MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

KOLLMORGEN

S70602-NANANA

DIGITAL SERVO AMPLIFIER

Used with the applicable S700 configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: S700 Digital Servo Amplifier; applicable manufacturer document pages 1, 10, 11, 12, 13, 14, 15, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 49, 50, 51, 52, 53, 54, 55, 59, 60, 61, 62

S700

Digital Servo Amplifier S701x2…S724x2 (STO dual channel)

Instruction Manual



Edition 02/2015
Translation of the original instruction manual.
Valid for Hardware Revision 02.20

Keep all manuals as a product component
during the life span of the product.
Pass all manuals to future users and owners
of the product.

2 Safety

This section helps you to recognize and avoid dangers to people and objects.

2.1 You should pay attention to this

Read the documentation!

Read the available documentation before installation and commissioning. Improper handling of the servo amplifiers can cause harm to people or damage to property. The operator must therefore ensure that all persons entrusted to work on the S700 have read and understood the manual and that the safety notices in this manual are observed.

Specialist staff required!

Only properly qualified personnel are permitted to perform such tasks as transport, assembly, setup and maintenance. Qualified specialist staff are persons who are familiar with the transport, installation, assembly, commissioning and operation of drives and who bring their relevant minimum qualifications to bear on their duties:

Transport :	only by personnel with knowledge of handling electrostatically sensitive components.
Unpacking:	only by electrically qualified personnel.
Installation :	only by electrically qualified personnel.
Setup :	only by qualified personnel with extensive knowledge of electrical engineering and drive technology

The qualified personnel must know and observe IEC 60364 / IEC 60664 and national accident prevention regulations.

Check the Hardware Revision!

Check the Hardware Revision Number of the product (see product label). This revision number must match the Hardware Revision Number on the cover page of the manual. If the numbers do not match up, visit the Tech-WIKI (http://www.wiki-kollmorgen.eu). The 'Download' section contains the various manual versions based on the hardware version number.

Pay attention to the technical data!

Adhere to the technical data and the specifications on connection conditions (rating plate and documentation). If permissible voltage values or current values are exceeded, the servo amplifiers can be damaged.

Observe electrostatically sensitive components!

The servo amplifiers contain electrostatically sensitive components which may be damaged by incorrect handling. Discharge your body before touching the servo amplifier. Avoid contact with highly insulating materials (artificial fabrics, plastic film etc.). Place the servo amplifier on a conductive surface.

Perform a risk assessment!

The manufacturer of the machine must generate a risk assessment for the machine, and take appropriate measures to ensure that unforeseen movements cannot cause injury or damage to any person or property. Additional requirements on specialist staff may also result from the risk assessment.

Automatic restart



The drive might restart automatically after power on, voltage dip or interruption of the supply voltage, depending on the parameter setting. Risk of death or serious injury for humans working in the machine. If the parameter AENA is set to 1, then place a warning sign to the machine (Warning: Automatic Restart at Power On) and ensure, that power on is not possible, while humans are in a dangerous zone of the machine. In case of using an undervoltage protection device, you must observe EN 60204-1:2006 chapter 7.5.

Hot surface!



The surfaces of the servo amplifiers can be hot in operation. Risk of minor burns!
The surface temperature can exceed 80°C. Measure the temperature, and wait until the motor has cooled down below 40°C before touching it.

Earthing!



It is vital that you ensure that the servo amplifiers are safely earthed to the PE (protective earth) busbar in the switch cabinet. Risk of electric shock. Without low-resistance earthing no personal protection can be guaranteed and there is a risk of death from electric shock.

High voltages!



The equipment produces high electric voltages up to 900V. During operation, servo amplifiers may have uncovered live sections, according to their level of enclosure protection. Capacitors can have dangerous voltages present up to eight minutes after switching off the supply power. There is a risk of death or severe injury from touching exposed contacts. Do not open or touch the equipment during operation. Keep all covers and cabinet doors closed during operation. Touching the equipment is allowed during installation and commissioning for properly qualified persons only.

There is a danger of electrical arcing when disconnecting connectors, because capacitors can still have dangerous voltages present after switching off the supply power. Risk of burns and blinding. Wait at least eight minutes after disconnecting the servo amplifiers from the main supply power before touching potentially live sections of the equipment (such as contacts) or removing any connections. Always measure the voltage in the DC bus link and wait until the voltage is below 60 V before handling components.

Reinforced Insulation!

Thermal sensors, motor holding brakes and feedback systems built into the connected motor must have reinforced insulation (according to IEC61800-5-1) against system components with power voltage, according to the required application test voltage. All Kollmorgen components meet these requirements.

Never modify the servo amplifiers!

It is not allowed to modify the servo amplifiers without permission by the manufacturer. Opening the housing causes loss of warranty and all certificates become unvalid. Warning signs are added to the device housing. If these signs are damaged, they must be replaced immediately.

2.2 Use as directed

Servo amplifiers are safety components that are built into electrical plant or machines, and can only be operated as integral components of such plant or machines.

The manufacturer of the machine must generate a risk assessment for the machine, and take appropriate measures to ensure that unforeseen movements cannot cause injury or damage to any person or property.

If the servo amplifiers are used in residential areas, in business and commercial areas, or in small industrial operations, then additional filter measures must be implemented by the user.

Cabinet and Wiring

The servo amplifiers must **only** be operated in a closed control cabinet, taking into account the ambient conditions defined on page 27. Ventilation or cooling may be necessary to keep the temperature within the cabinet below 40°C.

Use only copper conductors for wiring. The conductor cross-sections can be derived from the standard IEC 60204 (alternatively for AWG cross-sections: NEC Table 310-16, 60°C or 75°C column).

Power supply

S7xx6 : Servo amplifiers in the S7xx6 series (overvoltage category III acc. to EN 61800-5-1) can be supplied from 1-phase or 3-phase grounded (earthed) industrial supply networks (TN-system, TT-system with grounded neutral point, no more than 42kA symmetrical rated current at $110V_{-10\%}$ to $230V^{+10\%}$).

S7xx0 : Servo amplifiers in the S7xx0 series (overvoltage category III acc. to EN 61800-5-1) can be supplied from 3-phase grounded (earthed) industrial supply networks (TN-system, TT-system with grounded neutral point, no more than 42kA symmetrical rated current at $208V_{-10\%}$, 230V, 240V, 400V or $480V^{+10\%}$).

Periodic overvoltage between phases (L1, L2, L3) and the housing of the servo amplifier must not exceed 1000V crest. In accordance with IEC 61800, voltage spikes (< 50µs) between phases must not exceed 1000V. Voltage spikes (< 50µs) between a phase and the housing must not exceed 2000V.

Motors

The S700 family of servo amplifiers is **exclusively** intended for driving suitable brush less synchronous servomotors, asynchronous motors and DC motors with control of torque, speed and/or position.
The rated voltage of the motors must be at least as high as the DC bus link voltage divided by $\sqrt{2}$ produced by the servo amplifier ($U_{nMotor} \geq U_{DC}/\sqrt{2}$).

Safety

Observe the chapter "use as directed" on page 38 when you use the safety function STO.

To achieve PL e or SIL CL3, the safe switching of the pulse inhibitor must be tested periodically by analyzing the feedback signal from the safety control (⇨ p. 46).

Observe the user documentation for safety cards S1-2(S3) / S2-2(S4) when you use a safety expansion card.

2.3 Prohibited use

Other use than described in chapter 2.2 is not intended and can lead to damage of persons, equipment or things.

The use of the servo amplifier in the following environments is prohibited:
- potentially explosive areas
- environments with corrosive and/or electrically conductive acids, alkaline solutions, oils, vapors, dusts
- directly on non-grounded supply networks or on asymmetrically grounded supplies with a voltage >240V.
- on ships or off-shore applications

Commissioning the servo amplifier is prohibited if the machine in which it was installed,
- does not meet the requirements of the EC Machinery Directive
- does not comply with the EMC Directive or with the Low Voltage Directive
- does not comply with any national directives

The control of holding brakes by the S700 alone may not be used in applications, where functional safety is to be ensured with the brake.

2.4 Handling

2.4.1 Transport

- Transport by qualified personnel in the manufacturer's original recyclable packaging
- Avoid shocks while transporting
- Transport temperature: -25 to +70°C, max. rate of change 20K / hour, class 2K3 acc. to EN61800-2, EN 60721-3-1
- Transport humidity: max. 95% relative humidity, no condensation, class 2K3 acc. to EN61800-2, EN 60721-3-1
- If the packaging is damaged, check the unit for visible damage. In such an event, inform the shipper and the manufacturer.

NOTICE The servo amplifiers contain electrostatically sensitive components, that can be damaged by incorrect handling. Discharge yourself before touching the servo amplifier. Avoid contact with highly insulating materials, such as artificial fabrics and plastic films. Place the servo amplifier on a conductive surface.

2.4.2 Packaging

- Recyclable cardboard with inserts
- Dimensions: S701...S712 (HxWxD) 125x415x350 mm
  S724 (HxWxD) 155x415x350 mm
- Labeling: name plate on outside of box

2.4.3 Storage

- Storage only in the manufacturer's original recyclable packaging
- Max. stacking height: 8 cartons
- Storage temperature: -25 to +55°C, max. rate of change 20K / hour, class 1K4 acc. to EN61800-2, EN 60721-3-1
- Storage humidity: 5 … 95% relative humidity, no condensation, class 1K3 acc. to EN61800-2, EN 60721-3-1
- Storage duration:
  Less than 1 year: without restriction.
  More than 1 year: capacitors must be **re-formed** before setting up and operating the servo amplifier. To do this, remove all electrical connections and apply single-phase 230V AC for about 30 minutes to the terminals L1 and L2.

2.4.4 Maintenance, Cleaning

The devices do not require any maintenance, opening the devices invalidates warranty.

Cleaning : — if the casing is dirty: clean with Isopropanol or similar
NOTICE: ***Do not immerse or spray***
— Dirt inside the unit: must be cleaned by the manufacturer
— For dirty protective grill on fan: clean with a dry brush

2.4.5 Disassembling

Observe the sequence below, if a servo amplifier has to be disassembled (e.g. for replacement).

1. Electrical disconnection

a. Switch off the main switch of the switchgear cabinet and the fuses that supply the system.
b. Warning: Contacts can still have dangerous voltages present up to 8 min after switching off mains voltage. Risk of electric shock! Wait at least eight minutes after disconnecting the servo amplifier from the main supply power before touching potentially live sections of the equipment (e.g. contacts) or undoing any connections. To be sure, measure the voltage in the DC Bus link and wait until it has fallen below 60V.
c. Remove the connectors. Disconnect the earth (ground) connection at last.

2. Check temperature



Caution

During operation the heat sink of the servo amplifier may reach temperatures above 80°C (176°F). Risk of minor burns! Before touching the device, check the temperature and wait until it has cooled down below 40°C (104°F).

3. Disassembling

Remove the fan housing and disassemble the servo amplifier (reverse of the procedure described in chapter "Mechanical installation).

2.4.6 Repair

Repair of the servo amplifier must be done by the manufacturer. Opening the devices means loss of the guarantee. Use the telefax form on page 159 for repair request. You'll receive the current dispatch information.

Disassemble the equipment as described in chapter 2.4.5 and send it in the original packaging to the address given in the dispatch information.

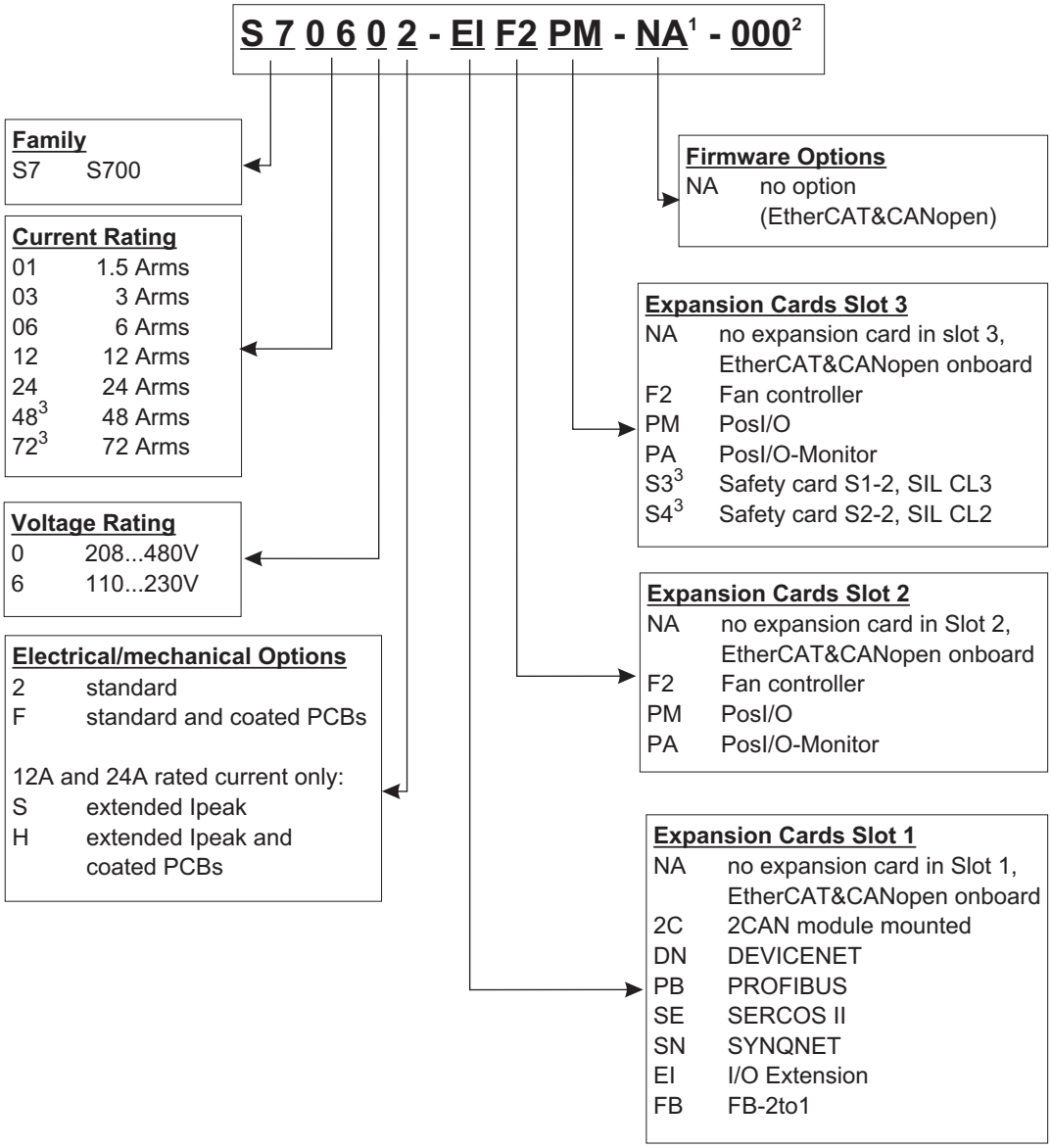
2.4.7 Disposal

In accordance to the WEEE-2002/96/EC-Guidelines we take old devices and accessories back for professional disposal. Transport costs are the responsibility of the sender. Use the telefax form on page 159 for disposal request. You'll receive the current dispatch information.

Disassemble the equipment as described in chapter 2.4.5 and send it in the original packaging to the address given in the dispatch information.

4.3 Part number scheme

The part number is identical with the order code.



1 is void with standard

2 additional coding defines customer specific specials.

3 described in seperate documentation

Example 1: S70602-EIF2PM-NA-000

S7	S700
06	6A rated current
0	208...480V rated voltage
2	no electr./mech. option
EI	I/O expansion card in Slot 1
F2	Expansion card Controlled Fan in Slot 2
PM	PosI/O expansion card in Slot 3
NA	Standard (EtherCAT&CANopen onboard)
000	no customer specific specials

Example 2: S7126S-EIF2S4-NA-000

S7	S700
12	12A rated current
6	110...230V rated voltage
S	extended Ipeak (30A)
EI	I/O Erweiterungskarte in Slot 1
F2	Expansion card Controlled Fan in Slot 2
S4	Safety Card S2-2 in Slot 3
NA	Standard (EtherCAT&CANopen onboard)
000	no customer specific specials

5 Technical description

5.1 The S700 family of digital servo amplifiers

Standard version

- Large supply voltage range: 1 x 110V$_{-10\%}$ … 3 x 480V$^{+\ 10\%}$
- Overvoltage category III acc. to IEC 61800-5-1
- 2 housing dimensions: S701...S712 70 mm
  S724 100 mm
- CANopen onboard
- EtherCAT onboard
- RS232 and 24V pulse direction interface onboard
- Resolver-, Encoder-, AquadB Encoder-, ComCoder- evaluation onboard
- Position controller onboard
- Safe Stop STO onboard (up to SIL CL3, PLe)
- 3 frontside slots for expansion cards
- Memory Card slot onboard
- Synchronous servomotors, linear motors, asynchronous motors and DC motors can be used

Power section

- S7xx6: Directly on grounded mains supply, 1x110V$_{-10\%}$ … 3x230V$^{+10\%}$, 50/60Hz
  S7xx0: Directly on grounded mains supply, 3x208V$_{-10\%}$ … 3x480V$^{+10\%}$, 50/60Hz
- TN-network or TT-network with grounded neutral point, 42kA max. symmetrical current rating, connection to other supply types only via isolating transformer,⇨p.62
- B6 bridge rectifier, integral supply filter and soft-start circuit
- Fusing (e.g. fusible cutout) to be provided by the user
- Shielding All shielding connections are made directly on the amplifier
- Output stage IGBT module with floating current measurement
- Brake circuit with dynamic distribution of the generated power between several amplifiers on the same DC bus link circuit. Internal brake resistor as standard, external brake resistors if required.
- DC bus link voltage 135...900 V DC, can be connected in parallel.
- Interference suppression filters are integrated for the electrical supply feed and the 24V auxiliary supply voltage (with motor cable ≤ 10m for C2 as per IEC 61800-3, with motor cable > 10m for C3 as per IEC 61800-3).

Integrated safety

- Appropriate insulation and creepage distances and electrical isolation ensure safe electrical separation, as per IEC 61800-5-1, between the power input / motor connections and the signal electronics.
- Soft-start, overvoltage detection, short-circuit protection, phase-failure monitoring.
- Temperature monitoring of the servo amplifier and motor (if our motors and prefabricated cables are used).
- Safe stop (up to SILCL3 acc. to IEC 62061, PLe acc. to ISO13849-1) ⇨ p.37.
- Slot for safety card with more safety functions for the safe drive operation, ⇨ p.148

Auxiliary supply voltage 24V DC

- Electrically isolated, internal fusing (amplifier and fan/brake separated), from an external 24V DC power supply unit.
- Separate 24V supply input for digital outputs

Operation and parameter setting

- With our user-friendly setup software DRIVEGUI.EXE, for setup via the serial interface of a PC.
- If no PC is available: direct operation by two keys on the servo amplifier and a 3-character LED display.
- Fully programmable via RS232 interface.
- Read and write access to parameter records and firmware via smartcard.

Completely digital control

- Digital current controller (space vector, pulse-width modulation, 62.5 µs)
- Adjustable digital speed controller (62.5 µs)
- Integrated position controller, with adaptation possibilities for all applications (250 µs, optionally 125 µs)
- Integrated 24V step/direction interface for connecting a servomotor to a stepper controller

Inputs and Outputs

- 2 programmable analog inputs ⇨ p. 94
- 4 programmable digital inputs ⇨ p. 95
- 2 programmable digital inputs/outputs (direction selectable) ⇨ p. 97
- Programmable logical combinations of digital signals
- 1 input Enable ⇨ p. 96
- 2 inputs STO Enable ⇨ p. 95

Expansions

Slot 1

Expansion cards in slot 1 can be combined with F2 Option in slot 2. More combinations of slot 1 and slot 2 expansion cards are not possible.

- I/O-14/08 expansion card, ⇨ p. 122
- PROFIBUS expansion card, ⇨ p. 125
- sercos® II expansion card, ⇨ p. 126
- DeviceNet expansion card, ⇨ p. 128
- SynqNet expansion card, ⇨ p. 131
- FB-2to1 expansion card, ⇨ p. 133
- -2CAN- expansion module, separated connectors for CAN bus and RS232 ⇨ p. 135

Slot 2

- PosI/O expansion card, ⇨ p. 138
- PosI/O-Monitor expansion card, ⇨ p. 138
- F2 Option, controlled fan, later insertion not possible, ⇨ p. 137, can be combined with expansion cards in slot 1.

Slot 3

- PosI/O expansion card, ⇨ p. 147
- PosI/O-Monitor expansion card, ⇨ p. 147
- F2 Option, controlled fan, later insertion not possible, ⇨ p. 147
- Safety expansion card (S3) S1-2 (SIL CL3), ⇨ p. 151
- Safety expansion card (S4) S2-2 (SIL CL2), ⇨ p. 148

Several third-party expansion cards (ModBus, LightBus, FIP-IO etc. please contact the manufacturer for further information)

Macro programming

More information can be found in our Technical WIKI (www.wiki-kollmorgen.eu).

- 62.5µs / 250µs / 1ms / 4ms / 16ms / IDLE / IRQ
- 128 kByte memory
- IEC 61131 structured text
- 400 easy instructions every 62.5 µs
- CAN objects for multi axis control

5.2 Technical data

5.2.1 Rated data S7xx0

Electrical data	DIM	S70102	S70302	S70602	S71202/ S7120S	S72402/ S7240S
Rated supply voltage (grounded supply, phase to phase)	V~	3 x 208V$_{-10\%}$ … 3 x 480V$^{+10\%}$, 50/60 Hz				
Rated input power for cont. operation	kVA	1.1	2.2	4.5	9	18
Permitted switch on/off frequency	1/h	30				
Auxiliary voltage supply	—	⇨ p.26				
Maximum DC bus link voltage	V=	900				
Rated output current (rms value, ± 3%)						
at 3x208V	Arms	2.5	5	6	12	24
at 3x230V	Arms	2	4	6	12	24
at 3x400V	Arms	1.5	3	6	12	24
at 3x480V	Arms	1.5	3	6	12	24
Peak output current (for approx.2s, ± 3%)	Arms	4,5	9	18	24/30	48/72
Peak output current (for approx.5s, ± 3%)	Arms	3	6	12	24	48
Switching frequency of output stage	kHz	8				
Voltage rise speed dU/dt, (measured without connected motor, see hints on page 70!)						
at 3x208V	kV/µs	3.0				
at 3x230V	kV/µs	3.3				
at 3x400V	kV/µs	5.7				
at 3x480V	kV/µs	6.9				
Technical data for brake circuit	—	⇨ p.30				
Threshold for overvoltage switch-off	VDC	⇨ p.30				
Motor inductance min.						
at 3x208V	mH	7.7	3.9	1.9	1.2	0.7
at 3x230V	mH	8.5	4.3	2.1	1.3	0.8
at 3x400V	mH	14.8	7.4	3.7	2.2	1.4
at 3x480V	mH	17.8	8.9	4.4	2.7	1.7
Motor inductance max.	mH	Consult our customer support				
Form factor of the output current (rated conditions, min. load inductance)	—	1.01				
Bandwidth of current controller	kHz	> 1,2 (bis 5)				
Residual voltage drop at rated current	V	4				6
Thermal dissipation, output stage disabled	W	max. 20				max.25
Thermal dissipation at rated current (incl. PSU losses, without brake dissipation)	W	40	70	100	160	330
Noise emission max.	dB(A)	43	43	58	65	65
Mechanical data						
Weight	kg	4.4				5.5
Height, without connectors	mm	345				348
Height, with connectors	mm	379				382
Width	mm	70				100
Depth, without connectors	mm	243				243
Depth, with connectors	mm	285				285

5.2.3 Inputs, outputs, aux. voltage supply

Interface	electr. data
Analog inputs 1 and2	±10V
Max. common-mode voltage	±10V
Digital control inputs	as per IEC 61131-2 type1, max. 30VDC, 15mA
Digital control outputs	as per IEC 61131-2 type1, max. 30VDC, 100mA
BTB/RTO output, relay contacts	max. 30VDC, max 42VAC
	500mA
24V-IO for digital outputs	20V - 30V
Auxiliary supply voltage, electrically isolated	24V (-0% +15%)
current without / with motor brake	1A / 3A
Min./max. output current to brake	0.15A / 2A

5.2.4 Connectors

Connector	Type	max. cross section*1	permiss. current*2	permiss. voltage*3
Control signals X3A,B,C	Mini-Combicon connector	1,5mm²	4A	160V
Aux. voltage X4A,B	Mini-Combicon connector	1,5mm²	4A	160V
Power signals X0, X8, X9	Power-Combicon connector	6mm²	24A	1000V
Resolver input X2	SubD 9pin (socket)	0,5mm²	1A	<100V
Encoder input X1	SubD15pin (socket)	0,5mm²	1A	<100V
PC interface, CAN X6	SubD 9pin (plug)	0,5mm²	1A	<100V
Encoder-Emulation, ROD/SSI X5 (optional)	SubD 9pin (plug)	0,5mm²	1A	<100V

*1 single-line connection
*2 single-line connection with recommended conductor cross section (chapter 5.2.8)
*3 rated voltage with pollution level 2

5.2.5 Recommended tightening torques

Connector	Tightening torque
X0, X8, X9	0.7 to 0.8 Nm
Grounding bolt	3.5 Nm

5.2.6 Fusing

Internal fusing, wire fuse or electronic

Circuit	Internal fuse
Auxiliary voltage 24V	4 A / 4 A
Brake resistor	electronic
STO-Enable	2 A

External fusing by user (US fuses in brackets)

Wire fuses or similar		S701 / S703	S706	S712	S724
AC supply feed	$F_{N1/2/3}$	6 AT (6A)*	10 AT (10A)*	16 AT (15A)*	30/35 AT (30A)*
24V feed	$F_{H1/2}$	max. 8 AT (8A)			
Brake resistor	$F_{B1/2}$	40 A**	40 A**	40 A**	50 A**

* EU fuses: types gRL or gL, 400V/500V, T means time-delay
US fuses: class RK5 or CC or J or T, 600VAC 200kA, time-delay
** Bussmann FWP-xx
Tips and detailed information can be found in the Product-Wiki on page "Fuses"

5.2.7 Ambient conditions, ventilation, mounting position

Storage hints	⇨ p.13
Transport hints	⇨ p.13
Ambient temperature in operation	0...+40°C under rated conditions +40...+55°C with power derating 2.5% / °C
Humidity in operation	rel. humidity 85%, no condensation
Site altitude	up to 1000 meters a.m.s.l. without restriction 1000…2500 meters a.m.s.l. with power derating 1.5% / 100meters
Pollution level	Pollution level 2 as per IEC 60664-1
Vibrations	Class 3M1 according to IEC 60721-3-3
Enclosure protection	IP 20 according to IEC 60529
Mounting position	vertical ⇨ p.50
Ventilation	built-on fan

NOTICE

The servo amplifier shuts down (error F01 and F13, see p.118, motor has no torque) in case of excessively high temperature in the control cabinet.
Make sure that there is sufficient forced ventilation within the control cabinet.

5.2.8 Conductor cross-sections

Following IEC 60204, we recommend for **single-axis systems**:

Interface	Cross section	Techn. requirements
AC connection	S701...706: 1.5 mm² (16awg) S712: 2.5 mm² (14awg) S724: 4 mm² (12awg)	600V,80°C
DC bus link Brake resistor	S701...724: 6 mm² (10awg)	1000V, 80°C, shielded for lengths >0.20m
Motor cables without choke, max. 25 m	S701...706: 1...1.5 mm² (16awg) S712: 2.5 mm² (14awg) S724: 4 mm² (12awg)	600V,80°C, shielded, capacitance <150pF/m
Motor cables with choke 3YL or 3YLN, 25 - 50m*	S701...706: 1 mm² (16awg) S712: 2.5 mm² (14awg) S724: 4 mm² (12awg)	600V,80°C, shielded, capacitance <150pF/m
Resolver, motor thermal control, max.100m*	4x2x0.25 mm² (24awg)	twisted pairs, shielded, capacitance <120pF/m
Encoder, motor thermal control, max. 50m*	7x2x0.25 mm² (24awg)	twisted pairs, shielded, capacitance <120pF/m
ComCoder, motor thermal control, max. 25m	8x2x0.25 mm² (24awg)	twisted pairs, shielded, capacitance <120pF/m
Setpoints, AGND, max 30m	0.25 mm² (24awg)	twisted pairs, shielded
Control signals, BTB, DGND, max 30m	0.5 mm² (21awg)	
Holding brake (motor)	min. 0.75 mm² (19awg)	600V, 80°C, shielded, **check voltage drop**
+24 V and XGND, max 30m	max. 2.5 mm² (14awg)	**check voltage drop**

NOTICE

For multi-axis systems, observe the specific operating conditions for your system.
To reach functional safety with the max. permitted cable length, observe cable requirements ⇨ p. 57.

* Kollmorgen North America supplies cables up to 39 meters
Kollmorgen Europe supplies cables up to max. length

5.3 Motor holding brake

A 24V / max. 2A holding brake in the motor can be controlled directly by the amplifier.

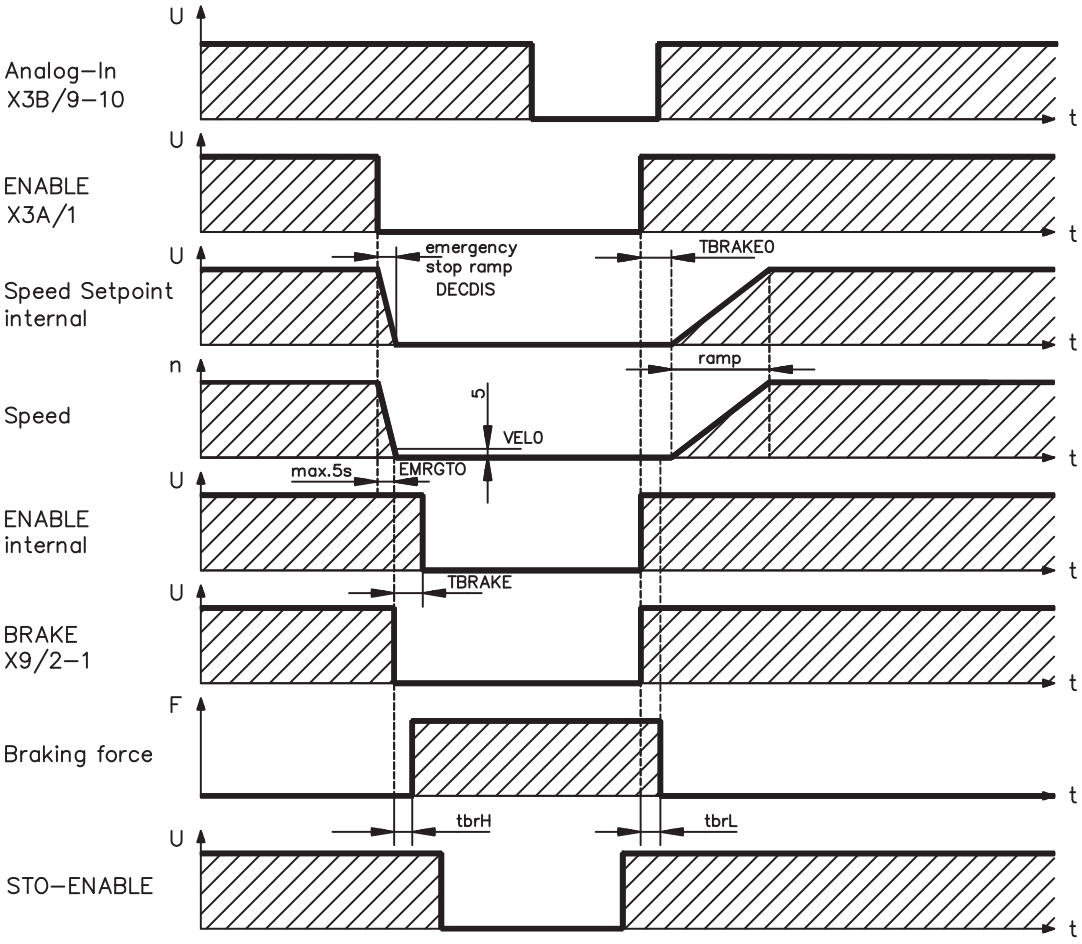
CAUTION

This function does not ensure functional safety! Danger by falling load (in case of suspended load, vertical axes). An additional mechanical brake is required for funktional safety, which must be safely operated, e.g. via the Safety Card S1-2 (see p.151).

NOTICE

The brake only works with sufficient voltage level (⇨ p.26). Check voltage drop, measure the voltage at brake input and check brake function (brake and no brake).

The brake function must be enabled through the BRAKE setting (screen page: Motor). In the diagram below you can see the timing and functional relationships between the ENABLE signal, speed setpoint, speed and braking force. All values can be adjusted with parameters, the values in the diagram are default values.



During the internal ENABLE delay time of 100ms (DECDIS), the speed setpoint of the servo amplifier is internally driven down along an adjustable ramp to 0V. The output for the brake is switched on when the speed has reached 5 rpm (VELO), at the latest after 5s (EMRGTO). The release delay time (t_{brH}) and the engage delay time (t_{brL}) of the holding brake that is built into the motor are different for the various types of motor (see motor manual), the matching data are loaded from the motor database when the motor is selected. A description of the interface can be found on page 70.

5.4 LED display

A 3-character LED display indicates the status of the amplifier after switching on the 24V supply (⇨ p.117). When the keys on the front panel are used, the parameter and function numbers are shown, as well as the numbers for any errors and warnings that may occur (⇨ p.118ff).

5.5 Grounding system

AGND — analog inputs, internal analog ground
DGND — 24V-IO, digital inputs and digital outputs, optically isolated.
GND — internal digital ground, encoder Emulation, RS232, CAN
XGND — 24V supply, STO Enable, ventilator, brake

5.6 Dynamic braking (brake circuit)

During braking with the aid of the motor, energy is fed back into the servo amplifier. This generated energy is dissipated as heat in the brake resistor. The brake resistor is switched in by the brake circuit.

The setup software can be used to adapt the brake circuit (thresholds) according to the electrical supply voltage.

Our customer service can help you with the calculation of the brake power that is necessary for your system. A simple method is described in the "Product Wiki" which is accessible at www.wiki-kollmorgen.eu. A description of the interface can be found on page 68.

Functional description:

1.- Individual amplifiers, **not coupled** through the DC bus link circuit (DC+, DC-)

When the energy fed back from the motor has an average or peak power that exceeds the preset level for the brake power rating, then the servo amplifier generates the warning “n02 brake power exceeded” and the brake circuit is switched off.

The next internal check of the DC bus link voltage (after a few milliseconds) detects an overvoltage and the output stage is switched off, with the error message “Overvoltage F02” (⇨ p.118).

The BTB/RTO contact (terminals X3B/14,15) will be opened at the same time (⇨ p.97)

2.- Several servo amplifiers **coupled** through the DC bus link (DC+, DC-)

Using the built-in brake circuit, several amplifiers of the same series can be operated off a common DC bus link (**observe page 66**), without requiring any additional measures.

90% of the **combined power** of all amplifiers is always available for peak and continuous power. The switch-off on overvoltage takes place as described under 1. (above) for the amplifier that has the lowest switch-off threshold (resulting from tolerances).

Technical data of the brake circuits depend on the amplifiers type and the mains voltage situation. See table on the next page.

Technical Data S7xx0:

Brake circuit			Supply voltage		
Type	Rated data	DIM	230 V	400 V	480 V
S70102	Switch-on threshold of brake circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Internal brake resistor (RBi)	Ohm	33		
	Continuous power internal brake resistor (RBi)	W	50		
	Max. brake power (average for 1s)	kW	0,9	0,85	0,86
	Pulse brake power	kW	4	15	21
	External brake resistor (RBe), optional	Ohm	33		
	Continuous brake power external (RBe)	kW	0,3		
S70302	Switch-on threshold of brake circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Internal brake resistor (RBi)	Ohm	33		
	Continuous power internal brake resistor (RBi)	W	50		
	Max. brake power (average for 1s)	kW	0,9	0,85	0,86
	Pulse brake power	kW	4	15	21
	External brake resistor (RBe), optional	Ohm	33		
	Continuous brake power external (RBe)	kW	1		
S70602	Switch-on threshold of brake circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Internal brake resistor (RBi)	Ohm	33		
	Continuous power internal brake resistor (RBi)	W	75		
	Max. brake power (average for 1s)	kW	1,38	1,3	1,26
	Pulse brake power	kW	4	15	21
	External brake resistor (RBe), optional	Ohm	33		
	Continuous brake power external (RBe)	kW	1		
S71202/S7120S	Switch-on threshold of brake circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Internal brake resistor (RBi)	Ohm	33		
	Continuous power internal brake resistor (RBi)	W	100		
	Max. brake power (average for 1s)	kW	1,93	1,75	1,7
	Pulse brake power	kW	4	15	21
	External brake resistor (RBe), optional	Ohm	33		
	Continuous brake power external (RBe)	kW	1,5		
S72402/S7240S	Switch-on threshold of brake circuit	V	400	720	840
	Overvoltage F02	V	455	800	900
	Internal brake resistor (RBi)	Ohm	23		
	Continuous power internal brake resistor (RBi)	W	200		
	Max. brake power (average for 1s)	kW	3,93	3,55	3,45
	Pulse brake power	kW	6	23	30
	External brake resistor (RBe), optional	Ohm	23		
	Continuous brake power external (RBe)	kW	4		

NOTE Suitable external brake resistors can be found in our accessories manual.

6 Mechanical Installation

6.1 Important notes



WARNING

There is a danger of electrical shock by high EMC level which could result in injury, if the servo amplifier (or the motor) is not properly EMC-grounded. Do not use painted (i.e. non-conductive) mounting plates. In unfavourable circumstances, use copper mesh tape between the earthing bolts and earth potential to deflect currents.

NOTICE Protect the servo amplifier from impermissible stresses. In particular, do not let any components become bent or any insulation distances altered during transport and handling. Avoid contact with electronic components and contacts.

NOTICE The servo amplifier will switch-off itself in case of overheating. Ensure that there is an adequate flow of cool, filtered air into the bottom of the control cabinet, or use a heat exchanger. Please refer to page 27.

NOTICE Don't mount devices, which produce magnetic fields, directly beside the servo amplifier. Strong magnetic fields could directly affect internal components. Install devices which produce magnetic field with distance to the servo amplifiers and/or shield the magnetic fields.

6.2 Guide to mechanical installation

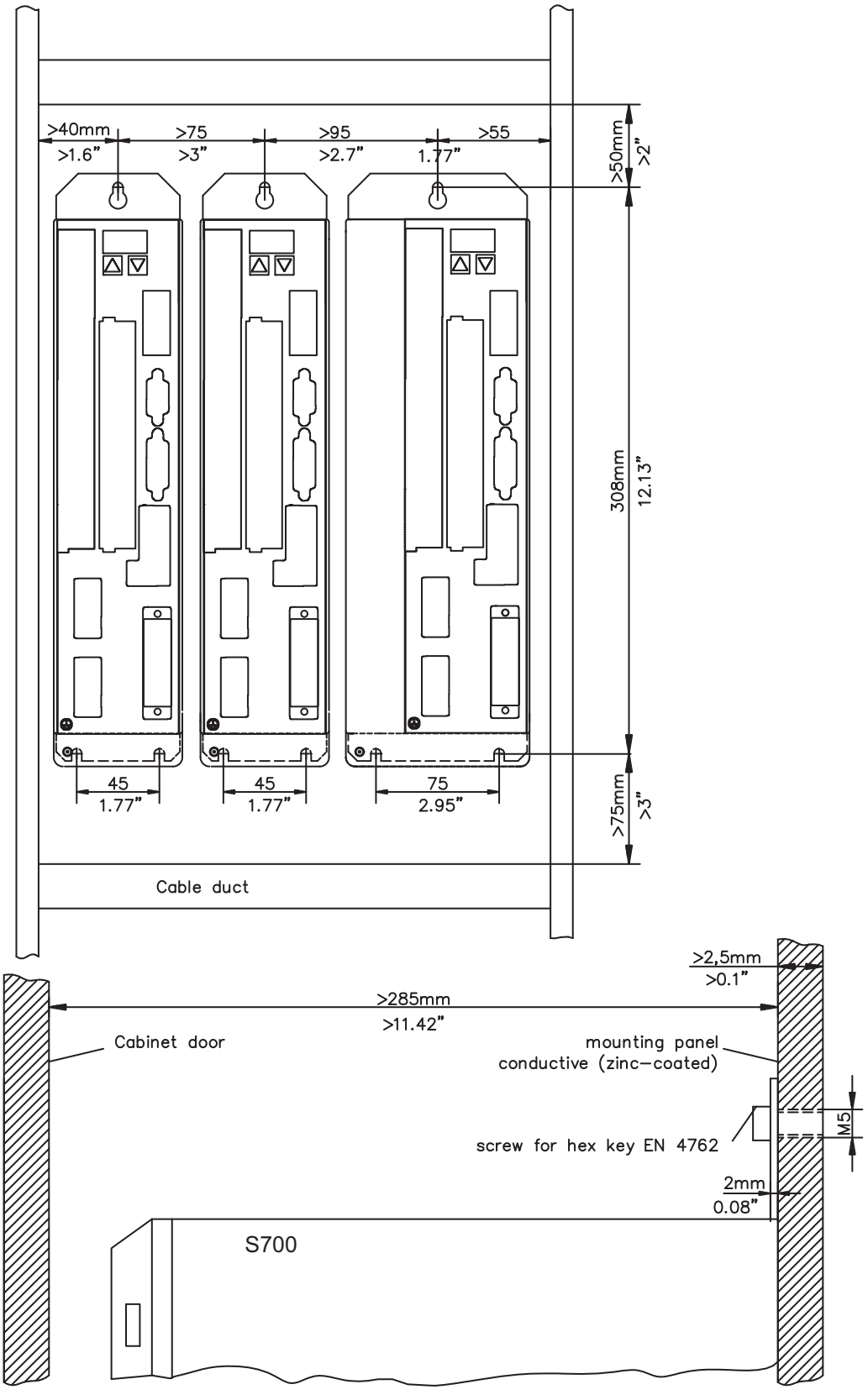
The following notes should help you to carry out the mechanical installation.

Site	In a closed control cabinet. Please refer to page 27. The site must be free from conductive or corrosive materials. For the mounting position in the cabinet ⇨ p.50.
Ventilation	Check that the ventilation of the servo amplifier is unimpeded, and keep within the permitted ambient temperature ⇨ p.27. Keep the required space clear above and below the servo amplifier ⇨ p.50.
Assembly	Assemble the servo amplifier and power supply close together, on the conductive, **grounded** mounting plate in the cabinet.
Grounding Shielding	For EMC-compliant shielding and grounding ⇨ p.61. Ground the mounting plate, motor housing and CNC-GND of the control system. Notes on connection techniques ⇨ p.56.

6.3 Assembly

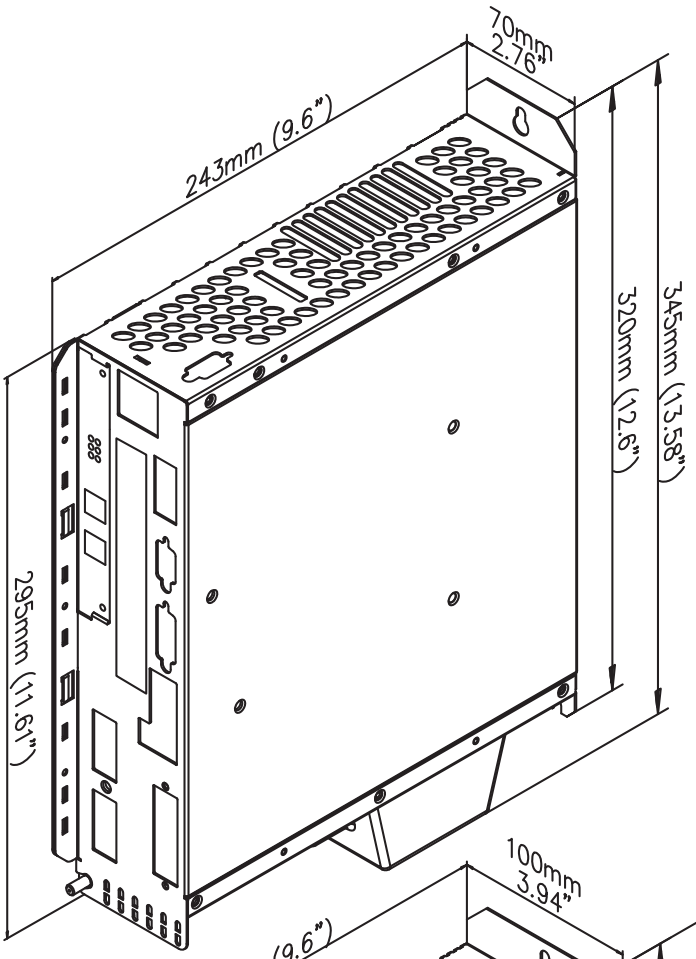
Material: three M5 hexagon socket screws to ISO 4762
Tool required : 4 mm Allen key

NOTE Remove the fan before mounting the servo amplifier and replace it again afterwards (⇨ p.52).

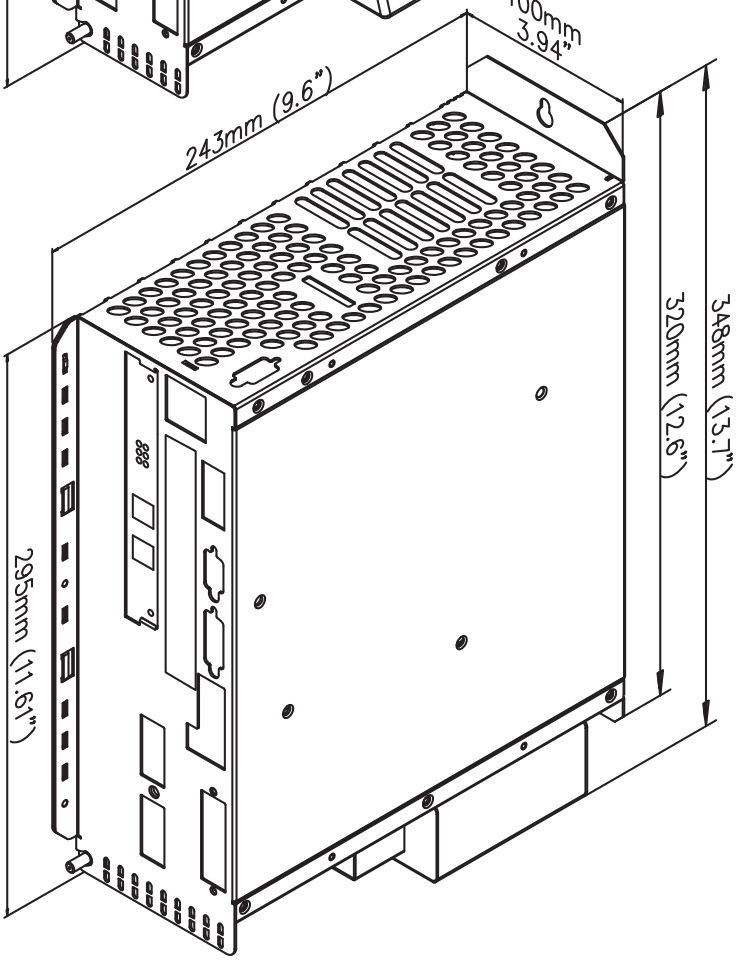


6.4 Dimensions

S701…712



S724

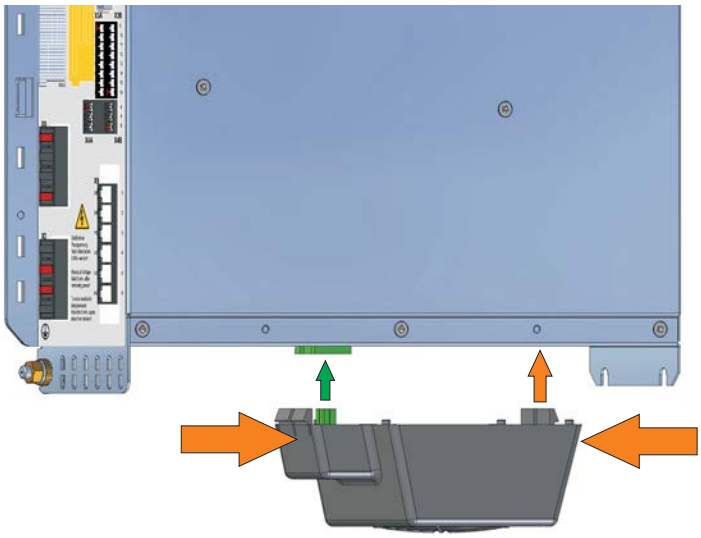


6.5 Fan assembly

The fan does not require wiring. Built-in connectors in the fan casing plug into sockets on the underside of the S700.

NOTE Remove the fan before mounting the servo amplifier and replace it again afterwards.

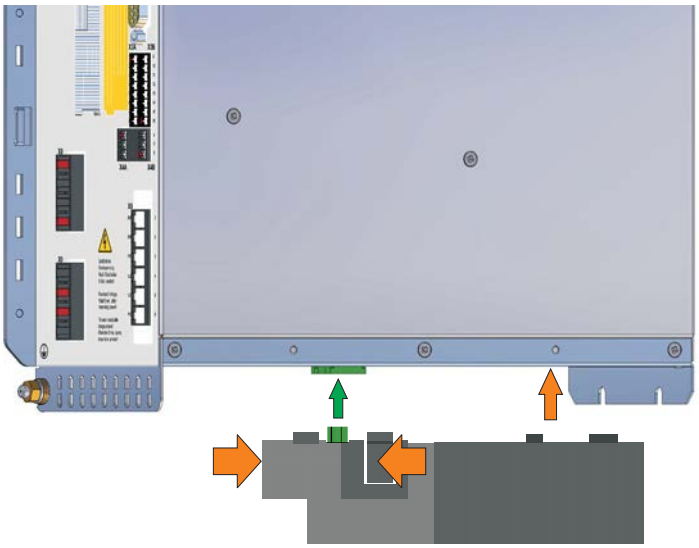
Mounting and removing the fan (models S701...712)



Removal:
Gently squeeze the fan casing together lengthwise and pull the fan casing down.

Mounting:
Position the fan so that the green connector is aligned with the socket in the S700. Push the fan onto the connector until the fan casing clicks into place. Gently squeeze the fan casing together lengthwise to check that it is fully engaged.

Mounting and removing the fan (model S724)



Removal:
Gently squeeze the fan casing together crosswise and pull the fan casing down.

Mounting:
Position the fan so that the green connector is aligned with the socket in the S700. Push the fan onto the connector until the fan casing clicks into place. Gently squeeze the fan casing together crosswise to check that it is fully engaged.

7 Electrical installation

7.1 Important notes



WARNING

There is a danger of electrical arcing when disconnecting connectors, because capacitors can still have dangerous voltages present up to eight minutes after switching off the supply power.
Risk of burns and blinding. The contacts become damaged.
Never undo any electrical connections to the servo amplifier while it is live. Wait at least eight minutes after disconnecting the installations from the main supply power before touching potentially live sections of the equipment (e.g. contacts) or undoing any connections.
To be sure, measure the voltage in the DC Bus link and wait until it has fallen below 60V. Control and power connections can still be live, even if the motor is not rotating.

NOTICE Wrong mains voltage, unsuitable motor or wrong wiring will damage the amplifier. Check the combination of servo amplifier and motor. Compare the rated voltage and current of the units. Implement the wiring according to the connection diagram on p. 55. Make sure that the maximum permissible rated voltage at the terminals L1, L2, L3 or +DC, –DC is not exceeded by more than 10% even in the most unfavorable circumstances (see IEC 60204-1).

NOTICE Excessively high external fusing will endanger cables and devices. The fusing of the AC supply input and 24V supply must be installed by the user, best values are given on p.26. Hints for use of Residual-current circuit breakers (FI) ⇨ p.47.

NOTICE Correct wiring is the basis for reliable functioning of the servo system.
Route power and control cables separately. We recommend a distance of at least 200mm. This improves the interference immunity. If a motor power cable is used that includes cores for brake control, the brake control cores must be separately shielded. Ground the shielding at both ends. Ground all shielding with large areas (low impedance), with metalized connector housings or shield connection clamps wherever possible. Notes on connection techniques can be found on page 56.

NOTICE Feedback lines may not be extended, since thereby the shielding would be interrupted and the signal processing could be disturbed. Lines between amplifiers and external brake resistor must be shielded. Install all cables with an adequate cross-section, as per IEC 60204 (⇨ p.27) and use the requested cable material (⇨ p. 57) to reach max. cable length.

NOTICE The servo amplifier's status must be monitored by the PLC to acknowledge critical situations. Wire the BTB/RTO contact in series into the emergency stop circuit of the installation. The emergency stop circuit must operate the supply contactor.

NOTE It is permissible to use the setup software to alter the settings of the servo amplifier. Any other alterations will invalidate the warranty.

7.2 Guide to electrical installation

The following notes should help you to carry out the electrical installation.

Cable selection

Select cables in accordance with IEC 60204 ⇨ p.27.

Grounding Shielding

For EMC-compliant shielding and grounding ⇨ p.61.
Ground the mounting plate, motor housing and CNC-GND of the control system. Notes on connection techniques ⇨ p.56.

Wiring

Note: Route power leads and control cables separately.
Wire the BTB/RTO contact in series into the emergency stop circuit of the system.

1. Connect the digital control inputs and outputs.
2. Connect the analog input source, if required.
3. Connect the feedback device.
4. Connect the expansion card
   (see corresponding notes from page 121).
5. Connect the motor cable
   Connect shielding to EMC connectors (shield connection) at both ends. Use the motor choke (3YL or 3YLN) if cable > 25 meters.
6. Connect motor-holding brake, connect shielding to EMC connector at both ends.
7. If required, connect the external brake resistor (with fusing).
8. Connect the auxiliary supply
   (maximum permissible voltage values ⇨ p.27).
9. Connect the main electrical supply
   (maximum permissible voltage values ⇨ p.27), hints for use of Residual-current circuit breakers (FI) ⇨ p.47
10. Connect the PC (⇨ p.98).

Final check

Final check of the implementation of the wiring against the wiring diagrams that have been used.

7.3 Wiring

The installation procedure is described as an example. A different procedure may be appropriate or necessary, depending on the application of the equipments.
We provide further know-how through **training courses** (on request).



DANGER

Severe electric shock injuries or death may be sustained when working on installations which have not been disconnected.
Only professional staff who are qualified in electrical engineering are allowed to install the servo amplifier.
Only install and wire up the equipment when it is not live, i.e. when neither the electrical supply nor the 24 V auxiliary voltage nor the supply voltages of any other connected equipment is switched on.
Take care that the cabinet is safely disconnected (with a lock-out, warning signs etc.). The individual voltages will be switched on for the first time during setup.

NOTE

The ground symbol ⏚, which you will find in all the wiring diagrams, indicates that you must take care to provide an electrically conductive connection with the largest feasible surface area between the unit indicated and the mounting plate in the control cabinet. This connection is for the effective grounding of HF interference, and must not be confused with the PE-symbol ⏚
(PE = protective earth, safety measure as per IEC 60204).

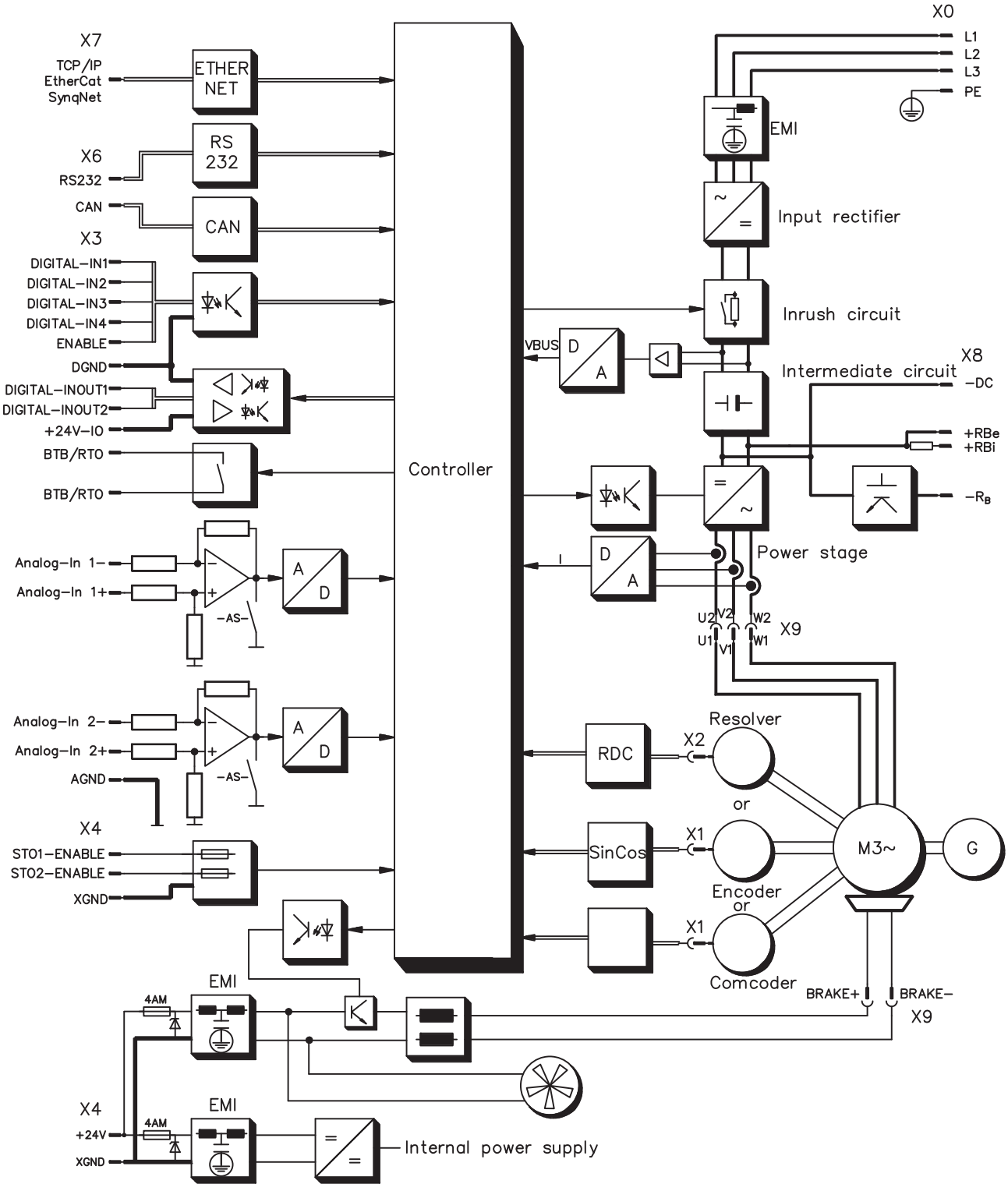
NOTE

Use the following connection diagrams:

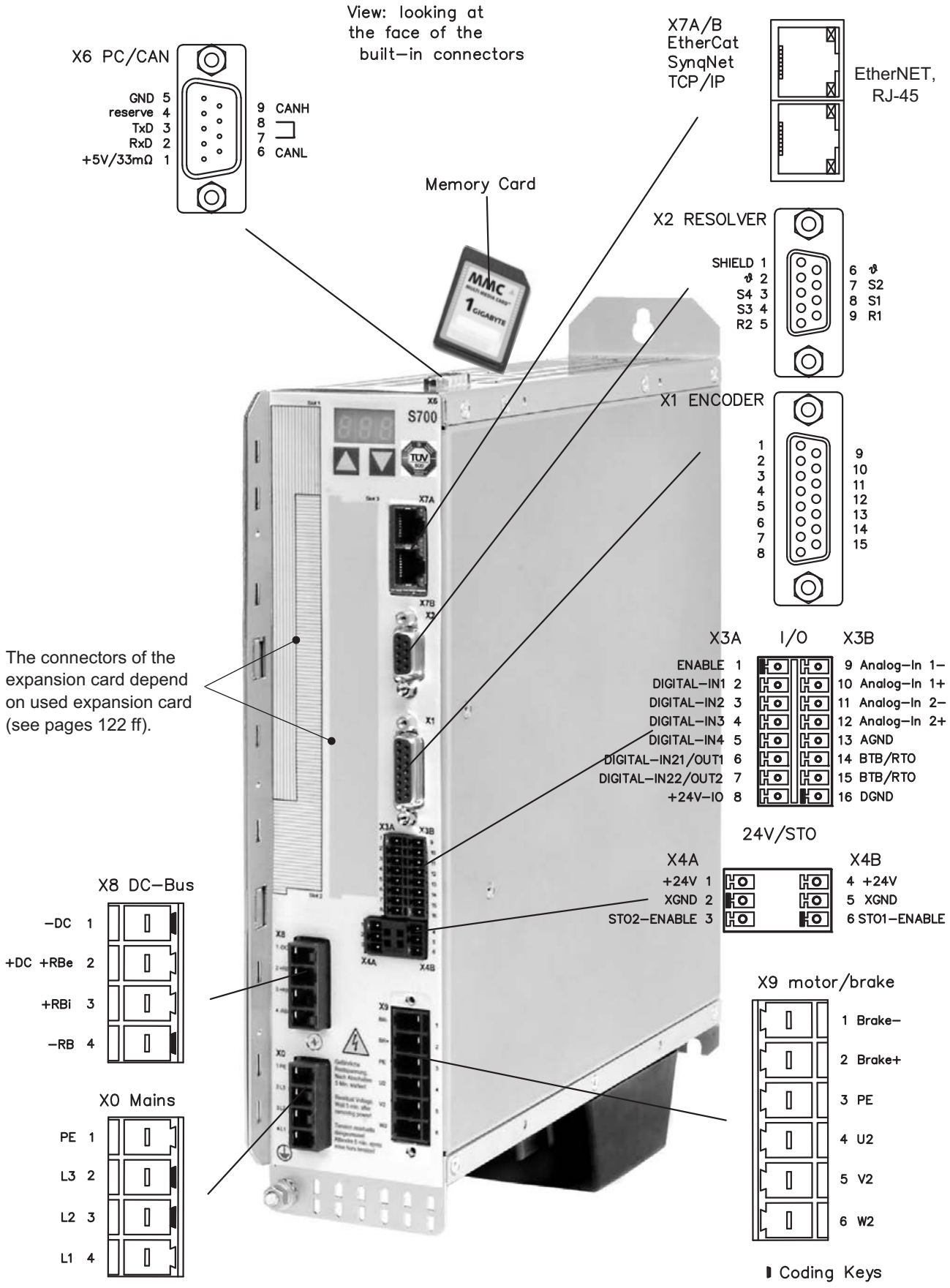
Overview	: page 61
Safe Torque Off STO	: page 42
Mains power	: page 64ff
Motor	: page 70
Feedback	: page 72ff
Electronic Gearing and Master Slave	
Master-Slave	: page 89
Pulse-Direction	: page 90
Digital and analog inputs and outputs	: page 94ff
RS232 / PC connection	: page 98
CANopen Interface	: page 99
EtherNET Interface	: page 100
Expansion cards for slot 1:	
I/O-14/08	: page 124
PROFIBUS	: page 125
sercos® II	: page 127
DeviceNet	: page 128
SynqNet	: page 132
FB-2to1	: page 133
2CAN	: page 135
Expansion cards for slot 2:	
PosI/O & PosI/O-Monitor	: page 138ff
Expansion cards for slot 3:	
PosI/O & PosI/O-Monitor	: page 147ff
Safety	: page 148ff

7.5 Block diagram

The block diagram below just provides an overview.

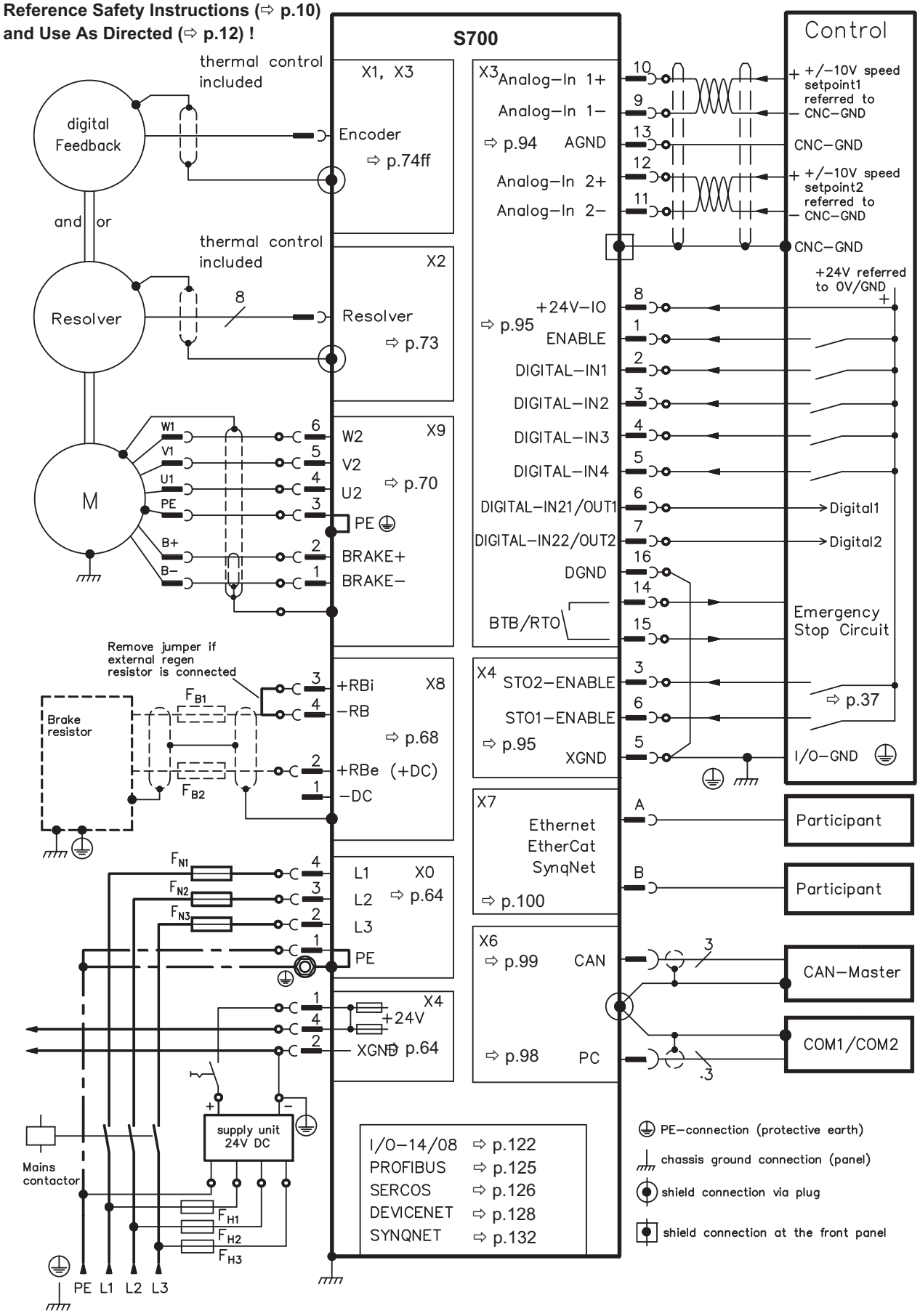


7.6 Connector assignments



7.7 Connection diagram (Overview)

Reference Safety Instructions (⇨ p.10) and Use As Directed (⇨ p.12) !



7.8 Electrical supply

7.8.1 Connection to various mains supply networks

WARNING

There is a danger of electrical shock with serious personal injury or death if the servo amplifier isn't properly grounded. An isolating transformer is required for 400V to 480V networks that are asymmetrically grounded or not grounded as shown below.

7.8.1.1 S7xx0 types

