9 Expansions

You can find information about availability and order numbers on page 161.

9.1 Expansion cards for slot 1

9.1.1 Guide to installation of expansion cards in slot 1

1 - Boundary of SLOT1


2 - Detach the film (at the perforations)


3 - Tear off the film (as far as the mark)


4 - Break the top rib


5 - Break the bottom rib

6 - Pull out the top plate


7 - Pull out the bottom plate


8 - Push in the card

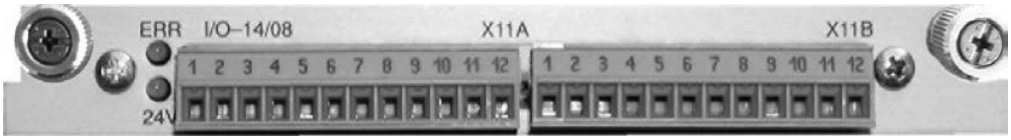

9 - Fasten the screws

9.1.2 Expansion card -I/O-14/08-

This section describes the additional features that the expansion card -I/O-14/08- provides for the S700. If you ordered the expansion card together with the servo amplifier, then it will be delivered already inserted into the expansion slot of the servo amplifier and screwed in place.
The -I/O-14/08- provides you with 14 additional digital inputs and 8 digital outputs. The functions of the inputs and outputs are adjustable with the setup software.

NOTE The 24V DC voltage must be supplied by an electrically isolated power supply (e.g. with isolating transformer).

The I/Os are used to initiate the motion tasks that are stored in the servo amplifier and to evaluate signals from the integrated position control in the higher-level control system. The functions of the inputs and signal outputs correspond to the functions that can be assigned to the digital I/Os on connector X3. All inputs and outputs are electrically isolated from the servo amplifier by optocouplers.



9.1.2.1 Technical data

Control inputs	24V / 7mA , PLC-compatible, IEC 61131
Signal output	24V / max. 500mA , PLC-compatible, IEC 61131
Supply inputs, to IEC 61131	24V (18 … 36V) / 100mA plus total current of the outputs (depends on the input wiring of the controls)
Fusing (external)	4 AT
Connectors	MiniCombicon, 12-pin, coded on PIN1 and 12
Cables	Data – up to 50m long : 22 x 0.5 mm², unshielded, Supply – 2 x 1mm², check voltage drop
Waiting time between 2 motion tasks	depends on the response time of the control system
Addressing time (minimum)	4ms
Starting delay (maximum)	2ms
Response time of digital outputs	max. 10ms

9.1.2.2 LEDs

Two LEDs are mounted next to the terminals on the expansion card. The green LED signals that the 24V auxiliary supply is available for the expansion card. The red LED signals faults in the outputs from the expansion card (overload of switching components, short-circuit).

9.1.2.3 Entering a motion block number (example)

Motion block number	A7	A6	A5	A4	A3	A2	A1	A0
binary 1010 1110	1	0	1	0	1	1	1	0
decimal 174	128	-	32	-	8	4	2	-

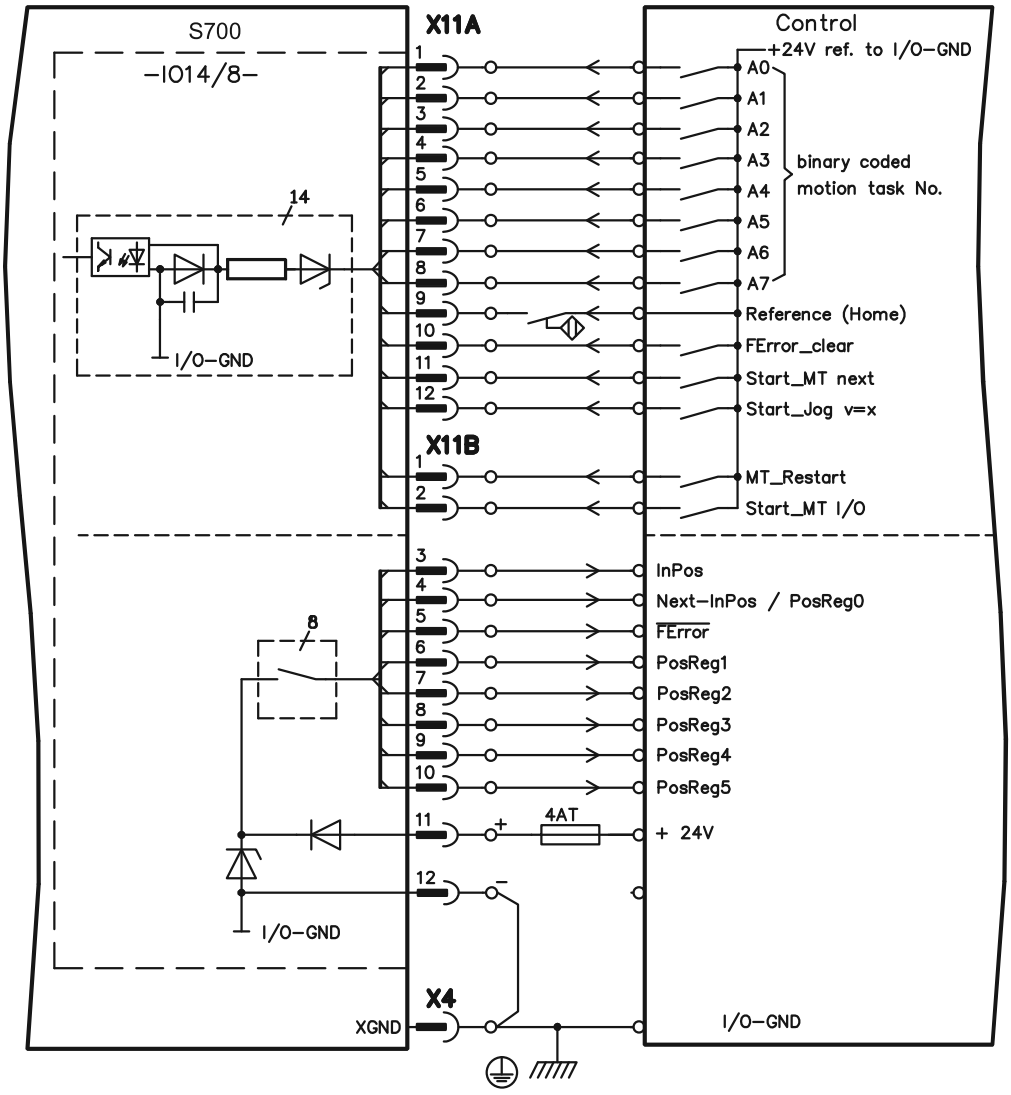
9.1.2.4 Connector assignments

The functions are adjustable with the setup software. In the table below the default values are described.

Connector X11A			
Pin	**Dir**	**Default function**	**Description**
1	In	A0	Motion block number, 2^0, LSB
2	In	A1	Motion block number, 2^1
3	In	A2	Motion block number, 2^2
4	In	A3	Motion block number, 2^3
5	In	A4	Motion block number, 2^4
6	In	A5	Motion block number, 2^5
7	In	A6	Motion block number, 2^6
8	In	A7	Motion block number, 2^7, MSB
9	In	Reference	Polls the home switch. If a digital input on the base unit is used as a home input, then the input on the expansion card will **not** be evaluated.
10	In	F_error_clear	Clears the warning of a following error (n03) or the response monitoring (n04)
11	In	Start_MT_Next	The following task, that is defined in the motion task by “Start with I/O” is started. The target position of the present motion task must be reached before the following task can be started. The next motion block can also be started by an appropriately configured digital input on the base unit.
12	In	Start_Jog v= x	Starts the "Jog Mode" with a defined speed. “x” is the speed saved in the servo amplifier for the function "Jog Mode". A rising edge starts the motion, a falling edge cancels the motion.

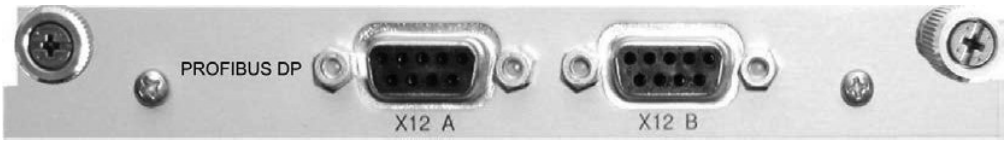
Connector X11B			
1	In	MT_Restart	Continues the motion task that was previously interrupted.
2	In	Start_MT I/O	Starts the motion task that is addressed by A0-A7 (connector X11A/1 to X11A8). If no motion task is addressed, then a homing task is started.
3	Out	InPos	When the target position for a motion task has been reached (the InPosition window), this is signaled by the output of a HIGH signal. **A cable break will not be detected.**
4	Out	Next-InPos	The start of each motion task in an automatically executed sequence of motion tasks is signaled by an inversion of the output signal. The output produces a LOW signal at the start of the first motion task of the sequence. The form of the message can be varied by using ASCII commands.
		PosReg 0	Can only be adjusted by ASCII commands or setup software.
5	Out	$\overline{\text{F\_error}}$	A LOW signal indicates that the position has gone outside the acceptable following error window.
6	Out	PosReg1	default: SW limit 1, indicated by a HIGH signal
7	Out	PosReg2	default: SW limit 2, indicated by a HIGH signal
8	Out	PosReg3	Can only be adjusted by ASCII commands or setup software.
9	Out	PosReg4	Can only be adjusted by ASCII commands or setup software.
10	Out	PosReg5	Can only be adjusted by ASCII commands or setup software.
11	-	24V DC	Supply voltage for output signals.
12	-	I/O-GND	Digital GND for the control system.

9.1.2.5 Connection diagram (default)



9.1.3 Expansion card -PROFIBUS-

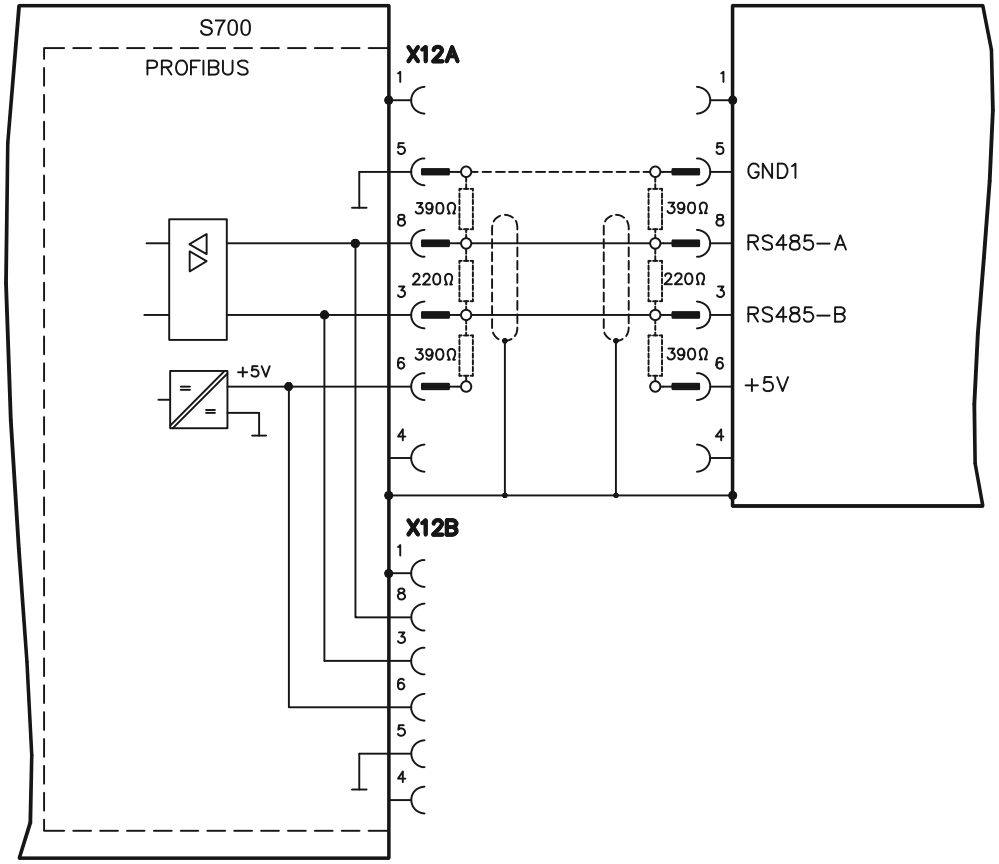
This section describes the PROFIBUS expansion card for the S700.
Information on the range of functions and the software protocol can be found in our manual “Communication Profile PROFIBUS DP”.
The PROFIBUS expansion card has two 9-pin SubD sockets wired in parallel.
The supply voltage for the expansion card is provided by the servo amplifier.



9.1.3.1 Connection technology

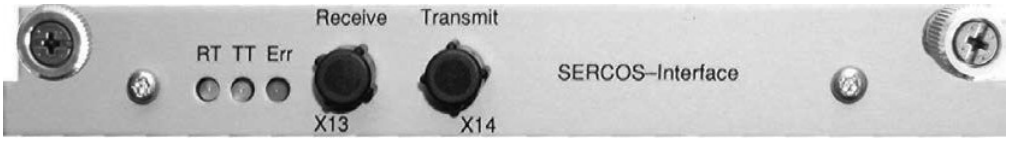
Cable selection, cable routing, shielding, bus connector, bus termination and transmission times are all described in the “Installation Guidelines for PROFIBUS-DP/FMS” from PNO, the PROFIBUS User Organization.

9.1.3.2 Connection diagram



9.1.4 Expansion card -SERCOS-

This section describes the sercos® II expansion card for S700. Information on the range of functions and the software protocol can be found in our manual “IDN Reference Guide sercos® ”.



9.1.4.1 LEDs

RT	Indicates whether sercos® telegrams are being correctly received. In the final Communication Phase 4 this LED should flicker, since cyclical telegrams are being received.
TT	Indicates that sercos® telegrams are being transmitted. In the final Communication Phase 4 this LED should flicker, since cyclical telegrams are being transmitted. Check the station addresses for the controls and the servo amplifier if: - the LED never lights up in sercos® Phase 1 or - the axis cannot be operated, although the RT LED is lighting up cyclically.
ERR	Indicates that sercos® communication is faulty or suffering from interference. If this LED is very bright, then communication is suffering strong interference, or is non-existent. Check the sercos® transmission speed for the controls and the servo amplifier (BAUD RATE) and the fiber-optic connection. If this LED fades or flickers, this indicates a low level of interference for sercos® communication, or the optical transmitting power is not correctly matched to the length of cable. Check the transmitting power of the (physically) previous sercos® station. The transmitting power of the servo amplifier can be adjusted in the setup software DRIVEGUI.EXE on the sercos® screen page, by altering the length parameter for the cable length.

9.1.4.2 Connection technology

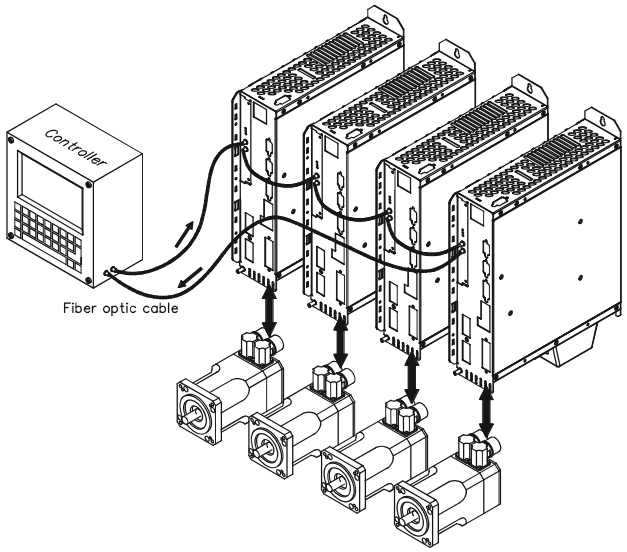
For the fiber optic cable connection, only use sercos® components to the sercos® Standard IEC 61491.

Receive data
The fiber optic cable carrying receive data for the drive in the ring structure is connected to X13 with an F-SMA connector.

Transmit data
Connect the fiber optic cable for the data output to X14 by F-SMA connector.

9.1.4.3 Connection diagram

Layout of the sercos® bus system in ring topology, with fiber optical cables (schematic).



9.1.4.4 Setup

Modifying the station address

The drive address can be set to a value between 0 and 63. With address 0, the drive is assigned as an amplifier in the sercos® ring. Set the station address with the:

Keys on the front of the servo amplifier
The sercos® address can be modified using the keys on the front of the amplifier (p. 120).

Setup software
The address can also be modified in the setup software, “CAN/Fieldbus” screen (please refer to the setup software online help). Alternatively, enter the command **ADDR #** in the “Terminal” screen, where # is the new address of the drive.

Modifying the baud rate and optical power

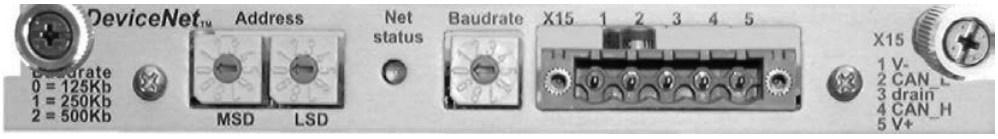
If the baud rate is not set correctly, communication is not possible.
The **SBAUD #** parameter can be used to set the baud rate, where # is the baud rate. If the optical power is not set correctly, errors occur in telegram transmission and the red LED on the drive lights up. During normal communication, the green send and receive LEDs flash, giving the impression that the relevant LED is on.
The **SLEN #** parameter can be used to specify the optical range for a standard 1 mm² glass fibre cable, where # is the length of the cable in meters.

SBAUD		SLEN	
2	2 Mbaud	0	Very short connection
4	4 Mbaud	1…< 15	Length of the connection with a 1 mm² plastic cable
8	8 Mbaud	15…< 30	Length of the connection with a 1 mm² plastic cable
16	16 Mbaud	≥ 30	Length of the connection with a 1 mm² plastic cable

Setup software
The parameters can be modified in the setup software, “SERCOS” screen (please refer to the setup software the online help). Alternatively, the commands **SBAUD #** and **SLEN #** can be entered in the “Terminal” screen.

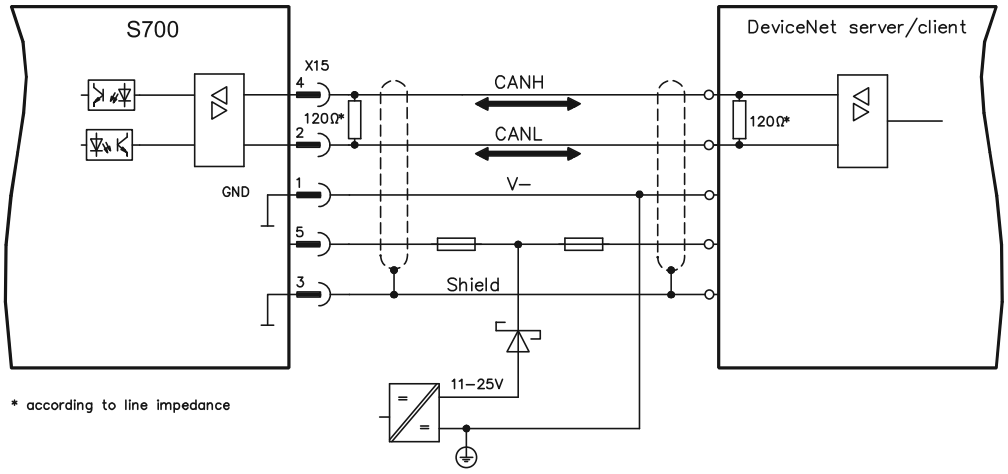
9.1.5 Expansion card - DEVICENET -

This section describes the DeviceNet expansion card for S700.
Information on the range of functions and the software protocol can be found in our manual “DeviceNet Communication Profile”.



9.1.5.1 Connection technology, Connection diagram

Cable selection, cable routing, shielding, bus connector, bus termination and transmission times are all described in the “DeviceNet Specification, Volume I, II”, published by ODVA.



9.1.5.2 Combined module status and network status LED

LED	Meaning
off	The device is not online. - The device has not yet finished the Dup_MAC_ID test. - The device is possibly not yet switched on.
green	The device is operating as normal, is online, and the connections have been established. The device has been assigned to a master.
blinking green	The device is operating as normal, is online, but the connections have not been established. - The device has passed the Dup_MAC_ID test and is online, but the connection to other nodes have not been established. - This device has not been assigned to a master. - Missing, incomplete or wrong configuration.
blinking red	An error that can be cleared and/or at least one I/O connection are in a waiting state.
red	- An error has occurred that cannot can be cleared; it may be necessary to replace the device. - Communication device failure. The device has detected a fault that prevents communication with the network (for instance, a MAC ID appears twice or BUSOFF).

9.1.5.3 Setup

Setting the station address (device address)

The station address for the servo amplifier can be set in three different ways:

- Set the rotary switches at the front of the expansion card to a value between 0 and 63. Each switch represents a decimal figure. For example, to set the address for the drive to 10, set MSD to 1 and LSD to 0.
- Set the rotary switches at the front of the expansion card to a value higher than 63. Now you can set up the station address by using the ASCII commands DNMACID x, SAVE, COLDSTART, whereby “x” stands for the station address.
- Set the rotary switches at the front of the expansion card to a value higher than 63. Now you can set up the station address by using the DeviceNet Object (Class 0x03, Attribute 1). This is normally carried out with the help of a DeviceNet software setup tool. You must save the parameters in non-volatile memory (Class 0x25, Attribute 0x65) and then restart the drive after setting or altering the address.

Setting the transmission speed

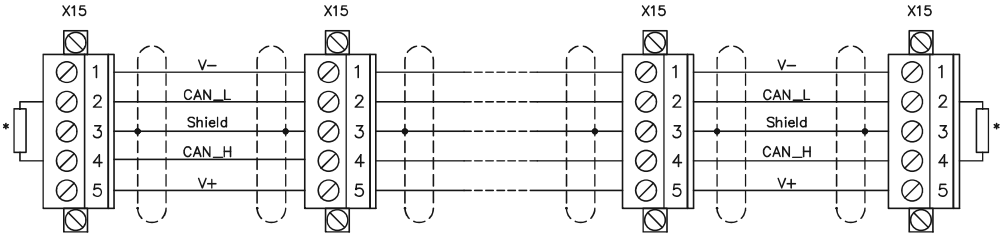
The DeviceNet transmission speed can be set in three different ways:

- Set the rotary switch for Baud rate (at the front of the option card) to a value between 0 and 2. 0 = 125 kbit/s, 1 = 250 kbit/s, 2 = 500 kbit/s.
- Set the rotary switch for Baud rate (at the front of the option card) to a value higher than 2. Now you can set the Baud rate by using the terminal commands DNBAUD x, SAVE, COLDSTART, whereby “x” stands for 125, 250 or 500 .
- Set the rotary switch for Baud rate (at the front of the option card) to a value higher than 2. Now you can set the Baud rate by using the DeviceNet Object (Class 0x03, Attribute 2) to a value between 0 and 2. This is normally carried out with the help of a DeviceNet software setup tool. You must save the parameters in non-volatile memory (Class 0x25, Attribute 0x65) and then restart the drive after altering the baud rate.

9.1.5.4 Bus cable

To meet ISO 11898, a bus cable with a characteristic impedance of 120 Ω should be used. The maximum usable cable length for reliable communication decreases with increasing transmission speed. As a guide, you can use the following values which we have measured, but they are not to be taken as assured limits.

General characteristic	Specification
Bit rates	125 kbit, 250 kbit, 500 kbit
Distance with larger bus connections	500 meters at 125 kBaud 250 meters at 250 kBaud 100 meters at 500 kBaud
Number of nodes	64
Signal environment	CAN
Modulation	Basic bandwidth
Coupling medium	DC-coupled differential transmit/receive operation
Isolation	500 V (option: optocoupler on the transceiver's node side)
Typical differential input impedance (recessive state)	Shunt C = 5pF Shunt R = 25KΩ (power on)
Min. differential input impedance (recessive state)	Shunt C = 24pF + 36 pF/m of the permanently attached stub cable Shunt R = 20KΩ
Absolute max. voltage range	-25 V to +18 V (CAN_H, CAN_L) The voltages for CAN_H and CAN_L refer to the ground pin of the transceiver. The voltage is higher than that on the V-terminal by the amount of the forward voltage drop of the Schottky diode. This voltage drop must be < 0.6V.



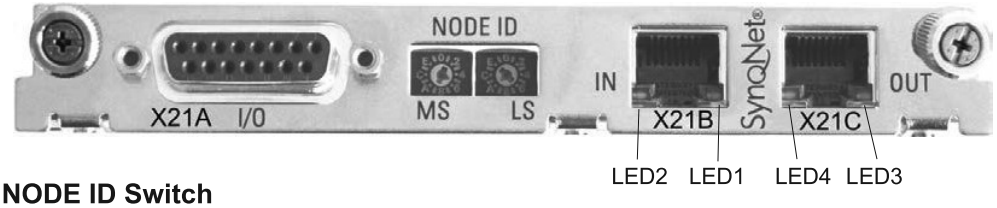
Grounding:
The DeviceNet network must only be grounded at one point, to avoid ground loops. The circuitry for the physical layer in all devices are referenced to the V-bus signal. The ground connection is made via the power supply for the bus system. The current flowing between V- and ground must not flow through any device other than the power supply.

Bus topology:
The DeviceNet medium utilizes a linear bus topology. Termination resistors are required at each end of the connecting cable. Stub cables are permitted up to a length of 6 meters, so that at least one node can be connected.

Termination resistors:
DeviceNet requires a termination **at each end** of the connecting cable.
These resistors must meet the following requirements: 120Ω, 1% metal-film, ¼ W

9.1.6 Expansion card -SYNQNET-

This section describes the SynqNet expansion card for S700. Information on the range of functions and the software protocol can be found in the SynqNet documentation.



9.1.6.1 NODE ID Switch

With these hexadecimal switches you can set the main and low significant bytes of the Node ID separately. SynqNet does not require an address for correct operation in the network, however in some machines this can be a convenient way of identifying build options to the application program.

9.1.6.2 Node LED table

LED#	Name	Function
LED1, green	LINK_IN	ON = receive valid (IN port) OFF= not valid, power off, or reset.
LED2, yellow	CYCLIC	ON = network cyclic BLINK = network not cyclic OFF = power off, or reset
LED3, green	LINK_OUT	ON = receive valid (OUT port) OFF = not valid, power off, or reset
LED4, yellow	REPEATER	ON = repeater on, network cyclic BLINK = repeater on, network not cyclic OFF = repeater off, power off, or reset

9.1.6.3 SynqNet Connection, Connector X21B/X21C (RJ-45)

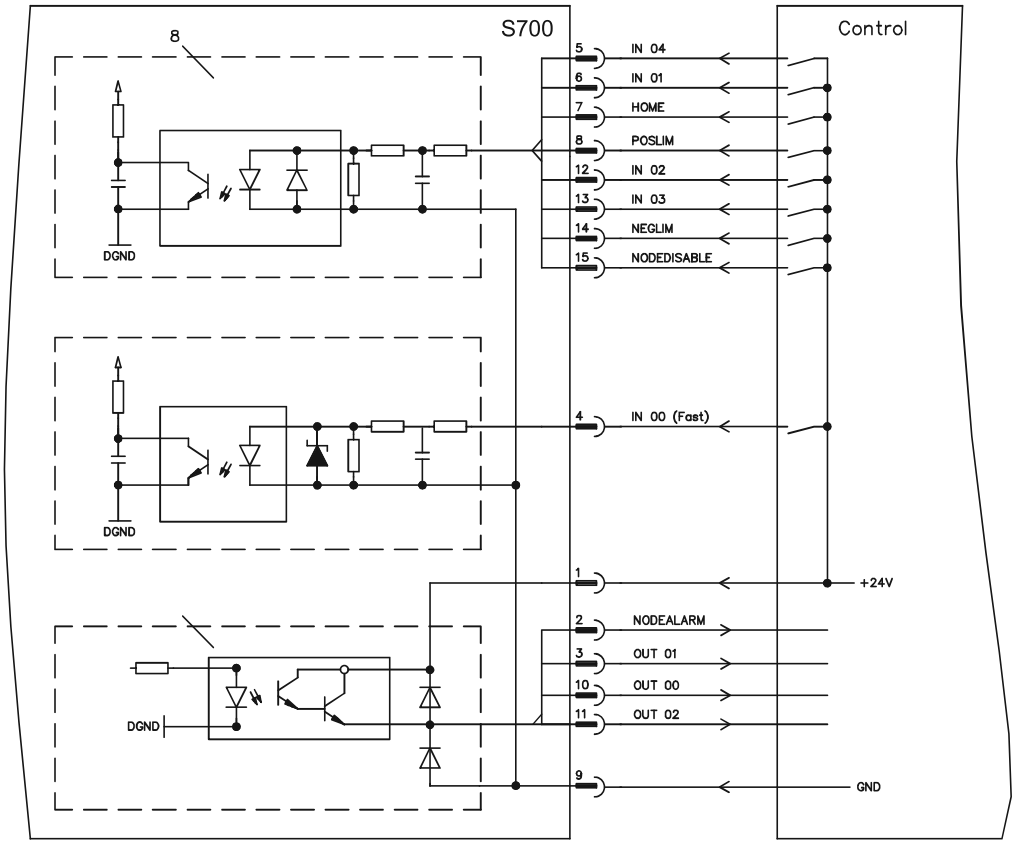
Connection to the SynqNet network via RJ-45 connectors (IN and OUT ports) with integrated LEDs.

9.1.6.4 Digital inputs and outputs, connector X21A (SubD 15-pin, socket)

Inputs (In): 24V (20...28V), opto-isolated, one high-speed input (Pin 4)
Outputs (Out): 24V, opto-isolated, Darlington driver

Pinout connector X21A (SubD 15 pin)							
Pin	**Type**	**Description**		**Pin**	**Type**	**Description**	
1	In	+24V	power supply	**9**	In	GND	power supply
2	Out	NODE-ALARM	indicates a problem with the node	**10**	Out	OUT_00	digital output
3	Out	OUT_01	digital output	**11**	Out	OUT_02	digital output
4	In	IN_00	capture input (fast)	**12**	In	IN_02	digital input
5	In	IN_04	digital input	**13**	In	IN_03	digital input
6	In	IN_01	digital input	**14**	In	NEGLIM	limit switch, negative direction
7	In	HOME	reference switch	**15**	In	NODE-DISABLE	disables Node
8	In	POSLIM	limit switch, positive direction				

9.1.6.5 Connection diagram digital inputs and outputs, connector X21A



9.1.7 Expansion card - FB-2to1 -

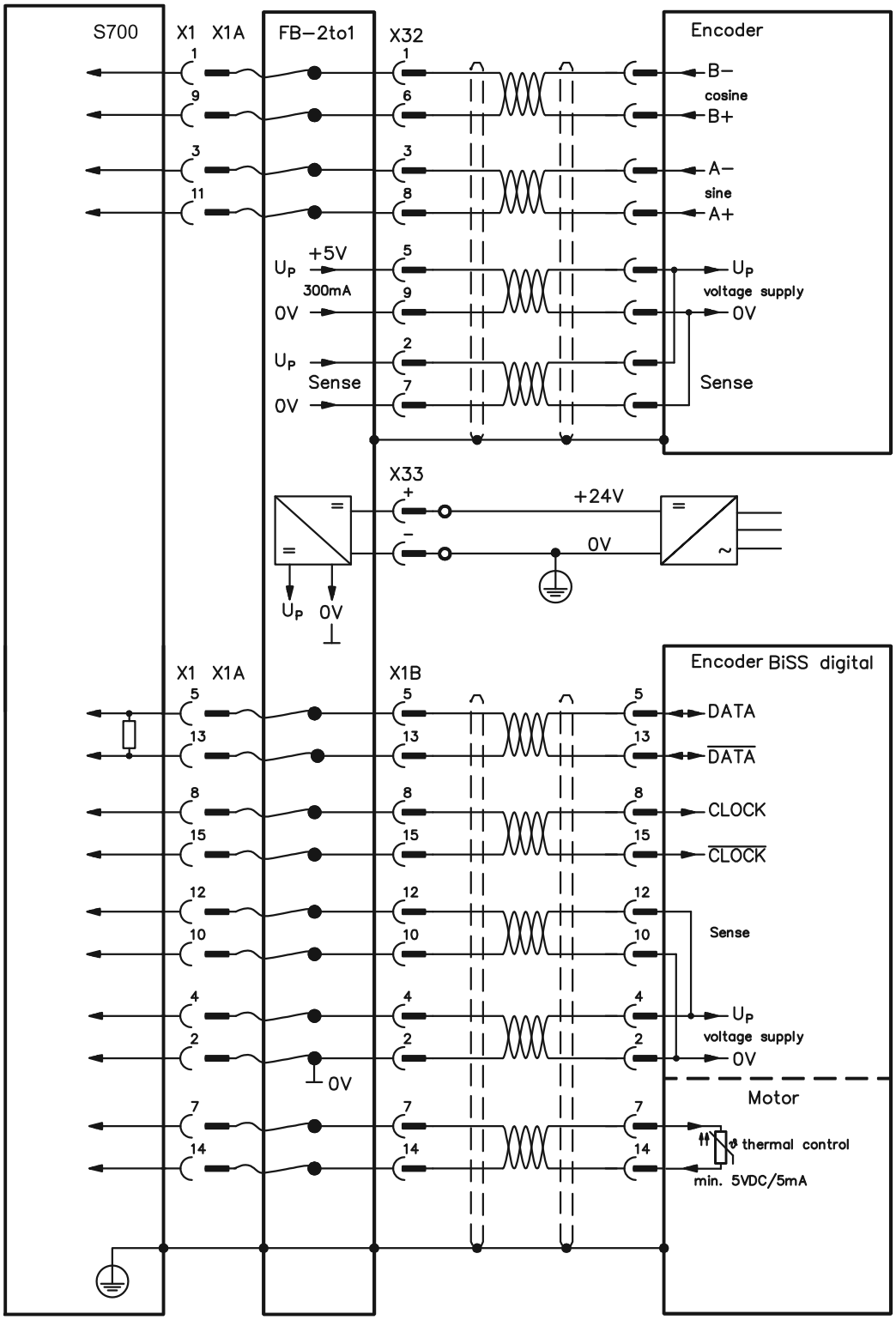
This chapter describes the Feedback extension card FB-2to1 for the S700. The card enables simultaneous connection of a digital primary and of an analog secondary feedback to the connector X1. The supply of 24V DC auxiliary voltage to X33 is converted on the extension card into a precise 5V DC encoder supply for the secondary feedback.

9.1.7.1 Pinout

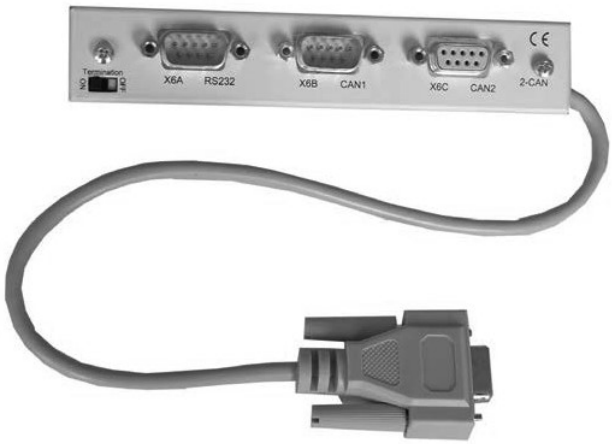
X33	Pinout Combicon Connector
+	+24V DC (20...30V), approx. 500mA
-	GND

X32	Pinout SubD 9 poles (secondary Feedback) SinCos (1V p-p)	X1B	Pinout SubD 15 poles (primary Feedback) EnDat 2.2, BiSS digital, SSI absolute
1	B- (Cosine)	1	n.c.
2	SENSE+	2	0V
3	A- (Sine)	3	n.c.
4	n.c.	4	+5V DC
5	+5V DC (300mA)	5	DATA
6	B+ (Cosine)	6	n.c.
7	SENSE-	7	Temperatur Sensor Motor
8	A+ (Sine)	8	CLOCK
9	0V	9	n.c.
-	-	10	Sense 0V
-	-	11	n.c.
-	-	12	Sense +5V
-	-	13	$\overline{\text{DATA}}$
-	-	14	Temperatur Sensor Motor
-	-	15	$\overline{\text{CLOCK}}$

9.1.7.2 Wiring example with BiSS digital (primary) and SinCos (secondary)



9.1.8 Expansion module -2CAN-



Connector X6 of the S700 is assigned to the signals for the RS232 interface and the CAN interface. It is therefore not the standard pin assignment for these interfaces, and a special cable is required to be able to use both interfaces simultaneously.
The -2CAN- expansion module provides the interfaces on separate Sub-D connectors. The two CAN connectors are wired in parallel. A termination resistor (120 Ω) for the CAN bus can be switched into circuit if the S700 is at the end of the bus.

9.1.8.1 Installation

The modul must be placed onto the option slot after levering off the cover of the option slot 1 (see p. 125):

NOTE

- Screw the distance pieces into the fixing lugs of the option slot.
- Place the expansion module onto the option slot.
- Screw the screws into the threads of the distance pieces.
- Plug the Sub-D9 socket into connector X6 on the S700

9.1.8.2 Connection technology

Standard shielded cables can be used for the RS232 and CAN interfaces.

NOTE

If the servo amplifier is the last device on the CAN bus, then the switch for the bus termination must be set to ON.
Otherwise, the switch must be set to OFF (condition as delivered).

9.1.8.3 Connector assignments

RS232		CAN1=CAN2	
X6A Pin	Signal	X6B=X6C Pin	Signal
1	Vcc	1	
2	RxD	2	CAN-Low
3	TxD	3	CAN-GND
4		4	
5	GND	5	
6		6	
7		7	CAN-High
8		8	
9		9	

9.1.8.4 Setup of Station Address and Baud Rate

During setup it makes sense to use the keypad on the front panel to preset the station addresses for the individual amplifiers and the Baud rate for communication.

NOTE

After changing the station address and baud rate you must turn the 24V auxiliary supply for the servo amplifier off and on again.

Possible ways for setup:

- keypad on the front panel of the servo amplifier
- setup software: screen page “CAN / Fieldbus”
- serial interface with a sequence of ASCII commands:
  ADDR nn ⇒ SAVE ⇒ COLDSTART (with nn = address)
  CBAUD bb ⇒ SAVE ⇒ COLDSTART (with bb = baud rate in kBaud)

Coding of the Baud rate in LED display:

Coding	Baud rate in kBit/s	Coding	Baud rate in kBit/s
1	10	25	250
2	20	33	333
5	50	50	500
10	100	66	666
12	125	80	800
		100	1000

9.2 Expansion cards for slot 2

9.2.1 Guide to installation of expansion cards in slot 2

Boundary of SLOT 2

The method of installing the expansion card in slot 2 is the same as that described for slot 1 (see p.125).

- Remove the **lower** crosshatched area of the front film (labeled slot 2).
- Lever out the cover plates under the film.
- Push the expansion card into the slot.
- Use the screws provided to fasten the front plate of the expansion card in place.

9.2.2 Option "F2", controlled Fan

To reduce noise emission the servo amplifiers can be ordered with the built-in option card F2. This option cannot be built-in later. The F2 option card fits to slot2 or 3 (see part number scheme on p.24).

NOTE Option card F2 can be used combined with a card in slot 1 even if it is plugged to slot 2!

Function

The fan is switched on and off or runs with 50% rated speed depending on temperature and brake power. That reduces the average noise emission.

Switching temperature

Monitoring	Fan off	Fan ~50%	Fan on
Internal temperature	< 55°C	~ 58°C	> 65°C
Heat sink temperature	< 60°C	~ 65°C	> 75°C
Brake resistor (internal)	< 20W	~ 30W	> 45W

9.2.3 Expansion cards "PosI/O" & "PosI/O-Monitor"

The **“PosI/O”** and **"PosI/O-Monitor"** expansion card can be pushed into slot2 or 3. The expansion cards cannot be combined and the use of only one slot in time is allowed.

PosI/O

This expansion card provides an extra SubD connector (X5) with high-speed, bidirectional, digital, 5 V inputs and outputs. The setup software can be used to preset various input and output functions, e.g.:

- Position encoder emulation (ROD- or SSI-compatible)
- Input for high-speed 5 V RS485 signals (electronic gearing, master-slave operation)

PosI/O-Monitor

This expansion card provides the features of the PosI/O card plus an extra connector X3C with analog +/-10V Inputs and Outputs (see page 150, chapter "Analog I/O"). Functionality can be set with the setup software or with macro functions.

9.2.3.1 Feedback

9.2.3.1.1 ROD (AquadB) 5V (X5, X1)

A 5V incremental encoder (AquadB) can be used as standard motor feedback (primary and secondary, ⇨ p.76).Every time the 24V auxiliary voltage is switched on, the amplifier need start-up information for the position controller (parameter value MPHASE). Depending on the feedback type either wake&shake is executed or the value for MPHASE is read out of the amplifier's EEPROM.

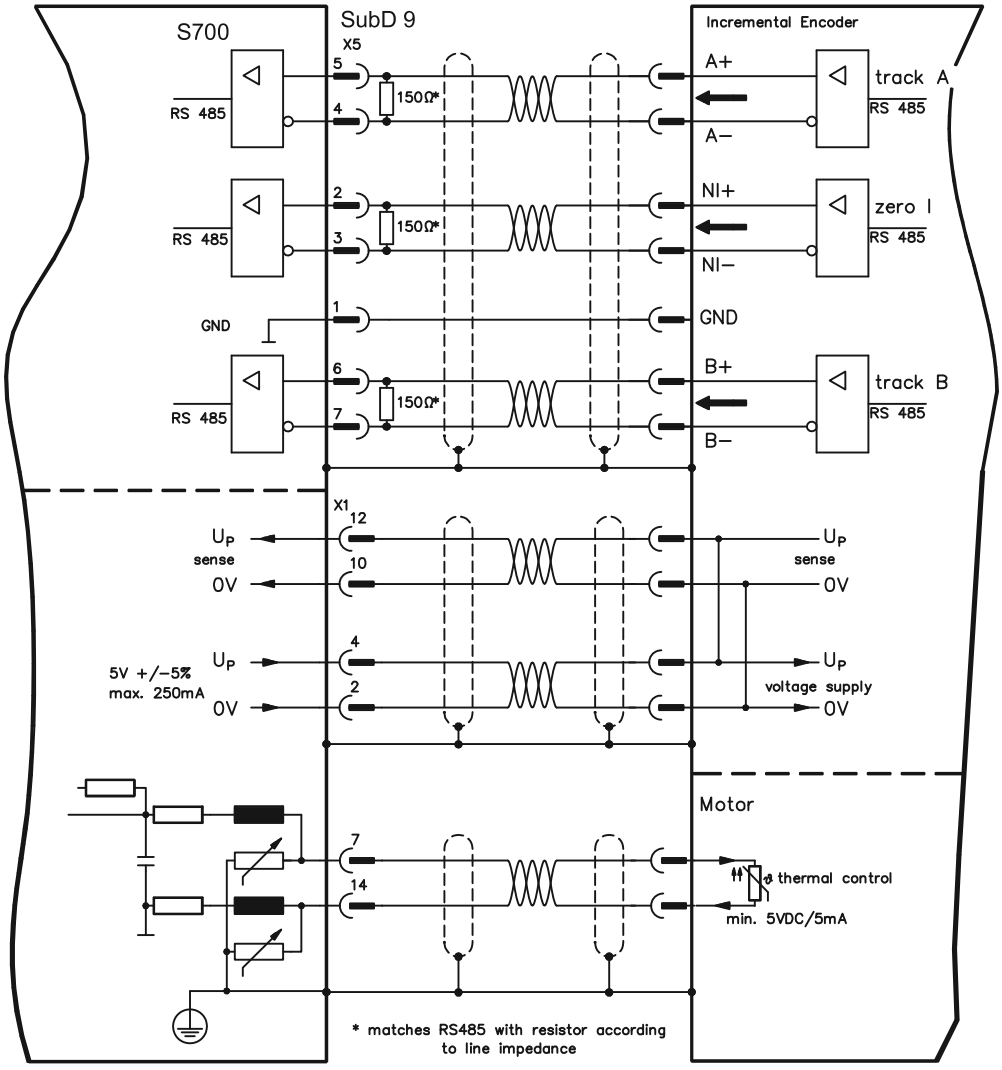
WARNING

With vertical load the load could fall during wake&shake, because the brake is not active and torque is not sufficient to hold the load.
Don't use wake&shake with vertical load (hanging load).

The power supply for the encoder and thermal control in the motor is connected to X1.
If lead lengths of more than 50m are planned please consult our customer service.
Frequency limit (A, B, N): 1.5 MHz

Type	FBTYPE	EXTPOS	GEARMODE	ENCMODE	Remarks
AquadB 5V	13	3	3	0	MPHASE from EEPROM
AquadB 5V	19	3	3	0	MPHASE wake & shake

Switch on supply voltage for the encoder at X1: set ENCVON to 1



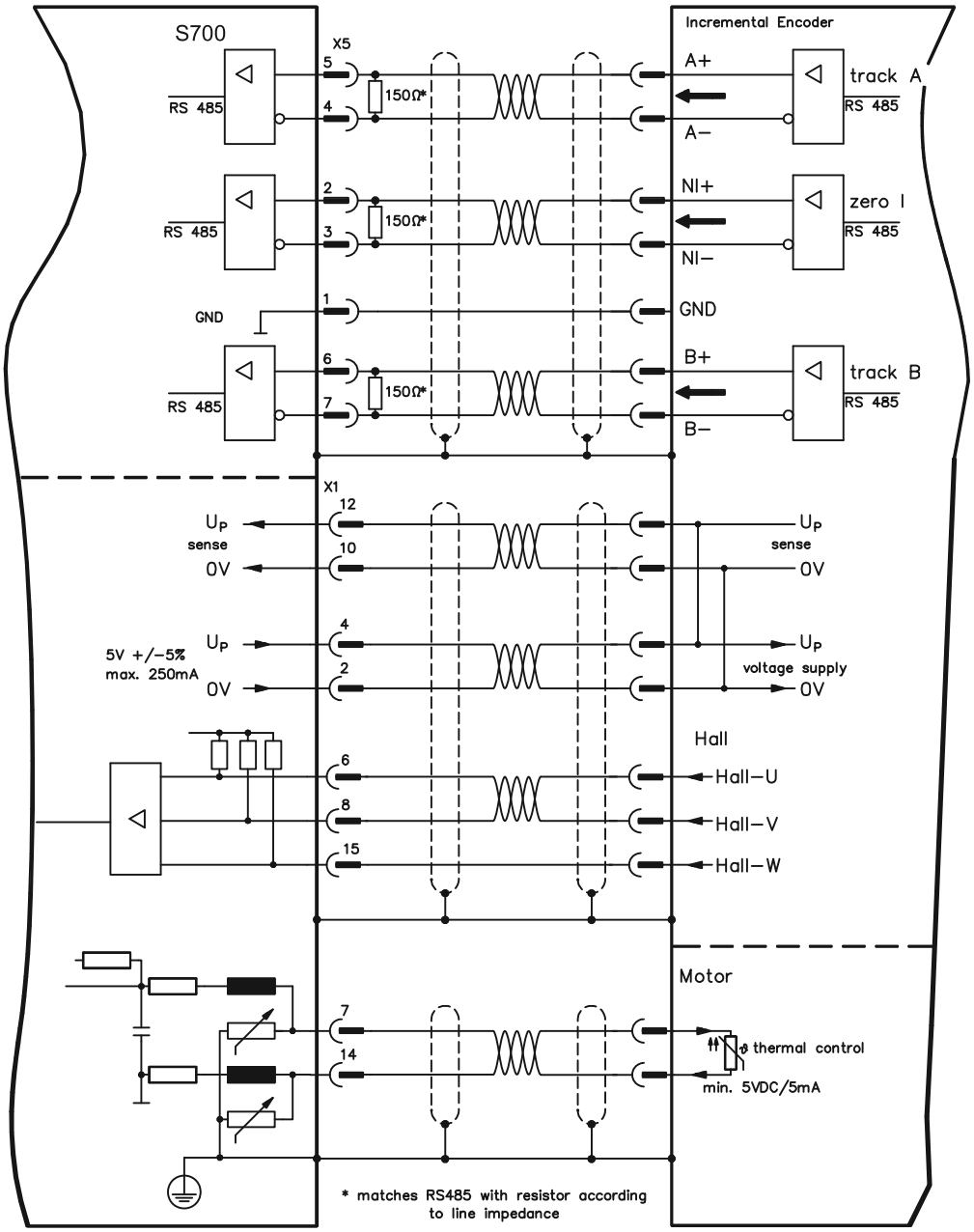
9.2.3.1.2 ROD (AquadB) 5V with Hall (X5, X1)

Wiring of a 5V incremental encoder (ROD, AquadB) with Hall sensors as a feedback unit (primary, ⇨ p.76). For the commutation hall sensors are used and for the resolution an incremental encoder.

The power supply for the encoder and thermal control in the motor is connected to X1 and evaluated there.

If cable lengths of more than 25m are planned, please consult our customer service. Frequency limit X5: 1.5 MHz, X1: 350 kHz

Type	FBTYPE	EXTPOS	GEARMODE	ENCMODE
AquadB 5V with Hall	18	-	-	0



9.2.3.1.3 SSI Encoder (X5, X1)

Wiring of a synchronous serial absolute-encoder as a feedback system (primary or secondary, ⇨ p.76). The signal sequence can be read in **Gray** code or in **Binary** (standard) code.

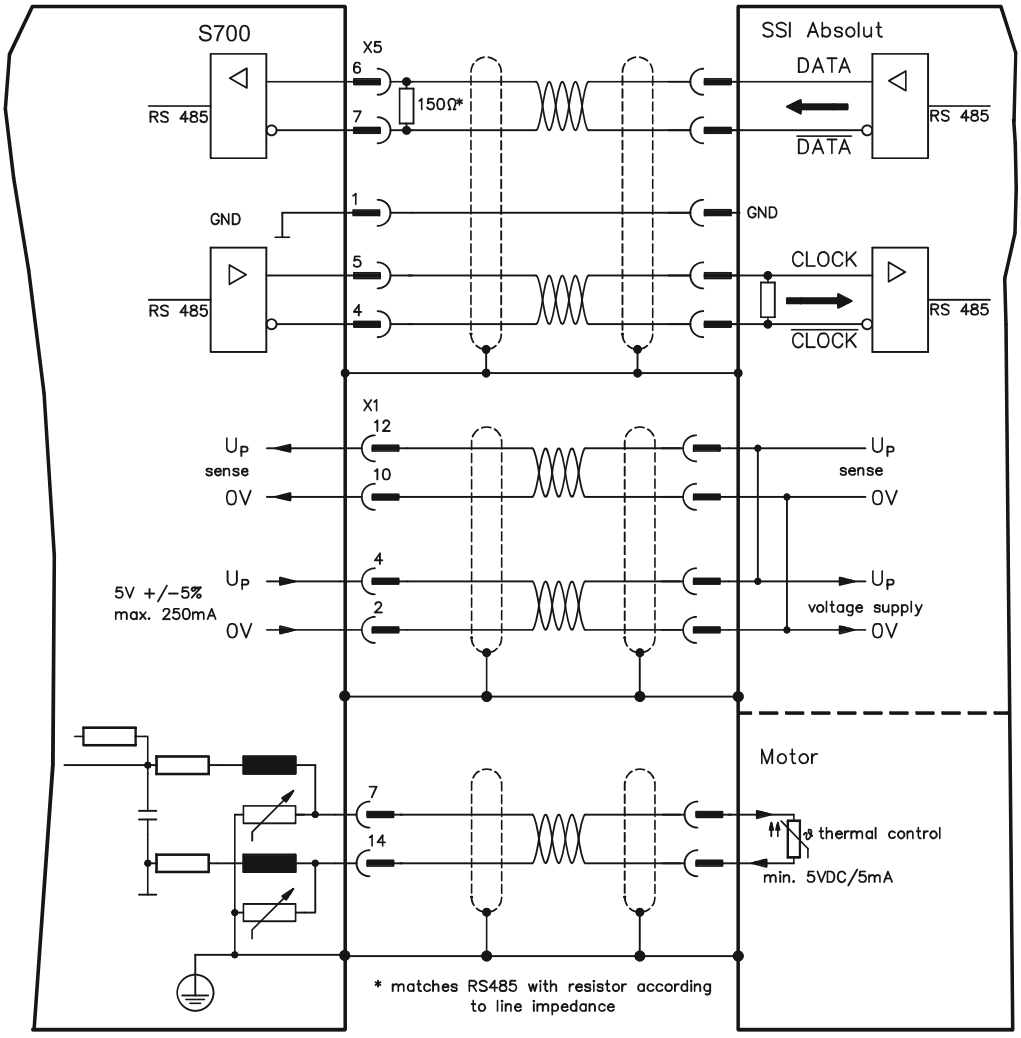
The power supply for the encoder and thermal control in the motor is connected to X1 and evaluated there.

If cable lengths of more than 50m are planned, please consult our customer service.

Frequency limit: 1.5 MHz

Type	FBTYPE	EXTPOS	GEARMODE	ENCMODE
SSI	9	5	5	0

Switch on supply voltage for the encoder at X1: set ENCVON to 1



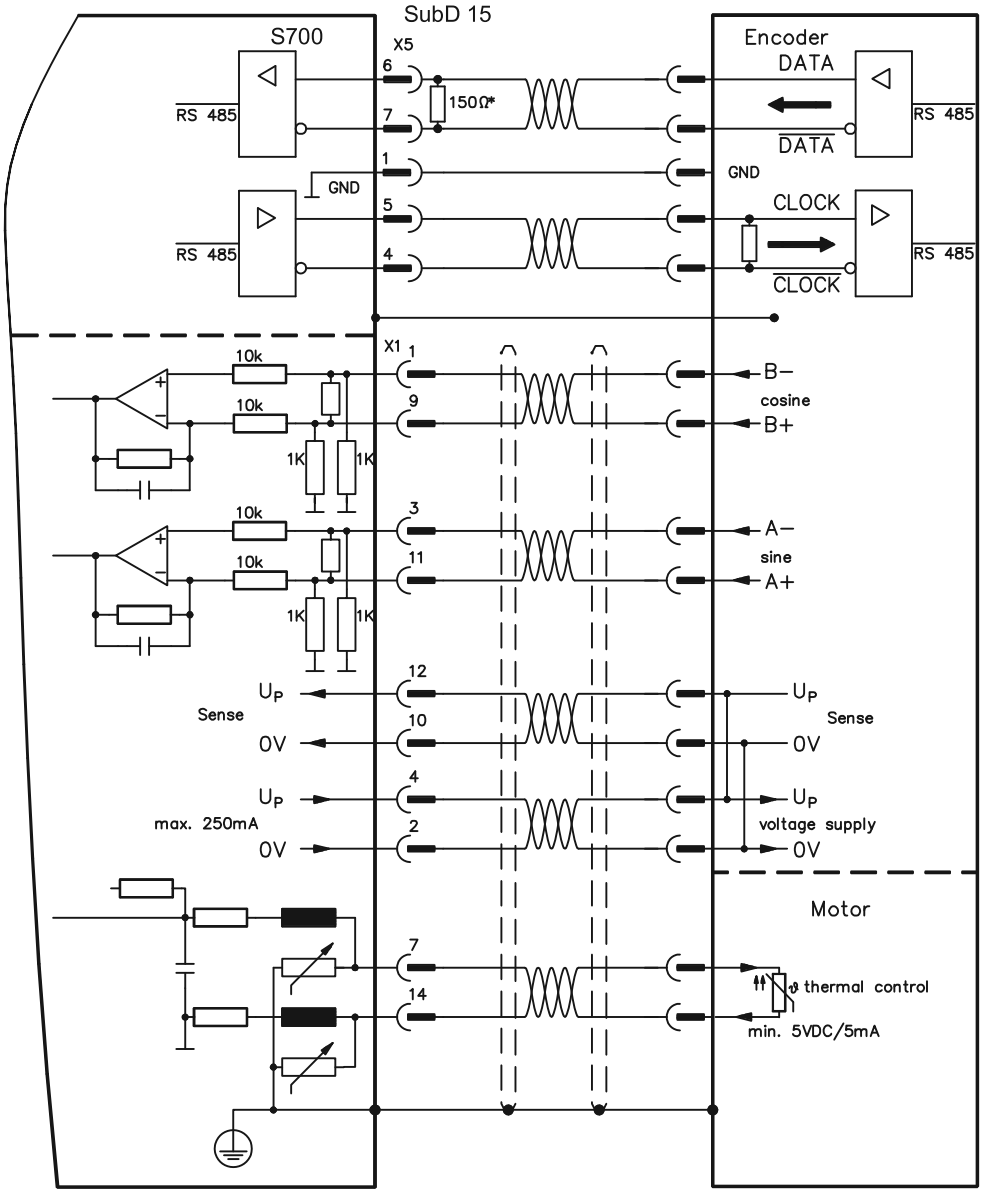
9.2.3.1.4 Sine Encoder with SSI (X5, X1)

Wiring of sine-cosine encoder with SSI interface as a linear feedback system (primary, ⇨ p.76).

The thermal control in the motor is connected via the encoder cable to X1 and evaluated there. All signals are connected using our pre-assembled encoder connection cable. If cable lengths of more than 50m are planned, please consult our customer service.

Frequency limit (sin, cos): 350 kHz

Type	FBTYPE	EXTPOS	GEARMODE	ENCMODE
SinCos SSI 5V linear	28	-	-	0



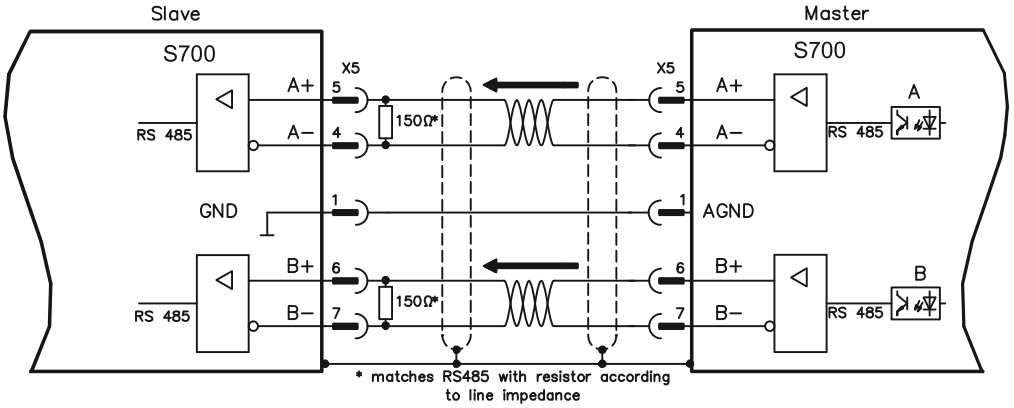
9.2.3.2 Electronic gearing, Master-Slave operation (X5)

9.2.3.2.1 Connection to a S700 master, 5V signal level (X5)

You can link several S700 amplifiers together in master-slave operation. Up to 16 slave amplifiers can be controlled by the master, via the encoder output. The SubD connector X5 is used for this purpose.
Master setup: position output to X5, screen page "Encoder emulation" (ENCMODE)
Slave setup: screen page "Electronic gearing" (GEARMODE)

Frequency limit: 1.5 MHz

Example for Master-Slave operation with two S700 amplifiers, ROD emulation is used:
Slave **GEARMODE: 3** Master **ENCMODE:1**



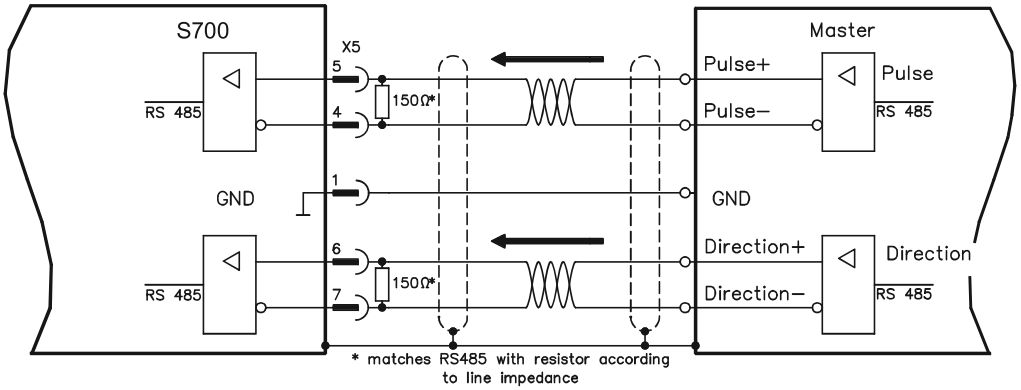
If SSI emulation is used, the master ENCMODE must be set to 2 and the slave GEAR-MODE to 5.

9.2.3.2.2 Connection to stepper motor controllers with 5 V signal level (X5)

Wiring of the servo amplifier (SubD connector X5) to a stepper-motor controller with a 5 V signal level.

Frequency limit: 1.5 MHz

Type	FBTYPE	EXTPOS	GEARMODE
Step/Direction 5V	-	-	4



9.2.3.3 Encoder-Emulation (X5)

9.2.3.3.1 Incremental encoder output - A quad B (X5)

Fast incremental encoder interface. Select encoder function ROD (A Quad B) Encoder ("Encoder Emulation" screen page). The servo amplifier calculates the motor shaft position from the cyclic- absolute signals of the resolver or encoder, generating incremental-encoder compatible pulses from this information. Pulse outputs on the SubD connector X5 are 2 signals, A and B, with 90° phase difference (i.e. in quadrature, hence the alternative term "A quad B" output), with a zero pulse.
The resolution (before multiplication) can be set by the RESOLUTION function:

Encoder function (ENCMODE)	Feedback system (FBTYPE)	Resolution (lines) (ENCOUT)	Zero pulse (NI)
1, ROD	0, Resolver	32...4096	once per turn (only at A=B=1)
	>0, Encoder	256...524288 (2^8 … 2^{19})	
3, ROD interpolation	Encoder	2^4 … 2^7 (multiplication) TTL line x encoder resolution	encoder signal passed through from X1 to X5

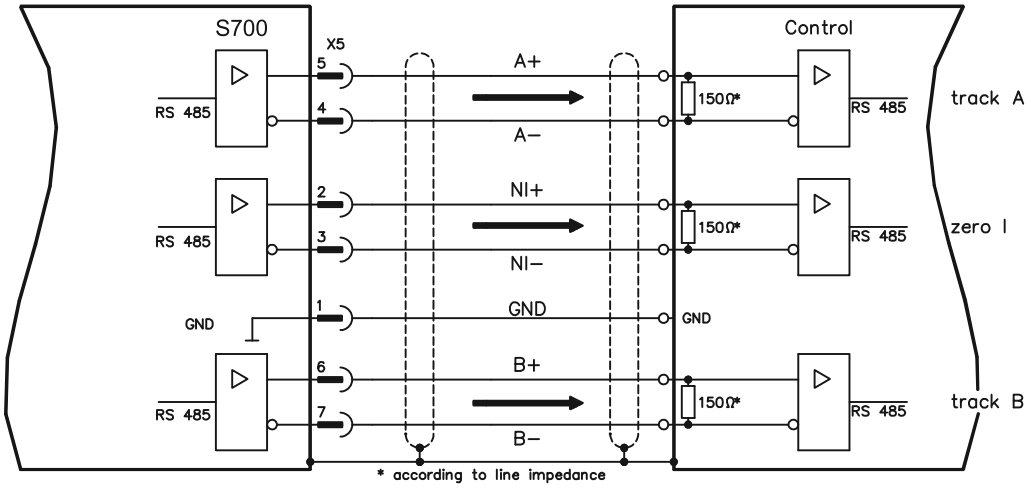
With built in safety card only binary resolutions up to 2^{12} are possible. Use the NI-OFFSET parameter to adjust + save the zero pulse position within one mechanical turn. The drivers operate off an internal supply voltage.

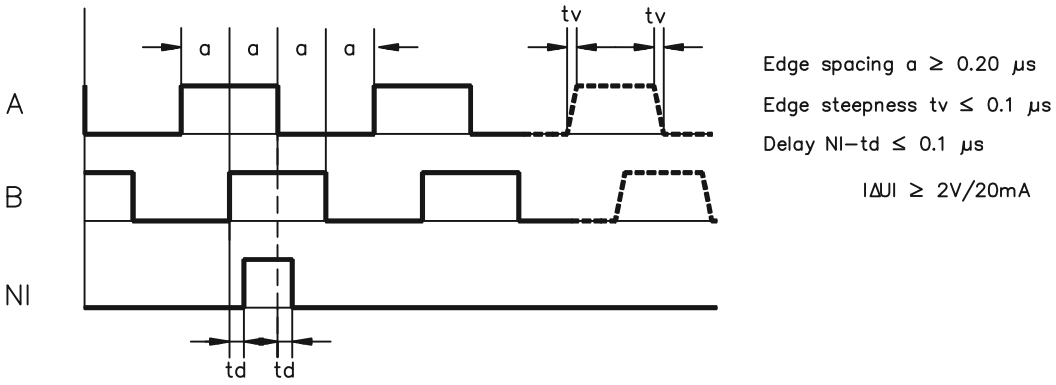
NOTE

The maximum permissible cable length is 100 meters.

Connections and signals for the incremental encoder interface :

Default count direction: UP when the motor shaft is rotating clockwise (looking at the shaft's end)





9.2.3.3.2 SSI encoder output (X5)

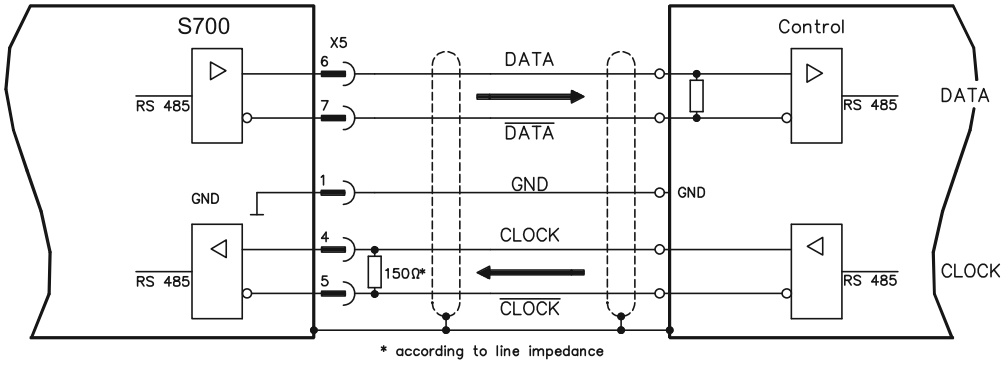
SSI interface (synchronous serial absolute-encoder emulation). Select encoder function SSI (“Encoder Emulation” screen page, ENCMODE 2). The servo amplifier calculates the motor shaft position from the cyclic-absolute signals of the resolver or encoder. From this information a SSI date (Stegmann patent specification DE 3445617C2) is provided. Max 32 bits are transferred. The leading data bit contains the number of revolutions and are selectable from 12 to 16 bits. The following max. 16 bits contain the resolution and are not variable.

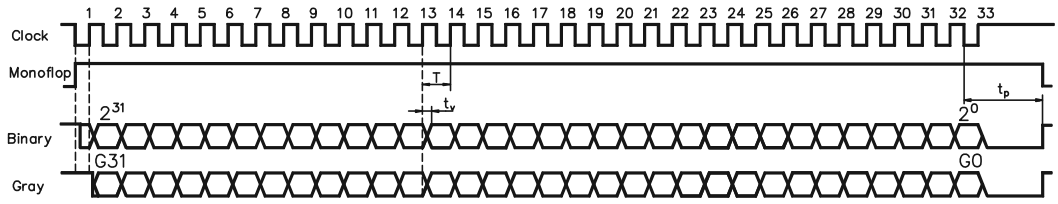
The following table shows the allocation of the SSI date depending upon selected number of revolutions:

	Revolution																Resolution (variable)															
	SSIREVOL																															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
		14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																
			13	12	11	10	9	8	7	6	5	4	3	2	1	0																
				12	11	10	9	8	7	6	5	4	3	2	1	0																
					11	10	9	8	7	6	5	4	3	2	1	0																

The signal sequence can be output in **Gray** code or in **Binary** (standard) code.
The servo amplifier can be adjusted to the clock frequency of your SSI-evaluation with the setup software.
The drivers operate off an internal supply voltage.

Connection and signals for the SSI interface :
Default count direction: UP when the motor shaft is rotating clockwise (looking at the end of the motor shaft)





Switch over time Data t_v ≤ 300nsec
Period T = 600 ns
Time Out t_p = 3µs/13µs (SSITOUT)

Output IΔUI ≥ 2V/20mA
Input IΔUI ≥ 0.3V

9.2.3.4 Analog Inputs and Outputs

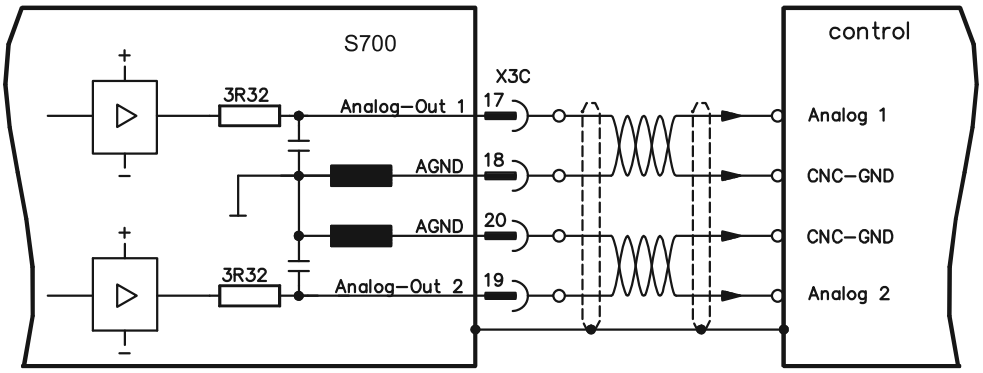
The expansion card "**PosI/O-Monitor**" adds analog inputs and outputs to the servo amplifier were pre-programmed signals can be assigned to. A listing of these pre-programmed functions can be found on the screen page "Analog I/O" of the setup software.

9.2.3.4.1 Analog Outputs ANALOG-OUT 1 and 2

You can use terminals X3C/17 (Analog-Out 1) respectively X3C/19 (Analog-Out 2) to deliver analog values converted from internal digital values (e.g. tachometer voltage).

Technical characteristics

— Reference ground is Analog-GND (AGND, terminal X3C/18 and X3C/20)
— Specification according to EN 61131-2 table 11
— Output voltage ±10 V
— Resolution: 0.38 mV, 16 Bit, Update rate 250 µs

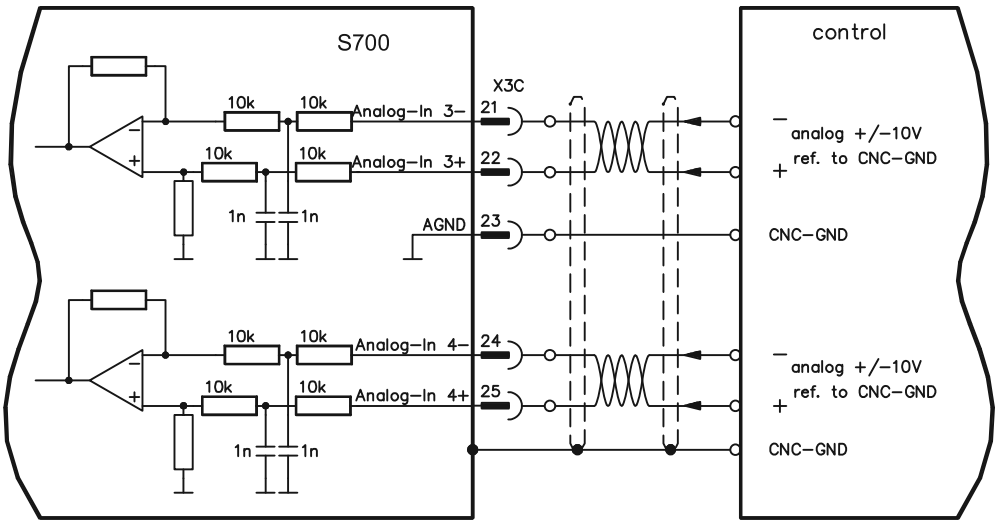


9.2.3.4.2 Analog Inputs ANALOG-IN 3 and 4

You can use terminals X3C/21-X3C/22 (Analog-In 3) respectively terminals X3C/24-X3C/25 (Analog-In 4) with several pre-programmed functions.

Technical characteristics

— Differential input voltage max. ± 10 V
— Resolution 1.25 mV, 16 bits, scalable
— Ground reference AGND, terminal X3C/23
— Input resistance 20 kΩ
— Common-mode voltage range for both inputs ± 10 V
— Update rate 62.5 µs



9.3 Expansion cards for slot 3

9.3.1 Guide to installation of expansion cards in slot 3

Boundary of SLOT3

The method of installing the expansion card in slot 3 is the same as that described for slot 1 (see p.125).

- Remove the area of the front film **colored yellow** (labeled slot 3).
- Lever out the cover plates under the film.
- Remove the small PCB (STO Bridge) which is plugged into slot. Use suitable pliers.
- Push the expansion card into the slot.
- Use the screws provided to fasten the front plate of the expansion card in place.

9.3.2 Option "F2", controlled Fan

To reduce noise emission the servo amplifiers can be ordered with the built-in option card F2. This option cannot be built-in later. The F2 option card fits to slot2 or 3 (see part number scheme on p.24).

Function

The fan is switched on and off or runs with 50% rated speed depending on temperature and brake power. That reduces the average noise emission.

Switching temperature

Monitoring	Fan off	Fan 50%	Fan on
Internal temperature	< 55°C	~ 58°C	> 65°C
Heat sink temperature	< 60°C	~ 65°C	> 75°C
Brake resistor (internal)	< 20W	~ 30W	> 45W

9.3.3 Expansion cards "PosI/O" & "PosI/O-Monitor"

The “PosI/O” and "PosI/O-Monitor" expansion cards can be pushed into slot 2 or 3. The expansion cards cannot be combined and the use of only one slot in time is allowed.
A detailed description of the interfaces can be found from page 142.

9.3.4 Expansion card "Safety 2-2" (S4)

This expansion card (Basic version) includes various safety functions for the safe operation of drive shafts. Rotatory synchronous motors are allowed when using this safety card. All functions fulfill the safety requirements **SIL CL2** according to IEC 62061 respectively performance level **PLd** according to ISO 13849-1.

9.3.4.1 Safe drive functions S2-2

The safety functions are activated using the digital inputs on the expansion card. The following functions are available:

Safe Torque Off (STO)
With the STO function, the power supply to the motor is interrupted safely directly in the drive. This corresponds to an uncontrolled braking in accordance with IEC 60204-1, category 0.

Safe Stop 1 (SS1)
With the SS1 function, the drive is stopped by controlled braking and then the power supply to the motor is interrupted safely. This corresponds to an uncontrolled braking in accordance with IEC 60204-1, category 1.

Safe Stop 2 (SS2)
With the SS2 function, the drive is stopped by controlled braking and then remains at a controlled standstill (SOS). This corresponds to a controlled braking in accordance with IEC 60204-1, category 2.

Safe Operating Stop (SOS)
The SOS function monitors the stop position reached and prevents any deviation outside a defined range.

Safely Limited Speed (SLS)
The SLS function monitors the drive to ensure that it maintains a defined speed.

Safe Limited Increments (SLI)
The SLI function monitors that the drive maintains a relative position.

Safe Speed Range (SSR)
The SSR function checks the current speed of the drive against maximum and minimum limiting values.

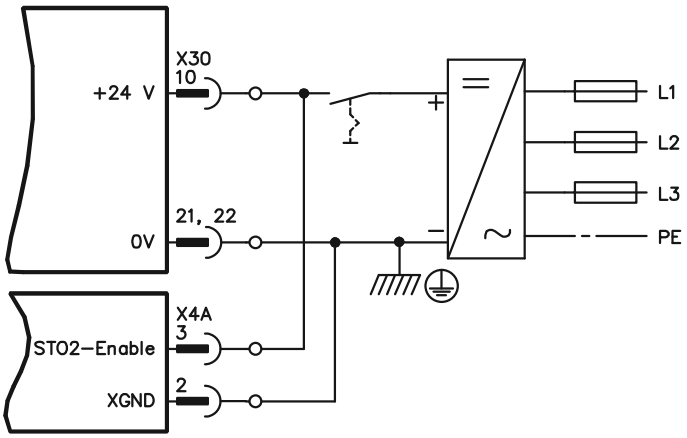
Safe Direction (SDI)
The SDI function ensures that the drive can only move in one (defined) direction.

9.3.4.2 Safety Notes S2-2

Comply with the operating instructions for the safety card. You can find the operating instructions on the CD-ROM provided with the product or on the Kollmorgen website.

9.3.4.3 Wiring supply voltage 24 V for digital outputs

NOTICE Input X4A/3 "STO2-Enable" must be connected to +24V DC and must not be used as additional STO input! Input STO1-Enable [X4B/6] must not be connected.

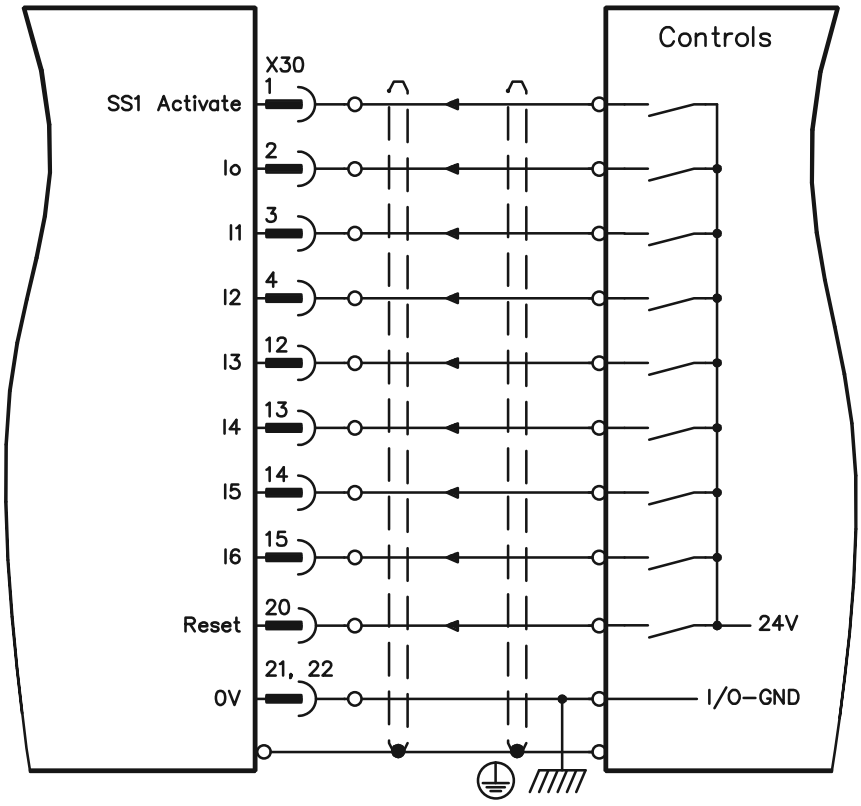


9.3.4.4 Safe inputs and outputs S2-2

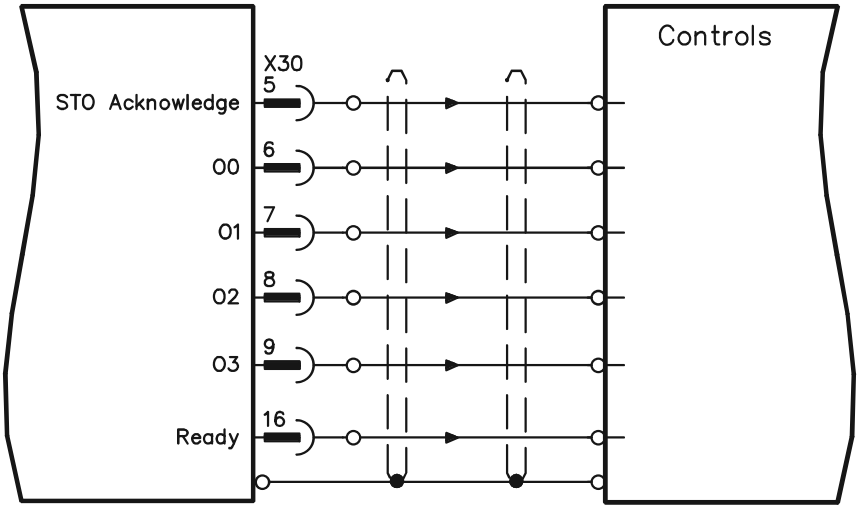
NOTICE Inputs X30/1 SS1_Activate and X30/20 Reset must always be connected. Only tested outputs from a safety control system may be connected to all inputs on X30.

X30	Pin	E/A	Description
SS1 Activate	1	I	Activates function SS1
I0	2	I	Programmable, activate safety function X
I1	3	I	Programmable, activate safety function X
I2	4	I	Programmable, activate safety function X
STO Acknowledge	5	O	Status: STO activated
O0	6	O	Programmable, status: safety function X activated
O1	7	O	Programmable, status: safety function X activated
O2	8	O	Programmable, status: safety function X activated
O3	9	O	Programmable, status: safety function X activated
24V Supply	10	-	24V supply of digital outputs
n.c.	11	-	n.c.
I3	12	I	Programmable, activate safety function X
I4	13	I	Programmable, activate safety function X
I5	14	I	Programmable, activate safety function X
I6	15	I	Programmable, activate safety function X
Ready	16	O	Message "Safety card is ready to operate"
n.c.	17	O	n.c.
n.c.	18	O	n.c.
n.c.	19	O	n.c.
Reset	20	I	Input for Reset
0V Supply	21	-	0V supply of digital outputs
0V Supply	22	-	0V supply of digital outputs

9.3.4.5 Wiring inputs S2-2



9.3.4.6 Wiring outputs S2-2



9.3.5 Expansion card "Safety 1-2" (S3)

This expansion card includes all available safety functions. Rotatory synchronous motors are allowed when using this safety card. All functions fulfill the safety requirements **SIL CL3** acc. to IEC 62061 respectively performance level **PLe** acc. to ISO 13849-1.

9.3.5.1 Safe drive functions S1-2

The safety functions are activated using the digital inputs on the expansion card. The following functions are available:

Safe Torque Off (STO)
With the STO function, the power supply to the motor is interrupted safely directly in the drive. This corresponds to an uncontrolled braking in accordance with IEC 60204-1, category 0.

Safe Stop 1 (SS1)
With the SS1 function, the drive is stopped by controlled braking and then the power supply to the motor is interrupted safely. This corresponds to an uncontrolled braking in accordance with IEC 60204-1, category 1.

Safe Stop 2 (SS2)
With the SS2 function, the drive is stopped by controlled braking and then remains at a controlled standstill (SOS). This corresponds to a controlled braking in accordance with IEC 60204-1, category 2.

Safe Operating Stop (SOS)
The SOS function monitors the stop position reached and prevents any deviation outside a defined range.

Safely Limited Speed (SLS)
The SLS function monitors the drive to ensure that it maintains a defined speed.

Safe Limited Increments (SLI)
The SLI function monitors that the drive maintains a relative position.

Safe Limited Position (SLP)
The SLP function monitors that the drive maintains an absolute position.

Safe Speed Range (SSR)
The SSR function checks the current speed of the drive against maximum and minimum limiting values.

Safe Direction (SDI)
The SDI function ensures that the drive can only move in one (defined) direction.

Safe Brake Control (SBC)
An external mechanical brake can be controlled by the 2 poles output "SBC+/SBC" of the safety card. SBC will become active with STO.

Safe Brake Test (SBT)
The safety function SBT can be used for testing the external mechanical brake and the internal motor holding brake.

9.3.5.2 Safety Notes S1-2

Comply with the operating instructions for the safety card. You can find the operating instructions on the CD-ROM provided with the product or on the website.