

SINAMICS G110D

Inverter

Getting Started Guide · May 2009



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Getting Started

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Proper use of Siemens products

Note the following:

 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Manual Collection and On-line Document Support

SD Manual Collection and on-line documentation

SD Manual Collection

The SD Manual Collection is a complete collection of all Standard Drives documentation across the entire range of Standard Drives products, including Inverters, Motors and Geared-Motors. It is available to order as a DVD which runs in its own java-driven HTML interface.

The order number for the SD Manual Collection is:

6SL3298-0CA00-0MG0

On-line documentation

All Standard Drives documentation is available on-line at the following site:

<http://support.automation.siemens.com/ww/view/en/4000024>

All documents are available for download, including Operating Instructions and Parameter Lists.

Device description files (GSD)

The device description files (GSD) are used to integrated an Inverter into a higher level control device, for example, SIMATIC S7. Not all Inverters require GSD files. The required GSD files can be downloaded from the internet at the following site:

<http://support.automation.siemens.com/ww/view/en/23450835>

Warnings and Cautions

2.1 Warning and Cautions

General

 WARNING
<p>This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with the warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.</p> <p>Protection in case of direct contact by means of SELV / PELV is only permissible in areas with equipotential bonding and in dry indoor rooms. If these conditions are not fulfilled, other protective measures against electric shock must be applied e.g. protective insulation.</p> <p>Only suitably qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.</p> <p>As the earth leakage for this product can be greater than 3.5 mA a.c., a fixed earth connection is required and the minimum size of the protective earth conductor shall comply with the local safety regulations for high leakage current equipment.</p> <p>Due to the high inrush currents in the earth conductor, this product is not compatible with an RCD (also referred to as an ELCB or RCCB).</p>

<p>The power supply, DC and motor terminals, the brake and thermistor cables can carry dangerous voltages even if the inverter is inoperative. Wait at least five minutes to allow the unit to discharge after switching off the line supply before carrying out any installation work.</p> <p>It is strictly prohibited for any mains disconnection to be performed on the motor-side of the system; any disconnection of the mains must be performed on the mains-side of the Inverter.</p> <p>When connecting the line supply to the Inverter, make sure that the terminal case of the motor is closed.</p>

<p>During operation and for a short time after switching-off the Inverter, the surfaces of the Inverter can reach a high temperature.</p> <p>This equipment is capable of providing internal motor overload protection according to UL508C. Refer to P0610 and P0335, i²t is ON by default.</p> <p>When changing from the ON to OFF-state of an operation if an LED or other similar display</p>

is not lit or active; this does not indicate that the unit is switched-off or powered-down.

The inverter must always be grounded.

Isolate the line supply before making or changing connections to the unit.

Use of mobile radio devices (e.g. telephones, walky-talkies) with a transmission power > 1 W in the immediate vicinity of the devices (< 1.8 m) can interfere with the functioning of the equipment.

Do not disconnect power connections when the Inverter and motor are under load.

Ensure that the inverter is configured for the correct supply voltage. The inverter must not be connected to a higher voltage supply.



Static discharges on surfaces or interfaces that are not generally accessible (e.g. terminal or connector pins) can cause malfunctions or defects. Therefore, when working with inverters or inverter components, ESD protective measures should be observed.

Take particular notice of the general and regional installation and safety regulations regarding work on dangerous voltage installations (e.g. EN 50178) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

 **CAUTION**

Children and the general public must be prevented from accessing or approaching the equipment!

This equipment may only be used for the purpose specified by the manufacturer. Unauthorized modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the equipment can cause fires, electric shocks and injuries.

NOTICE

Keep this manual within easy reach of the equipment and make it available to all users.

Whenever measuring or testing has to be performed on live equipment, the regulations of Safety Code BGV A2 must be observed, in particular § 8 "Permissible Deviations when Working on Live Parts". Suitable electronic tools should be used.

Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Transport and storage

 **WARNING**

Correct transport, storage as well as careful operation and maintenance are essential for the proper and safe operation of the equipment.

 **CAUTION**

Protect the equipment against physical shocks and vibration during transport and storage. It is important that the equipment is protected from water (rainfall) and excessive temperatures.

Commissioning

 **WARNING**

Working on the equipment by unqualified personnel or failure to comply with warnings can result in severe personal injury or serious damage to material. Only suitably qualified personnel trained in the setup, installation, commissioning and operation of the product should carry out work on the equipment.

 **CAUTION**

Cable connection

The control cables must be laid separately from the power cables. Carry out the connections as shown in the installation section in this manual, to prevent inductive and capacitive interference from affecting the correct function of the system.

Operation

 WARNING
<p>The Inverter operate at high voltages.</p> <p>When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.</p> <p>Emergency Stop facilities according to EN 60204, IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Any disengagement of the Emergency Stop facility must not lead to an uncontrolled or an undefined restart of the equipment.</p> <p>Certain parameter settings may cause the Inverter to restart automatically after an input power failure, for example, the automatic restart function.</p> <p>Wherever faults occurring in the control equipment can lead to substantial material damage or even grievous bodily injury (that is, potentially dangerous faults), additional external precautions must be taken or facilities provided to ensure or enforce safe operation, even when a fault occurs (e.g. independent limit switches, mechanical interlocks, etc.).</p> <p>Motor parameters must be accurately configured for motor overload protection to operate correctly.</p> <p>This equipment is capable of providing internal motor overload protection according to UL508C.</p> <p>Only Inverters with fail-safe functions can be used as an "Emergency Stop Mechanism" (see EN 60204, section 9.2.5.4).</p>

Repair

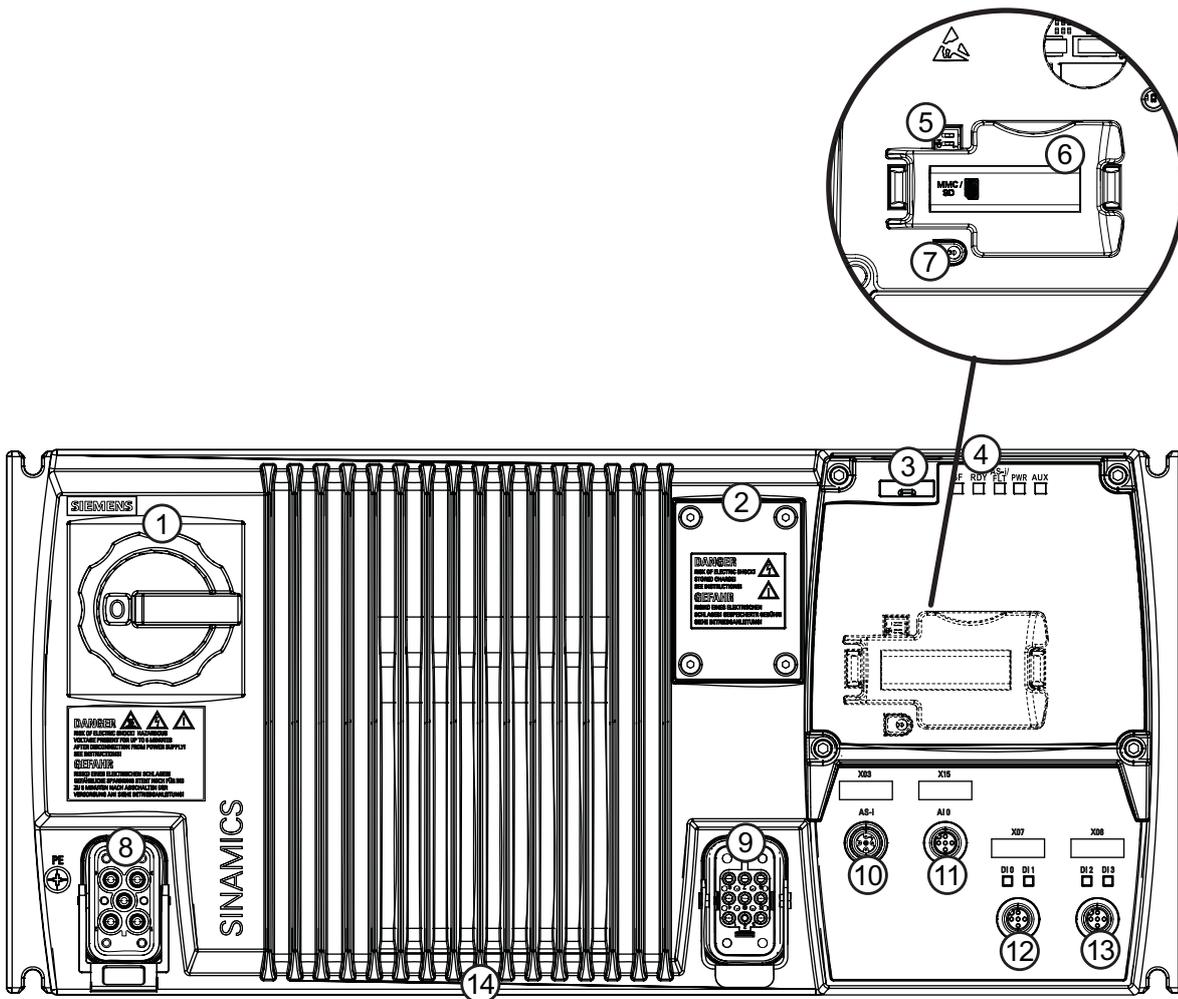
 WARNING
<p>Repairs on equipment may only be carried out by Siemens Service, by repair centers authorized by Siemens or by authorized personnel who are thoroughly acquainted with all the warnings and operating procedures contained in this manual.</p> <p>Any defective parts or components must be replaced using parts contained in the relevant spare parts list.</p> <p>Disconnect the power supply before opening the equipment for access.</p>

Dismantling and disposal

CAUTION
<p>The packaging of the Inverter is re-usable. Retain the packaging for future use.</p> <p>Easy-to-release screw and snap connectors allow you to break the unit down into its component parts. You can recycle these component parts, dispose of them in accordance with local requirements or return them to the manufacturer.</p>

Mechanical Installation

3.1 General layout of SINAMICS G110D



- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Repair switch 2. Braking resistor connection hatch 3. Optical PC connection 4. Status LEDs 5. Analog DIP-switches (underneath CU cover) 6. Optional MMC/SD card holder (underneath CU cover) 7. ASi device address port (underneath CU cover) | <ul style="list-style-type: none"> 8. Mains supply connection 9. Motor, brake and temperature sensor connection 10. AS-i input connection 11. Analog input (AI0) 12. Digital inputs (DI0 & DI1) 13. Digital inputs (DI2 & DI3) 14. Heatsink |
|--|--|

Figure 3-1 SINAMICS G110D Inverter

3.2 Removal of CU area cover and braking resistor connection hatch

Removal of CU area cover and braking resistor connection hatch

Should the CU area cover require to be removed, for example, to fit a Memory Card, it should be removed as shown in the diagram below. The braking resistor connection hatch is removed using the same technique.

<p>⚠ CAUTION</p> <p>Seals fitted correctly</p> <p>Should the CU area cover or the braking resistor connection hatch be removed from the Inverter, it is important to ensure that the seals around these areas are fitted properly when reassembling the Inverter to ensure the IP65 rating.</p> <p>TN and TT mains supplies</p> <p>The SINAMICS G110D Inverter with the Class A integrated mains filter is only suitable for operation on TN and TT mains supplies.</p>
--

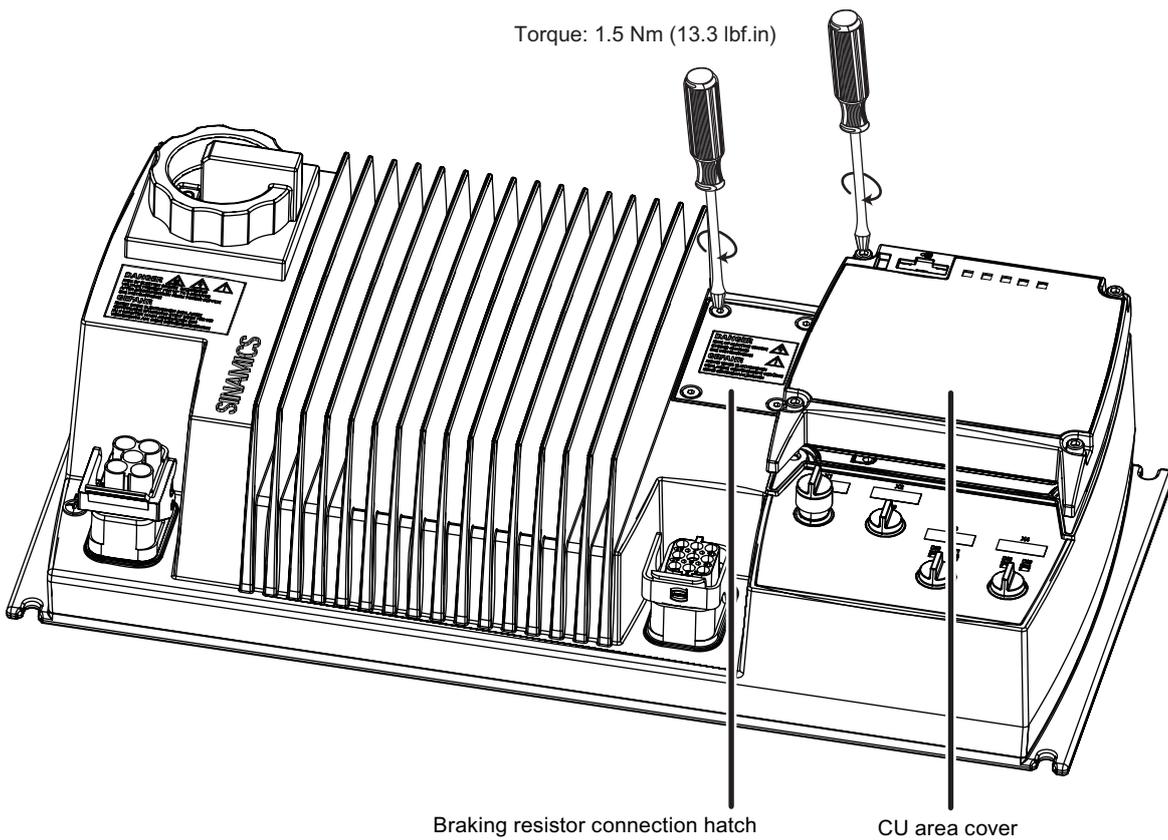


Figure 3-2 Removal of CU area cover and braking resistor connection hatch

3.3 Drill pattern for the SINAMICS G110D

Drill pattern for the SINAMICS G110D Inverter

The Inverter has an identical drill pattern for all frame sizes. The drill pattern, depth and tightening torques are shown in the diagram below.

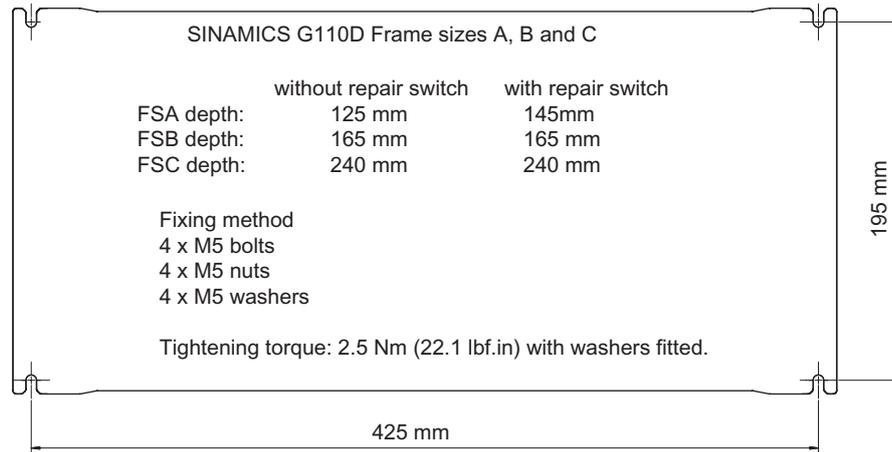


Figure 3-3 Drill pattern SINAMICS G110D

3.4 Mounting orientation

Correct mounting orientation of the Inverter

In the figure below the correct mounting orientation of the Inverter is shown.

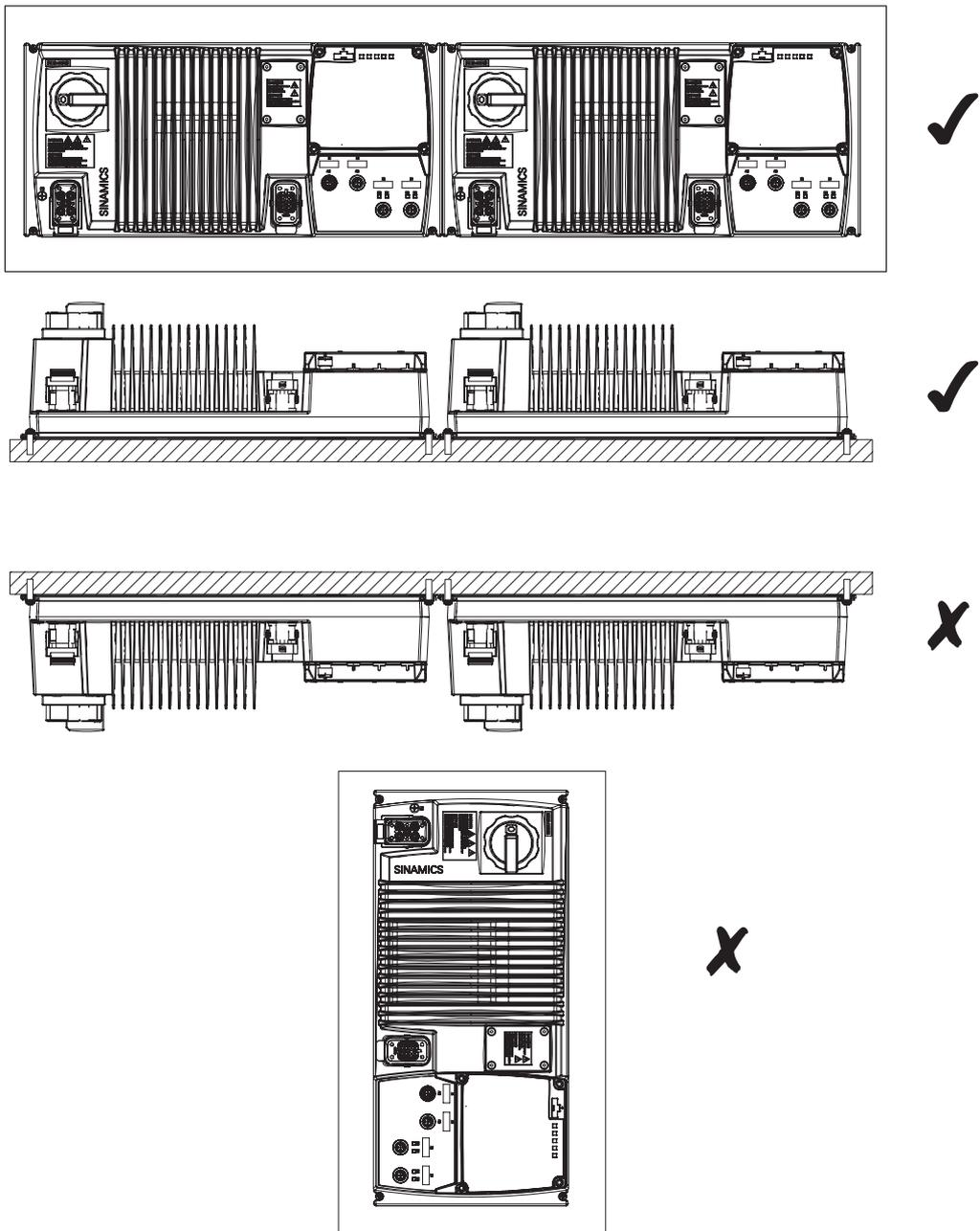


Figure 3-4 Correct Inverter orientation

3.5 Ambient operating conditions

Temperature

The operating temperature range is shown diagrammatically in the figure below:

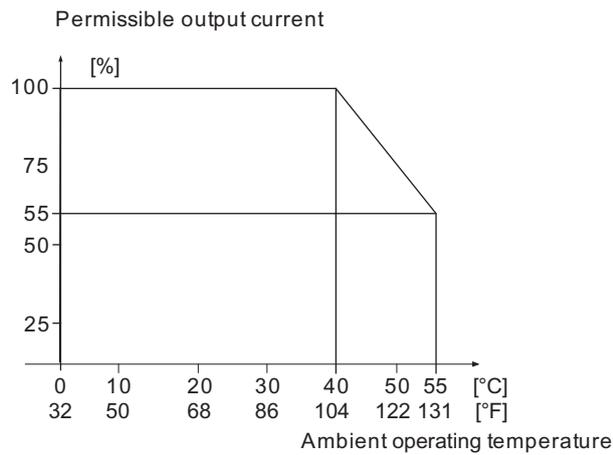


Figure 3-5 Power derating for temperature

Humidity range

Relative air humidity for the Inverter is $\leq 95\%$ non-condensing.

Altitude

If the Inverter is to be installed at an altitude $> 1000\text{ m}$ ($> 3280\text{ ft}$) derating will be required. The figures below show the derating required according to altitude.

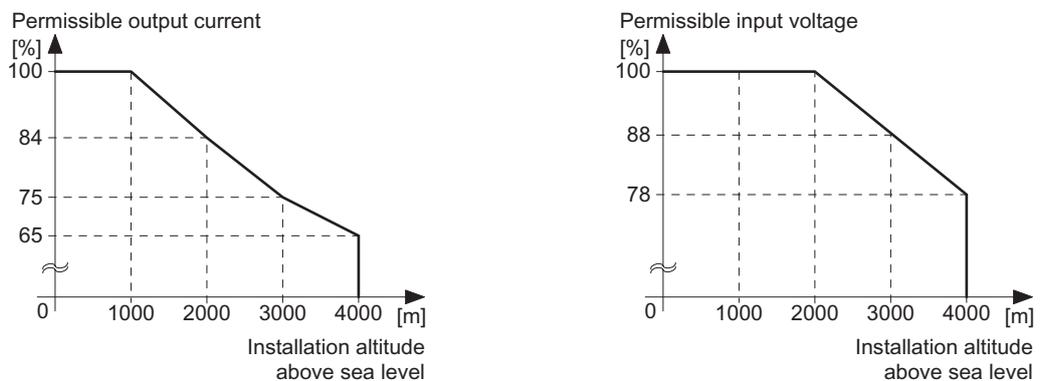


Figure 3-6 Derating for altitude

Shock and vibration

Do not drop the Inverter or expose to sudden shock. Do not install the Inverter in an area where it is likely to be exposed to constant vibration.

Electromagnetic radiation

Do not install the Inverter near sources of electromagnetic radiation.

Atmospheric pollution and water

When fully assembled the inverter has an IP65 rating. This means that the inverter is totally protected against dust and low pressure jets of water. Any unused connections should be covered with the correct sealing caps to ensure the IP65 rating.

Electrical Installation

4.1 SINAMICS G110D Specifications

SINAMICS G110D specifications

Table 4- 1 Rated Output, Input and Fuses

Product	Frame size	Rated output		HO		Fuse	Circuit breakers	
		kW	hp	Rated output current	Rated input current		3NA3...	Order Number
6SL3511-...								
0PE17-5AM0	A	0.75	1	2.3	2.0	10	803	3RV1021-1FA10
							-	
0PE21-5AM0	A	1.5	1.5	4.3	3.9	10	803	3RV1021-1JA10
							-	
0PE23-0AM0	A	3	4	7.7	7.0	16	805	3RV1021-4AA10
							-	
0PE24-0AM0	B	4	5	10.2	9.1	20	807	3RV1021-4BA10
							-	
0PE25-5AM0	C	5.5	7.5	13.2	12.2	20	807	3RV1031-4EA10
							-	
0PE27-5AM0	C	7.5	10	19	17.9	32	812	3RV1031-4FA10
							-	

For further technical information, please refer to the Operating Instructions.

Group fusing

Group fusing is where one circuit breaker or fuse is intended to provide protection for two or more devices. The protection device is called a branch circuit protection (BCP) device.

For more information, please read the following FAQ:

<http://support.automation.siemens.com/WW/view/en/35935349>

For additional information please see the following FAQs:

<http://support.automation.siemens.com/WW/view/en/14399444>

<http://support.automation.siemens.com/WW/view/en/23995621>

4.2 Cables and connections

Connections and cables

 WARNING
Switches and contactors Under no circumstances shall any kind of switch or contactor be placed in the circuits between the Inverter and the motor. For maintenance, ensure that the motor cable is unplugged at the Inverter.
Temperature sensor and brake module connections The temperature sensor and brake module connections are at DC link negative potential. Appropriate precautions against touching these connections and appropriate insulation on the cables must be used. The motor terminal box must be kept closed whenever the mains is applied to the Inverter. Cables that are not used should be individually insulated and not earthed.

The following block diagram and tables describe the details and limitations of the connections of the inverter.

Cable lengths

All inverters will operate at full specification with motor cable lengths as follows:

- Screened - 15 m (49 ft)
- Unscreened - 30 m (98 ft)

Note

Brake voltage 180VDC (400VAC with rectifier)

The brake output of the Inverter is designed to be connected directly to the coil of the brake within the motor, that is, no rectifier module is required within the motor. For operation of the Inverter on a 400VAC supply the brake should be rated for approximately 180VDC (400VAC with rectifier). The brake voltage is dependent on the mains supply voltage (brake voltage = mains voltage x 0.45).

The UL approved current rating for the brake output is 600mA.

The maximum current rating for the brake output without UL is 1A.

Brake voltage 205VDC (230VAC with rectifier)

The brake output of the Inverter is designed to be connected directly to the coil of the brake within the motor, that is, no rectifier module is required within the motor. For operation of the Inverter on a 400VAC supply the brake should be rated for approximately 205VDC (230VAC with rectifier). The brake voltage is dependent on the mains supply voltage (brake voltage = mains voltage x 0.9).

The UL approved current rating for the brake output is 600mA.

The maximum current rating for the brake output without UL is 1A.

For operation of a 205VDC brake the parameter P1215 must be set P1215=2.

Analog input DIP-switches

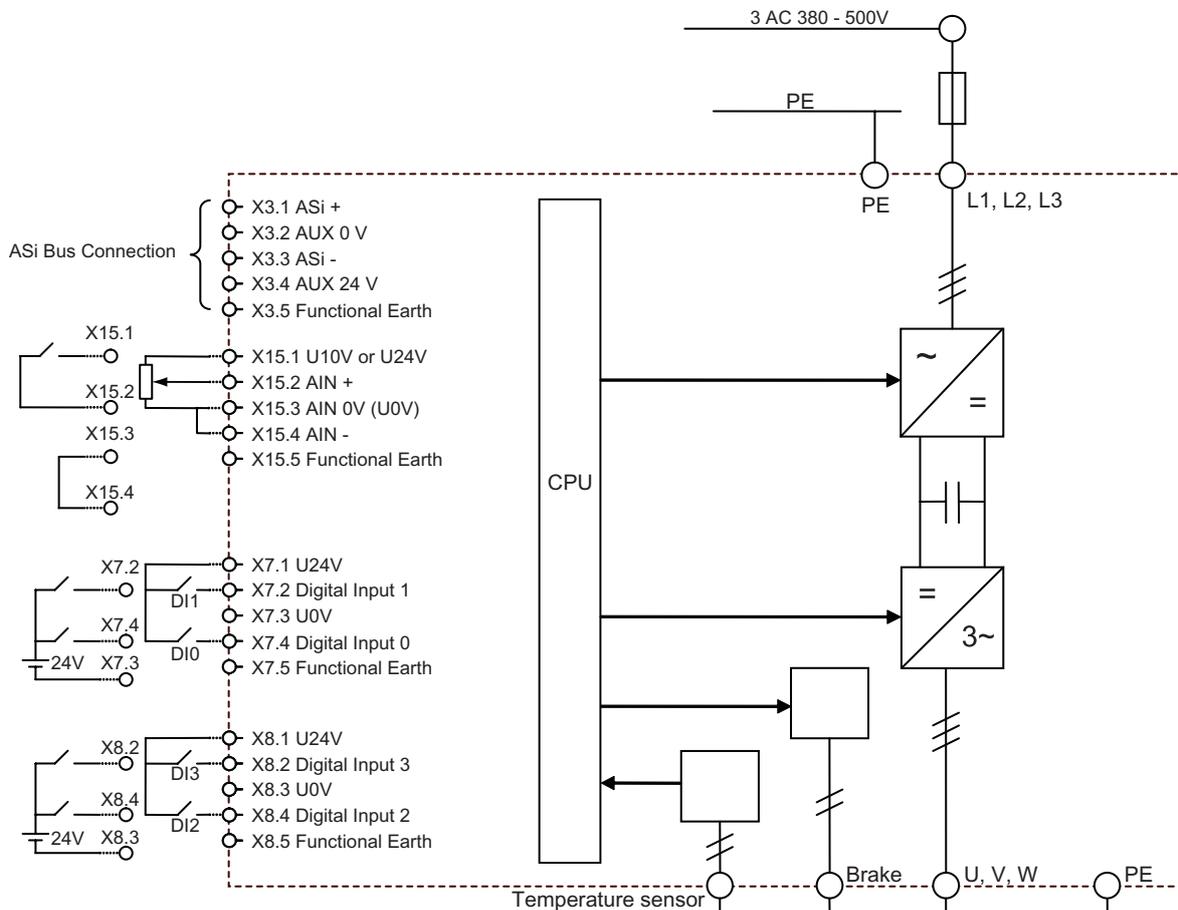
The analogue input can be configured as an additional digital input. In order to achieve this AIN- (X15.4) should be connected to AIN 0V (X15.3) and the digital input should be connected to AIN+ (X15.2). To make this easier a switch has been provided under the control unit cover that, when operated, makes this connection internally. It is also possible to select whether connection X15.1 provides a 10V (10mA) supply, normally used for an analogue input, or a 24V (25mA) supply, normally used for a digital input. See block diagram below for details.

Auxillary (AUX) power

To operate this product, 24V power supplies need to be provided on both the AS-i + / AS-i - and AUX 24V / 0V pins of connector X3. When the product is connected to an AS-i network the 24V power supply on the AS-i + / AS-i - pins is provided by the AS-i network itself. In this case additionally a separate independent 24V power supply must be provided on the AUX 24V / 0V pins.

If the product is not connected to an AS-i network then a 24V power supply still needs to be connected to the AS-i + / AS-i - pins. This can be the same power supply as connected to the AUX 24V / 0V pins as shown in the block diagram below.

Block diagram



When the SINAMICS G110D is used as a standalone Inverter and is not connected to an AS-i network, an external 24V supply must be used.

In this case the external 24V supply is connected as shown in the diagram opposite, to the AS-i bus connection of the Inverter..

Analog DIP-Switch

Link X15.3 to X15.4 No internal link X15.3 to X15.4

X15.1 = U24V X15.1 = 10V

Default settings

Important:
When the Inverter is operating on an AS-i network the AS-i power supply must be between +31.6 V and +26.5 V. The aux power supply [black cable] is always 24 V ± 15%.

If the Inverter is operating independently of an AS-i network, the external power supply range can be +24 V ± 15%.

To achieve a UL compliant installation the external 24V dc supply must be Class 2 or limited voltage/current according to UL1310; when the SINAMICS G110D is connected to an AS-i network the external 24V power supply must be PELV according to IEC 60364-4-41.

Figure 4-1 SINAMICS G110D block diagram

Cable, connectors and tools specifications

The detailed specifications for the cables, connectors and tools required to manufacture the necessary cables for the SINAMICS G110D are listed in the following tables.

NOTICE
NFPA compatibility
These devices are intended only for installation on industrial machines in accordance with the "Electrical Standard for Industrial Machinery" (NFPA79). Due to the nature of these devices they may not be suitable for installation in accordance with the "National Electrical Code" (NFPA70).

Table 4- 2 Tools

	Harting part number
Crimp tool (Q8/0 and Q4/2)	0999-000-0110
Removal tool (Q8/0)	0999-000-0319
Removal tool (Q4/2)	0999-000-0305
No special tools are required for the Control Unit connectors	

Table 4- 3 Control Unit connectors

Connector	Binder part numbers	
	Straight connector	Right-angle connector
ASI (M12)	99-0436-14-05	99-0436-24-05
Digital input and Analog output (M12)	99-0437-14-05	99-0437-24-05

Table 4- 4 Mains supply connector

Power rating	cable size	cable type	All connector parts are Harting Q4/2				
			Shell	Crimp size	Crimp number	Hood	Gland/Seal
0.75 kW	1.5 mm ² 16 AWG	(3+E) YY Unscreened	Harting Q4/2 0912 006 3141	1.5 mm ² 16 AWG	0932 000 6204	0912 008 0527	0900 000 5059
1.50 kW					0932 000 6205		
3.00 kW	2.5 mm ² 14 AWG	(3+E) YY Unscreened		4 mm ² 12 or 10 AWG	2.5 mm ² 14 AWG	1912 008 0526	
4.00 kW							
5.50 kW	4 mm ² 12 or 10 AWG	(3+E) YY Unscreened			4 mm ² 12 or 10 AWG	0932 000 6207	
7.50 kW							

4 x crimps are required for each inverter; use 75°C copper wire only

4.2 Cables and connections

Table 4- 5 Motor connector

Power rating	cable size	Belcom "DESINA" Cable No.	All connector parts are Harting Q8/0					
			Shell	Crimp size	Crimp number	Hood	Gland/Seal	
0.75 kW	1 mm ² 18 AWG	13EBN17Z08P	Harting Q8/0 0912 008 3001	1 mm ² 18 AWG	0933 000 6105	1912 008 0502	1912 000 5057	
1.50 kW								
3.00 kW	2.5 mm ² 14 AWG	13EBN13Z08P		2.5 mm ² 14 AWG	0933 000 6102	1912 008 0528		LUTZE 600173 (NOT Harting)
4.00 kW								
5.50 kW	4 mm ² 12 or 10 AWG	13EBN11Z08P		4 mm ² 12 or 10 AWG	0933 000 6107			
7.50 kW								

4 x crimps are required for each inverter for the motor connections; use 75°C copper wire only

Table 4- 6 Temperature sensor and EM brake

Power rating	cable size	Belcom "DESINA" Cable No.	Temperature sensor pair		EM Brake pair	
			Crimp size	Crimp number	Crimp size	Crimp number
0.75 kW	1 mm ² 18 AWG	13EBN17Z08P	0.75 mm ² 20 AWG	0933 000 6114	0.75 mm ² 20 AWG	0933 000 6114
1.50 kW						
3.00 kW	2.5 mm ² 14 AWG	13EBN13Z08P	1 mm ² 18 AWG	0933 000 6105	1 mm ² 18 AWG	0933 000 6105
4.00 kW						
5.50 kW	4 mm ² 12 or 10 AWG	13EBN11Z08P	1 mm ² 18 AWG	0933 000 6105	1.5 mm ² 18 AWG	0933 000 6104
7.50 kW						

2 x crimps are required for each auxiliary signal pair; use 75°C copper wire only

Connection specifications

Table 4- 7 Mains supply and motor output specifications

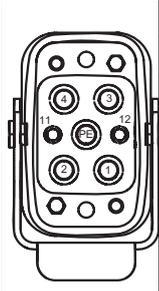
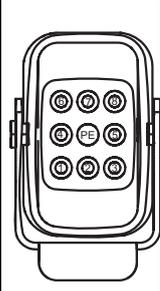
	Mains supply			Motor output	
	Pin	Function		Pin	Function
1	L1	1	U		
2	L2	2	Not connected		
3	L3	3	W		
4	-	4	EM Brake (-)		
11	-	5	Temperature sensor (+)		
12	-	6	EM Brake (+)		
PE	Protective Earth	7	V		
		8	Temperature sensor (-)		
		PE	Protective Earth		
Type	HAN Q4/2 (Male)	Type	HAN Q8 (Female)		
Spec.	3AC 380V...500V ± 10%	Spec.	-		

Table 4- 8 Digital input specifications

	Digital input (2 sockets, 4 DIs)	
	Pin	Function
	1	+24 V (25mA max.)
	2	DI1 or DI3
	3	U0V
	4	DI0 or DI2
	5	Functional Earth
	Shield	Functional Earth
	Type	M12 - 5 pole (Female)
	Spec	PNP, SIMATIC-compatible, low < 5 V, high > 10 V, max. input voltage 30V

Table 4- 9 Analog input specifications

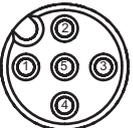
	Analog connections	
	Pin	Function
	1	10V (10 mA) / 24 V
	2	AIN+
	3	0V
	4	AIN-
5	Functional Earth	

Table 4- 10 AS-i connector specifications

	ASI connections			
	Pin	Function	Description	AS-i system cable colour
	1	ASi+	AS-i positive	Yellow
	2	AUX-	Auxiliary 0 V	Black
	3	ASi-	AS-i negative	Yellow
	4	AUX+	Auxiliary 24 V	Black
5	Function earth	Earth connection	-	

4.3 Configuring the AS-i slave

Overview

Before data transfer can take place between the AS-i Master and the slave devices each slave must be assigned an address. The address of a AS-i slave can be assigned using the following methods:

- Addressing off-line using the Siemens Addressing Programmer
- Addressing on-line using the controlling system, such as a PLC via the AS-i Master (it should be noted that only one slave with address 0 may be present on the bus if this method is to be implemented).

The addresses are designated numbers between 1 and 31, with each slave device having a preset address of 0. If the AS-i master detects a slave with address 0, it recognizes the device and can automatically assign an address to the device and integrate the device into the AS-i network (If more than one slave device has the address 0, the automatic address assignment and integration is not possible).

Note

Profile 3.0

Under AS-i Profile 3.0 it is possible to address 62 digital or 62 analog slave devices or a combination of both digital and analog but not exceeding a total of 62 slave devices. This is accomplished by using the A/B address system. For example, two slaves can be assigned as number 1 slave device, by assigning them as 1A and 1B.

The addresses of the slave devices do not have to be sequential, for example the first slave device can have the address 21, the next 10.

Prior to the installation and commissioning of the Inverter, the AS-i communications and devices have to be set-up correctly. The equipment shown in the table below will be necessary for the successful integration of more than one Inverter onto the AS-i bus network.

Table 4- 11 Equipment for installation of SINAMICS G110D (AS-i)

Item	Order Number	
Address cable	3RK1901-3HA01	
AS-i address programmer	3RK1904-2AB01	
AS-i connection kit	3RK1901-1NR21	

CAUTION

AS-i Master

The AS-i Master must be disconnected from the network prior to addressing any AS-i slaves. If the AS-i Master is connected to the network during the addressing process, the addressing of an AS-i slave will not be possible.

Addressing Unit

When assigning the address of the slaves in the Inverter with the Addressing Unit, the digital inputs and analog input must be disconnected to prevent the Addressing Unit from being overloaded by their power consumption.

When the Addressing Unit is plugged into the device address port of the Inverter; the AS-i communications are terminated automatically. Therefore there is no requirement to disconnect the M12 AS-i connection on the Inverter.

1. Connect the M12 connector to the Inverter AS-i port ①.
2. Connect the AS-i cable to the M12 branch ②.
3. Remove the Control Unit cover ③.
4. Connect the Address Programmer to the AS-i addressing port on the Inverter ④.
5. The address of the Inverter (as a slave device) can now be completed. Full instructions are given with the Address Programmer.
6. Refit the Control Unit cover, ensure that the seals are correctly in place to preserve the Inverter IP65 rating.

4.3 Configuring the AS-i slave

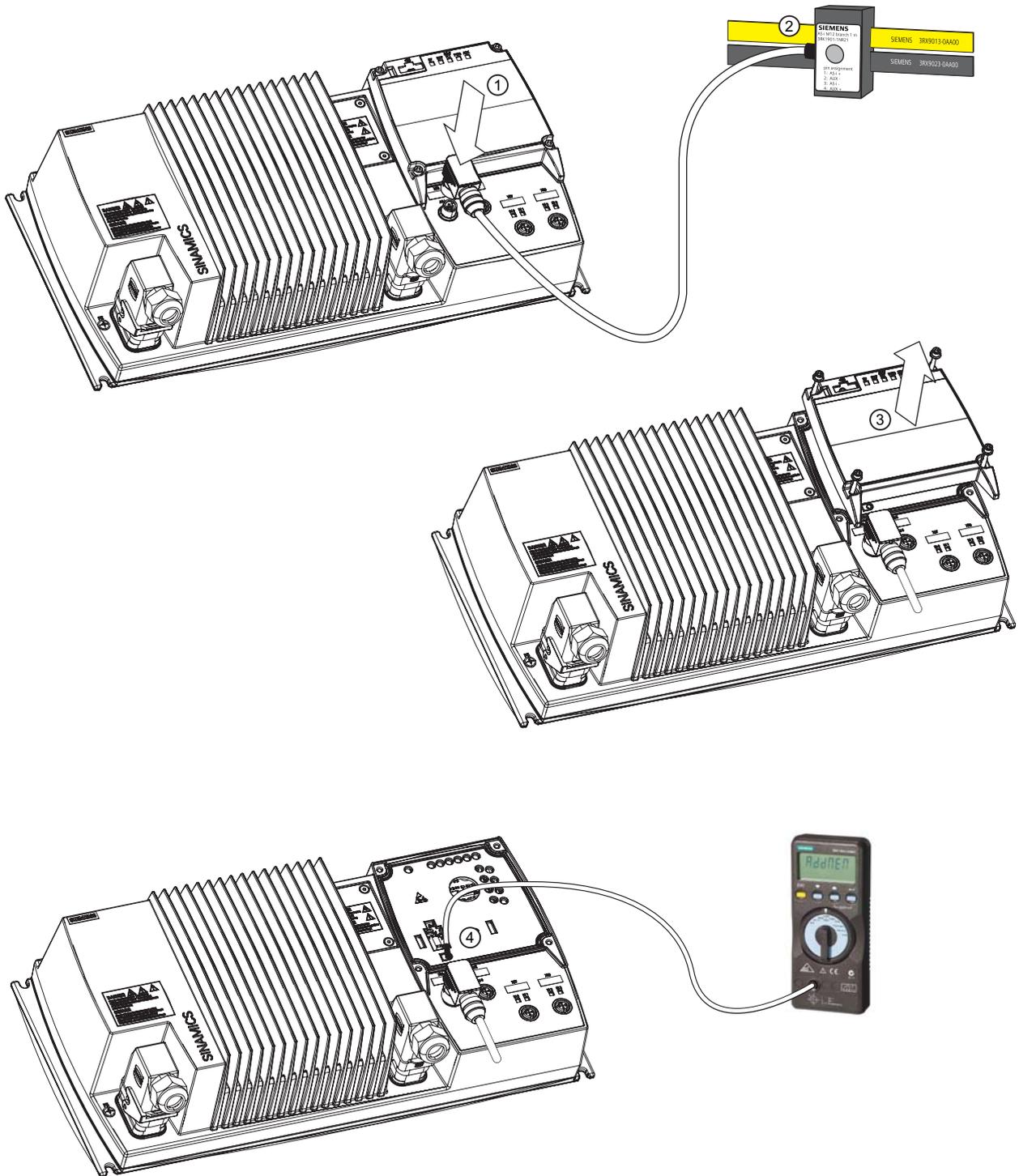


Figure 4-3 Addressing the ASi slave

Check List

5.1 Installation check list

Installation check list

Before power is applied to the inverter/motor system, the following checks should be performed:

	Check that:	✓
1	The environmental conditions conform to the inverter/motor specifications	
2	The inverter and the motor are securely mounted	
3	The inverter and motor are correctly installed with adequate cooling provision	
4	The motor and the application/equipment are ready to start, i.e. safe state - motor can rotate	
5	The inverter is correctly earthed/grounded	
6	The input power (supply) voltage matches the inverter's nominal input voltage	
7	The input power (mains) fuses are the correct type and installed correctly	
8	The motor connections are connected to ensure the correct direction of rotation of the motor at start-up	
9	The motor and mains connections are connected and tightened to the required specification	
10	The motor cable is routed away from other cables	
11	The control connections are connected and tightened to the required specification	
12	No tools or other objects that can cause damage to the system are present	
13	The inverter is the only power source to the motor	

Commissioning

6.1 Commissioning with STARTER

Basic commissioning

The STARTER software uses a series of dialogs to guide the user through the basic commissioning of the Inverter. For specific application configuration and parameterization the expert list within STARTER should be used.

Note**STARTER knowledge**

This procedure assumes that you have a working knowledge of the STARTER software.

What do you need?

The following items are required to commission the Inverter with STARTER:

- The PC connection cable - order number: 3RK1922-2BP00 or the USB connection cable - order number: 6SL3555-0PA00-2AA0.
- STARTER software installed on your PC - order number: 6SL3072-0AA0-0AG0 (the version of STARTER should be version 4.1 Service Pack 3 or higher).

Note**PC connection cable 3RK1922-2BP00**

Version E02 or higher of the PC connection cable should be used with the SINAMICS G110D/G120D Inverter.

Commissioning procedure

Once STARTER is running it will present an empty screen - from the File menu selected new project.

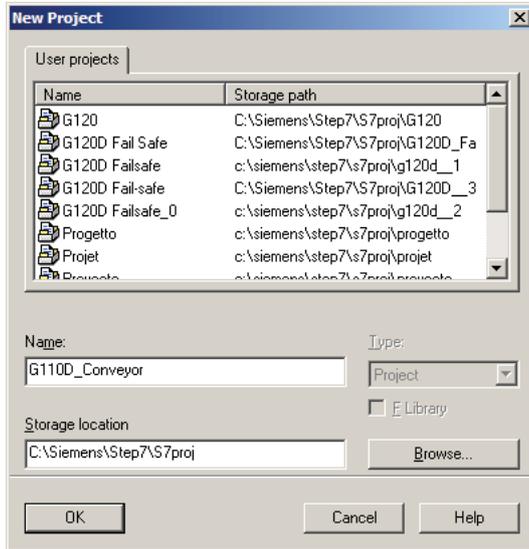


Figure 6-1 Create new project dialog

Click OK and the dialog disappears and the normal STARTER screen appears with the project name appears in the project tree on the right-hand side of the screen.

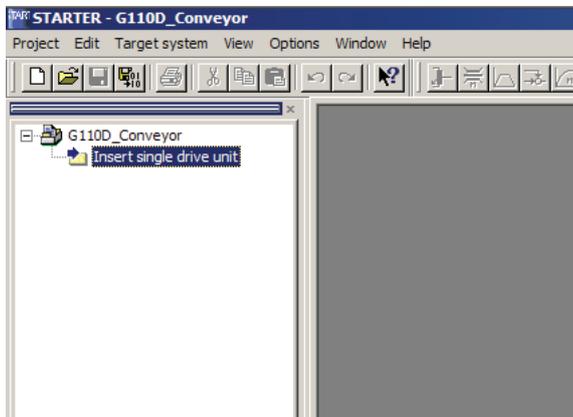


Figure 6-2 Insert drive

Double-click the "Insert single drive unit"; the select drive dialog appears.

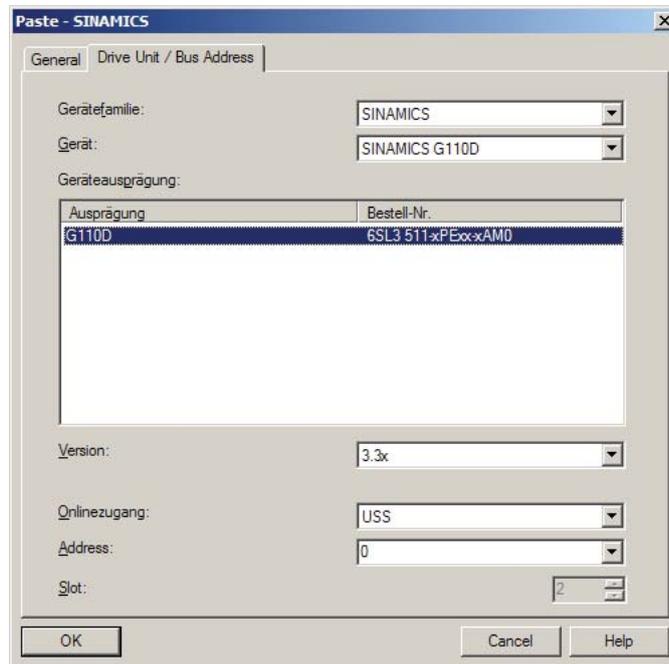


Figure 6-3 Select drive dialog

Select the appropriate Inverter and click OK.

The inserted drive will appear in the project tree.

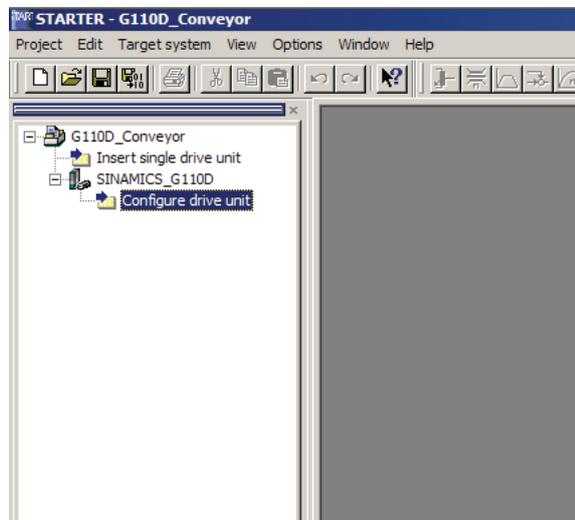


Figure 6-4 Configure drive unit

Double-click "configure drive unit"; the select Inverter dialog will appear.

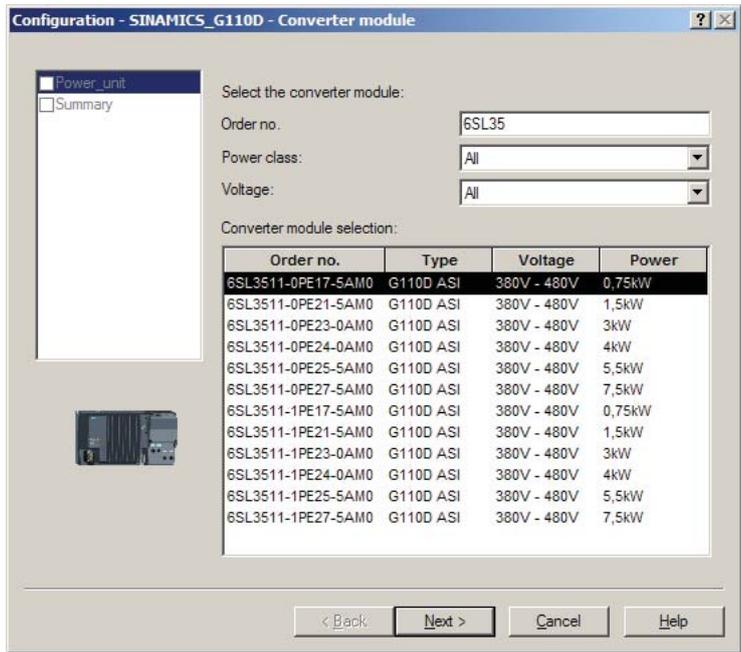


Figure 6-5 Select power unit dialog

Using the order number of the Inverter, select the appropriate Inverter power unit. Press "next" to display the summary screen.

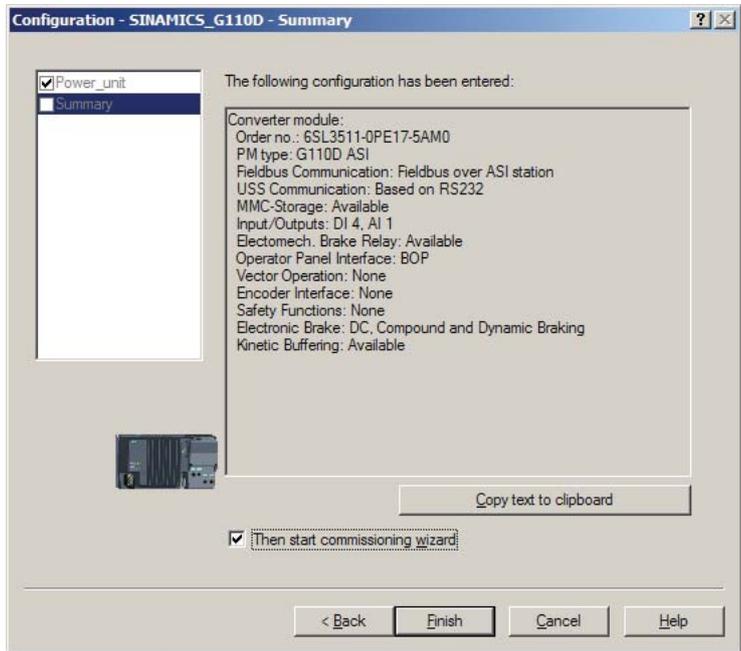


Figure 6-6 Summary dialog

The summary screen displays the configuration settings that have been completed up to this point of the process. The details of the configuration can be copied to the clipboard and pasted into another application such as Notepad to allow a permanent record of the configuration to be stored.

Ensure that "Then start commissioning wizard" is selected and click "Finish".

The "Control Method" dialog is displayed.

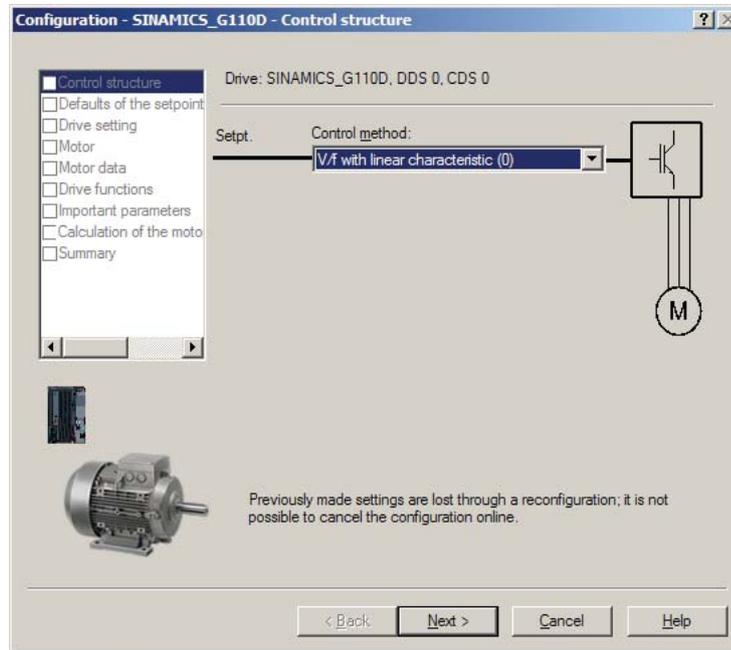


Figure 6-7 Select control method dialog

Select the required control method and click "Next". The command and setpoints source dialog is displayed.

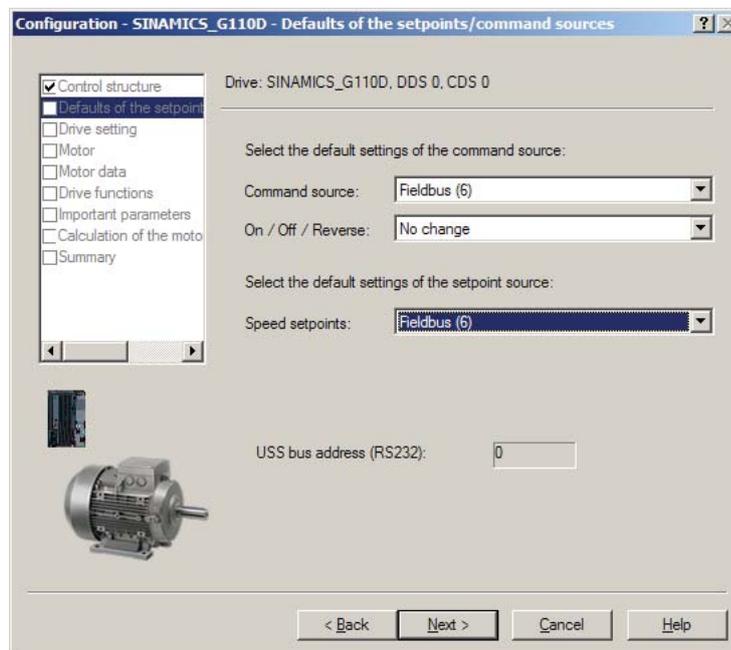


Figure 6-8 Select command and setpoint source dialog

The default command and setpoint source for the Inverter is Fieldbus.

Click "Next". The drive setting characteristics dialog is displayed.

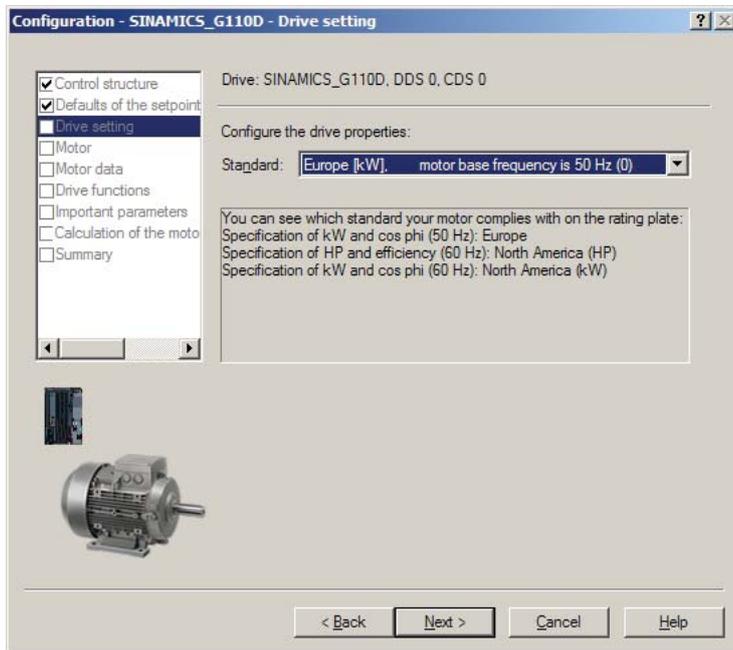


Figure 6-9 Select drive settings dialog

Select the appropriate settings for your region and supply characteristics.

Click "Next". The Motor dialog is displayed.

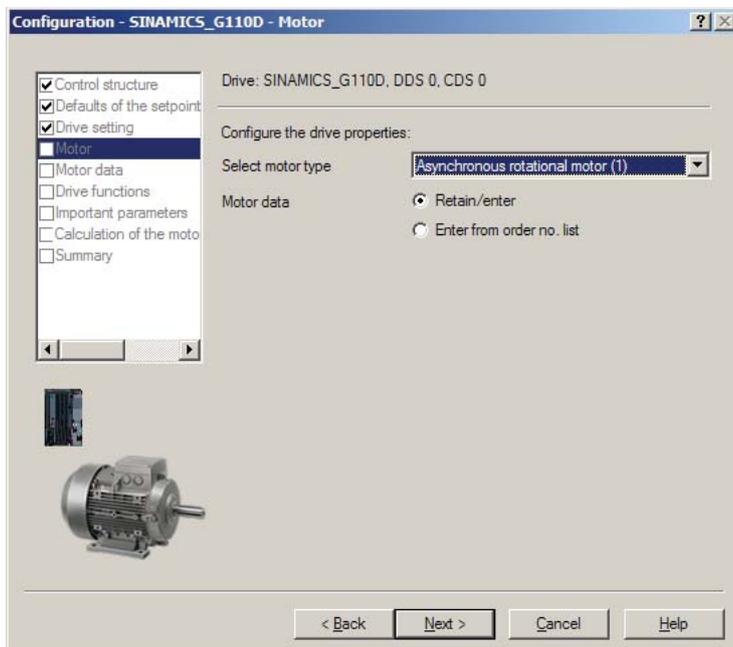


Figure 6-10 Select motor type dialog

Select the type of motor to which the Inverter is connected. Click "Next"; the motor data dialog is displayed.

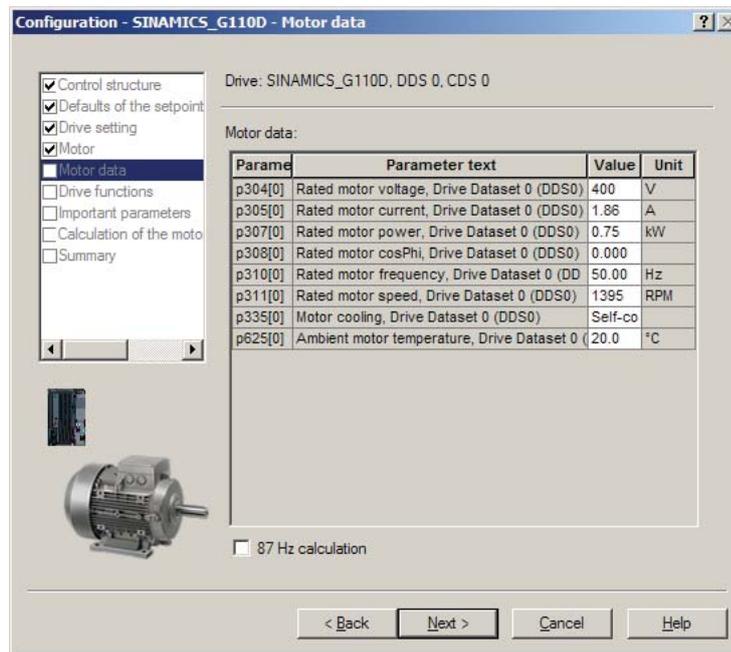


Figure 6-11 Motor data dialog

Enter the motor data, which can be found on the motor rating plate. Click "Next"; the Motor identification dialog is displayed.

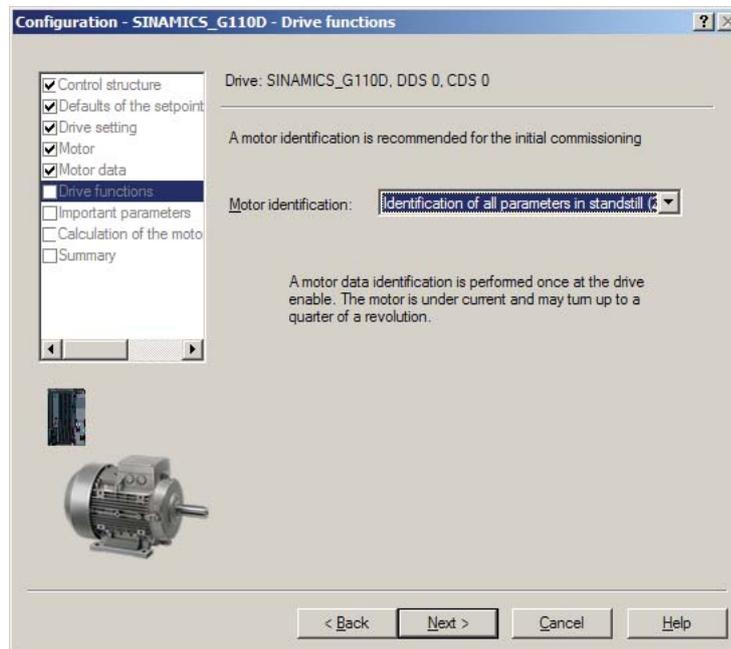


Figure 6-12 Motor identification dialog

Select which type of motor identification is required. It is recommended that a motor identification is actually completed. Click "Next"; the Important parameters dialog is displayed.

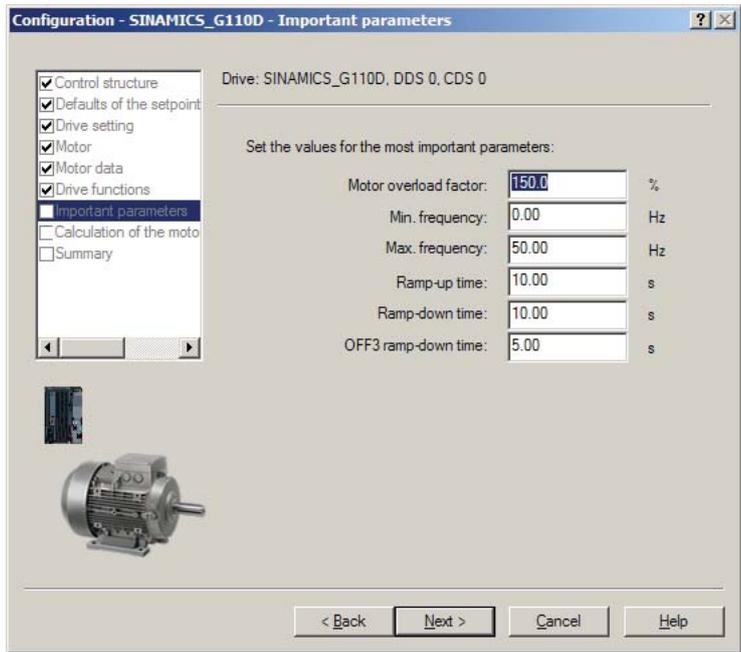


Figure 6-13 Important parameters dialog

Enter the values for the listed parameters. Click "Next"; the motor calculation dialog is displayed.

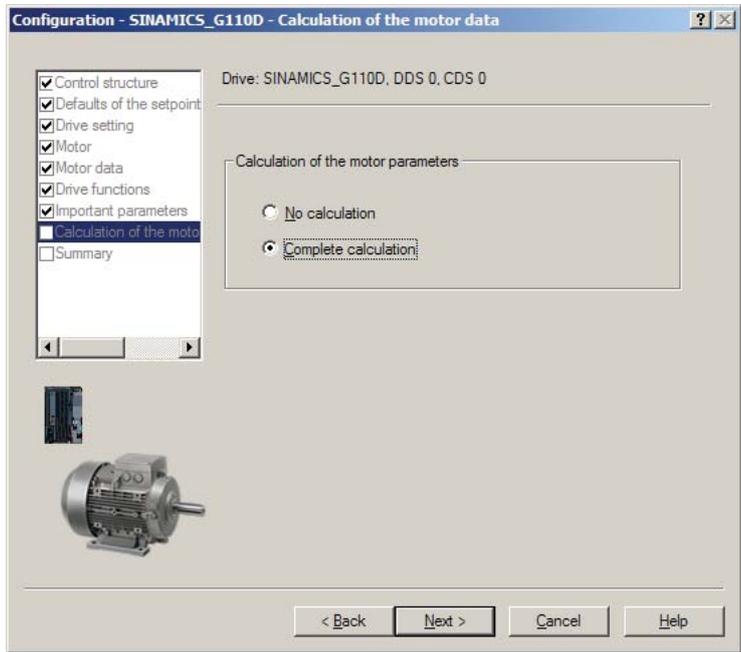


Figure 6-14 Calculate motor data dialog

Select "complete calculation" and click "Next"; the summary screen will be displayed.

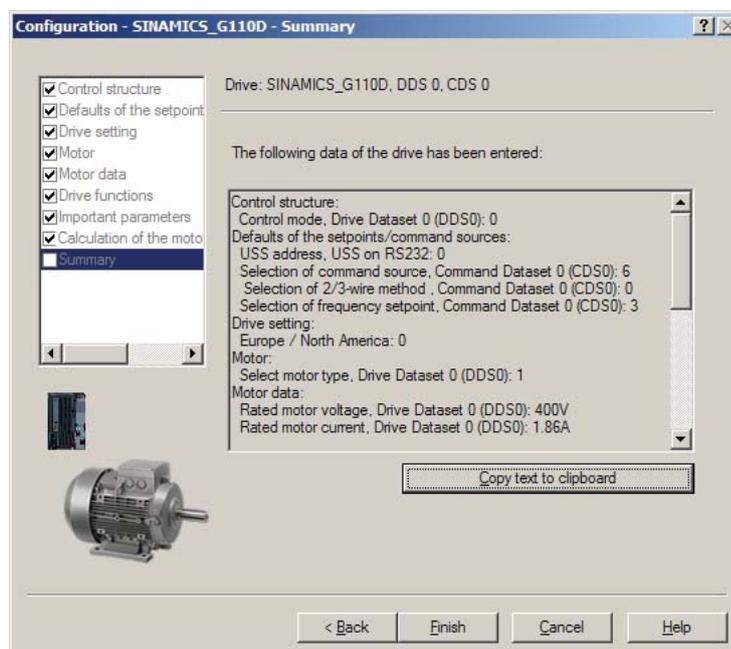


Figure 6-15 Configuration summary

The summary information can be copied to the clipboard for pasting into another application, such as, Notepad as a permanent record of the configuration.

Click "Finish".

To complete the basic commissioning of the Inverter, the following tasks must be completed:

- Ensure that the Inverter and motor are powered-up (no run command should be issued).
- Ensure that the Inverter is correctly connected to the PC, using the appropriate communications cable.

In the project tree under commissioning, select "Control panel". The control panel will appear at the bottom of the screen.

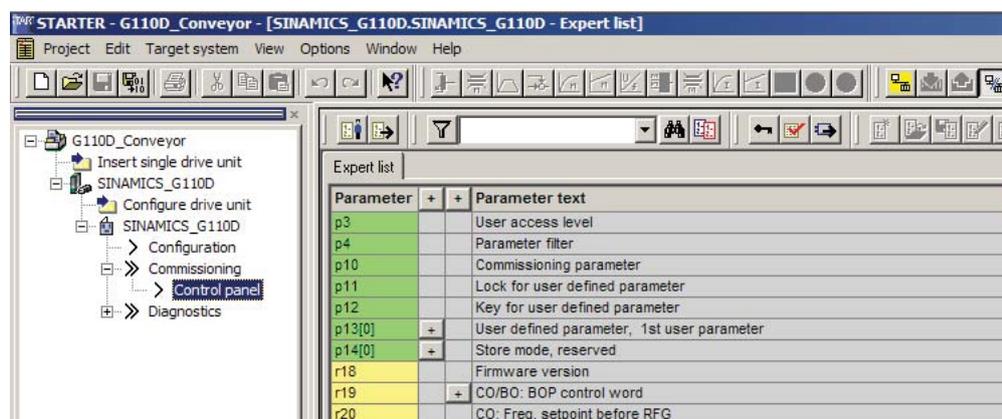


Figure 6-16 Control panel activation

Press the Start [I] button and the motor calculation will be performed. When this has been completed, the basic commissioning of the Inverter and motor has been completed.

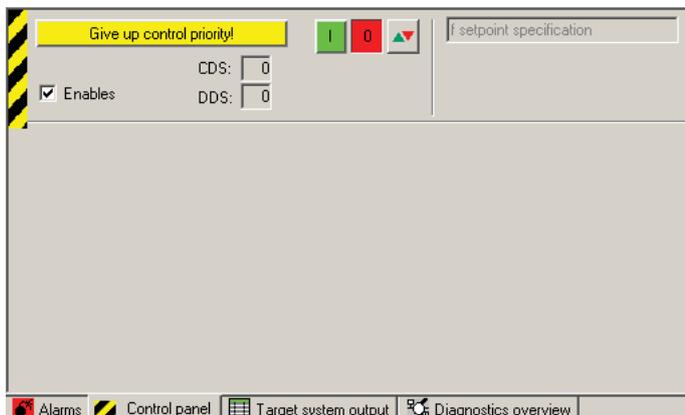


Figure 6-17 STARTER control panel

Commissioning the application

To specifically parameterize the Inverter for an application, the "Expert list" should be used to gain access to any of the required parameters. The values can be modified from within STARTER.

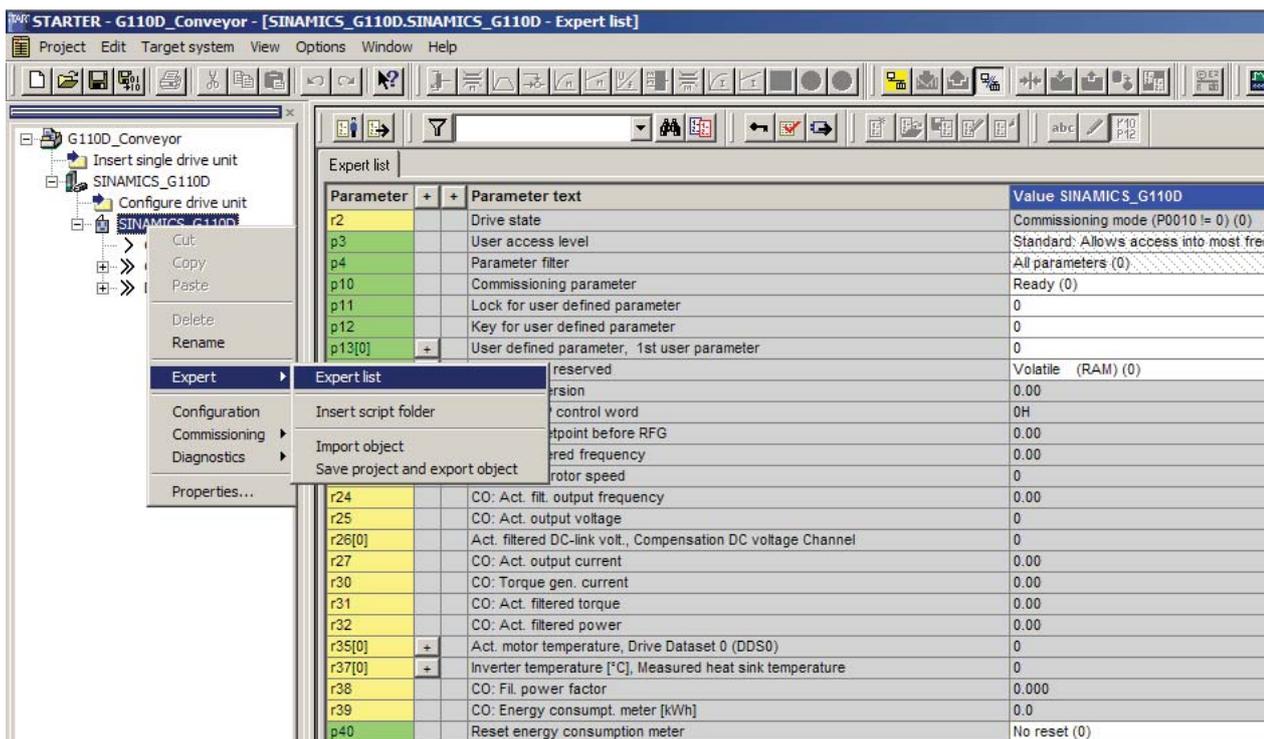


Figure 6-18 Expert list

Saving parameter data

While the STARTER is online and connected to Inverter it is possible to save all the parameter data and configuration data to the Inverter by uploading the data to the Inverter memory.

To upload the data to the Inverter, simply press .

6.2 Commissioning with the IOP

Functions of the Intelligent Operator Panel (IOP)

The Intelligent Operator Panel (IOP) has been designed to enhance the interface and communications capabilities of SINAMICS Inverters.

The IOP Hand-held Kit is required to connect the IOP to the Inverter. The IOP should automatically recognise the devices from the SINAMICS range.

The IOP provides support, using the USB connection utilizing a PC, for the following functions:

- Downloading of wizards
- Downloading additional languages

Note

IOP functional support

- Devices prior to version 3.0 firmware may not be fully supported by the IOP.
 - The actual menu structure and functionality of the IOP will be influenced by the following factors:
 - The software version and type of Control Unit to which the IOP is fitted.
 - The firmware and software version of the IOP.
 - The selected functional group filtering of the parameters.
-

Layout and functions

The physical layout of the IOP is shown below:

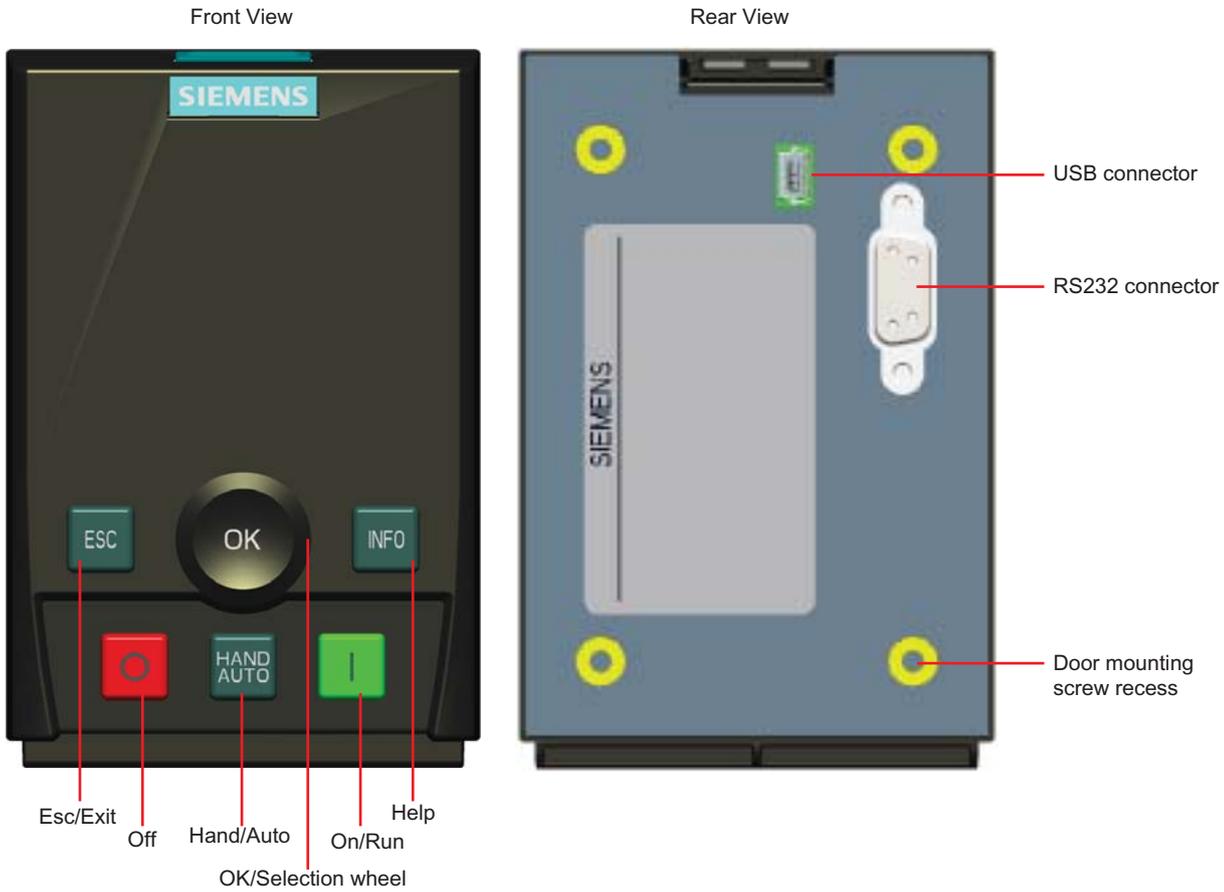


Figure 6-19 Layout of IOP

The IOP is operated by using a push-wheel and five additional buttons. The specific functions of the push-wheel and buttons are shown in the table below.

Table 6- 1 Function of the IOP controls

Key	Function
	<p>The push-wheel has the following functions:</p> <ul style="list-style-type: none"> • In a menu, turning the push-wheel changes the selection. • When a selection is highlighted, pressing the push-wheel confirms the selection. • When editing a parameter, turning the push-wheel changes the displayed value; clockwise increases the value and anti-clockwise decreases the displayed value.
	<p>The ON key has the following functions:</p> <ul style="list-style-type: none"> • In AUTO mode, the screens displays an information screen, stating that the command sources is AUTO and can be changed by pressing the HAND/AUTO KEY. • In HAND mode the Inverter is started - the Inverter status icon starts turning. <p>Notes: When running in AUTO mode, HAND mode cannot be selected unless the Inverter is stopped. When the Inverter is running in HAND mode, the motor stops when switched to AUTO.</p>
	<p>The OFF key has the following functions:</p> <ul style="list-style-type: none"> • If pressed for longer than 3 seconds the Inverter will perform an OFF2; the motor will then coast down to a standstill. • If pressed for less than 3 seconds the following actions will be performed: <ul style="list-style-type: none"> – If in AUTO mode the screen will display an information screen stating that the command sources is AUTO and can be changed using the HAND/AUTO key. The Inverter will not be stopped. – If in HAND mode the Inverter will perform an OFF1; the motor will come to a standstill in the ramp-down time set in parameter P1121.
	<p>The ESC key has the following functions:</p> <ul style="list-style-type: none"> • If pressed for less than 3 seconds the IOP returns to the previous screen or if a value has been edited, the new value is not saved. • If pressed longer than 3 seconds the IOP returns to the status screen. <p>When using the ESC key in the parameter editing mode, no data is saved unless the OK key is pressed first.</p>
	<p>The INFO key has the following functions:</p> <ul style="list-style-type: none"> • Displays additional information for the currently selected item. • Pressing INFO again will display the previous screen.
	<p>The HAND/AUTO key switches the command source between HAND and AUTO mode.</p> <ul style="list-style-type: none"> • HAND sets the command source to the IOP. • AUTO sets the command source to an external source, for example, fieldbus.

Locking and unlocking the keypad

To lock the IOP keypad press **ESC** and **INFO** simultaneously for 3 seconds or more. To unlock the keypad press **ESC** and **INFO** simultaneously for 3 seconds or more.

IOP Handheld Kit

The IOP has no internal power source, so to increase the IOP's versatility, the hand-held device has been designed.



Figure 6-20 IOP Handheld Kit

Table 6-2 Handheld device order information

Order number	Item quantity	Item	Remarks
6SL3255-0AA00-4HA0	1	IOP	
	1	Hand-held module	
	1	Power supply unit	
	4	Rechargeable batteries	1.2 V NiMH
	1	RS232 cable	

Note**Optical cables**

The cable supplied with the IOP hand-held kit is not suitable for use with the SINAMICS G110D Inverter. The following cables can be ordered:

- USB optical cable - order number: 6SL3555-0PA00-2AA0
- RS232 optical cable - order number: 3RK1922-2BP00.

The USB optical cable is used to allow a PC to be connected to the Inverter, utilizing the optical interface on the SINAMICS G110D.

The USB optical cable cannot be used to connect the IOP Hand-held device to the SINAMICS G110D Inverter.

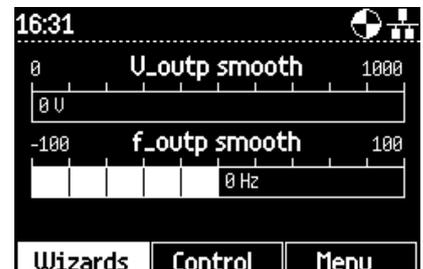
The RS232 optical cable is used to allow the IOP Hand-held device to be connected to the Inverter, utilizing the optical interface on the SINAMICS G110D.

Commissioning the Inverter

As previously stated, the IOP is a menu driven operator panel. By choosing the appropriate menu options the user will be guided through a series of questions, which when answered, will set the appropriate values for any parameters involving the selected function.

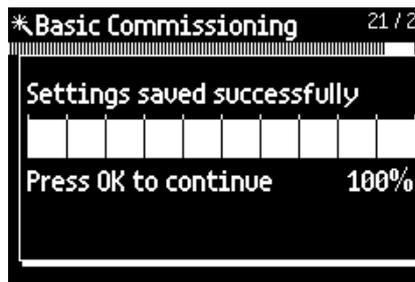
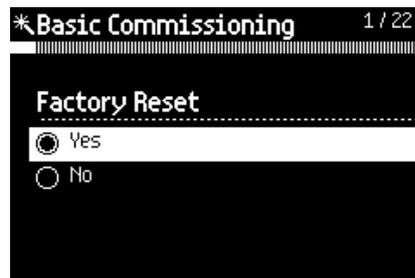
The basic commissioning of the Inverter is performed using the following procedure:

1. From the status screen select the Wizards menu.
2. The wizards menu will display a list of functions that can be selected.
3. Using the wheel, scroll down to the "Basic Commissioning" wizard.
4. Press the wheel to confirm selection.
5. The screen will now display the first of a series of questions.
6. Using the wheel select the required answer.
7. Push the wheel to confirm your selection.
8. The screen will then display the next question in the series.
9. Some questions require that a value be set, if the default value is not acceptable.
10. Using the wheel rotate the wheel to increase or decrease the value of the individual digits and press the wheel to move to the next digit in the



sequence.

11. When all the questions have been answered, a summary screen will display all the settings that have been selected.
12. If a particular settings is wrong or needs to be changed, press the ESC key to return to the previous screen and continue from that point by answering the questions again.
13. If all the settings are correct, then using the wheel scroll down and highlight "continue".
14. Press the wheel to confirm your selection.
15. The IOP will now set all the parameters to the selected values required for basic commissioning.
16. On completion of the saving process, a screen will appear to confirm the settings have been saved.
17. Pressing the wheel will return the IOP to the status screen.



Commissioning the application

The IOP, depending upon the type of Inverter, will display a number of wizards, which will guide the user through the setting up standard applications and functions.

In the Operating Instructions of the IOP are a number of wiring diagrams associated with each application wizards. If the Inverter is wired in accordance with these diagrams, then the application can be configured using the relevant wizard.

6.3 Setting-up AS-i parameters

Once the inverter has been installed and assigned an appropriate address the Inverter is ready to be commissioned.

Once the Inverter is switched on, the Inverter should be automatically recognized by the AS-i network.

The status LEDs on the Inverter will indicated the status of the AS-i communications with regard to the Inverter.

The following parameters must be set to configure the AS-i communications of the Inverter.

Table 6- 3 AS-i parameters

Parameter	Description	Value
P2021	AS-i slave address (if not already set manually with programmer)	0000 hex
P0927	Parameter modification source	00 (AS-i fieldbus)
P2040	Fieldbus telegram time-out	500 ms
P2061	CTT2 data to AS-i master (see note below)	21[0]
P2063	AS-i master digital input for slave	53.13
* For further details, please refer to the parameter manual		

CAUTION**Cold restart**

Parameters settings directly affecting the AS-i communications, for example, P2040 will not take effect until the Inverter has been restarted by a cold restart. This cold restart must be initiated by switching the power off and then on again.

Note**CTT2 data**

Combined Transaction Type 2 (CTT2) is intended for simple and complex field devices such as temperature sensors, displays with more than eight characters, speed controlled motors with actual value feedback, analog process valves with position feedback or similar field devices in which digital data needs to be sent in both directions. Data exchange is full-duplex, that is, both binary data as well as digital input and output data can be sent at the same time. No special switching of the data transfer direction is required.

6.4 Example application

Commissioning the applications

The following information is provided to allow a simple conveyor application to be setup. The logic and control mechanism is provided by a PLC.

The conveyor section consists of three sensors:

- A: This sensor detects the arrival of an item on the conveyor.
- B: This sensor detects the item and signals the next section to start and be ready to receive an item. This requires two speeds, one for the normal movement of the load and a faster speed for the transfer between conveyor sections.
- C: This sensor detects the load leaving the conveyor section.

The sensors are directly connected to the Inverter to allow their individual status to be sent to the controlling PLC.

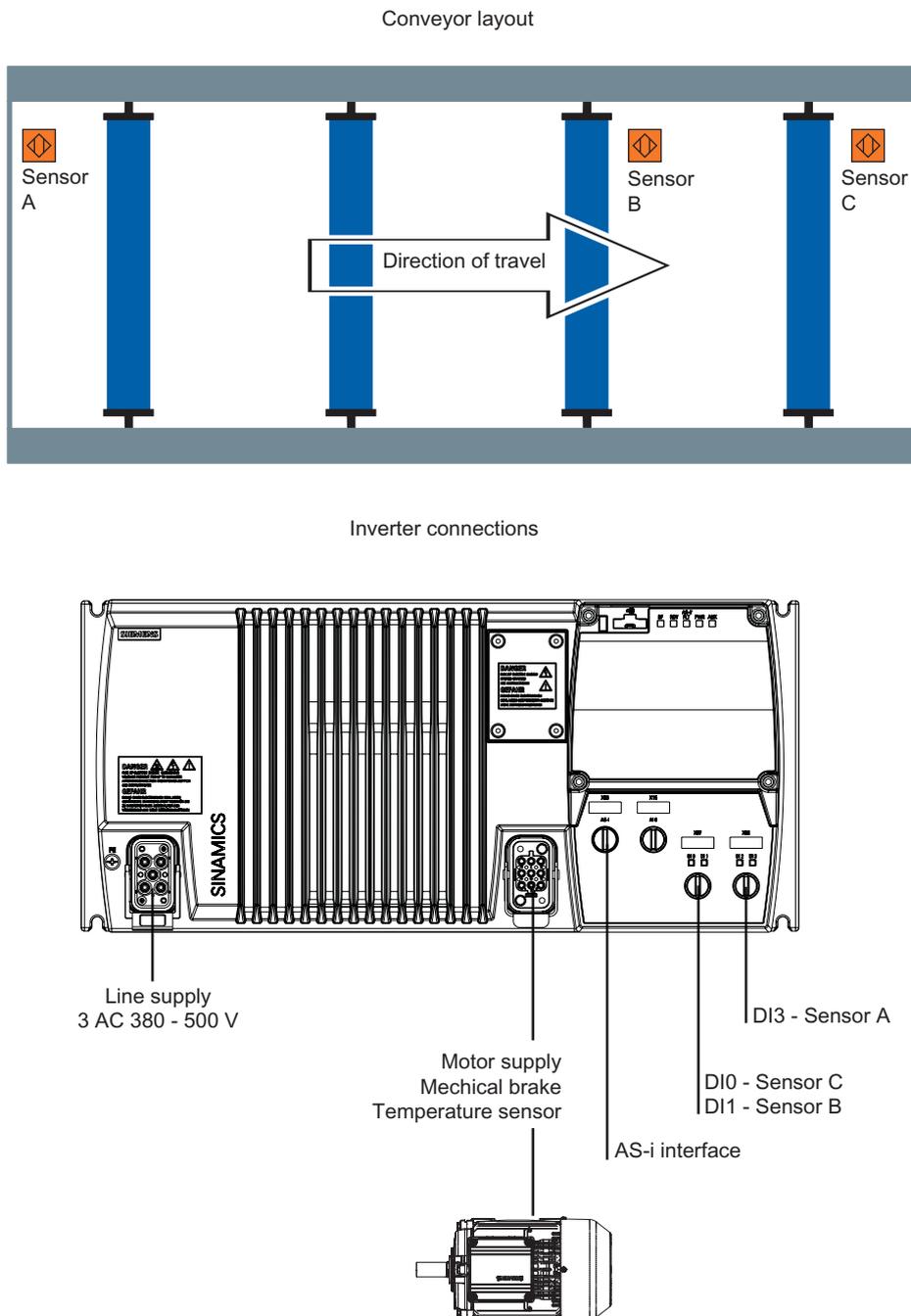


Figure 6-21 Example conveyor application

Application parameters

Using the "Expert List" mode in STARTER (as previously described) the following parameters should be modified as shown in the table below. Before setting the parameters listed below, you must wait until $P3900 = 0$.

In addition to the AS-i specific parameters discussed in the previous section the following parameters should be modified to allow the digital inputs to be read by the controlling PLC.

Table 6- 4 Conveyor application parameters

Parameter	Setting	Description
P0701 [0]	22	Digital input DI0 set to Quick Stop source 1 allowing DI0 to be used as Quick Stop input
P0971	1	Transfers parameter values from RAM to EEPROM

Example S7 script and ladder logic

The following is an example S7 script which the PLC will use to communicate with the Inverter.

Baustein:	FC2	Example application
Network:	1	Start conveyor
	U	"START"
	=	"G110D _ FAST"
Network:	2	Generate message occupied
	U	"G110D _ DI3"
	FP	"EdgeDI3"
	S	"ConveyorOccupied"
Network:	3	Switch from FAST to SLOW
	U	"G110D _ DI1"
	U	"NextConveyorOccupied"
	-	"G110D _ SLOW"
Network:	4	Wait for following conveyor
	UN	"NextConveyorOccupied"
	=	"G110D _ QSdisable"
Network:	5	Generate message occupied
	UN	"G110D _ DI0"
	FN	"EdgeDI0"
	R	"ConveyorOccupied"

Figure 6-22 Example S7 script

The following is an example ladder logic diagram.

Commissioning

6.4 Example application

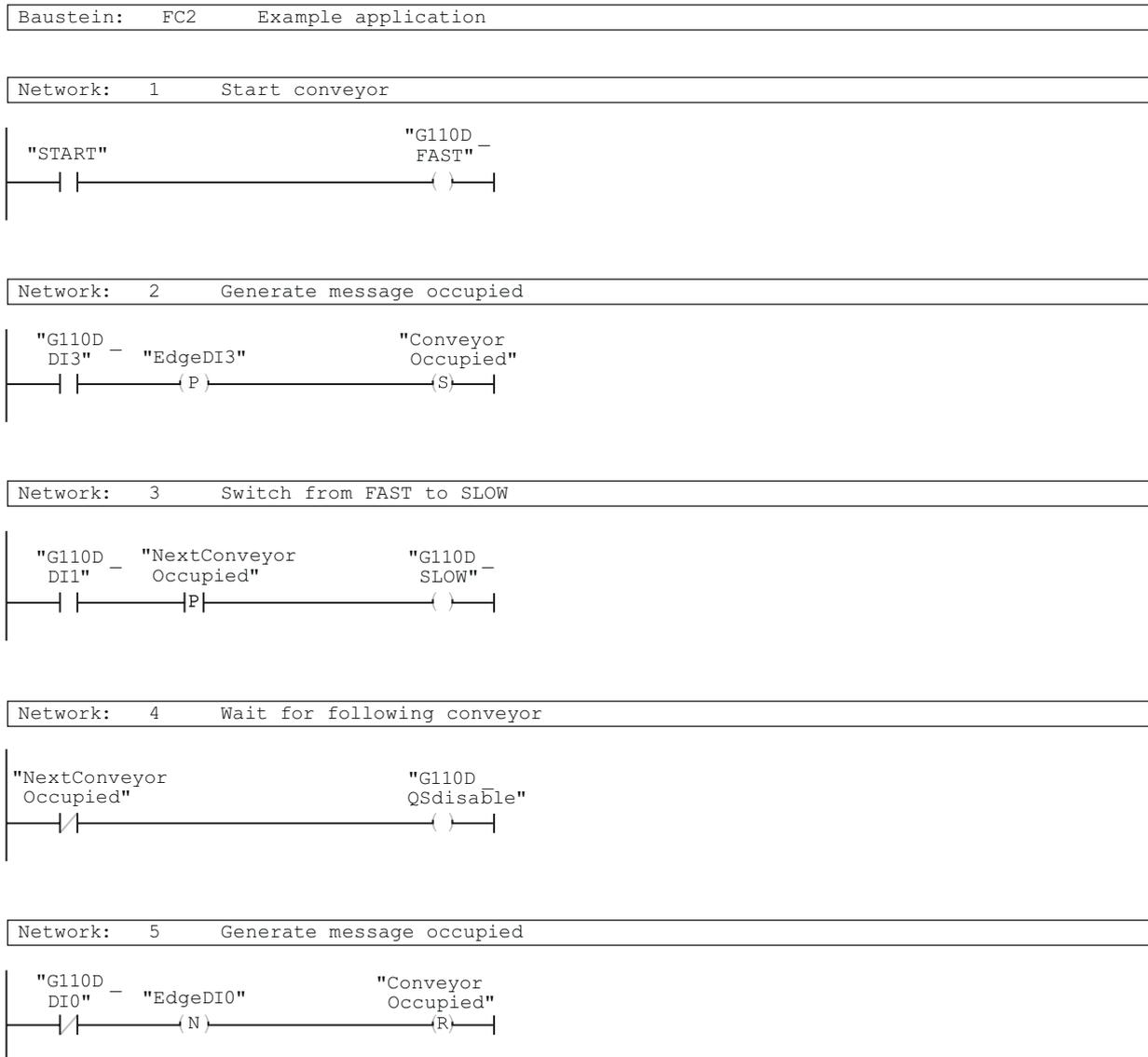


Figure 6-23 Example S7 ladder logic

Factory Reset

7.1 Factory Reset

Description

With a factory reset a defined initial state of all of the inverter parameters can be re-established.

To perform a factory reset with STARTER, the inverter must be in the online mode. If it is offline, perform "connect to target system" ()

The factory reset is performed in the following steps:

Select the drive unit in the navigation tree ()

- Click the factory reset icon ()

Note

When resetting the parameters to the factory setting, the communications memory is re-initialized. This means that communications are interrupted for the time it takes to perform the reset.

Diagnostics

8.1 Fault codes

The inverter has the capability to identify internal and external fault conditions, the most common faults are shown in the following tables. More detailed information on faults can be found in the Parameter List.

Table 8- 1 Fault codes description

Fault Number	Meaning	
F00001	Cause	Overcurrent - Motor power does not correspond to the inverter power
	Remedy	Check that the motor and inverter power ratings are the same.
F00002	Cause	Overvoltage - mains supply voltage too high or motor is in regenerative mode.
	Remedy	Check the mains supply voltage
F00003	Cause	Undervoltage - mains / 24 V supply has failed
	Remedy	Check mains supply / 24 V supply
F00004	Cause	Inverter over temperature - the inverter has exceeded the temperature limits
	Remedy	Check motor loading, pulse frequency setting, ambient temperature or if fitted the fan is working correctly.
F00030	Cause	Fan failure
	Remedy	Fan no longer working - replace fan.
F00041	Cause	Motor data identification failure
	Remedy	check that the motor is connected to the inverter correctly and that the motor data entered is correct.
F00062	Cause	MMC contents invalid
	Remedy	Recopy data to MMC and ensure that the process is completed.
F00070	Cause	PLC setpoint fault - the communications failure monitoring times, set by P2040 has expired.
	Remedy	Check: <ul style="list-style-type: none"> • If the AS-interface master has stopped or is in 'program' mode. • The cable connection between the bus nodes. • check if the communication monitoring time has been set too short in P2040.
F00071	Cause	USS setpoint fault - no setpoint values from USS during telegram off time.
	Remedy	Check and improve monitoring timing using STARTER
F00073	Cause	Control Panel setpoint fault - no setpoint values from Control Panel during telegram off time.
	Remedy	<ul style="list-style-type: none"> • Check and improve - if necessary - the value in P3984 • Acknowledge fault • If fault persists, contact Service Department or change Inverter.

8.2 LED States

The Inverter has five main LEDs which are used to indicate the state of the Inverter. Each digital input has its own status LED. These are shown in the figure below.

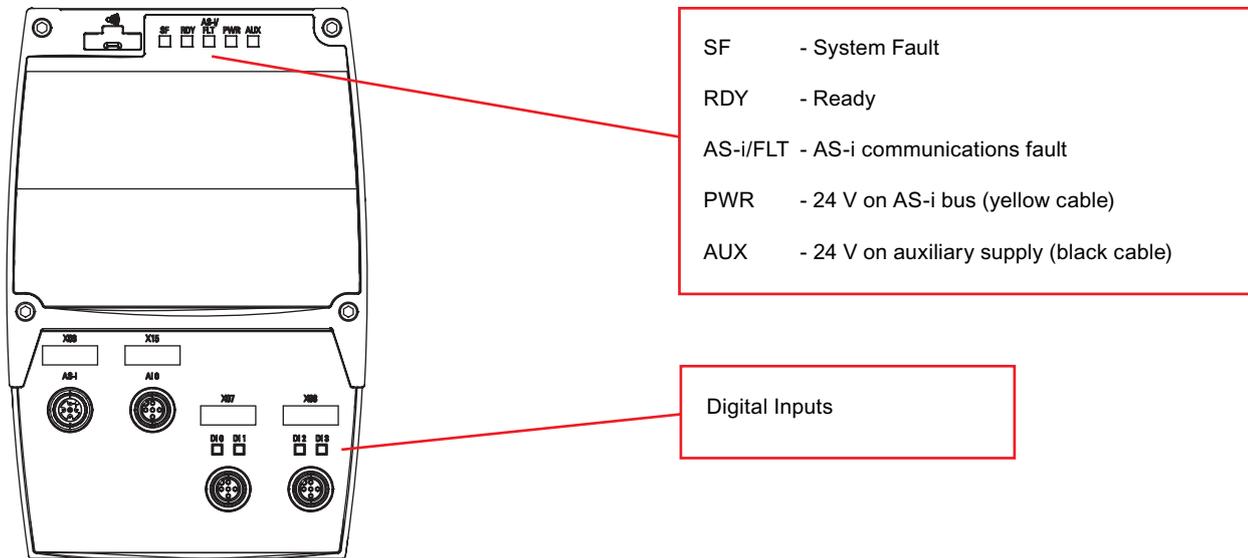


Figure 8-1 SINAMICS G110D LEDs

In the table below is shown all the possible states of the LEDs and their meaning.

Table 8- 2 SINAMICS G110D LED states

SF	RDY	AS-i/FLT	PWR	AUX	DI	Description
OFF	Flashing	-	-	-	-	Commissioning
Flashing	Flashing	-	-	-	-	Update from memory card or parameter download
ON	OFF	-	-	-	-	General fault
OFF	ON	-	-	-	-	Inverter ready or running
-	-	Flashing RED	-	-	-	No communications between processors within the Inverter
-	-	Flashing RED YELLOW	-	-	-	Slave address 0
-	-	Flashing GREEN RED	-	-	-	Inverter trip
-	-	RED	-	-	-	AS-i master not connected
-	-	GREEN	-	-	-	System OK
-	-	-	GREEN	-	-	Power OK
-	-	-	OFF	-	-	No power (yellow cable)
-	-	-	-	GREEN	-	Power OK
-	-	-	-	OFF	-	No power (black cable)
-	-	-	-	-	GREEN	Digital input active
-	-	-	-	-	OFF	No signal

Notes

Notes

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