Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

indicates an **imminently** hazardous situation which, if not avoided, will result in death, serious injury and considerable damage to property.

WARNING

indicates a **potentially** hazardous situation which, if not avoided, could result in death, serious injury and considerable damage to property.

CAUTION

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesireable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

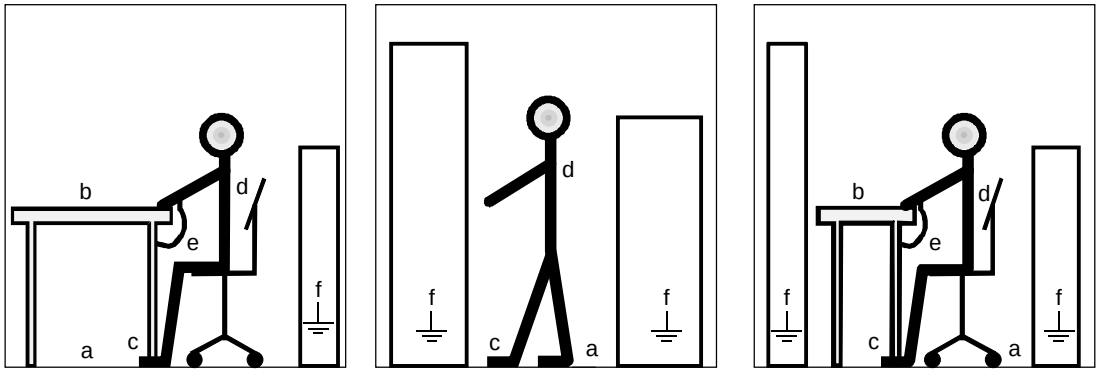
Components which can be destroyed by electrostatic discharge (ESD)

The optional boards contain electrostatic sensitive devices. These devices may be destroyed by improper handling. Please pay attention to the following notes regarding the use of electronic boards:

- Electronic boards should only be touched when absolutely necessary
- The human body must be electrically discharged before touching an electronic board
- Boards must not come into contact with highly insulating materials - e.g. plastic foils, insulated desktops, articles of clothing manufactured from man-made fibers
- Boards must only be placed on conductive surfaces
- When soldering, the soldering iron tip must be grounded
- Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes, metal containers)
- If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ECB protective measures are clearly shown in the following diagram:

a = Conductive floor surface
b = ESD table
c = ESD shoes
d = ESD overall
e = ESD chain
f = Cubicle ground connection



2 CBP/CBP2 – Communication Board PROFIBUS

2.1 Description

The CBP optional board (PROFIBUS communication board) is for linking drives to higher-level automation systems via PROFIBUS.

The optional board has three LEDs (green, yellow, red) for providing information on the current operating status.

Voltage is supplied from the basic unit.

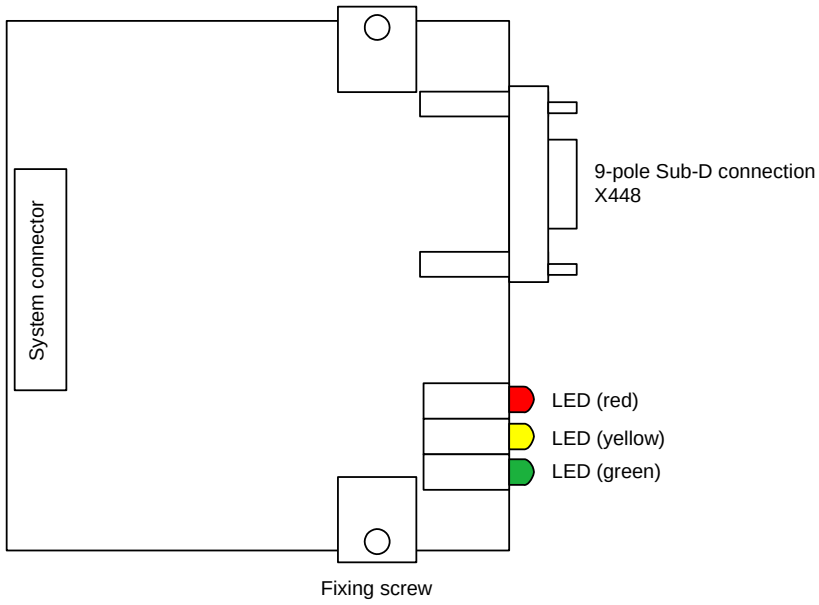


Fig. 2-1 View of the CBP optional board

Data exchange via PROFIBUS

The bus system enables very fast transfer of data between higher-level systems (e.g. SIMATIC, SIMADYN D, PC/PGs) and the drives. Access to the drives is made in the bus system according to the master-slaves method. The drives are always the slaves and each slave is clearly defined by its address.

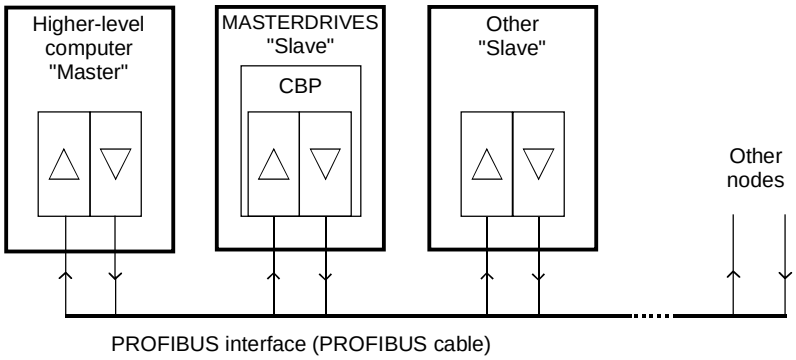


Fig. 2-2 PROFIBUS connections

PROFIBUS telegram

Data is exchanged via telegrams. Useful data are transferred in each telegram which can be divided up into two groups:

- 1. Parameters (parameter identifier value, PKW)
- 2. Process data (PZD)

Protocol frame (Header)	**Useful data**		Protocol frame (Trailer)
	Parameters (PKW)[1)]	**Process data (PZD)**	

[1)] PKW: Parameter identifier value

Fig. 2-3 Structure of useful data in the PROFIBUS DP telegram

In the PKW area, all data intended for reading or writing parameter values and for reading parameter characteristics are transferred.

In the PZD area, all information necessary for guiding a variable-speed drive is transferred. Control information (control words) and setpoints are given to the slaves by the PROFIBUS DP master. Information on the status of the slaves (status words) and actual values are transferred in the reverse direction.

The length of the PKW and PZD data portions in the telegram is determined by the master. The master also specifies the baud rate. Only the bus address and, if necessary, the telegram failure time are set on the slave.

2.2 Technical Data

Order number	CBP: 6SE7090-0XX84-0FF0 CBP2: 6SE7090-0XX84-0FF5
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)
Supply voltage	5 V ± 5 %, max. 600 mA, internally from basic unit
Output voltage	5 V ± 10 %, max. 100 mA, electrically isolated supply (X448/Pin 6) - for bus termination of the serial interface or - for supply of an OLP (Optical Link Plug)
Data transfer rate	max. 12 MBaud

Table 2-1 Technical Data

NOTE For reasons of space, optical link plugs cannot be used for Compact units, types 1 and 2!

2.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

CAUTION

The boards contain components which can be damaged by electrostatic discharge; these boards can be destroyed if incorrectly handled.

Please comply with the guidelines in the operating instructions for the basic unit.

NOTE

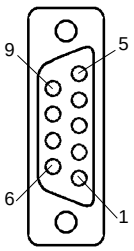
Generally, you can install the CBP optional board (communication board PROFIBUS) in every slot. However, bear in mind that a sensor board always requires slot C.

Two CBPs can be fitted per device.

2.4 Connecting-up

The CBP optional board has a 9-pole Sub-D socket (X448) which is provided for connecting it up to the PROFIBUS system. The connections are floating.

X448 - Profibus connector



Pin	Designation	Significance	Range
1	SHIELD	Ground connection	
2	-	Not connected	
3	RxD/TxD-P	Receive/transmit data - P (B / B')	RS485
4	CNTR-P	Control signal P	TTL
5	DGND	PROFIBUS data reference potential (C / C')	
6	VP	Supply voltage Plus	5 V ± 10 %
7	-	not connected	
8	RxD/TxD-N	Receive/transmit data - N (A / A')	RS485
9	-	Reference filtered	M_EXT

Table 2-2 Connection X448

Cable connectors

The cables must be connected via the PROFIBUS connector, as this contains the bus terminating resistors.

The possible PROFIBUS connectors with the different cable outputs are illustrated in the following.

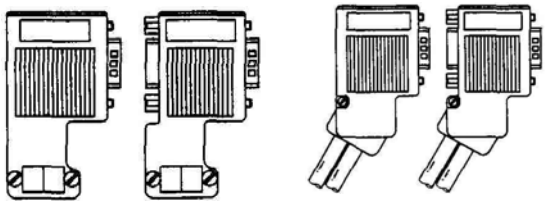


Fig. 2-4 PROFIBUS connectors

NOTE

PROFIBUS connectors with **90° angle**

– must **not** be inserted in slots **E and G** on Compact units

– if these connectors are used on CompactPLUS units contour faults may occur on slots **A and B**.

(See Compendium, Chapter "PROFIBUS", Section "Connecting the CBP to PROFIBUS".)

Bus terminating resistors

The terminating resistors at the first and last nodes in the line have to be activated because otherwise data transfer is not able to operate satisfactorily.

The cable shield must be connected on both sides and through a large surface area.

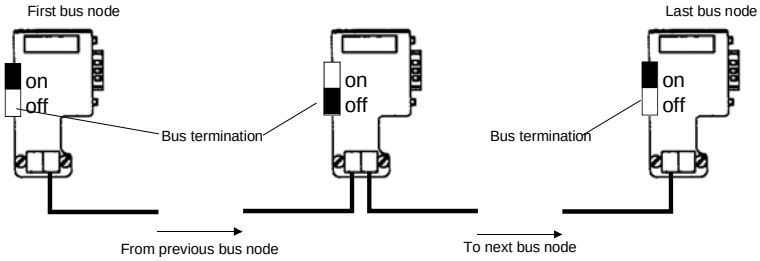
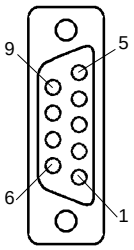


Fig. 2-5 Position of the bus terminating resistors

CBP2 only:
X448 pin assignments for connection to USS.
The connections are floating.

X448 - USS



Pin	Designation	Significance	Range
1	SHIELD	Ground connection	
2	-	Not connected	
3	RxD/TxD-P	Receive/transmit data - P (B / B')	RS485
4	-	Not connected	
5	DGND	data reference potential (C / C')	
6	VP	Supply voltage Plus	5 V ± 10 %
7	-	not connected	
8	RxD/TxD-N	Receive/transmit data - N (A / A')	RS485
9	-	not connected	

Table 2-3 Connection X448

NOTICE

The CBP2 does **not** have an internal bus connection. An external bus connection can be wired to pins 5/6.

2.5 Displays

There are three LED displays on the front of the CBP optional board which supply information on the current operating status. The following LEDs are provided:

- CBP operating (red)
- Data transfer with basic unit (yellow)
- Useful data transfer via PROFIBUS (green)

NOTE

- During normal operation, all three LEDs repeatedly light up at the same time and for the same length of time (flashing)!
- If an LED is continuously on or off, this indicates an exceptional condition (parameterization phase or fault)!

Operating display

LED	Status	Diagnostic information
Red	Flashing	CBP operating; voltage supply on
Yellow	Flashing	Fault-free data exchange with the basic unit
Green	Flashing	Fault-free useful data transfer via the PROFIBUS

Table 2-4 Operating display of the CBP

Fault display

LED	Status	Diagnostic information
Red	off/on	Voltage supply for CBP cut off; replace CBP or basic unit
Yellow	off/on	Data exchange with the basic unit is not possible; replace CBP or basic unit
Green	off/on	Transfer of useful data via PROFIBUS is not possible; PROFIBUS cable not connected or is defective

Table 2-5 CBP fault display

2.6 Start-up

After installation of the CBP optional board has been completed, an automatic self-test will be carried out when the basic unit (converter/inverter) is powered-up.

Afterwards, the new board may have to be logged in on the basic unit and provided with a bus address. Please refer to the documentation on the basic unit for further details in this respect.

NOTE

Please refer to the documentation for the respective basic unit regarding instructions for parameterization using the quick procedure.

3 CBC – Communication Board CAN-Bus

3.1 Description

The CBC optional board (Communication Board CAN) is for linking drives to higher-level automation units or other field units via the CAN protocol (Controller Area Network).

The optional board has three LEDs (green, yellow, red) for providing information on the current operating status.

Voltage is supplied from the basic unit.

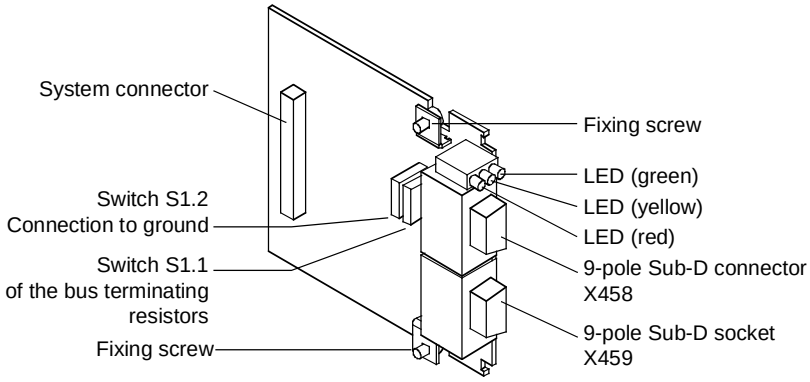


Fig. 3-1 View of the CBC optional board

3.2 Technical Data

Order number	6SE7090-0XX84-0FG0
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)
Supply voltage	5 V ± 5 %, max. 500 mA, internally from basic unit

Table 3-1 Technical data CBC

3.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE

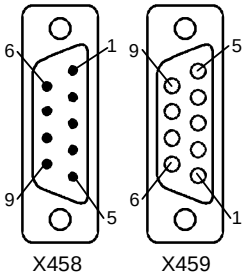
Generally, you can install the CBC optional board (communication board CAN) in every slot. However, bear in mind that a sensor board always requires slot C.

One CBC can be installed per unit.

3.4 Connecting-up

The CBC optional board has a 9-pole Sub-D connector (X458) and a 9-pole Sub-D socket (X459) which are provided for connecting it up to the CAN bus.
The two connections have identical assignment and are through-connected internally; they are short-circuit-proof and floating.

X458, X459



Pin	Designation	Significance
1	-	Not connected
2	CAN_L	CAN_L bus line
3	CAN_GND	CAN ground (M5)
4	-	Not connected
5		Not connected
6	CAN_GND	CAN ground (M5)
7	CAN_H	CAN_H bus line
8	-	not connected
9	-	not connected

Table 3-2 Connections X458 (socket) and X459 (pins)

NOTE

- The bus cable must be terminated at both ends with bus terminating resistors to ensure trouble-free CAN bus operation. In this case, the bus cable has to be regarded as being one bus cable from the first CAN bus node up to the last CAN bus node, to enable the CAN bus to be terminated twice.
- Switch S1.1 of the bus terminating resistors is located on the optional board behind connector X458.

NOTE

- If the CAN bus interface of the master is operated ungrounded, you can close switch S1.2 on one node in order to obtain a bus connection to ground.
- The switch for connecting to ground is located on the optional board behind connector X458.

3.5 Displays

There are three LED displays on the front of the CBC optional board which supply information on the current operating status. The following LEDs are provided:

- CBC operating (red)
- Data exchange with basic unit (yellow)
- Telegram traffic via CAN (green)

NOTE

- During normal operation, all three LEDs repeatedly light up at the same time and for the same length of time (flashing!)
- If an LED is continuously on or off, this indicates an exceptional condition (parameterization phase or fault)!

Operating display

LED	Status	Diagnostic information
Red	Flashing	CBC operating; voltage supply on
Yellow	Flashing	Fault-free data exchange with the basic unit
Green	Flashing	Fault-free process data transfer via the CAN bus

Table 3-3 CBC operating display

Fault displays

LED	Status	Diagnostic information
Red	Flashing	Cause of fault:
Yellow	Continuous	Serious fault on CBC
Green	Continuous	Remedy: replace CBC

Table 3-4 Fault display of faults on the CBC

LED	Status	Diagnostic information
Red	Flashing	CBC is waiting for the
Yellow	Off	converter/inverter to start
Green	Continuous	parameterization

Table 3-5 Fault display during parameterization

LED	Status	Diagnostic information
Red	Flashing	CBC is waiting for the
Yellow	Continuous	converter/inverter to
Green	Off	finish parameterization

Table 3-6 Fault display during parameterization

LED	Status	Diagnostic information
Red	Flashing	No net data transfer via the CAN bus
Yellow	Flashing	e.g. bus connector withdrawn, EMC fault,
Green	Off	connections with incorrect polarity, node is not being supplied with net data via the CAN bus.

Table 3-7 Fault display during operation

3.6 Start-up

After installation of the CBC optional board has been completed, an automatic self-test will be carried out when the basic unit (converter/inverter) is powered-up.

Afterwards, the new board may have to be logged in on the basic unit and provided with a bus address. Please refer to the documentation on the basic unit for further details in this respect.

Please refer to the Compendium for detailed start-up instructions with complete parameterization.

4 SLB – SIMOLINK Board

4.1 Description

The SLB optional board (SIMOLINK board) is used for connecting up drives to SIMOLINK.

Each SLB optional board is a node on SIMOLINK. The maximum number of nodes is restricted to 201.

The SIMOLINK drive link is used for the fast transfer of data between various drives and for the synchronization of these drives to a common system clock. It is based on a closed ring in which all nodes are interlinked.

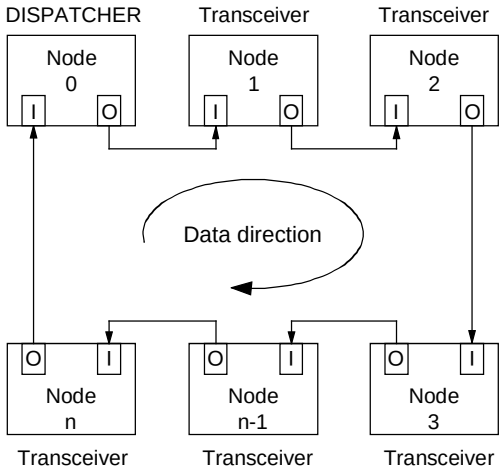


Fig. 4-1 Bus ring structure

Data is transferred between the individual nodes via fiber-optic cables. Plastic or glass-fiber cables can be used as a transfer medium.

The SLB optional board has a 24 V voltage input for the external voltage supply of the board. This ensures that data transfer in SIMOLINK is maintained even with powered-down converter/inverter.

The optional board is provided with three LED displays for supplying information on the current operating status.

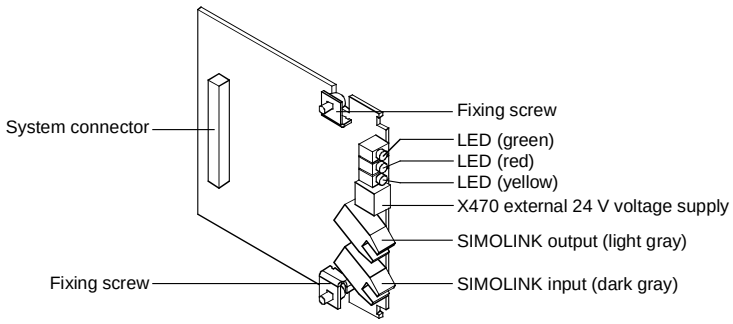


Fig. 4-2 View of the SLB optional board

Mode of operation

The SLB optional board links the converters/inverters to SIMOLINK. It can be used as the SIMOLINK dispatcher or as a SIMOLINK transceiver. The functionality can be changed over by means of parameterization.

Data traffic

The optional board reads all telegrams on SIMOLINK and stores the selected telegrams in a receive memory. There is also a separate memory area for the telegrams which have to be changed or re-generated.

Telegram access

The stored telegrams are archived in double-word connectors. A dedicated connector is available for each of the eight stored telegrams. The output telegrams are archived in BICO parameters.

Voltage supply

The optional board can be supplied with the required operating voltage internally from the converter/inverter, as well as externally. Priority is given to the external voltage supply. Changeover is effected automatically on the optional board.

NOTE

It is not permissible to change over from external voltage supply during bus operation. During automatic changeover of the voltage supply, a reset signal is generated on the optional board which results in the loss of some telegrams.

4.2 Technical Data

Order number	6SE7090-0XX84-0FJ0
Size (length x width)	90 mm x 83 mm
Degree of pollution	Pollution degree 2 according to IEC 644-1(DIN VDE 0110/T1, moisture condensation is not permissible in operation
Mechanical strength During stationary duty - Deflection - Acceleration During transport - Deflection - Acceleration	According to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 according to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - During operation - During storage - During transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (moisture condensation not permissible)
Power supply	• DC 5 V, max. 600 mA, internally from the basic unit • DC 24 V, max. 200 mA, external voltage supply
Transfer rate	11 MBaud
Duration delay	max. 3 clock times
Cable length (max.) between two nodes	- 40 m (plastic) - 300 m (glass fiber)

Table 4-1 Technical Data

4.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE

Generally, you can install the SLB (SIMOLINK) optional board in any slot, but you must take into account that a sensor board always requires slot C.

4.4 Connecting-up

The SLB optional board is provided with

- two connections for SIMOLINK and
- one connection for the external voltage supply

4.4.1 Connecting SIMOLINK

Two connections for the fiber-optic cables are available for SIMOLINK, one input and one output respectively.

You must always connect SIMOLINK up to both connections.

CAUTION

If you confuse the two connections for signal input and signal output, SIMOLINK cannot operate.

SIMOLINK connection

SIMOLINK is provided with its own input and its own output connection.

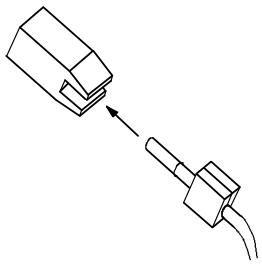


Fig. 4-3 Bus connection

Position and color of the connections

The SIMOLINK input is located in the lower area of the optional board. It is dark gray.

The SIMOLINK output is located above the SIMOLINK input. It is light gray.

4.4.2 Forming the bus cable

Fiber-optic cables

Plastic fiber-optic cables are used for connecting the optional board to SIMOLINK.

The distance between two nodes is permitted to be up to 40 m. The total length of the ring bus is permitted to be up to 1000 m.

Connecting the cable

Proceed as follows to connect up the fiber-optic cable:

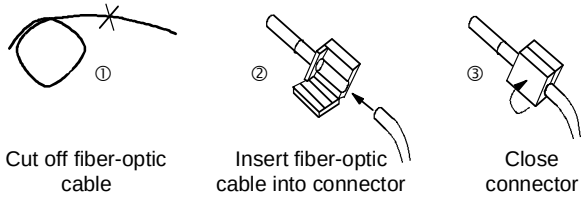


Fig. 4-4 Connecting the cable

1. Cut off the required length of fiber optic cable by cutting at right angles to the cable. Use a **sharp** knife for this purpose (Fig. 4-4 ①).
2. Remove approx. 7 mm in length of the black sheathing from the fiber optic cable with a suitable insulation stripper. Damage to the fiber optic cable must be avoided at all costs!
3. Put the fiber optic cable into the plug-in connector (Fig. 4-4 ②) and push it into the cylindrical sleeve as far as it will go. The transparent fiber optic cable then protrudes from the sleeve.
4. Fold round the gripping halves of the plug-in connector and close it by hand (Fig. 4-4 ③). When the top gripping half latches into the lower one, the cable is fixed firmly in the connector.
5. Cut off the fiber optic cable protruding out of the sleeve. Use a **sharp** knife to do this and cut off the cable almost flush. Cut at right angles to the axis of the fiber optic cable. A side cutter, scissors, etc., are **not** suitable for this purpose.
6. The cut surface of the fiber optic cable must now be polished. To do this, place the end of the sleeve vertically onto the matt rough side of the green polishing foil supplied and "draw" a figure eight. Then clean the end with a clean, fluff-free cloth.
7. In order to achieve minimum throughput loss, the end can then be fine-polished. Fine polishing improves throughput loss by approximately 2 dB. To do this, again place the end of the sleeve vertically onto the matt rough side of the pink polishing foil and "draw" a figure eight about 25 times. Then clean the end again with a clean, fluff-free cloth.

If the fiber optic cable connections between the SLB modules are not in good order or have been damaged (e.g. kinked), it can happen that the SIMOLINK will continue to function. Depending on how badly transmission is affected, CRC or timeout errors will occur (possibly after a considerable time has elapsed). The errors will occur in the SIMOLINK module that is downstream (in the transmission direction) of the bad connection. The occurrence of such errors can be tested with the aid of diagnostics parameter r748 (see function diagram 140). The

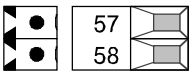
diagnostics counter in r748.002 counts the CRC errors, and the counter in r748.003 the timeout errors. From firmware version V1.50 onwards, these counters can also be connected to the trace memory via connectors K7082 (CRC) and K7083 (timeout). The diagnostics counters are reset every time the power is switched (OFF) ON. After the power has been switched ON and initialization completed, the CRC error count should stand at zero and the timeout error count at 1, 2 or 3.

4.4.3 External voltage supply

X470 - External voltage supply

The SLB optional board is provided with connection X470 for the external voltage supply of the optional board. The external voltage supply is available in addition to the internal voltage supply through the converter/inverter.

If you wish the converter/inverter in which the SLB optional board is installed to be disconnected from the supply voltage irrespective of any other units connected to SIMOLINK, you have to use the external voltage supply.



Terminal	Designation	Significance	Range
57	M	Ground	0 V
58	P24 V	External voltage supply	DC 18 - 33 V, 200 mA

Connectable cross-section: 1.5 mm² (AWG 16)

Terminal 57 is at the top when installed.

Table 4-2 Terminal assignment at connection X470

NOTE

The SIMOLINK bus system can only function if all the nodes are operating.This requires that all nodes are always connected to a voltage supply. If one of the nodes on SIMOLINK is not operating, SIMOLINK is interrupted.

NOTE on EMC

DC supply cables

Operation of unshielded DC supply cables
(e. g. 24 V infeed for external current supply):

- DC supply cables: Length max. 10 m permissible

In the case of longer cables a suitable overvoltage protection device must be connected by the user, e.g. following type:

DC supply; Weidmüller; Art. No.: PU DS 24V 16 A

Weidmüller GmbH & Co. KG
An der Talle 89
33102 Paderborn
http://www.weidmueller.com

4.5 Displays

Three LED displays are provided on the front side of the SLB optional board which give information on the current operating status.
These are as follows:

- SIMOLINK operating (green)
- Board operating (red)
- Data exchange with the basic unit (yellow)

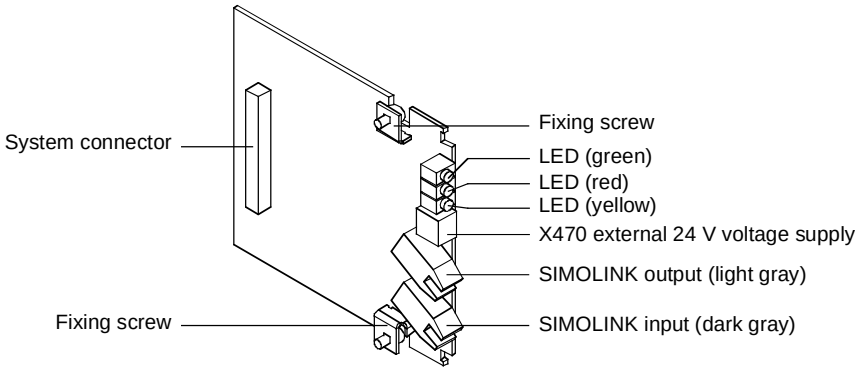


Fig. 4-5 SLB displays

Operating display

LED	Status	Diagnostic information
Green	Flashing	Fault-free net data transfer via SIMOLINK
Red	Flashing	SLB operating
Yellow	Flashing	Data exchange with basic unit is okay

Table 4-3 SLB operating display

Fault display

LED	Status	Diagnostic information
Green	off/on	No net data exchange possible via SIMOLINK; bus cable is not connected or is defective
Red	off	Voltage supply for SLB cut off; replace SLB or basic unit
Yellow	off/on	No data exchange with the basic unit; bus cable is not connected or is defective; replace SLB or basic unit

Table 4-4 SLB fault display

4.6 Start-up

After installation of the SLB optional board has been completed, an automatic self-test is carried out when the basic unit (converter/inverter) is powered up.

After this, the new board in the basic unit must be provided with a bus address. Please refer to the documentation on the basic unit for further details.

NOTE

Please refer to the documentation of the respective basic unit regarding instructions for the quick method of parameterization.

5 EB1 – Expansion Board 1

5.1 Description

Range of application The digital and analog inputs and outputs can be expanded with Expansion Board 1 (EB1).

The EB1 optional board has the following:

- 3 digital inputs
- 4 bidirectional digital inputs/outputs
- 1 analog input with differential signal which can be used as a current input and as a voltage input
- 2 analog inputs (single-ended), which can also be used as digital inputs
- 2 analog outputs
- 1 connection for the external 24 V voltage supply for the digital outputs

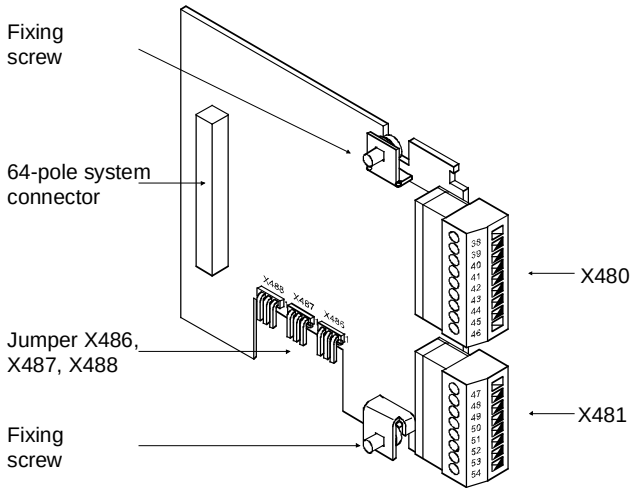


Fig. 5-1 View of the EB1 optional board

5.2 Technical Data

Order number	6SE7090-0XX84-0KB0
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)

Table 5-1 General technical data

Digital inputs	DI1, DI2, DI3
• Voltage range LOW	0 V (- 33 V ... + 5 V)
• Voltage range HIGH	+ 24 V (+ 13 V ... + 33 V)
• Input resistance	4 kΩ
• Smoothing	250 µs
• Electrical isolation	none
Bidirectional digital inputs/outputs	DIO1, DIO2, DIO3, DIO4
As input	
• Voltage range LOW	0 V (- 33 V ... + 5 V)
• Voltage range HIGH	+ 24 V (+ 13 V ... + 33 V)
• Input resistance	4 kΩ
As output	
• Voltage range LOW	open
• Voltage range HIGH	> P24 ext. -2.5 V / 100 mA
• ON delay	typ. 200 µs
• OFF delay	typ. 150 µs

Analog input (differential input)	AI1P, AI1N
• Input range Voltage Current	 ± 10.0 V (± 1 V reserve) ± 20 mA (± 2 mA reserve)
• Input resistance Voltage Current	 40 kΩ to ground 50 Ω to ground
• Hardware smoothing	220 µs
• Resolution	13 bit + sign
Analog input (single-ended), can also be used as digital input	**AI2, AI3 AIM**
• Input range	± 10,0 V (± 1 V Reserve)
• Input resistance	40 kΩ to ground
• Hardware smoothing	220 µs
• Resolution	13 bit + sign
• As digital input: Switching threshold HIGH	 > 8 V
Analog output Current or voltage signal	**AO1, AO2, AOM**
• Voltage range	± 10.0 V / ± 5 mA
• Hardware smoothing	10 µs
• Resolution	11 bit + sign

Table 5-2 Technical data of EB1

5.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either two or up to six slots on the basic unit depending on the type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE

Generally, you can install the EB1 optional board in every slot. However, please observe that an encoder board for MASTERDRIVES Motion Control always requires slot C.

A maximum of two EB1s can be installed per unit.

5.4 Connecting-up

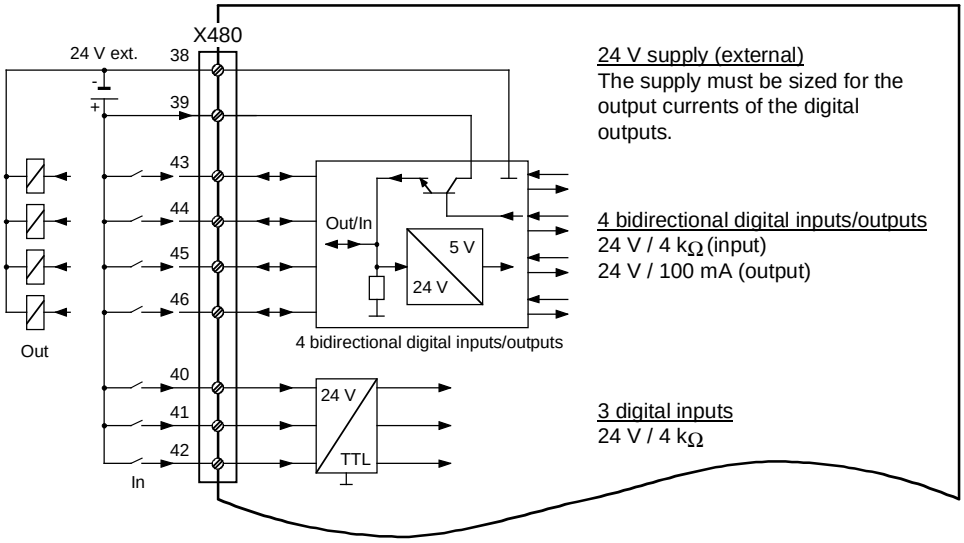


Fig. 5-2 X480 connection overview

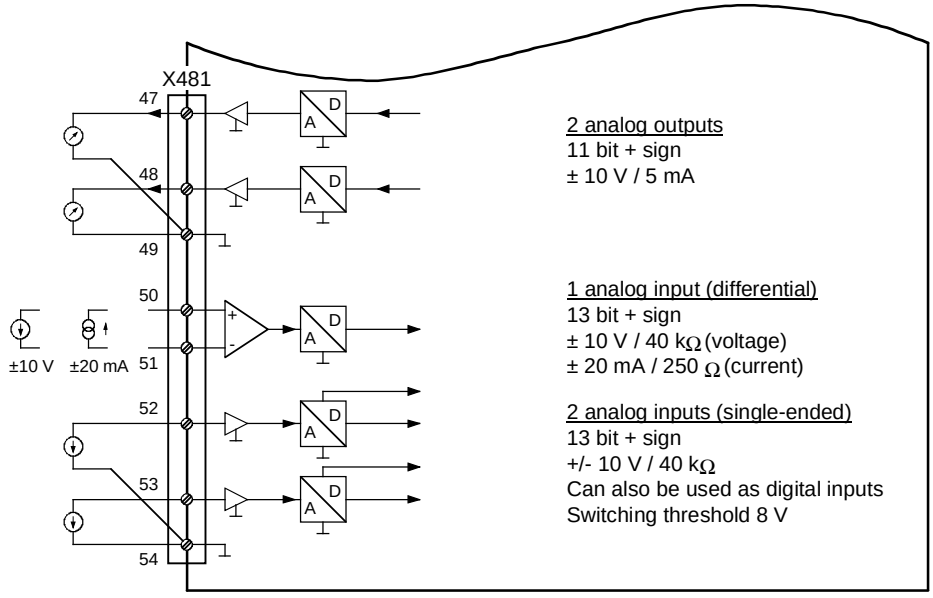
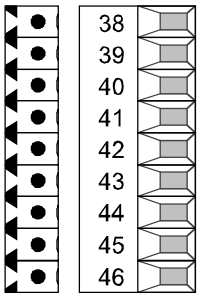


Fig. 5-3 X481 connection overview

X480 - Digital inputs and outputs

The following connections are provided on the terminal strip:

- 3 digital inputs
- 4 bidirectional digital inputs/outputs



Terminal	Designation	Significance	Range
38	M	Ground digital	0 V
39	P24ext.	Ext. 24 V supply	+20 V ... +33 V
40	DI1	Digital input 1	24 V, Ri = 4 kΩ
41	DI2	Digital input 2	24 V, Ri = 4 kΩ
42	DI3	Digital input 3	24 V, Ri = 4 kΩ
43	DIO1	Digital input/output 1	Input:
44	DIO2	Digital input/output 2	24 V, 4 kΩ
45	DIO3	Digital input/output 3	Output:
46	DIO4	Digital input/output 4	P24ext. - 2.5 V, 100 mA

Connectable cross-section: 1.5 mm² (AWG 16)

The ground cables are protected by a reactor.

Terminal 46 is at the top when installed.

Table 5-3 Terminal assignment at connection X480

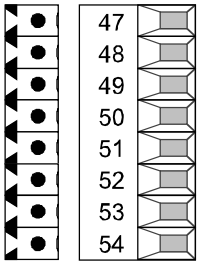
WARNING

The external 24 V supply must be sized for the currents of the digital outputs.

X481 - Analog inputs and outputs

There are the following connections on the terminal strip:

- 1 analog input with differential signal which can be used as a current input and as a voltage input
- 2 analog inputs (single-ended), which can also be used as digital inputs
- 2 analog outputs



Terminal	Designation	Significance	Range
47	AO1	Analog output 1	± 10 V, 5 mA
48	AO2	Analog output 2	± 10 V, 5 mA
49	AOM	Ground analog output	0 V
50	AI1P	Analog input 1 +	Voltage: ± 10 V, 40 kΩ
51	AI1N	Analog input 1 -	Current: ± 20 mA, 250 Ω
52	AI2	Analog input 2	± 10 V, 40 kΩ
53	AI3	Analog input 3	± 10 V, 40 kΩ
54	AIM	Ground analog input	0 V

Connectable cross-section: 1.5 mm² (AWG 16)

The ground cables are protected by a reactor

Terminal 47 is at the top when installed.

Table 5-4 Terminal assignment at connection X481

Jumper settings

Analog input 1 can be used as a voltage input or as a current input.

Analog inputs 2 and 3 can also be used as digital inputs. The switching threshold is 8 V.

Switchover is made via jumpers on the lower section of the board. The assignment is shown in the following table:

Connector	Significance
X486	Digital/analog input switchover at AI2
• Jumper 1 + 2	• Digital input
• Jumper 2 + 3	• Analog input
X487	Digital/analog input switchover at AI3
• Jumper 1 + 2	• Digital input
• Jumper 2 + 3	• Analog input
X488	Current/voltage input switchover at AI1P, AI1N
• Jumper 1 + 2	• Current input
• Jumper 2 + 3	• Voltage input

Table 5-5 Jumper settings

5.5 Start-up

After installation of the EB1 terminal expansion board has been completed, an automatic self-test is carried out when the basic unit (converter/inverter) is powered up.

If you want to use an input or output of the optional board, you have to activate the respective function block.

NOTE

Please bear in mind that if two EB1 terminal expansions are installed, each board is provided with its own parameter set.

Please refer to the Compendium for further information regarding parameterization of the EB1 terminal expansion board.

6 EB2 – Expansion Board 2

6.1 Description

Range of application The digital and analog inputs and outputs can be expanded with Expansion Board 2 (EB2).

The EB2 option board has the following:

- 2 digital inputs
- 24 V voltage supply for the digital inputs
- 1 relay output with changeover contacts
- 3 relay outputs with NO contact
- 1 analog input with differential signal, which can be used as a current input and as a voltage input
- 1 analog output which can be used as a current output and as a voltage output

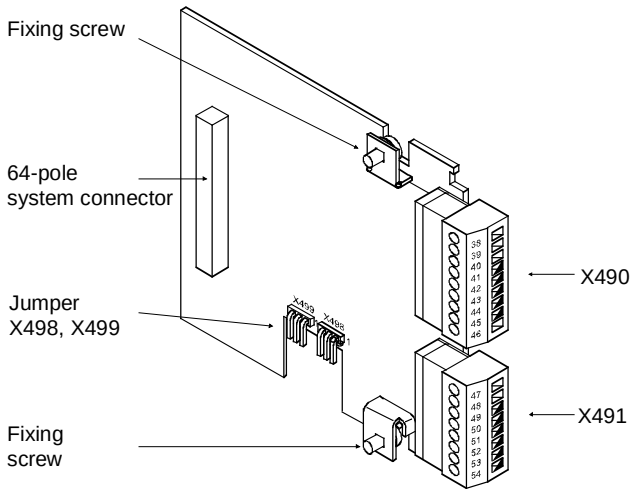


Fig. 6-1 View of the EB2 option board

6.2 Technical Data

Order number	6SE7090-0XX84-0KC0
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)

Table 6-1 General technical data

Digital inputs	DI1, DI2, DIM
• Voltage range LOW	0 V (- 33 V ... + 5 V)
• Voltage range HIGH	+ 24 V (+ 13 V ... + 33 V)
• Input resistance	4 kΩ
• Smoothing	250 µs
• Electrical isolation	none
Digital outputs (relay)	DO1, DO2, DO3, DO4
• Type of contact	Changeover / NO contact
• Max. switching voltage	60 V AC, 60 V DC
• Max. switching capacity - at 60 V AC: - at 60 V DC:	 16 VA (cos φ = 0,4) 60 VA (cos φ = 1,0) 24 W
• Necessary minimum load	1 mA, 1 V

Analog input (differential input)	AI1P, AI1N
• Input range Voltage Current	 ± 10.0 V (± 1 V reserve) ± 20 mA (± 2 mA reserve)
• Input resistance Voltage Current	 40 kΩ to ground 250 Ω to ground
• Hardware smoothing	200 µs
• Resolution	11 bit + sign
Analog output Current or voltage signal	AO, AOM
• Voltage signal	± 10.0 V / ± 5 mA
• Current signal	± 20 mA at 500 Ω
• Hardware smoothing	10 µs
• Resolution	9 bit + sign

Table 6-2 Technical data of EB2

6.3 Installation

If the inverters/converters are ordered with optional functions, the option boards are already installed in the units when they are delivered.

It is possible to retrofit option boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the type of construction for mounting the option boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install option boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE

Generally, you can install the EB2 option board in every slot. However, bear in mind that a sensor board always requires slot C.

A maximum of two EB2s can be installed per unit.

6.4 Connecting-up

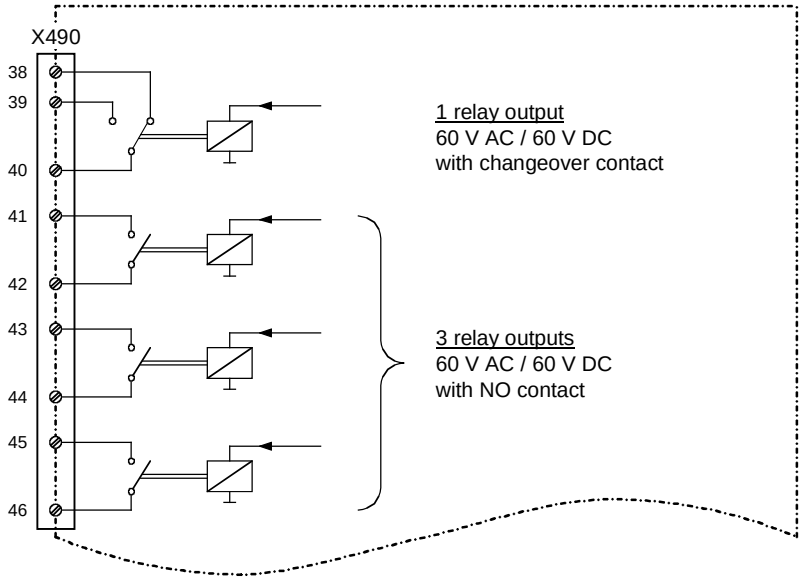


Fig. 6-2 X490 connection overview

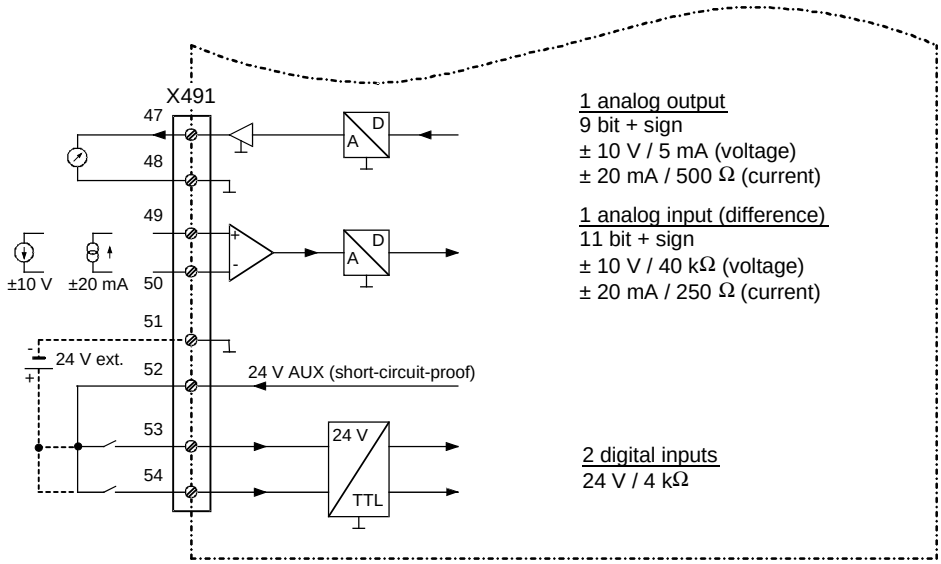
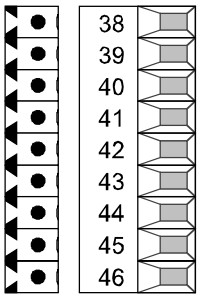


Fig. 6-3 X491 connection overview

X490 – Relay outputs



The following connections are provided on the terminal strip:

- 1 relay output (changeover contact)
- 3 relay outputs (NO contact)

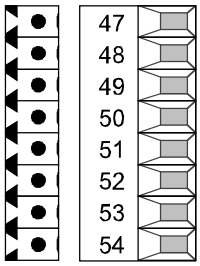
Terminal	Designation	Significance
38	DO13	Relay output 1, NC contact
39	DO12	Relay output 1, NO contact
40	DO11	Relay output 1, reference contact
41	DO22	Relay output 2, NO contact
42	DO21	Relay output 2, reference contact
43	DO32	Relay output 3, NO contact
44	DO31	Relay output 3, reference contact
45	DO42	Relay output 4, NO contact
46	DO41	Relay output 4, reference contact

Connectable cross-section: 1.5 mm^2 (AWG 16)

Terminal 38 is at the top when installed.

Table 6-3 Terminal assignment at connection X490

X491 - Analog input and output, digital inputs



Terminal	Designation	Significance	Range
47	AO	Analog output	Voltage: ± 10 V, 5 mA
48	AOM	Ground analog output	Current: ± 20 mA, 500 Ω
49	AI1P	Analog input +	Voltage: ± 10 V, 40 kΩ
50	AI1N	Analog input -	Current: ± 20 mA, 250 Ω
51	DIM	Ground digital input	0 V
52	P24AUX	24 V supply	24 V, 150 mA
53	DI1	Digital input 1	24 V, 4 kΩ
54	DI2	Digital input 2	24 V, 4 kΩ

Connectable cross-section: 1.5 mm^2 (AWG 16)

Table 6-4 Terminal assignment of connection X491

NOTE

Terminal P24AUX supplies digital inputs DI1 and DI2. No external 24 V supply may be connected to this terminal.The current output at terminal P24AUX, i.e. the total outputs of all option boards, must not exceed 150 mA.

The board EB2 is designed as a PELV circuit (Protective Extra Low Voltage). The ground of board EB2 is connected internally to earth.

Loadability of the relay contacts

Type of contact	Changeover contact
Maximum switching voltage	60 V AC, 60 V DC
Maximum switching capacity	16 VA at 60 V AC (cos φ = 0.4) 60 VA at 60 V AC (cos φ = 1.0) 24 W at 60 V DC
Required minimum load	1 mA, 1 V

Jumper settings

The analog input can be used as a voltage input or as a current input. The analog output can be used as a voltage output or as a current output.
Switchover is made via jumpers on the lower section of the board. The assignment is shown in the following table:

Connector	**Significance**
X498	Current/voltage input switchover at AI1
• Jumper 1 + 2	• Current input
• Jumper 2 + 3	• Voltage input
X499	Current/voltage output switchover at AO
• Jumper 1 + 2	• Current output
• Jumper 2 + 3	• Voltage output

Table 6-5 Jumper settings

6.5 Start-up

After installation of the EB2 terminal expansion board has been completed, an automatic self-test is carried out when the basic unit (converter/inverter) is powered up.

If you want to use an input or output of the option board, you have to activate the respective function block.

NOTE

Please bear in mind that if two EB2 terminal expansions are installed, each board is provided with its own parameter set.

Please refer to the Compendium for further information regarding parameterization of the EB2 terminal expansion board.

7 SBP - Sensor Board Pulse

7.1 Description

The SBP optional board (Sensor Board Pulse) enables a pulse encoder to be connected up to the converter and inverter modules.

Connectable pulse encoders

You can connect all conventional pulse encoders to the optional board.

The pulses can be processed as TLL or HTL level bipolar or unipolar pulses.

Evaluation of the encoder signals is possible up to a pulse frequency of 410 kHz (4096 pulses per revolution at 6000 rpm). Encoder monitoring by evaluation of the control track is also possible.

The supply voltage of the connected encoder can be set to 5 V or 15 V.

Temperature sensor

In addition to a pulse encoder, you can connect a temperature sensor (either a KTY, PT100 or a PTC sensor) to the optional board for monitoring the motor temperature.

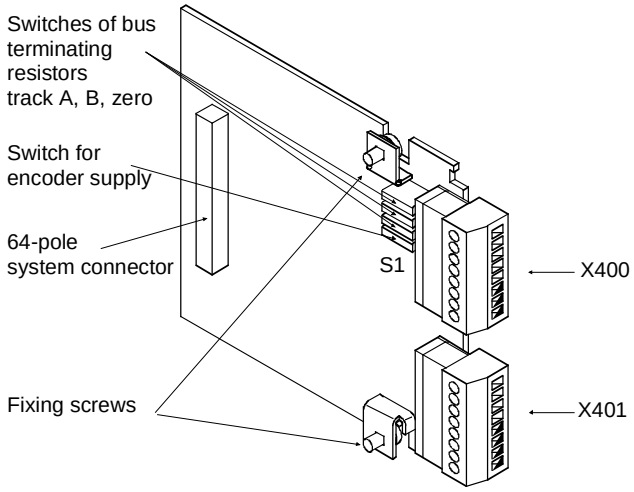


Fig. 7-1 View of the SBP optional board

Function principle

Pulse encoders supply a defined number of pulses per revolution. These pulses are counted in the evaluation electronics. The number of pulses arriving in a certain period provides a measure for the distance covered in this time segment.

Most pulse encoders are provided with pulse tracks A and B. These supply two pulse sequences offset by 90°. By evaluating all edge transitions, it is possible to duplicate the pulses and increase the resolution. The sense of rotation can be seen from the time sequence.

In addition to tracks A and B, most pulse encoders also have a zero track. This provides one pulse per revolution.

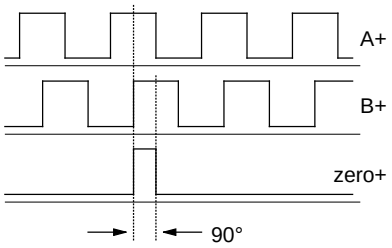


Fig. 7-2 Example of a pulse sequence

7.2 Technical Data

Order number	6SE7090-0XX84-0FA0
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)

Table 7-1 Technical data

7.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE

Generally, you can install the SBP optional board in every slot. However, if you want to evaluate the motor temperature with the board, you have to install it in slot C as the analog signals of the temperature sensor (KTY, PT100 or PTC) are only passed on in this slot.

7.4 Connecting-up

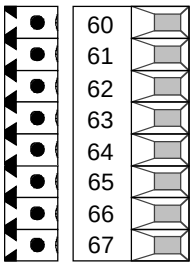
The optional board has two terminal strips for the signal cables.

Connect the signal cables at the corresponding connection; terminal X401/75 is provided for the shield.

NOTES

- The signal inputs of tracks A, B and zero of connector X401 are provided internally with bus terminating resistors. These are powered up in the factory setting (switches S1-1 to S1-3 closed).
- The switches of the bus terminating resistors are located on the optional board behind connector X400. Of the four switches, the upper three in the correct installation position are responsible for the bus terminating resistors (in the sequence A, B, zero, counting from the top).
- The bus terminating resistors should normally be powered up. If several boards are controlled with pulses from one source, all the bus terminating resistors have to be powered down except for the last one in the row.
- The power supply for the encoders can be switched OFF with switch S1-4. The encoders must then be connected to an external supply. As set at the factory, the encoder supply is active (S1-4 open).
- In the case of MASTERDRIVES MC, the power supply to the encoders (5 V or 15 V) is adjusted by means of parameter P150 and in the case of MASTERDRIVES VC it is adjusted by means of parameter P139 (see Compendium, Function diagrams, Pulse encoder evaluation).

Connection X400



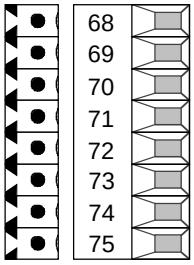
Terminal	Designation	Significance	Range
60	+ V_{SS}	Power supply for pulse encoder	5 / 15 V I_{max} = 250 mA
61	- V_{SS}	Ground for power supply	
62	- Temp	Minus (-) connection KTY84/PTC100	
63	+ Temp	Plus (+) connection KTY84/PTC100	3 mA accuracy ±1 %
64	Ground rough/fine	Ground	
65	Rough pulse 1	Digital input rough pulse 1	
66	Rough pulse 2	Digital input rough pulse 2	
67	Fine pulse 2	Digital input fine pulse 2	

Connectable cross-section: 1.5 mm² (AWG 16)

Terminal 60 is at the top when installed.

Table 7-2 Connection X400

Connection X401



Terminal	Designation	Significance	Range
68	Track A+	Plus(+) connection track A	TTL/HTL/HTL unipolar
69	Track A-	Minus(-) connection track A	TTL/HTL/HTL unipolar
70	Track B+	Plus(+) connection track B	TTL/HTL/HTL unipolar
71	Track B-	Minus(-) connection track B	TTL/HTL/HTL unipolar
72	Zero pulse +	Plus(+) connection zero track	TTL/HTL/HTL unipolar
73	Zero pulse -	Minus(-) connection zero track	TTL/HTL/HTL unipolar
74	CTRL+	Plus(+) connection control track	TTL/HTL/HTL unipolar
75	CTRL- = M	Minus (-) connection control track = ground	TTL/HTL/HTL unipolar

Connectable cross-section: 1.5 mm² (AWG 16)

Terminal 68 is at the top when installed.

Table 7-3 Connection X401

Voltage range of the encoder inputs

	RS422 (TTL)	HTL bipolar	HTL unipolar
Voltage range - Input		max. 33 V min. -33V	
Voltage range + Input		max. 33 V min. -33V	
Switching level Differential voltage - LOW	Min -150 mV	Min -2 V	Min 4 V
Switching level Differential voltage - HIGH	Max 150 mV	Max 2 V	Max 8 V

Table 7-4 Voltage range of the encoder inputs

NOTE

For the connection of unipolar signals, a ground connection at the CTRL- terminal is adequate for all signals. In view of the possibility of interference radiation, it is recommended in the case of cables with lengths of more than 100 m to bypass the four terminals A–, B–, zero pulse– and CTRL– and to connect to the encoder ground.

NOTE

The SBP board is designed as a PELV circuit (Protective Extra Low Voltage). The earth of the SBP board is connected with the PE conductor (earth) inside the device.

Voltage range of the digital inputs

	Rated value	Min.	Max.
Voltage range LOW	0 V	-0,6 V	3 V
Voltage range HIGH	24 V	13 V	33 V

Table 7-5 Voltage range of digital inputs

Input current at a rated value of 24 V for HIGH level:

	Min.	Rated value	Max.
Input current LOW	8 mA	10 mA	12 mA

Table 7-6 Input current for HIGH level

Input current at a rated value of 24 V for LOW level:

	Min.	Rated value	Max.
Input current LOW		≤ 2 mA	

Table 7-7 Input current for LOW level

NOTE

The inputs are non-floating. The rough pulse is smoothed with 0.7 ms, and the fine pulse with approx. 200 ns.

NOTE

The SBP board is designed as a PELV circuit (Protective Extra Low Voltage). The earth of the SBP board is connected with the PE conductor (earth) inside the device.

Example of connecting encoder signals with HTL level unipolar

The encoder is provided with signals of track A+, B+ and an additional zero pulse.

In order to avoid any interference radiation on the signals, you should bypass terminals A-, B-, zero- and CTRL- and connect to the encoder ground.

The screen of the encoder line must be connected to ground over a wide area, both on the motor side and on the converter side.

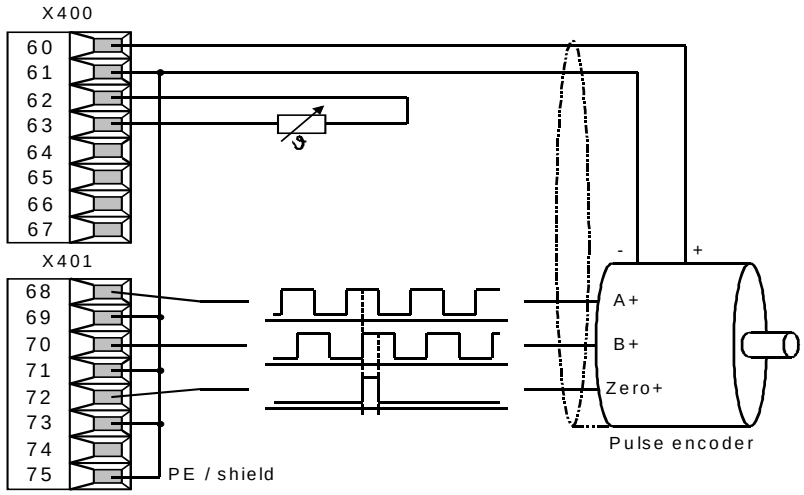


Fig. 7-3 Connection of a pulse encoder with HTL level

Example of connecting encoder signals with TTL level, bipolar (RS422)

The encoder is provided with signals of track A+, A-, B+, B- zero+, zero- and an additional control signal for monitoring the encoder cable.

The additional transmission of the inverted signals results in increased interference immunity, which means that longer signal cables can be used than for unipolar signal transmission.

The screen of the encoder line must be connected to earth ground a wide area, both on the motor side and on the converter side.

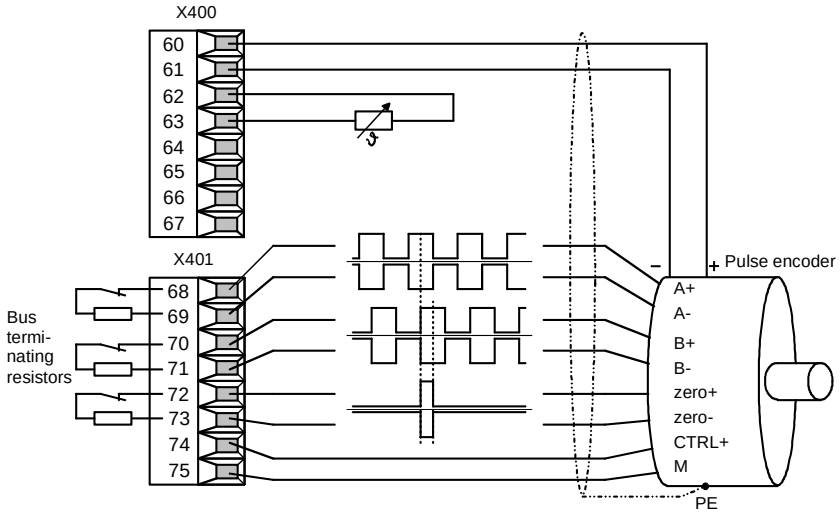


Fig. 7-4 Connecting a pulse encoder with TTL level, bipolar (RS422)

7.5 Start-up

After installation of the SBP optional board has been completed, an automatic self-test is carried out when the basic unit (converter/inverter) is powered up.

NOTE

Please refer to the documentation for the respective basic unit regarding instructions for parameterization using the quick procedure.

WARNING

If the SBP pulse encoder board is used as a motor encoder, the direction of rotation and rotational speed of the motor shaft must correspond with the signals of the SBP pulse encoder board (positive direction of rotation of motor = positive encoder signal).

The correct connection of the pulse encoder board can be checked on MASTERDRIVES VC with the “tachometer test” function. For this purpose, set parameter P115 = 7 in MASTERDRIVES VC.

For further information please refer to the Compendium.

8 SBR1/2 – Sensor Board Resolver (only for MASTERDRIVES Motion Control)

8.1 Description

The SBR optional board (Sensor Board Resolver) enables a resolver to be connected to the converter and inverter modules.

NOTE

The SBR optional board is available in two versions:

- SBR1 Optional board for connecting up a resolver
- SBR2 Optional board for connecting up a resolver with additional pulse encoder simulation

Connectable resolvers

You can connect all standard 2-pole resolvers and resolvers with the pole pair number of the motor to the optional board. Adaptation to the different types of resolvers is effected on the optional board by automatic adjustment of the signal amplitude and the sampling time.

Temperature sensor

As well as a resolver, you can connect a temperature sensor (either a KTY or a PTC sensor) to the optional board for monitoring the motor temperature.

Pulse encoder simulation

As an option, the SBR2 optional board can be equipped with pulse encoder simulation. This provides A+, A-, B+, B-, zero+ and zero- signals according to the standard RS422 which can be picked up via an additional front socket.

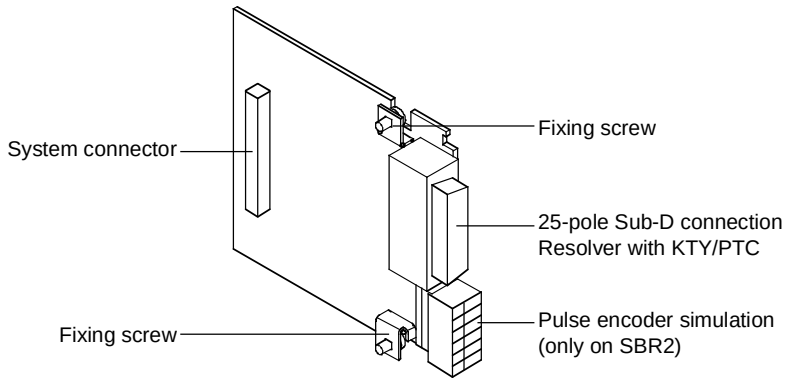


Fig. 8-1 View of the SBR2

Function principle

The position of an exciter coil in the rotor in relation to two stator coils is evaluated in the resolver.

A high-frequency carrier signal (5 to 10 kHz) is injected into the rotor winding of the resolver via a rotary transformer. The high-frequency current flowing in the rotor induces a high-frequency voltage into the two stator coils arranged at right-angles to each other. The amplitude of this voltage depends on the present position of the rotor winding or of the rotor. The envelope curve of the voltage induced into the stator coils is a sine or cosine curve.

On account of the right-angle arrangement of the stator coils, one coil will supply the sine value, and the other coil the cosine value of the present rotor position. Both signals are sensed via A/D transformers.

Subsequently, the unit software calculates the position angle α from these two signals via trigonometry functions.

The change of the position angle α between two sampling times provides the current speed of the motor.

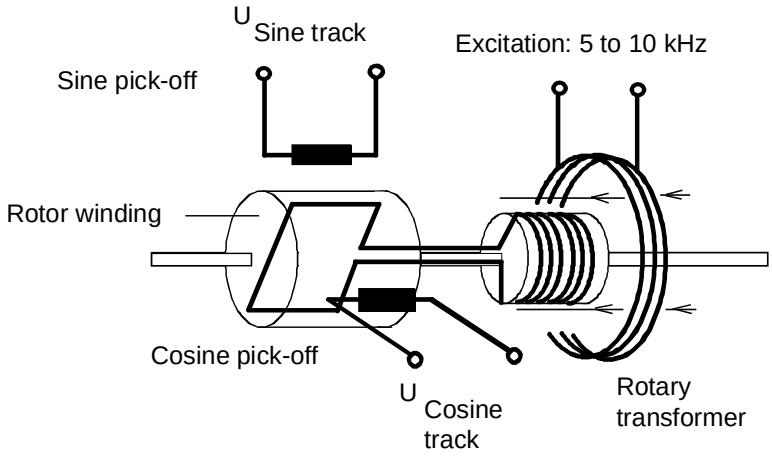


Fig. 8-2 Schematic diagram of a resolver

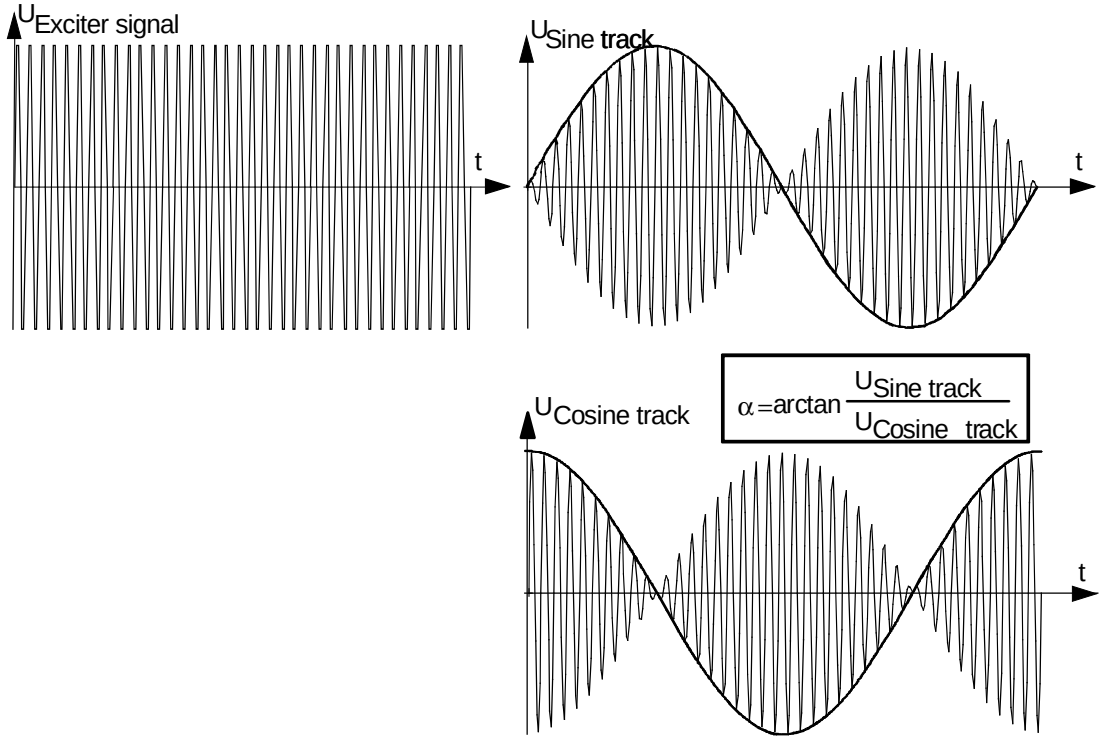


Fig. 8-3 Resolver output signals

Adjustment

Via a PLL control loop, the SBR optional board is capable of setting the phase position of the exciter signal such that the sine or cosine signal induced in the stator windings of the resolver is always sensed at maximum.

At the same time, the amplitude of the exciter signal is adjusted to the maximum resolution of the internal A/D transformer. This enables the position angle of the stator winding to be sensed with the maximum possible accuracy.

8.2 Technical Data

Order numbers	6SE7090-0XX84-0FB0 (SBR1) Resolver evaluation without pulse encoder simulation 6SE7090-0XX84-0FC0 (SBR2) Resolver evaluation with pulse encoder simulation
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)

Table 8-1 Technical Data

8.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the unit type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE Install the SBRx optional board in slot C. The SBRx optional board does not operate in other slots.

8.4 Connecting-up

Connecting-up

The optional board is provided with the following connections for the signal cables:

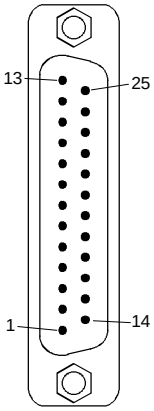
- X414 Encoder connection via a 25-pole SUB D connector
- X410 Pulse encoder simulation via a 6-pole terminal strip (only for SBR2)

Connect the shielded signal cables to the appropriate connection and place the shield on the shield plate.

Encoder connection

Connect the resolver to the optional board by means of the shielded encoder cable. Use the pre-assembled cable for this purpose.

Connection is via a 25-pole SUB D connector on the front side of the optional board.



Pin	Significance	Range
3	Resolver output voltage sin+	
4	Resolver output voltage sin-	
5	Internal shield for 3 and 4	
6	Resolver output voltage cos+	
7	Resolver output voltage cos-	
8	Internal shield for 6 and 7	
9	Resolver excitation U_{SS}	0 V to 7 V automatic adaption, 5...10 kHz sine
11	Ground for resolver excitation	
13	Motor temperature sensing PTC/KTY	
24	Internal shield for 13 and 25	
25	Motor temperature sensing PTC/KTY	
Housing	External shield	

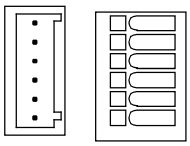
Table 8-2 Pin assignment at connection X414

Pulse encoder simulation (only for SBR2)

At connection X410 you can pick up the signals of the pulse encoder simulation generated on the optional board.

The optional board generates 512 or 1024 pulses alternatively per electrical revolution. In the case of a two-pole resolver the set pulses (512 or 1024) are generated accordingly, in the case of a four-pole resolver 1024 or 2048 pulses are generated, and in the case of a six-pole resolver, 1536 or 3072 pulses are generated per mechanical resolver revolution.

The simulation signals are available as differential signals according to standard RS 422.



Terminal	Designation	Significance	Range
90	A+	Pulse encoder simulation track A+	RS 422-
91	A-	Pulse encoder simulation track A-	standard
92	B+	Pulse encoder simulation track B+	RS 422-
93	B-	Pulse encoder simulation track B-	standard
94	N+	Pulse encoder simulation track zero+	RS 422-
95	N-	Pulse encoder simulation track zero-	standard

Connectable cross-section: 0.5 mm² (AWG 20)

Terminal 90 is at the top when installed.

Table 8-3 Terminal assignment at connection X410

8.5 Start-up

After installation of the SBR optional board has been completed, an automatic self-test is carried out when the basic unit (converter/inverter) is powered up.

NOTE

Please refer to the documentation for the respective basic unit regarding instructions for parameterization using the quick procedure.

9 SBM – Sensor Board Encoder / Multiturn (only for MASTERDRIVES Motion Control)

9.1 Description

Range of application

The SBM optional board (Sensor Board Multiturn / sin-/cos-Encoder) enables sin-/cos-encoder phase-angle sensors and multiturn phase-angle sensors to be connected and evaluated.

Encoders with a pulse number from 4 to 16384 are supported.

The usual communication protocols (EnDat and SSI) with baud rates from 100 kHz to 2 MHz are supported for the multiturn phase-angle sensor.

The supply voltage for the encoders can be set to 5 V, 7.5 V or 15 V. By connecting the sense cable, the voltage at the encoder input can be monitored and adjusted in the case of long encoder cables (4-wire principle).

In addition to the processing of encoder signals, the motor temperature is also sensed on this board (either a KTY or a PTC sensor).

The signals A+, A-, B+, B-, zero+ and zero- are provided by the pulse encoder simulation via an additional front connector in accordance with standard RS422. The indicated number of pulses/revolution corresponds to the pulse number of the encoder or the multiturn encoder. The types ERN 1387 / 1381 (sine/cosine encoder) and EQN 1324 (multiturn encoder) each have 2048 pulses.

SBM2

The SBM2 board additionally enables an offset correction of the signals to be made and can therefore be used for an external encoder with a high resolution.

View of the SBM

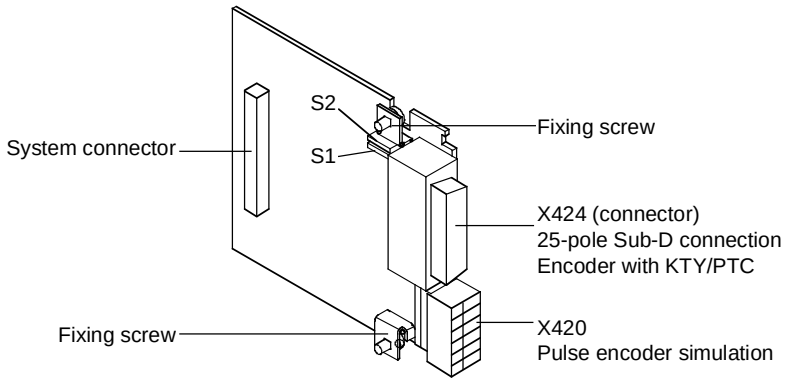


Fig. 9-1 View of the SBM optional board

The hook switches S1 and S2 are for adjusting the encoder supply voltage.

Switch S1	Switch S2	Voltage	
open	open	5 V	(factory setting)
open	closed	7,5 V	
closed	closed	15 V	

WARNING

An incorrectly set supply voltage can cause damage to the encoder!

View of the SBM2

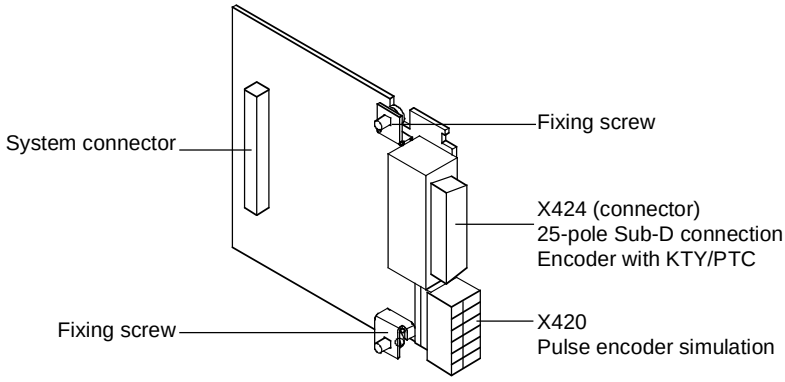


Fig. 9-2 View of the SBM2 optional board

NOTE

The encoder supply voltage can be adjusted on the SBM2 optional board by means of parameters.

9.2 Technical Data

Order number	SBM:6SE7090-0XX84-0FD0 SBM2:6SE7090-0XX84-0FE0
Size (length x width)	90 mm x 83 mm
Pollution degree	Pollution degree 2 acc. to IEC 664-1 (DIN VDE 0110/T1), moisture condensation is not permissible in operation
Mechanical strength During stationary operation - Deflection - Acceleration During transport - Deflection - Acceleration	Acc. to DIN IEC 68-2-6 (for correctly installed board) 0.15 mm in frequency range 10 Hz to 58 Hz 19.6 m/s² in frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Type of cooling	Natural-air cooling
Permissible ambient or coolant temperature - during operation - during storage - during transport	 0° C to +70° C (32° F to 158° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % in operation (condensation not permissible)

Table 9-1 General technical data

Designation	**Value**
Encoder supply	5 / 7.5 / 15 V can be switched over, Imax = 390 mA
Motor temperature sensing	PTC / KTY
A+, A- (sine)	1 V_{SS} (0.8 V ... 1.2 V)
B+, B- (cosine)	1 V_{SS} (0.8 V ... 1.2 V)
R+, R- (zero track)	0,5 V_{SS} (0.2 V ... 0.8 V)
C+, C- (1 sine / revolution)	1 V_{SS} (0.8 V ... 1.2 V)
D+, D- (1 cosine / revolution)	1 V_{SS} (0.8 V ... 1.2 V)
Cycle+, Cycle-	100 kHz ... 2 MHz, RS422
Data+, Data-	RS485
Supported protocols	EnDat and SSI
Pulse encoder simulation Tracks A+, A-, B+, B-, zero+, zero-	 RS422

Table 9-2 Technical data of the SBM

9.3 Installation

If the inverters/converters are ordered with optional functions, the optional boards are already installed in the units when they are delivered.

It is possible to retrofit optional boards and this can be carried out by the user.

For this purpose, there are either three or up to six slots on the basic unit depending on the type of construction for mounting the optional boards.

An exact description of installation is included with the relevant basic unit. As the unit has to be removed and opened in order to install optional boards, attention must be paid to the ESD measures. Please refer to the operating instructions of the basic unit in this regard.

NOTE

Generally, you can install the SBM optional board in every slot. However, bear in mind that a sensor board always requires slot C.

9.4 Connecting-up

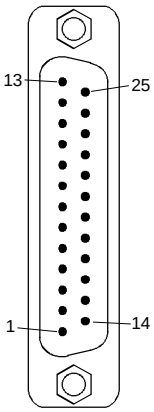
The optional board is provided with the following connections for the signal cables:

- X424 Encoder connection (encoder or multiturn encoder) via a 25-pole Sub-D connector
- X420 Pulse encoder simulation via a 6-pole terminal strip

Connect the shielded signal cables at the appropriate connection and place the shield on the shield plate.

X424 - Encoder connection

The following signal cables are provided for connecting an encoder to the SBM optional board:

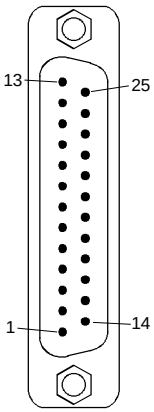


View of the connector (pins) of the board in mounting position

Pin	Designation	Significance
1	P encoder	Encoder supply 5 / 7.5 / 15 V, Imax = 390 mA
2	M encoder	Ground, encoder supply
3	A+	1 V_{SS} (0.8 V - 1.2 V)
4	A-	
5	Internal shield	
6	B+	1 V_{SS} (0.8 V - 1.2 V)
7	B-	
8	Internal shield	
13	+Temp	Motor temperature sensing PTC / KTY
14	Encoder sense	Sense input - encoder supply
16	0 V sense	Ground, sense input - encoder supply
17	R+	Zero track 0.5 V_{SS} (0.2 V - 0.8 V)
18	R-	
19	C+	1 sine / revolution 1 V_{SS} (0.8 V - 1.2 V)
20	C-	
21	D+	1 cosine / revolution 1 V_{SS} (0.8 V - 1.2 V)
22	D-	
24	Internal shield	
25	-Temp	Motor temperature sensing PTC / KTY
Housing	External shield	

Table 9-3 Pin assignment at connector X424 for encoder

X424 - Multiturn encoder



View of the connector (pins) of the board in mounting position

The following signal cables are provided for connecting a multiturn encoder to the SBM optional board:

Pin	Designation	Significance
1	P encoder	Encoder supply 5 / 7.5 / 15 V, Imax = 390 mA
2	M encoder	Masse Geberversorgung
3	A+	1 V_{SS}
4	A-	(0.8 V – 1.2 V)
5	Internal shield	
6	B+	1 V_{SS}
7	B-	(0.8 V – 1.2 V)
8	Internal shield	
10	Cycle +	Baud rate 100 kHz - 2 MHz parameterizable
12	Cycle -	RS422
13	+Temp	Motor temperature sensing PTC / KTY
14	Encoder sense	Sense input encoder supply
15	Data +	RS485
16	0 V Sense	Ground, sense input encoder supply
23	Data -	RS485
24	Internal shield	
25	-Temp	Motor temperature sensing PTC / KTY
Housing	External shield	

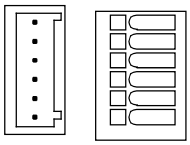
Table 9-4 Pin assignment at connection X424 for absolute-value/multiturn encoder

X420 - Pulse encoder simulation

At connection X420 you can pick up the signals of the pulse encoder simulation generated on the optional board.

A zero pulse which does not exist (if a multiturn encoder is connected) is simulated by the board.

The simulation signals are available as differential signals according to standard RS 422.



Terminal	Designation	Significance	Range
80	A+	Pulse encoder simulation track A+	RS 422-
81	A-	Pulse encoder simulation track A-	standard
82	B+	Pulse encoder simulation track B+	RS 422-
83	B-	Pulse encoder simulation track B-	standard
84	N+	Pulse encoder simulation track zero+	RS 422-
85	N-	Pulse encoder simulation track zero-	standard

Connectable cross-section: 0.5 mm² (AWG 20)
Terminal 80 is at the top when installed.

Table 9-5 Terminal assignment at connection X420

9.5 Start-up

After installation of the SBM optional board has been completed, an automatic self-test is carried out when the basic unit (converter/inverter) is powered up.

NOTE

Please refer to the documentation for the respective basic unit regarding instructions for parameterization using the quick procedure.