
Operation as current input			
Connection designation		X3/AI1, X3/AI2	
Input current	mA	0 ... 20	
		4 … 20	open-circuit monitored
Accuracy	mA	± 0.1	Typical
Input current in case of open circuit	mA	< 0.1	Display "0"
Input resistance	Ω	< 250	
Electric strength of external voltage	V	± 24	

Analog outputs

Short-circuit strength		Unlimited period	
Electric strength of external voltage	V	+ 24V	
Operation as voltage output			
Resolution of D/A converter	Bit	12	
Output voltage DC	V	0 ... 10	
max. output current	mA	5	
min. load resistance	kΩ	≥ 2.2	
max. capacitive load	µF	1	
Accuracy	mV	± 100	Typical
Operation as current output			
Output current	mA	0 ... 20	
		4 ... 20	open-circuit monitored
Accuracy	mA	± 0.3	Typical

10 V output

Use		Primarily for the supply of a potentiometer (1 ... 10 kΩ)
Output voltage DC		
Typical	V	10
Accuracy	mV	± 100
Max. output current	mA	10
Max. capacitive load	µF	1
Short-circuit strength		Unlimited period
Electric strength of external voltage	V	+ 24

24 V input

Use		Input for mains-independent DC supply of the control electronics (incl. communication)	
Input voltage DC			
Typical	V	24	IEC 61131-2
Area	V	19.2 … 28.8	
Input power			
Typical	W	3.6	
Max.	W	6	Depending on the use and state of inputs and outputs.
Input current			
Typical	A	0.150	
Max.	A	1.0	When switching on for 50 ms
Capacity to be charged	µF	440	
Polarity reversal protection		When polarity is reversed: No function and no destruction	
Suppression of voltage pulses		Suppressor diode 30 V, bidirectional	
Power supply unit		SELV/PELV	Externally to create a mains-independent DC supply
Max. current	A	8.0	While looping-through

24 V output

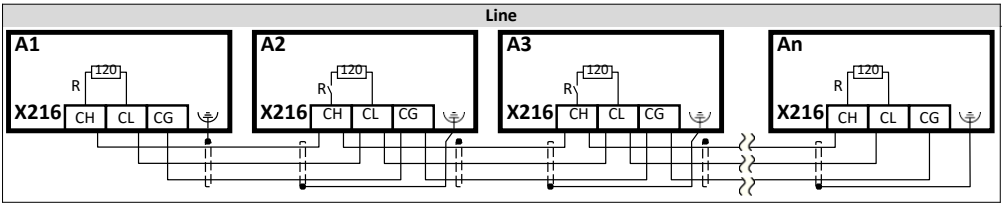
Use		Primarily for supplying digital inputs or passive sensors at X1	SELV/PELV
Output voltage DC			
Typical	V	24	
Range	V	16 … 28	
max. output current	mA	100	Total current for DO... and 24V
Short-circuit strength		Unlimited period	
External-voltage protection	V	+ 30	
Overcurrent fusing			

Networks

CANopen

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

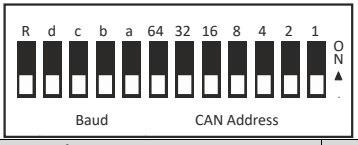
Typical topologies



Connection description		CANopen
Connection		X216
Connection type		pluggable double spring terminal
Max. cable cross-section	mm²	2.5
Max. cable cross-section	AWG	12
Stripping length	mm	10
Stripping length	inch	0.39
Tightening torque	Nm	-
Tightening torque	lb-in	-
Required tool		0.4 x 2.5

Basic network settings

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



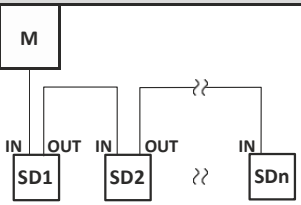
Bus termination	Baud rate					CAN node address						
R	d	c	b	a		64	32	16	8	4	2	1
OFF	OFF	ON	OFF	ON	20 kbits/s	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
Inactive	OFF	OFF	ON	ON	50 kbits/s	Value from parameter						
ON	OFF	OFF	ON	OFF	125 kbits/s	Node address - example:						
Active	OFF	OFF	OFF	ON	250 kbits/s	OFF	OFF	ON	OFF	ON	ON	ON
	OFF	**OFF**	**OFF**	**OFF**	Value from parameter (500 kbits/s)	Node address = 16 + 4 + 2 + 1 = 23						
	OFF	ON	OFF	OFF	1 Mbit/s							
	All other combinations				Value from parameter (500 kbits/s)							

Bold print = default setting

EtherCAT

Typical topologies

Line



M Master
SD Slave Device

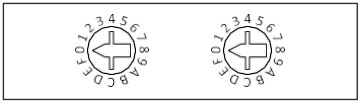
Bus-related information			
Name		EtherCAT	
Communication medium		Ethernet 100 Mbps, full duplex	
Use		Connection of the inverter to an EtherCAT network	
Connection system		RJ45	
Status display		2 LEDs	
Connection designation		IN: X246 OUT: X247	

LED "RUN"

Blinking pattern	State	Meaning
off	OFF	No supply voltage.
	Initialisation (Init)	Network not active No data transfer
Blinking 1:1	Pre-Operational (Pre-Op)	Access possible No process data transfer
Blinking slowly 3:1	Safe-Operational (Safe-Op)	States of the safe inputs are readable.
on	Operational (Op)	Data transfer in action

Basic network settings

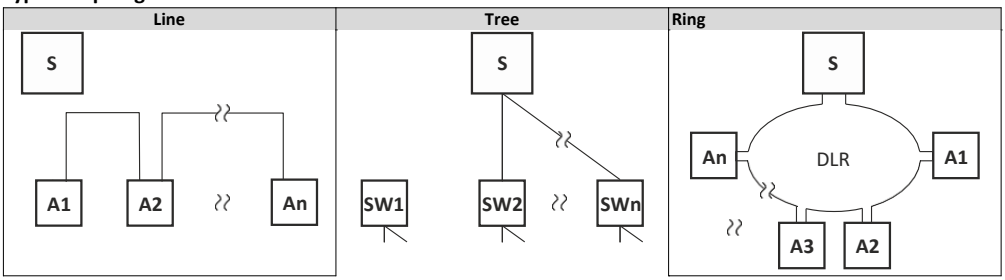
The rotary encoder switch allows you to set an EtherCAT identifier.



Setting	Identifier
0x00	Value from parameter
0x01 ... 0xFF	Switch position

EtherNet/IP

Typical topologies



S Scanner
A Adapter
SW Switch

Bus-related information			
Name		EtherNet/IP	
Communication medium		Ethernet 10 Mbps, 100 Mbps, half duplex, full duplex	
Use		Connection of the inverter to an EtherNet/IP network	
Connection system		RJ45	
Status display		2 LEDs	
Connection designation		IN: X266 OUT: X267	

Status displays at the RJ45 sockets

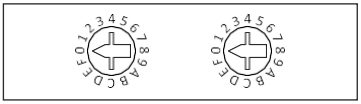
The LEDs at the RJ45 sockets indicate the connection status to the network:

LED "Link" (green)	Status/meaning
off	No connection to the network.
on	A physical connection to the network is available.

LED "Activity" (yellow)	Status/meaning
off	No data transfer.
on or flickers	Data is exchanged via the network.

Basic network settings

The rotary encoder switch allows you to set the last byte of the IP address.

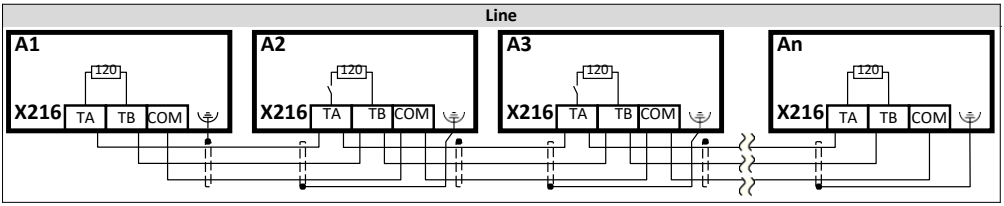


Setting	Value of last byte	Resulting IP address
0x00	Value from parameter	Value from parameter
0x01 ... 0xFE	Switch position	192.168.124.<switch position>
0xFF	Default setting	192.168.124.16

Modbus RTU

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.

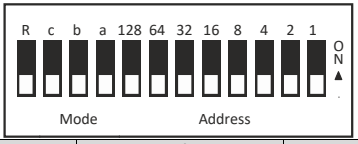
Typical topologies



Connection description		Modbus RTU
Connection		X216
Connection type		pluggable double spring terminal
Max. cable cross-section	mm²	2.5
Max. cable cross-section	AWG	12
Stripping length	mm	10
Stripping length	inch	0.39
Tightening torque	Nm	-
Tightening torque	lb-in	-
Required tool		0.4 x 2.5

Basic network settings

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

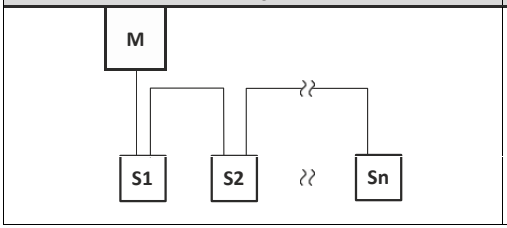
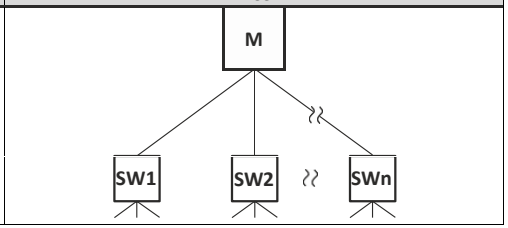


Bus termination		Baud rate	Parity	Modbus node address							
R	c	b	a	128	64	32	16	8	4	2	1
OFF	n. c.	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
Inactive		Automatic detection	Automatic detection	Value from parameter							
ON		ON	ON	Node address - example:							
Active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

Bold print = default setting

Modbus TCP

Typical topologies

Line	Tree
	

M Master
S Slave

SW Switch

Bus-related information			
Name		Modbus TCP	
Communication medium		Ethernet 10 Mbps, 100 Mbps, half duplex, full duplex	
Use		Connection of the inverter to a Modbus TCP network	
Connection system		RJ45	
Status display		2 LEDs	
Connection designation		Port 1: X276 Port 2: X277	

Status displays at the RJ45 sockets

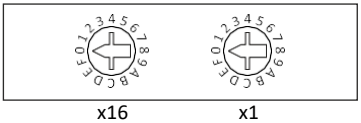
The LEDs at the RJ45 sockets indicate the connection status to the network:

LED "Link" (green)	Status/meaning
off	No connection to the network.
on	A physical connection to the network is available.

LED "Activity" (yellow)	Status/meaning
off	No data transfer.
on or flickers	Data is exchanged via the network.

Basic network settings

The rotary encoder switch allows you to set the last byte of the IP address.



x16 x1

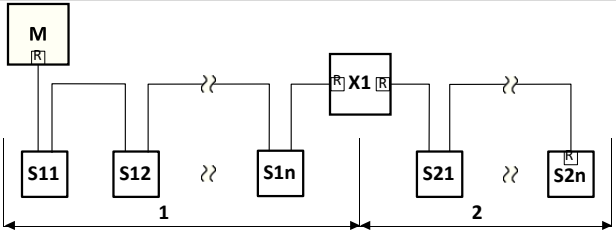
Setting	Value of last byte	Resulting IP address
0x00	Value from parameter	Value from parameter
0x01 ... 0xFE	Switch position	192.168.124.<switch position>
0xFF	Default setting	192.168.124.16

PROFIBUS

The network must be terminated with a resistor at the physically first and last node.
Activate the bus terminating resistor at these nodes in the bus connection plug.

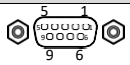
Typical topologies

Line with repeater



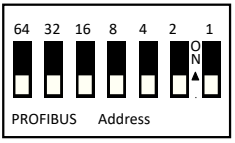
M	Master	X	Repeater
S	Slave	R	Activated bus terminating resistor

Sub D socket 9-pin - X226

View	Pin	Assignment	Description
	1	Shield	Additional shield connection
	2	n.c.	
	3	RxD/TxD-P	Data line-B (received data/transmitted data +)
	4	RTS	Request To Send (received data/transmitted data, no differential signal)
	5	M5V2	Reference potential (bus terminating resistor -)
	6	P5V2	5 V DC / 30 mA (bus terminating resistor +, OLM, OLP)
	7	n.c.	
	8	RxD/TxD-N	Data line-A (received data/transmitted data -)
	9	n.c.	

Basic network settings

Use the DIP switch to set the station address.
The baud rate is detected automatically.

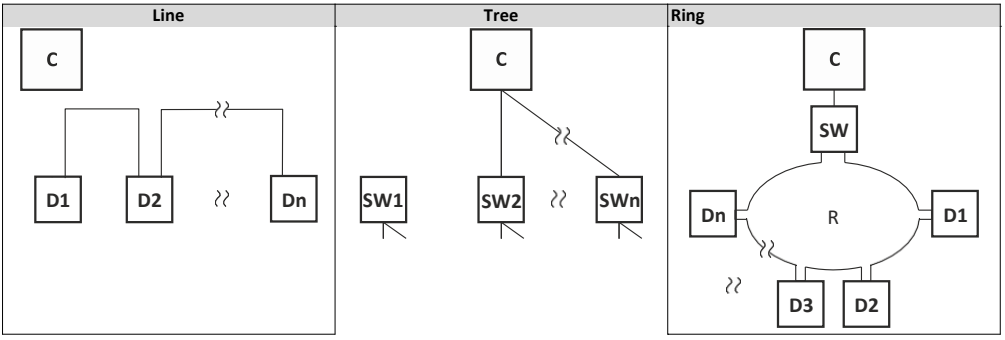


PROFIBUS station address						
64	**32**	**16**	**8**	**4**	**2**	**1**
OFF	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
Value from parameter						
Station address - example:						
OFF	OFF	ON	OFF	ON	ON	ON
Station address = 16 + 4 + 2 + 1 = 23						
Do not set station address = 126 and station address = 127. These station addresses are invalid.						

Bold print = default setting

PROFINET

Typical topologies



C	IO controller	SW	Switch SCALANCE (MRP capable)
D	IO device	R	Redundant domain

Bus-related information			
Name		PROFINET RT	
Communication medium		Ethernet 100 Mbps, full duplex	
Use		Connection as PROFINET IO Device	
Connection system		RJ45	
Status display		2 LEDs	
Connection designation		X256 X257	

Status displays at the RJ45 sockets

The LEDs at the RJ45 sockets indicate the connection status to the network:

LED "Link" (green)	Status/meaning
off	No connection to the network.
on	A physical connection to the network is available.

LED "Activity" (yellow)	Status/meaning
off	No data transfer.
on or flickers	Data is exchanged via the network.

LED "BUS RDY" (green)

Blinking	State	Meaning
Off	Not connected	No connection to the IO-Controller
Blinking	Connected	IO-Controller in STOP
On	Data exchange	IO-Controller in RUN (DATA_EXCHANGE)

LED "BUS ERR" (red)

Blinking	State	Meaning
Off	No fault	No fault
flickers	IO-Device identifies (localises)	The PROFINET function "node flashing test" is triggered by IO-Controller. The flickering LED serves to identify (locate) an accessible IO-Device.
Blinking	Impermissible settings	Impermissible settings: Stack, station name or IP parameters are invalid.
On	Fault	Communication error (e. g. Ethernet cable removed)

The rotary encoder switch has no function.

Functional safety

DANGER !

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

Possible consequence: Death or severe injuries

- ► Safety engineering systems may only be installed and commissioned by qualified personnel.
- ► All control components (switch, relay, PLC, ...) must comply with the requirements of EN ISO 13849−1 and the EN ISO 13849−2.
- ► Switches, relays with at least IP54 enclosure.
- ► Control cabinet with at least IP54 enclosure.
- ► The wiring must be shielded.
- ► 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!
- ► For safety-related braking functions, use safety-rated brakes only.
- ► 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 !

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

Excessively high humidity or condensation

Malfunction or destruction of the safety component

- ► Only commission the safety component when it has acclimatised.

NOTICE

Overvoltage

Destruction of the safety component

- ► Make sure that the maximum voltage (maximum rated) at the supply terminals X5 and X82 30 V DC does not exceed 30 V DC.

Basic Safety - STO

DANGER !

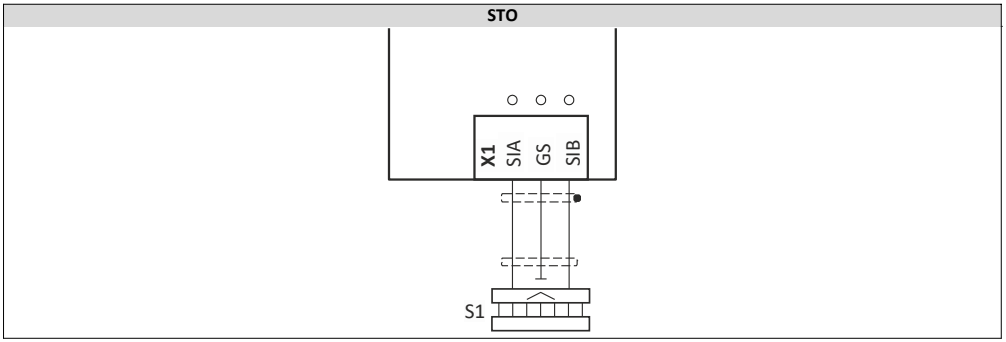
With the "Safe torque off" (STO) function, no “emergency-stop" can be executed according to EN 60204−1 without additional measures. There is no electrical isolation between the motor and inverter and no service switch or maintenance switch!

Possible consequences: Death or severe injuries

► "Emergency stop" requires electrical isolation, e. g. via a central mains contactor.

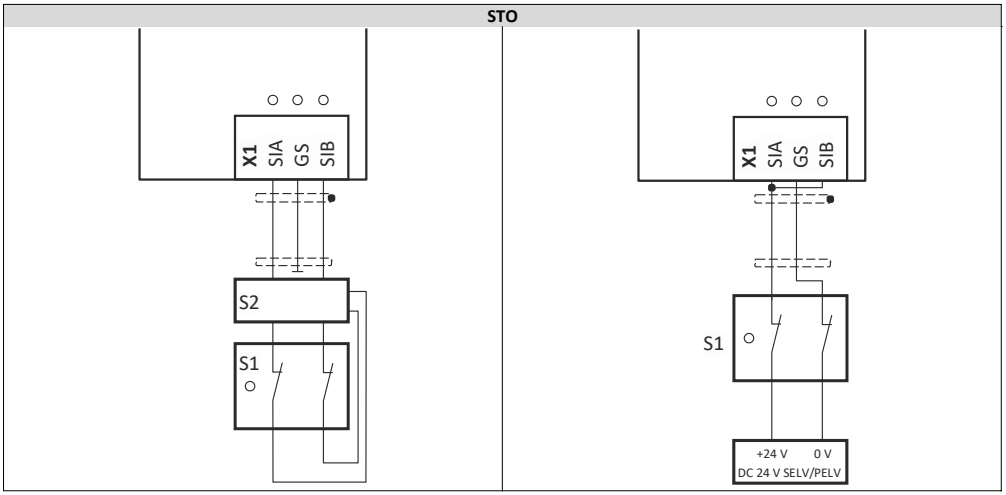
Connection diagram

Active sensors



S1 Active sensor - example of lightgrid

Passive sensors



S1 Passive sensor
S2 Safety switching device

S1 Passive sensor

Terminal data

X1	Specification	Unit	min.	typ.	max.
SIA, SIB	LOW signal	V	-3	0	+5
	HIGH signal	V	+15	+24	+30
	Running time	ms		3	
	Clear time	ms		50	60
	Input current SIA	mA		10	14
	Input current SIB	mA		7	12
	Input peak current	mA		100	
	Test pulse duration	ms			1
	Test pulse interval	ms	10		
GS	Reference potential for SIA and SIB				

Connection description		Basic Safety - STO
Connection		X1
Connection type		pluggable double spring terminal
Max. cable cross-section	mm^2	1.5
Max. cable cross-section	AWG	16
Stripping length	mm	9
Stripping length	inch	0.35
Tightening torque	Nm	-
Tightening torque	lb-in	-
Required tool		0.4 x 2.5

Commissioning

The purpose of commissioning is to adapt the inverter as part of a machine with a variable-speed drive system to its drive task.

Important notes

DANGER !

Incorrect wiring can cause unexpected states during the commissioning phase.
Possible consequences: death, severe injuries or damage to property
Ensure the following before switching on the mains voltage:

- ► Wiring must be complete and correct.
- ► Wiring must be free of short circuits and earth faults.
- ► The motor circuit configuration (star/delta) must be adapted to the inverter output voltage.
- ► The motor must be connected in-phase (direction of rotation).
- ► The "emergency off" function of the overall system must operate correctly.

Initial switch-on and functional test

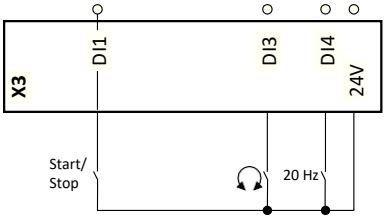
Target: achieve rotation of the motor connected to the inverter as quickly as possible.

Requirements:

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

1. Preparation

1. Wire power terminals.
2. Wire digital inputs X3/DI1 (start/stop), X3/DI3 (reversal) and X3/DI4 (frequency preset 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

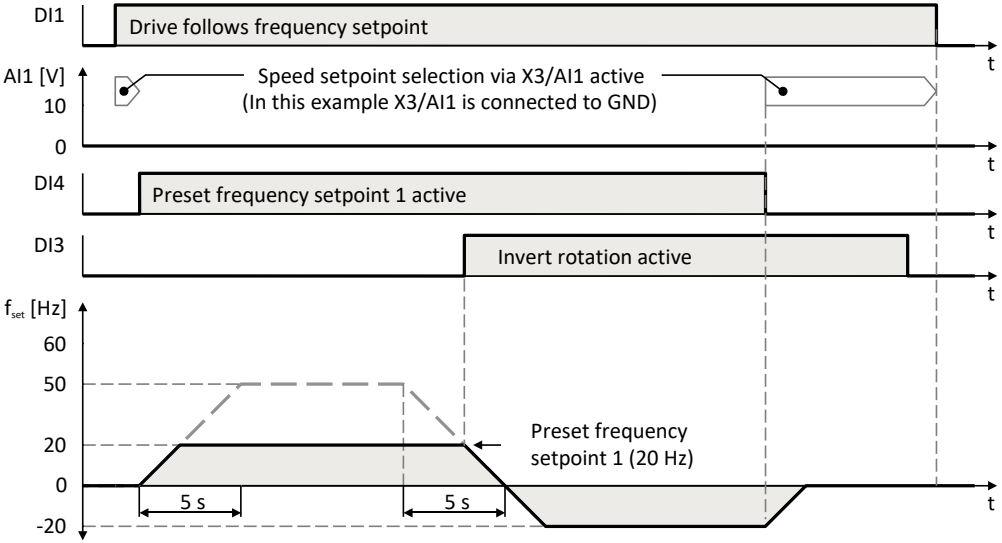
"RDY" LED (blue)	"ERR" LED (red)	Status/meaning	
off	off	No supply voltage.	
blinking (1 Hz)	off	Safe torque off (STO) active.	
	blinking fast (4 Hz)	Safe torque off (STO) active. Warning active.	
blinking (2 Hz)	off	Inverter inhibited.	
	lit every 1.5 s for a short time	Inverter inhibited, no DC-bus voltage.	
	blinking fast (4 Hz)	Inverter inhibited, warning active.	
	on	Inverter inhibited, fault active.	
on	off	Inverter enabled.	The motor rotates according to the setpoint specified or quick stop active.
	blinking fast (4 Hz)	Inverter enabled, warning active.	
	blinking (1 Hz)	Inverter enabled, quick stop as response to a fault active.	

Carry out a functional test

1. Start drive

1. Start inverter: X3/DI1 = HIGH.
   a) If the inverter is equipped with an integrated safety system: X1/SIA = HIGH and X1/SIB = HIGH.
2. Activate frequency preset 1 (20 Hz) as speed setpoint: X3/DI4 = HIGH.
   The drive rotates with 20 Hz.
3. Optional: Activate reversal.
   a) X3/DI3 = HIGH.
   The drive rotates with 20 Hz in the opposite direction.
   b) Now deactivate reversal: X3/DI3 = LOW.

Speed characteristic (example)



2. Stop drive

1. Now deactivate frequency preset 1: X3/DI4 = LOW.
2. Now stop inverter: X3/DI1 = LOW.

The functional test is completed.

Technical data

Standards and operating conditions

Conformities/approvals

Conformity		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
EAC	TR CU 004/2011	Eurasian conformity: safety of low voltage equipment
	TR CU 020/2011	Eurasian conformity: electromagnetic compatibility of technical means
RoHS	2011/65/EU	Restrictions on the use of certain hazardous substances in electrical and electronic devices

Protection of persons and device protection

Degree of protection		
IP20	EN 60529	Data applies for operationally ready mounted state and not in wire range of terminals
Insulation resistance		
Overvoltage category III	EN 61800-5-1	0 … 2000 m amsl
Overvoltage category II	EN 61800-5-1	over 2000 m amsl
Isolation of control circuits		
Safe mains isolation via double/reinforced insulation	EN 61800-5-1	
Leakage current		
> 3.5 mA AC, > 10 mA DC	EN 61800-5-1	Please observe regulations and safety instructions!
Starting current		
≤ 3 x rated mains current		
Protective measures against		
Short circuit		
Earth fault		Earth-fault protected depending on operating status
Overtemperature of motor		PTC or thermal contact, I^2xt monitoring
Overvoltage		
Motor stalling		

EMC data

Noise emission		
Category C1	EN 61800-3	See rated data
Category C2	EN 61800-3	See rated data
Category C3	EN 61800-3	See rated data
Noise immunity		
Fulfills requirements according to	EN 61800-3	
Operation on public supply systems		
Take measures to limit the expected radio interference:		The machine or system manufacturer is responsible for compliance with the requirements for the machine/system!
< 1 kW: With mains choke > 1 kW for mains current ≤ 16 A: Without additional measures	EN 61000-3-2	
Mains current > 16 A: with mains choke or mains filter, with dimensioning for rated power.	EN 61000-3-12	

Motor connection

Requirements for the shielded motor cable		
Capacitance per unit length		
C-core-core/C-core-shielding < 75/150 pF/m		≤ 2.5 mm² / AWG 14
C-core-core/C-core-shielding < 150/300 pF/m		≥ 4 mm² / AWG 12
Electric strength		
Uo/U = 0.6/1.0 kV		Uo = r.m.s. value external conductor to PE
		U = r.m.s. value from external conductor to external conductor

Environmental conditions

Energy efficiency		
Class IE2	EN 50598-2	
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 amsl		
1000 ... 4000 m amsl		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	In original packaging
Operation		
Amplitude 1 mm	Germanischer Lloyd	5 ... 13.2 Hz
Acceleration resistant up to 0.7 g		13.2 ... 100 Hz
		up to 11 kW
Amplitude 0.075 mm	EN 61800-5-1	10 ... 57 Hz
Acceleration resistant up to 1 g		57 ... 150 Hz

Electrical supply conditions

Permissible power systems		
TT		Voltage to earth: max. 300 V
TN		Voltage to earth: max. 300 V
IT		Please employ the measures described for IT systems!

Overcurrent operation

The inverters can be driven at higher amperages beyond the rated current if the duration of this overcurrent operation is time limited.

Two utilization cycles of 15 s and 180 s are defined. Within these utilization cycles, an overcurrent is possible for a certain time if afterwards an accordingly long recovery phase takes place.

Cycle 15 s

During this operation, the inverter may be loaded for 3 s with up to 200 % of the rated current if afterwards a recovery time of 12 s with max. 75 % of the rated current is observed. A cycle corresponds to 15 s.

Cycle 180 s

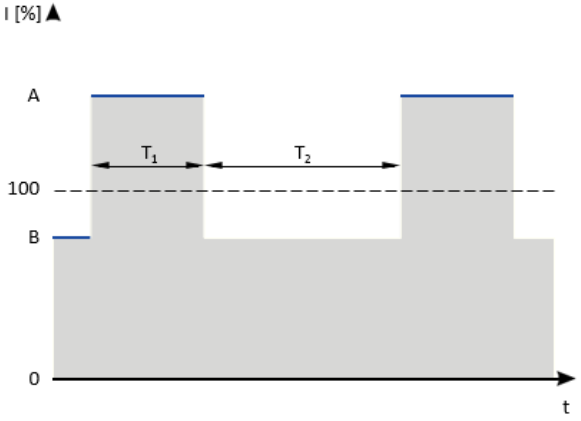
During this operation, the inverter may be loaded for 60 s with up to 150 % of the rated current if afterwards a recovery time of 120 s with max. 75 % of the rated current is observed. A cycle corresponds to 180 s.

The monitoring of the device utilization (Ixt) causes the set error response if one of the two utilization values exceeds the threshold of 100 %.

The maximum output currents correspond to the switching frequencies and the overload behavior of the inverters are given in the rated data.

In case of rotating frequencies < 10 Hz, the time-related overload behavior may be reduced.

The graphics shows a cycle. The basic conditions given in the table (graphics field highlighted in grey) have to be complied with in order that the inverter will not be overloaded. Both cycles can be combined with each other.



	Max. output current	Max. overload time	Max. output current during the recovery time	Min. recovery time
	A	T_1	B	T_2
	%	s	%	s
Cycle 15 s	200	3	75	12
Cycle 180 s	150	60	75	120

Inverter load characteristics

The inverter has two different load characteristics: "Light Duty" and "Heavy Duty". The "Light Duty" load characteristic allows for a higher output current with restrictions regarding overload capacity, ambient temperature and switching frequency. This allows the motor required for the application to be driven by a less powerful inverter. Select the load characteristic according to the application.

Heavy Duty compared to Light Duty

This table compares the two load characteristics:

	Heavy Duty	Light Duty
Characteristics	High dynamic requirements	Low dynamic requirements
Typical applications	Main tool drives, travelling drives, hoist drives, winders, forming drives and conveyors	Pumps, fans, general horizontal materials handling technology and line drives
Overload capacity	3 s/200 %, 60 s/150 % See technical data	Restricted See technical data

3-phase mains connection 400 V "Heavy Duty"

Rated data

The output currents apply to these operating conditions:
- At a switching frequency of 2 kHz or 4 kHz: Max. ambient temperature 45°C.
- At a switching frequency of 8 kHz or 16 kHz: Max. ambient temperature 40 °C.

Inverter		SINUS S 0001 4T	SINUS S 0002 4T	SINUS S 0003 4T	SINUS S 0005 4T
Rated power	**kW**	**0.37**	**0.75**	**1.5**	**2.2**
Rated power	**hp**	**0.5**	**1**	**2**	**3**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz			
Output voltage		3 AC 0-400/480 V			
Rated mains current					
Without mains choke	A	1.8	3.3	5.4	7.8
With mains choke	A	1.4	2.6	3.7	5.3
Apparent output power	kVA	0.9	1.6	2.6	3.8
Rated output current					
2 kHz	A	-	2.4	3.9	5.6
4 kHz	A	1.3	2.4	3.9	5.6
8 kHz	A	1.3	2.4	3.9	5.6
16 kHz	A	0.9	1.6	2.6	3.7
Power loss					
2 kHz	W	-	30	45	62
4 kHz	W	20	32	48	66
8 kHz	W	24	40	61	85
16 kHz	W	24	40	61	85
For controller inhibit	W	6	6	6	6
Cyclic mains switching		3 times per minute			
Max. motor cable length shielded					
Without EMC category	m	15	50	50	50
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	3	3	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	15	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	15	20	35	35
Weight	kg	0.8	1	1.35	1.35
Weight	lb	1.8	2.2	3	3

Inverter		SINUS S 0006 4T	SINUS S 0007 4T	SINUS S 0011 4T	SINUS S 0014 4T	SINUS S 0017 4T
Rated power	**kW**	**3**	**4**	**5.5**	**7.5**	**11**
Rated power	**hp**	**4**	**5**	**7.5**	**10**	**15**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz				
Output voltage		3 AC 0-400/480 V				
Rated mains current						
Without mains choke	A	9.6	12.5	17.2	20	28.4
With mains choke	A	6.9	9	12.4	15.7	22.3
Apparent output power	kVA	4.9	6.4	8.7	11	16
Rated output current						
2 kHz	A	7.3	9.5	13	16.5	23.5
4 kHz	A	7.3	9.5	13	16.5	23.5
8 kHz	A	7.3	9.5	13	16.5	23.5
16 kHz	A	4.9	6.3	8.7	11	15.7
Power loss						
2 kHz	W	79	102	137	172	242
4 kHz	W	85	110	145	185	260
8 kHz	W	110	140	190	240	340
16 kHz	W	109	140	189	238	337
For controller inhibit	W	6	6	6	6	6
Cyclic mains switching		3 times per minute				
Max. motor cable length shielded						
Without EMC category	m	50	50	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	50	50
Weight	kg	1.35	1.35	2.3	3.7	3.7
Weight	lb	3	3	5	8	8

Inverter		SINUS S 0020 4T	SINUS S 0025 4T	SINUS S 0030 4T	SINUS S 0034 4T
Rated power	**kW**	**15**	**18.5**	**22**	**30**
Rated power	**hp**	**20**	**25**	**30**	**40**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz			
Output voltage		3 AC 0-400/480 V			
Rated mains current					
Without mains choke	A	38.7	48.4	-	-
With mains choke	A	28.8	36	42	54.9
Apparent output power	kVA	22	27	32	41
Rated output current					
2 kHz	A	32	40	47	61
4 kHz	A	32	40	47	61
8 kHz	A	32	40	47	61
16 kHz	A	21.3	26.6	31.3	40.6
Power loss					
2 kHz	W	340	420	491	639
4 kHz	W	360	450	520	680
8 kHz	W	460	570	670	880
16 kHz	W	469	581	680	884
For controller inhibit	W	18	18	18	25
Cyclic mains switching		3 times per minute			
Max. motor cable length shielded					
Without EMC category	m	100	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	35
Weight	kg	10.3	10.3	10.3	17.2
Weight	lb	23	23	23	38

3-phase mains connection 400 V "Light Duty"

Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Ambient temperature above 40 °C with a rated output current reduced by 2.5 %/°C.
- If the load characteristic "Light Duty" and the switching frequencies 8 kHz or 16 kHz are selected, only the values of the load characteristic "Heavy Duty" are reached.

Inverter		**SINUS S 0006 4T**	**SINUS S 0007 4T**	**SINUS S 0011 4T**	**SINUS S 0014 4T**	**SINUS S 0017 4T**
Rated power	**kW**	**4**	**5.5**	**7.5**	**11**	**15**
Rated power	**hp**	**5**	**7.5**	**10**	**15**	**20**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz				
Output voltage		3 AC 0-400/480 V				
Rated mains current						
Without mains choke	A	10.3	14	18.3	28	-
With mains choke	A	8.2	11	14.5	22	27.1
Apparent output power	kVA	5.9	8	10.5	15	19
Rated output current						
2 kHz	A	8.8	11.9	15.6	23	28.2
4 kHz	A	8.8	11.9	15.6	23	28.2
8 kHz	A	-	-	-	-	-
16 kHz	A	-	-	-	-	-
Power loss						
2 kHz	W	94	125	163	238	290
4 kHz	W	100	133	173	253	309
8 kHz	W	-	-	-	-	-
16 kHz	W	-	-	-	-	-
For controller inhibit	W	6	6	6	6	6
Cyclic mains switching		3 times per minute				
Max. motor cable length shielded						
Without EMC category	m	50	50	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	50	50
Weight	kg	1.35	1.35	2.3	3.7	3.7
Weight	lb	3	3	5	8	8

Technical data

3-phase mains connection 400 V "Light Duty"

Rated data

Inverter		SINUS S 0020 4T	SINUS S 0025 4T	SINUS S 0030 4T	SINUS S 0034 4T
Rated power	**kW**	**18.5**	**22**	**30**	**37**
Rated power	**hp**	**25**	**30**	**40**	**50**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz			
Output voltage		3 AC 0-400/480 V			
Rated mains current					
Without mains choke	A	48	-	-	-
With mains choke	A	36	43	55	69
Apparent output power	kVA	26	32	38	49
Rated output current					
2 kHz	A	38.4	48	56.4	73.2
4 kHz	A	38.4	48	56.4	73.2
8 kHz	A	-	-	-	-
16 kHz	A	-	-	-	-
Power loss					
2 kHz	W	404	501	585	761
4 kHz	W	430	533	623	810
8 kHz	W	-	-	-	-
16 kHz	W	-	-	-	-
For controller inhibit	W	18	18	18	25
Cyclic mains switching		3 times per minute			
Max. motor cable length shielded					
Without EMC category	m	100	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	35
Weight	kg	10.3	10.3	10.3	17.2
Weight	lb	23	23	23	38

3-phase mains connection 480 V “Heavy Duty”

Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Max. ambient temperature 45°C.
- At a switching frequency of 8 kHz or 16 kHz: Max. ambient temperature 40 °C.

Inverter		**SINUS S 0001 4T**	**SINUS S 0002 4T**	**SINUS S 0003 4T**	**SINUS S 0005 4T**
Rated power	**kW**	**0.37**	**0.75**	**1.5**	**2.2**
Rated power	**hp**	**0.5**	**1**	**2**	**3**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz			
Output voltage		3 AC 0-400/480 V			
Rated mains current					
Without mains choke	A	1.5	2.8	4.5	6.5
With mains choke	A	1.2	2.2	3.1	4.4
Apparent output power	kVA	0.9	1.6	2.6	3.8
Rated output current					
2 kHz	A	-	2.1	3.5	4.8
4 kHz	A	1.1	2.1	3.5	4.8
8 kHz	A	1.1	2.1	3.5	4.8
16 kHz	A	0.7	1.4	2.3	3.2
Power loss					
2 kHz	W	-	30	45	62
4 kHz	W	20	32	48	66
8 kHz	W	24	40	61	85
16 kHz	W	24	40	61	85
For controller inhibit	W	6	6	6	6
Cyclic mains switching		3 times per minute			
Max. motor cable length shielded					
Without EMC category	m	15	50	50	50
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	3	3	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	15	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	15	20	35	35
Weight	kg	0.8	1	1.35	1.35
Weight	lb	1.8	2.2	3	3

Inverter		SINUS S 0006 4T	SINUS S 0007 4T	SINUS S 0011 4T	SINUS S 0014 4T	SINUS S 0017 4T
Rated power	**kW**	**3**	**4**	**5.5**	**7.5**	**11**
Rated power	**hp**	**4**	**5**	**7.5**	**10**	**15**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz				
Output voltage		3 AC 0-400/480 V				
Rated mains current						
Without mains choke	A	8	10.5	14.3	16.6	23.7
With mains choke	A	5.8	7.5	10.3	13.1	18.6
Apparent output power	kVA	4.9	6.4	8.7	11	16
Rated output current						
2 kHz	A	6.3	8.2	11	14	21
4 kHz	A	6.3	8.2	11	14	21
8 kHz	A	6.3	8.2	11	14	21
16 kHz	A	4.2	5.5	7.3	9.3	14
Power loss						
2 kHz	W	79	102	137	172	242
4 kHz	W	85	110	145	185	260
8 kHz	W	110	140	190	240	340
16 kHz	W	109	140	189	238	337
For controller inhibit	W	6	6	6	6	6
Cyclic mains switching		3 times per minute				
Max. motor cable length shielded						
Without EMC category	m	100	100	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	50	50
Weight	kg	2.3	2.3	2.3	3.7	3.7
Weight	lb	5	5	5	8	8

Inverter		SINUS S 0020 4T	SINUS S 0025 4T	SINUS S 0030 4T	SINUS S 0034 4T
Rated power	**kW**	**15**	**18.5**	**22**	**30**
Rated power	**hp**	**20**	**25**	**30**	**40**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz			
Output voltage		3 AC 0-400/480 V			
Rated mains current					
Without mains choke	A	32.3	40.3	47.4	-
With mains choke	A	24	30	35.3	45.7
Apparent output power	kVA	22	27	32	41
Rated output current					
2 kHz	A	27	34	40.4	52
4 kHz	A	27	34	40.4	52
8 kHz	A	27	34	40.4	52
16 kHz	A	18	22.6	26.9	34.6
Power loss					
2 kHz	W	340	420	491	639
4 kHz	W	360	450	520	680
8 kHz	W	460	570	670	880
16 kHz	W	469	581	680	884
For controller inhibit	W	18	18	18	25
Cyclic mains switching		3 times per minute			
Max. motor cable length shielded					
Without EMC category	m	100	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	35
Weight	kg	10.3	10.3	10.3	17.2
Weight	lb	23	23	23	38

3-phase mains connection 480 V "Light Duty"

Rated data

The output currents apply to these operating conditions:

- At a switching frequency of 2 kHz or 4 kHz: Ambient temperature above 40 °C with a rated output current reduced by 2.5 %/°C.
- If the load characteristic "Light Duty" and the switching frequencies 8 kHz or 16 kHz are selected, only the values of the load characteristic "Heavy Duty" are reached.

Inverter		**SINUS S 0006 4T**	**SINUS S 0007 4T**	**SINUS S 0011 4T**	**SINUS S 0014 4T**	**SINUS S 0017 4T**
Rated power	**kW**	**4**	**5.5**	**7.5**	**11**	**15**
Rated power	**hp**	**5**	**7.5**	**10**	**15**	**20**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz				
Output voltage		3 AC 0-400/480 V				
Rated mains current						
Without mains choke	A	8.6	11.2	15.3	22	-
With mains choke	A	6.8	8.8	12.1	17.2	22.6
Apparent output power	kVA	5.9	8	10.5	15	19
Rated output current						
2 kHz	A	7.6	9.8	13.2	18.3	25.2
4 kHz	A	7.6	9.8	13.2	18.3	25.2
8 kHz	A	-	-	-	-	-
16 kHz	A	-	-	-	-	-
Power loss						
2 kHz	W	94	125	163	238	290
4 kHz	W	100	133	173	253	309
8 kHz	W	-	-	-	-	-
16 kHz	W	-	-	-	-	-
For controller inhibit	W	6	6	6	6	6
Cyclic mains switching		3 times per minute				
Max. motor cable length shielded						
Without EMC category	m	100	100	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	50	50
Weight	kg	2.3	2.3	2.3	3.7	3.7
Weight	lb	5	5	5	8	8

Inverter		SINUS S 0020 4T	SINUS S 0025 4T	SINUS S 0030 4T	SINUS S 0034 4T
Rated power	**kW**	**18.5**	**22**	**30**	**37**
Rated power	**hp**	**25**	**30**	**40**	**50**
Mains voltage range		3/PE AC 340 V ... 528 V, 45 Hz ... 65 Hz			
Output voltage		3 AC 0-400/480 V			
Rated mains current					
Without mains choke	A	40	-	-	-
With mains choke	A	30	38	46	59
Apparent output power	kVA	26	32	38	49
Rated output current					
2 kHz	A	32.4	40.8	48.5	62.4
4 kHz	A	32.4	40.8	48.5	62.4
8 kHz	A	-	-	-	-
16 kHz	A	-	-	-	-
Power loss					
2 kHz	W	404	501	585	761
4 kHz	W	430	533	623	810
8 kHz	W	-	-	-	-
16 kHz	W	-	-	-	-
For controller inhibit	W	18	18	18	25
Cyclic mains switching		3 times per minute			
Max. motor cable length shielded					
Without EMC category	m	100	100	100	100
Category C1 (2 kHz, 4 kHz, 8 kHz)	m	-	-	-	-
Category C2 (2 kHz, 4 kHz, 8 kHz)	m	20	20	20	20
Category C3 (2 kHz, 4 kHz, 8 kHz)	m	35	35	35	35
Weight	kg	10.3	10.3	10.3	17.2
Weight	lb	23	23	23	38