

Servo Controller SE-48

▪ Operating Instructions



Operating manual
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Declaration of Incorporation

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Description and identification of the partly complete machinery:

Product Servo controller SE-48

Types SE-48 I/O integriert
SE-48 I/O stand alone /
SE-48 Profibus integriert
SE-48 Profibus stand alone

The designated products are in conformance with the regulations of the following European Directives.

Number	2004/108/EC
Text	Electromagnetic Compatibility
Applied harmonized standards	IEC / EN 61000-6-2 IEC / EN 61000-6-4

Important information

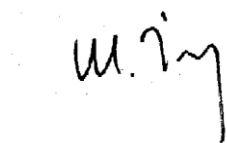
Servo controllers are **no** products in the sense of the EC Machinery Directive.

The servo controllers may only be used in machines or systems after the manufacturer of the machine or system has guaranteed the CE conformity of the overall machine or system.

According to the EMC Directive, the devices mentioned are no products which can be operated as stand-alone products. Compliance with the directive requires correct installation of the products, adherence to the specific installation notes and the product documentation.

Place/Date : Huttwil, February 2012

Afag Automation AG (automatic manufacturing technology)



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These operating instructions apply to:

Type	Order No.
SE-48 I/O stand alone	50102766
SE-48 Profibus stand alone	50102767
SE-48 I/O integrated	50101757
SE-48 Profibus integrated	50101760

Issue of this documentation: SE-48-OI-vers. 3.4 en.20.02.2012

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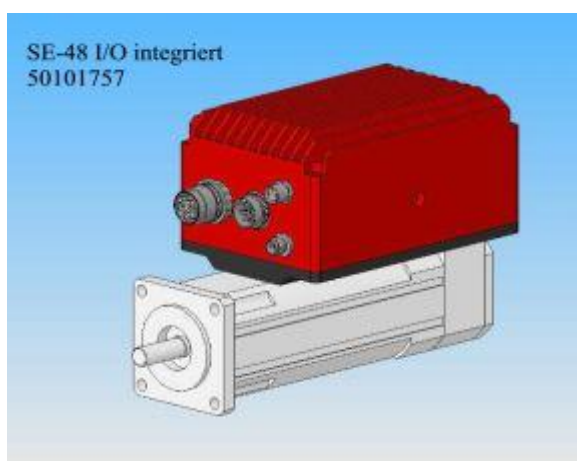
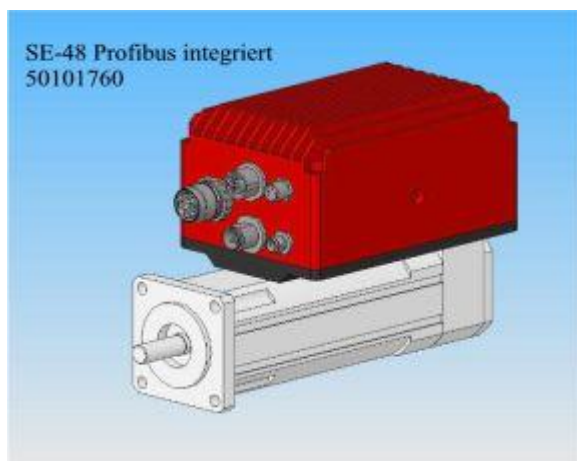
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1 General

This operating manual provides instructions on the safe use of the servo positioning regulator SE-48. It contains safety instructions that must be complied with.

1.1 Scope of supply



Accessories	see catalogue
-------------	---------------

2 Safety instructions for electrical drives and controllers

2.1 Symbols used in this handbook



Information
Important information and notes.



Caution!
Non-adherence can result in significant property damage.



Danger!
Non-adherence can cause **property damage** and **injuries to persons**.



Caution! Dangerous voltages.
The safety instruction contains a pointer to the occurrence of voltages which may be dangerous to life.

2.2 General instructions

In case of damage owing to non-compliance with the warnings in this operating manual, Afag AG will not accept any liability.

If the documentation in the language that has been supplied is not easily understood, please ask and inform the supplier.

The faultless and safe operation of the servo positioning regulator presupposes an appropriate and professional transport, storage, mounting and installation as well as careful operation and service. Only educated and trained personnel must be deployed for handling electrical equipment:

TRAINED AND QUALIFIED PERSONNEL

in the meaning of this product manual or the warning instructions on the product itself, are those persons who are familiar with the installation, the assembly, commissioning and operation of the product as well as with all the warnings and precautionary measures according to the operating instructions in this product manual and have the necessary qualifications corresponding to their activity:

- Training and instruction or authorization to switch on and off devices/systems in accordance with the standards of safety engineering, to ground them and to mark them meaningfully according to the work instructions.

- Training or instruction according to the standards of safety engineering in the maintenance and use of the proper safety equipment.
- Training in First Aid.

The following notes must be read before the initial start-up of the system for avoiding bodily injuries and/or damage to property:



These safety instructions must be complied with at all times.



Do not attempt to install or commission the servo positioning regulator before you have carefully read all the safety instructions for electrical drives and controllers in this document. These safety instructions and all other user instructions must be read before any work on the servo positioning regulator.



Should you not have access to any of the user instructions for the servo positioning regulator, please contact the responsible sales representative. Demand immediate dispatch of these documents to the person(s) responsible for the safe operation of the servo positioning regulator.



In case of sale, lending or other form of transfer of the servo positioning regulator, these safety instructions must also be enclosed.



Opening of the servo positioning regulator by the owner/operator is not permitted for reasons of safety and the warranty.



Precondition for trouble-free working of the servo positioning regulator is a technically sound planning!



Danger!

Improper handling of the servo positioning regulator and non-compliance with the warning instructions given here or improper intervention in the safety devices can result in damage to property, bodily injury, electrical shocks or in extreme cases, in death.

2.3 Dangers from improper use



Danger!

High electrical voltage and high operating current!

Danger to life or possibility of serious injury from electrical shock!



Danger!

High electrical voltage owing to wrong connection!

Danger to life or possibility of injury from electrical shock!



Danger!

The surfaces of the machine housing may be hot!

Danger of injury! Danger of burns!



Danger!

Movements that cause danger!

Danger to life, serious bodily injury or damage to property from unintentional movements of the motors!

2.4 Safety instructions

2.4.1 General safety instructions



The servo positioning regulator corresponds to the protection class IP20, as well as the pollution class 1. Care must be taken that the ambience conforms to this protection class and degree of pollution.



Use only accessories and spare parts that have been approved by the manufacturer.



It must be possible to connect the servo positioning regulators to the mains supply according to the EN-standards and VDE specifications in such a way that they can be isolated from the mains using suitable isolating devices (e.g. main switch, contactors, power circuit breakers).



The servo positioning regulator can be secured with an all-current sensitive FI-cut-off switch (RCD = Residual Current Protective Device) 300 mA.



Gold-plated contacts or contacts with a high contact pressure must be used for connecting the control contacts.



As a precaution, interference suppression measures must be taken for the switchgear, e.g. contactors and relays with RC-elements or diodes.



The safety specifications and regulations of the country in which the device is to be used must be complied with.



The ambient conditions specified in the product documentation must be complied with. Safety-critical applications are not allowed until they are expressly approved by the manufacturer.



The technical data, the connection and installation conditions for the servo positioning regulator can be obtained from this product manual and must be complied with without fail.



Danger!

The general installation and safety specifications for the work on power installations (e.g. DIN, VDE, EN, IEC or other national or international specifications) must be observed.

Non-compliance can result in death, bodily injuries or considerable damage to property.



Without any claims to completeness, the following specifications shall apply:

VDE 0100 Regulation for the mounting of power installations up to 1000 volt

EN 60204 Electrical equipment of machines

EN 50178 Electronic equipment for use in power installations

2.4.2 Safety instructions for installation and maintenance

For the installation and maintenance of the system, the relevant DIN, VDE, EN and IEC specifications, as well as all national and local safety and accident prevention regulations apply in any case. The system manufacturer or the owner/operator must ensure compliance with these regulations:



The operation, maintenance and/or repairs to the servo positioning regulator may only be carried out by personnel who are trained and qualified to work on electrical machinery.

Avoiding accidents, bodily injuries and/or damage to property:



Additionally secure vertical axes against dropping or lowering after switching off the motor, such as by:

- mechanical interlocking of the vertical axis,
- external braking/ catching/ clamping device or
- sufficient weight balancing of the axis.



The standard motor brake that is supplied or an external motor brake controlled by the drive control unit alone is not suitable for personnel safety!



Render the electrical equipment free of voltage via the main switch and secure it against being switched on again, wait until the intermediate circuit has been discharged during:

- maintenance work and repairs
- cleaning work
- long operational downtimes



Before carrying out any maintenance work, it must be ensured that the power supply has been switched off, locked and the intermediate circuit has been discharged.



The external or internal brake resistance is live in operation and can carry a dangerous intermediate circuit voltage for up to about 5 minutes after switching off the servo positioning regulator, this can result in death or serious bodily injuries if touched.



Care must be taken at the time of installation. It must be ensured that both at the time of installation as well as during the subsequent operation of the drive, no drilling chips, metal dust or parts from the assembly procedures (screws, nuts, bits of cable) fall into the servo positioning regulator.



So also, it must be ensured that the external voltage supply of the regulator (24 V) is switched off.



The intermediate circuit or the mains voltage must always be switched off before the 24V voltage supply of the regulator is switched off.



Work in the vicinity of the machine must always be carried out with the AC or DC voltage supply switched off and the switches locked. Output stages or regulator releases that are switched off are no suitable locking devices. In case of a fault, this may result in an unintended movement of the drive.



The commissioning must be carried out with coasting motors, to avoid mechanical damage, e.g. owing to a wrong direction of rotation.



Electronic devices are basically not fail-safe. It is the responsibility of the user to ensure that upon failure of the electrical device, his system is taken into a safe state.



The servo positioning regulator and in particular the brake resistance, external or internal, can reach high temperatures, and upon touching them, serious bodily burning can occur.

2.4.3 Protection against touching electrical parts

This section only pertains to devices and drive components with voltages above 50 V. If parts with voltages above 50 V are touched, this can become dangerous to persons and result in electrical shock. When operating electrical devices, certain parts of such devices are necessarily live and carry a dangerous voltage.



Danger!

High electrical voltage!

Danger to life, danger of injury from electrical shock, or serious bodily injury!

For normal operations, the relevant DIN, VDE, EN and IEC - specifications apply in any case, as well as all the national and local safety and accident prevention regulations. The system manufacturer or the owner/operator must ensure compliance with these regulations:



Before switching on, put on the covers and protective devices, which are intended to prevent touching, on the appliances. For installed devices, protection against direct touching of electrical parts must be provided by an external housing, such as a switch cabinet. The VGB4 specifications must be complied with!



Always connect the protective conductor of the electrical equipment and the devices firmly to the mains supply. Owing to the integrated mains filter, the leakage current is greater than 3.5 mA!



Keep in mind the minimum copper cross-section for the protective conductor connection over its entire length in accordance with the standard EN60617.



Before commissioning, even for a short time for measuring and testing purposes, always connect the protective conductor to all the electrical devices according to the circuit diagram, or connect it to the ground. Otherwise, there may be high voltages on the housing, which cause an

electrical shock.



Do not touch electrical connection points of the components in the powered on state.



Before accessing electrical parts with voltages greater than 50 V, disconnect the device from the mains supply or the voltage source. Secure against being switched on.



At the time of installation, attention must be paid to the intermediate circuit voltage, particularly with reference to the insulation and protective measures. Care must be taken to ensure proper grounding, conductor dimensioning and the corresponding short circuit resistance.



The device has an intermediate circuit discharge circuit according to EN 60204 Section 6.2.4. In certain device configurations, especially with parallel connection of several servo positioning regulators in the intermediate circuit, or in the case of a brake resistance that has not been connected, however, the fast discharge may be ineffective. The servo positioning regulators can then carry a dangerous voltage for up to 5 minutes after switching off (capacitor residual charge).

2.4.4 Protection through protective low voltage (PELV) from electrical shocks

All connections and terminals with voltages from 5 to 50 V at the servo positioning regulator are protective low voltages that are made with safe contacts according to the following standards:

International: IEC 60364-4-41

European countries in the EC: EN 50178/1998, Section 5.2.8.1



Danger!

High electrical voltage owing to wrong connection!

Danger to life, danger of injury from an electrical shock!

Only those devices, electrical components and cables, which have a protective low voltage (PELV = Protective Extra Low Voltage) may be connected to all connections and terminals with voltages from 0 to 50 volt.

Connect or apply only such voltages or electrical circuits that are safely isolated from dangerous voltages. Safe isolation is achieved, for example, by isolation transformers, safe opto-couplers or mains-free battery operation.

2.4.5 Protection from dangerous movements

Dangerous movements can be caused by erroneous control of the connected motors. The causes can be of the most varied kinds:

- untidy or faulty wiring or cabling
- error during the operation of the components
- error in the measuring and signal transmitters
- faulty or non-EMC-conformant components
- error in the software in the superset control system

These faults can occur immediately after switching on, or after an indefinite time during operation.

The monitoring devices in the drive components exclude the possibility of a malfunction in the connected drives to a great extent. With regard to the personnel protection, particularly the danger of bodily injury, and/or property damage, however, all trust must not be placed in this fact alone. Until such time as the built-in monitoring devices become active, however, faulty drive movements must be expected, the magnitude of which depends on the type of the controller and the operating state.

**Danger!**

Movements that cause danger!

Danger to life, danger of injury, serious bodily injury or property damage!

Protection of persons must be ensured by means of monitoring devices or measures that are set up at the plant site. These are provided according to the specific conditions of the system and a danger and fault analysis by the system manufacturer. The safety regulations applicable for the system are also included thereby. Switching off, bypassing or wrong activation of safety devices can result in random unwanted movements of the machine or other malfunctions.

2.4.6 Protection against touching hot parts

**Danger!**

The surfaces of the machine housing may be hot!

Danger of injury! Danger of burns!



Do not touch the housing surface in the vicinity of hot heat sources!
Danger of burns!



Before access, allow the devices to cool for 10 minutes after switching off.



If hot parts of the equipment, like machine housings, in which radiators and resistors are located are touched, burns may result!

2.4.7 Protection during handling and installation

The handling and installation of certain parts and components in an unsuitable manner can result in injury under certain circumstances.



Danger!

Danger of injury from improper handling!

Bodily injury possible from crushing, shearing, cutting, impacts!

General safety instructions apply in this context:



Follow the general installation and safety specifications on handling and installation.



Use suitable installation and transportation equipment.



Prevent squeezing and crushing by taking suitable precautionary measures.



Only use suitable tools. If prescribed, use special tools.



Use hoists and tools in a technically sound manner.



If required, use suitable protective fittings (for example: safety goggles, safety shoes, protective gloves).



Do not stay under suspended loads.



Immediately wipe off any liquids which have escaped since there is a danger of slipping.

3 Product description

3.1.1 Basic information

The servo positioning regulator of the SE-48 series is an intelligent servo-converter with a comprehensive range of parameterisation options. This enables it to be flexibly combined with a large number of electrical axes from Afag.

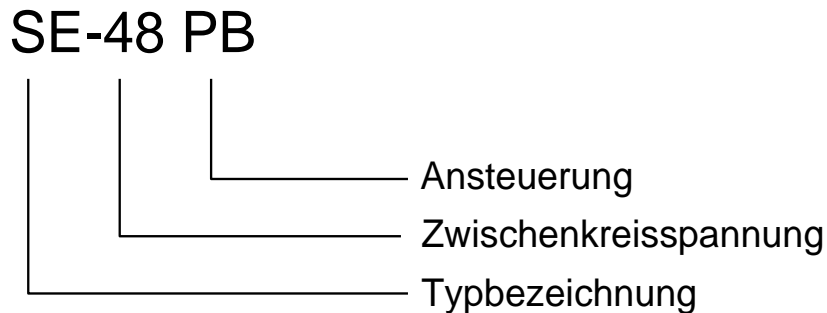


Figure 1: Type code

3.1.2 Field of application and proper use

The servo positioning regulator SE-48 is designed for the decentralised control and regulation of three phase permanent magnet synchronous machines.

It is normally mounted directly on the motor, however it is also possible to isolate the SE-48 from the motor, connecting it via a short, shielded cable. Further information on installation can be found in the appendix, **Chapter 6 Mechanical installation**

The servo positioning regulator SE-48 is supplied with a 24 VDC (logic), i.e. 48 VDC (intermediate circuit) protective low voltage via a mains adapter. At the motor connection, the synchronous machine is supplied with a pulse width modulated symmetrical 3 phase rotating field with variable frequency, current and voltage.

The SE-48 is designed as a positioning controller for Afag handling components such as:

Rotary module RME-080-xxx

Spindle extension SA-3-xxx, SA-6-xxx

Portal axes PME-c

Before the SE-48 is deployed in special fields of application with higher normative and device safety standards, e.g. medical technology or avionics, the user must check in each individual case whether the SE-48 meets the respective technical requirements. In case of doubt please contact your sales partner.

The SE-48 is only to be deployed under the stated operating conditions and in accordance with its technical data. Furthermore, the assembly, commissioning, disassembly and maintenance instructions are to be complied with.

3.1.3 SE-48 performance features

The SE-48 has the following performance features:

Compact construction; the five-sided, closed housing can be mounted directly on the motor or by using an adapter plate.

Full integration of all components for the controller and power section including an RS232 interface for the PC communication.

Integrated universal rotary encoder analysis for the resolver and the incremental encoder with commutation signals.

Integrated driver stage for 24 V parking brakes.

Compliance with the current CE and EN norms without the need for additional external filter measures.

Optimised metal EMC housing for attachment directly to the motor. The device has a degree of protection IP65.

Integration of all necessary filters within the device for operational (industrial) compliance with the EMC regulations, e.g. filters for the 24 V power supply as well as inputs and outputs.

Use as position controller.

Jerk-free or time optimal positioning, absolute or relative to a reference point.

User friendly parameterisation with the PC program SE-48 SE-Commander.

Simple connection to a higher level controller, e.g. to a PLC via the I/O level or a field bus.

I²t monitoring for limiting the medium power loss in the power output stage and motor.

Integrated brake chopper.

4 Technical data / electrical connection

4.1 Ambient conditions and qualification

Parameters	Values	
Permissible temperature range	Storage temperature:	-25°C to +70°C
	Operating temperature:	0°C to +40°C
Permissible installation altitude	Up to 1000 m above sea level, 1000 to 4000 m above sea level with reduction in performance	
Air humidity	Rel. air humidity up to 90%, no condensation	
Degree of protection	IP65	
Pollution class	1	
CE conformity: Low voltage directive: EMC directive:	Not applicable EN 61 800 - 3	

4.2 Dimensions and weight

Parameters	Values
Dimensions (H*W*D)	68 x 84 x 125 mm (without mating plug connector)
Weight	approx. 650 g

4.3 Power data

Parameters	Values
Intermediate circuit voltage	48 V DC nominal / 10 A nominal ¹⁾
24 V power supply	24 V DC [$\pm 20\%$] approx. 200 mA ²⁾ $U_{\text{Ripple}} < 1.5 V_{\text{ss},100\text{Hz}}$ +700 mA ³⁾ +100 mA ⁴⁾ Internal protection via Polyswitch, switches at approx. 1 A

¹⁾ An internal 15 A fuse is required.

²⁾ Current consumption of SE-48 without additional circuit

³⁾ Maximum permissible current consumption of an optional parking brake on the motor

⁴⁾ Maximum current consumption with load on DOUT0 to DOUT2

4.4 Motor temperature monitoring

Parameters	Values	
Analog sensor	KTY84-130	$R_{100} \approx 1000 \Omega$

4.5 Motor connection data

Parameters	Values
Data for the operation on 48V / $T_{\text{Housing max.}} = 50^{\circ}\text{C}$	
Output power	500 VA
Max. output power for 2 s	1500 VA
Pulse frequency	10 kHz / 20 kHz
Max. cable length	1.5m

4.6 Resolver [X2]

Parameters	Value
Suitable resolver	Industry standard
Carrier frequency	10 kHz
Resolution	> 12 bit (type 15 bit)
Max. rotational speed	16,000 min^{-1}

4.7 Incremental encoder analysis [X2]

Parameters	Value
No. of encoder pulses	Programmable from 32 to 1024 encoder pulses per revolution
Connection level	5 V differential / RS422 standard
Encoder supply	+5 V / 100 mA max.
Input impedance	$R_i \approx 1600 \Omega$
Limit frequency	$f_{\text{limit}} = 100 \text{ kHz (pulses/s)}$

4.8 RS232 [X5]

Parameters	Value
RS232	According to RS232 specification, 9600 bit/s to 115.2 k bit/s

4.9 Digital inputs and outputs [X1]

Parameters	Value
Signal level of logic inputs	24V (8V...30V) active high, in conformity with EN 1131-2
Signal level of logic outputs	24V (8V...30V) active high, short-circuit-proof against GND

4.10 Electrical connection SE-48

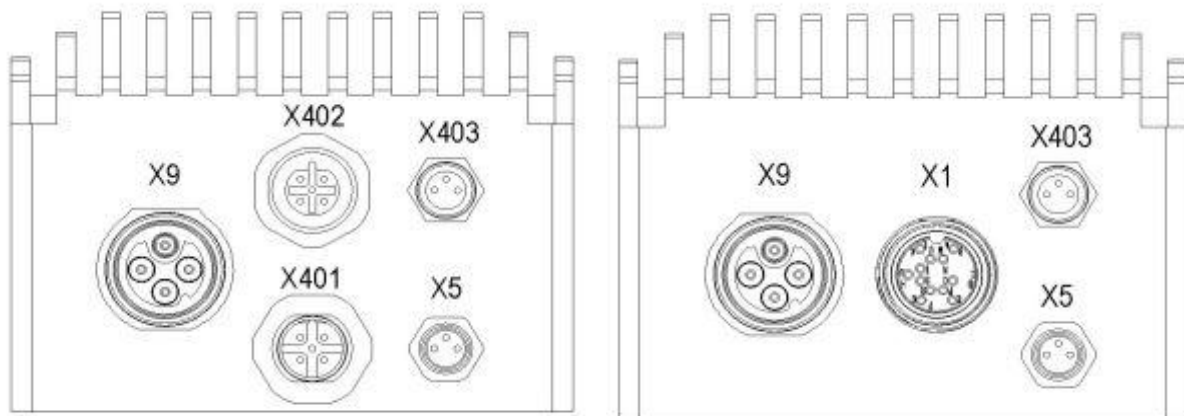


Figure 2: View of socket types; Profibus (left) and I/O (right)

Plug	Designation
X1	I/O interface
X5	Programming interface RS232
X9	Power and logic supply
X401	Profibus In (M12)
X402	Profibus Out (M12)
X403	Basic position switch

4.10.1 Input and output connections [X1]

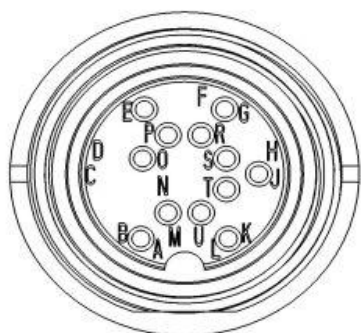


Figure 3: View of plug [X1]

4.10.1.1 Type on device [X1]

Coninvers: 12 pole Flanged socket PV-12P1N12HG00

4.10.1.2 Mating plug [X1]

SE-48 I/O cable 5m, Afag No. 50119231

4.10.1.3 Pin assignment [X1]

Pin No.	Designation	Specification
A	Not used	DIN0, white
E	Start reference run	DIN1, green
G	Position bit 0	DIN2, yellow
J	Position bit 1	DIN3, grey
L	Position bit 2	DIN4, pink
M	Position bit 3	DIN5, blue
O	Start positioning	DIN6, red
P	Turn on output stage	DIN9, black
R		Reserve, violet
S	Operational	DOUT0, grey-pink
T	Reference valid	DOUT1, red-blue
U	In position	DOUT2, brown-green

4.10.1.4

4.10.1.5 Description of the inputs and outputs

DIN1 start reference run

With a signal change from 0 to 1 a reference run is carried out.

DIN2, DIN3, DIN4, DIN5 Pos bit:

Setting out a bit pattern enables the 16 run profiles to be selected

DIN6 start positioning:

With a signal change from 0 to 1 the selected run profile is started

DIN9 start output stage

With a signal change from 0 to 1 the motor is activated, i.e. regulated. While regulated the motor remains stationary until the signal 0 is set. If the controller contains an error message, this can be cleared with the signal change from 1 to 0, provided the error is no longer present.

DOUT0 operational:

If there is no error message in the controller, the controller is “Operational”, i.e. the DOUT0 signal is 1

DOUT1 reference valid:

If a reference run is completed successfully, the signal changes from 0 to 1. This signal must be 1 before a positioning can be initiated.

DOUT2 In position:

When the motor reaches the target window for the desired position, the signal changes from 0 to 1. While traversing the signal is at 0.

4.10.2 RS232 interface connection [X5]

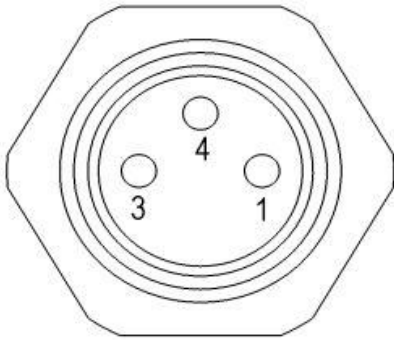


Figure 4: View of plug [X5]

4.10.2.1 Type on device [X5]

Phoenix; 3 pole M8 flush-type socket; SACC-E-M8MS-3CON-M 8/0.5 (15 00 33 4)

4.10.2.2 Mating plug [X5]

SE-48 programming cable, Afag No. 50103890

4.10.2.3 Pin assignment [X5]

Pin No.	Designation	Specification
1	RxD	Receive Data
3	GND	Ground
4	TxD	Transmit Data

4.10.3 Power supply connection [X9]

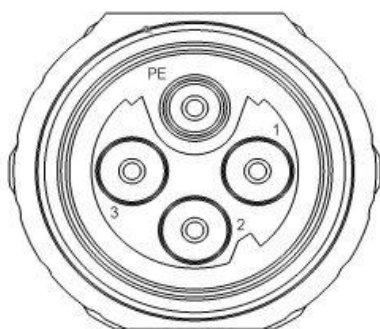


Figure 5: View of plug [X9]

4.10.3.1 Type on device [X9]

Intercontec, 4 pole M17 ; Flush-type power socket; BEGA894MR0900004A000

4.10.3.2 Mating plug [X9]

SE-48 power cable, Afag No. 50118124

4.10.3.3 Pin assignment [X9]

Pin No.	Designation	Specification
1	0 Volt	Common ground potential for intermediate circuit voltage and 24V logic supply. Conductor cross-section at least 1.5mm ²
2	24 Volt	Power supply for the control electronics Conductor cross-section at least 1.5mm ²
3	48 Volt	Intermediate circuit voltage Conductor cross-section at least 1.5mm ²
PE	PE	Connection to housing

4.10.4

4.10.5 Profibus In connection [X401]

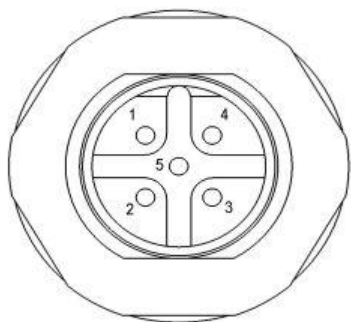


Figure 6: View of plug [401]

4.10.5.1 Type on device [X401]

Phoenix; 5 pole M12 flush-type socket
SACC-EC-M12MSB-5CON-PG 9/0.5 (15 15 05 7)

4.10.5.2 Mating plug [X401]

Phoenix; 5 pole M12 plug connector, sleeve, shielded, with screw connection, B coded, SACC-M12FSB-5CON-PG9 SH AU (15 07 77 7)

4.10.5.3 Pin assignment [X401]

Pin No.	Designation	Specification
1	+5V (VCC_ISO)	Brown
2	A line (R/TxD-N)	White
3	ISOGND	Blue
4	B line (R/TxD-P)	Black
5	PE	Grey

4.10.6

4.10.7 Profibus Out connection [X402]

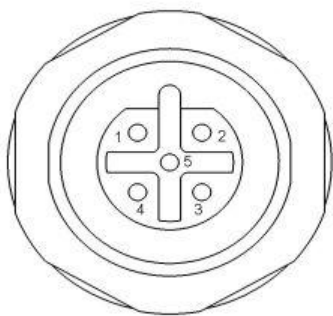


Figure 7: View of plug [402]

4.10.7.1 Type on device [X402]

Phoenix; 5 pole M12 flush-type socket
SACC-EC-M12FSB-5CON-PG 9/0.5 (15 15 04 4)

4.10.7.2 Mating plug [X402]

Phoenix; 5 pole M12 plug connector, pin, shielded, with screw connection,
B coded, SACC-M12MSB-5CON-PG9 SH AU

4.10.7.3 Pin assignment [X402]

Pin No.	Designation	Specification
1	+5V (VCC_ISO)	Brown
2	A line (R/TxD-N)	White
3	ISOGND	Blue
4	B line (R/TxD-P)	Black
5	PE	Grey

4.10.8 Basic position switch connection [X403]

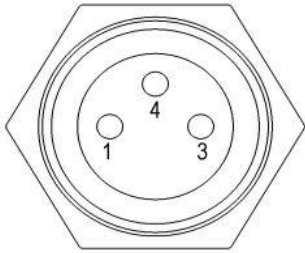


Figure 8: View of plug [X403]

4.10.8.1 Type on device [X403]

Phoenix; 3 pole M8 flush-type socket; SACC-E-M8FS-3CON-M 8/0.5 (15 00 35 0)

4.10.8.2 Mating plug [X403]

Reference cable R2, Afag No. 11017754

4.10.8.3 Pin assignment [X403]

Pin No.	Designation	Specification
1	24 Volt	Brown
3	0 Volt	Blue
4	Reference signal	Black

4.11 Connection: Motor / encoder

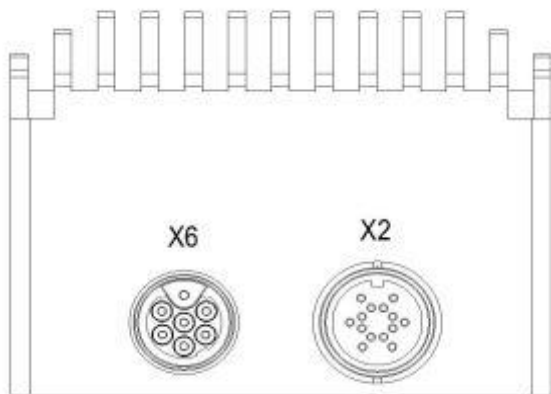


Figure 9: View of plug; stand alone type

Plug	Designation
X2	Encoder plug, incremental encoder or resolver
X6	Motor connector

4.11.1 Encoder connection [X2]

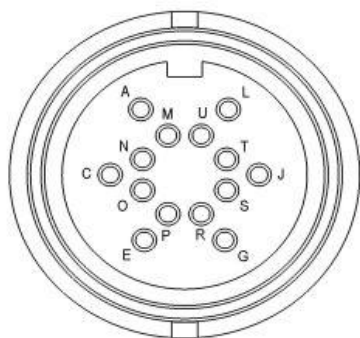


Figure 10: View of plug [X2]

4.11.1.1 Type on device [X22]

Binder, miniature circular connector 14 pole, series 423, 09-0454-80-14

4.11.1.2 Mating plug [X2]

Binder, miniature circular connector 14 pole, series 423, 99-5651-15-14

4.11.1.3 Resolver pin assignment [X2]

Pin No.	Designation	Specification
A	MTemp -	Motor temperature sensor reference potential
C		
E		
G		
J	S1	Resolver signal
L		
M	S3	Resolver signal
N		
O	S2	Resolver signal
P		
R	S4	Resolver signal
S	MTemp +	Motor temperature sensor, KTY, PTC, opener
T	R1	Resolver signal
U	R2	Resolver signal

4.11.1.4

4.11.1.5 Encoder pin assignment [X2]

	Designation	Specification
A	Encoder GND	Incremental encoder reference potential
C	0V Hall sensor	Hall sensor reference potential
E	+ 5V encoder	Incremental encoder power supply (100mA)
G	+ 5V Hall sensor	Linear Hall sensor power supply (100mA)
J	A	Encoder signal
L	Hall_U	Hall sensor phase U
M	#A	Encoder signal
N	Hall_V	Hall sensor phase V
O	B	Encoder signal
P	Hall_W	Hall sensor phase W
R	#B	Encoder signal
S	MTemp +	Motor temperature sensor, KTY, PTC, opener
T	N (Z) (I)	Encoder signal
U	#N (#Z) (#I)	Encoder signal

4.11.2

4.11.3 Motor connection [X6]

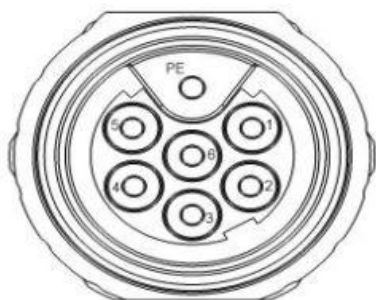


Figure 11: View of plug [X6]

4.11.3.1 Type on device [X6]

Intercontec, 7 pole, M17 flush-type power socket; BEGA 880 FR 08 00 002A 000

4.11.3.2 Mating plug [X6]

Intercontec, 7 pole, M17 power cable plug; BSTA 878 MR 08 86 001A 000

4.11.2.3 Pin assignment [X6]

Pin No.	Designation	Specification
1	U	Motor phase 1
2	V	Motor phase 2
3	W	Motor phase 3
4		
5	Brake +	
6	Brake -	
PE	PE	

5 Documentation

This software handbook provides information on the correct operation of the SE-48 parameterisation program SE-Commander for the servo positioning regulator SE-48.

Additional information can be found in the following manuals of the SE-48 product family:

Profibus handbook “SE-48_Profibus handbook”: Description of the Profibus controllers implemented.

The servo positioning regulator is equipped with a FLASH program memory which enables the controller operating software to be updated, even following delivery and installation. The controller operating software is being continually developed by the manufacturer in order to meet a wide range of customer needs.

6 Mechanical installation

6.1 Important information

The servo positioning regulator SE-48 is designed for direct mounting on the motor.

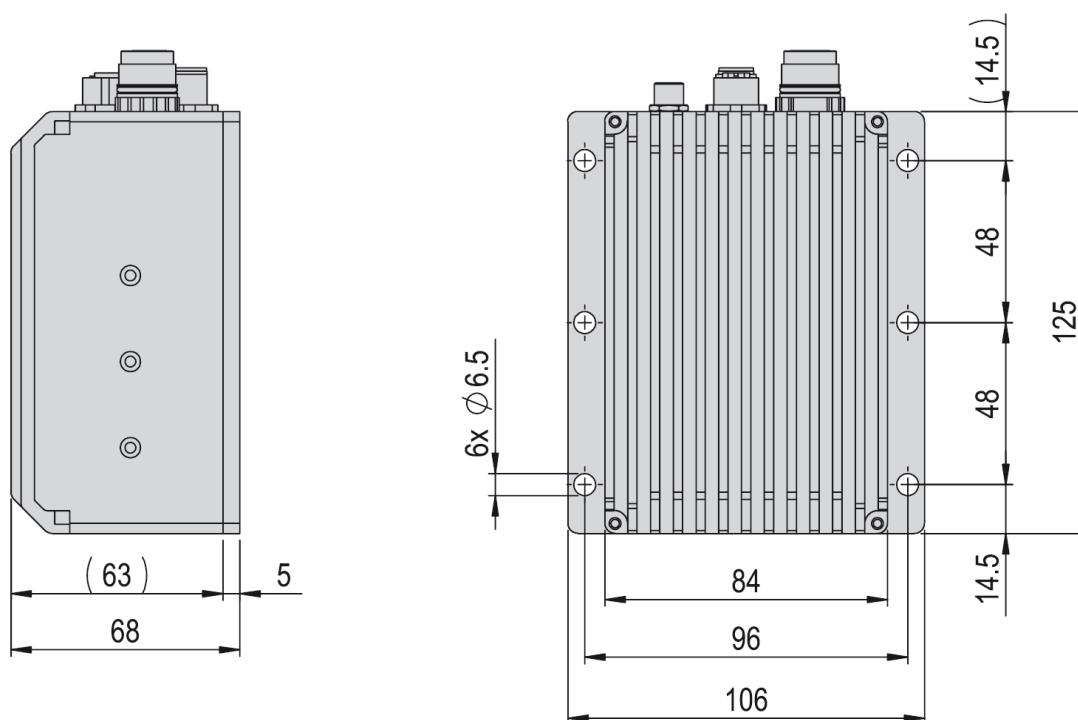
It is also possible to operate it separately from the motor. In this case an additional connection cable between the motor and the servo positioning regulator SE-48 is required. This should be kept as short as possible, the maximum length is 1.5 m.

The optimal cooling is achieved when the servo positioning regulator SE-48 is mounted with the cooling fins facing upwards.

The maximum permissible temperature of the housing, in order to guarantee the specified lifetime of the electronics, is 70°C.

Assembly space

In order to ensure adequate ventilation of the device, a distance of at least 100 mm from the next sub-assembly, both above and below the device, must be maintained.



7 1 Error messages/fault diagnosis chart

7.1 Overview of faults

The following chart provides an overview of all possible faults.

In the column **Reaction**, you will find all the reaction options available for parameterisation by you the user, indicated by an “**X**”.

The acronyms **C**, **F** and **W** have the following meaning:

Critical fault: A controlled operation of the motor cannot be guaranteed.
The output stage is immediately switched off; the motor comes to a standstill.

Fault: The motor is braked on the safety ramp.
The output stage is then switched off.

Warning: The operation of the motor is still possible, i.e. for a limited period of time.
Whether warnings are displayed can be parameterised:

Display: The disturbance is displayed, no further action is taken.

Don't display: The disturbance is completely ignored.

Table 1: Overview of faults

Fault No.	CAN fault code	Meaning	Possible cause / course of action	Release time	Reaction		
					C	F	W
3	4310	Over-temperature of motor	Check the configuration of the temperature monitoring Is the temperature sensor wired correctly? Mechanics are sluggish, motor too hot?	< 100ms	X	X	X
4	4210	Under-temperature / overtemperature of electronics	Temperature of the power electronics < -40°C or > 85°C. Heating of the SE-48 via the motor? Thermal decoupling of SE-48 as required Check / improve mounting and cooling conditions	< 100ms	X	X	
5	7392	Fault in the SINCOS supply	Angle transmitter connected? Angle transmitter cable defective? Angle transmitter faulty? Check the configuration of the angle transmitter	< 5ms	X		
6	7391	Fault in SINCOS – RS485 communication	Angle transmitter connected? Angle transmitter cable defective? Angle transmitter faulty? Check configuration of angle transmitter interface New or unknown SINCOS encoder employed?	< 5ms	X		
7	7390	Fault in SINCOS track signal	Angle transmitter connected? Angle transmitter cable defective? Angle transmitter faulty? Check configuration of angle transmitter interface	< 5ms	X		
8	7380	Fault in resolver track signal or carrier failure	Resolver connected? Angle transmitter cable defective? Angle transmitter faulty? Check configuration of angle transmitter interface	< 5ms	X		
9	5113	Fault in 5V electronics power supply	Fault can occur as a result of a defect angle transmitter / defect Hall sensor or a wiring error in X2 Possible fault in Techno module X8 Electronic fault in SE-48 device, cannot be rectified oneself. Return servo-positioning controller to sales partner.	< 5ms	X		
10	5114	Fault in 12V electronics power supply	Fault can occur as a result of a defect angle transmitter / SINCOS encoder or a wiring error in X2! Electronic fault in SE-48 device, cannot be rectified oneself. Return servo-positioning controller to sales partner.	< 5ms	X		

Fault No.	CAN fault code	Meaning	Possible cause / course of action	Release time	Reaction		
					C	F	W
11	5112	Fault in 24V logic power supply	<p>24 V logic power supply too high or too low?</p> <p>24 V logic power supply fails under high load, e.g. when switching on parking brake?</p> <p>Fault in the parking brake or the wiring of X3 or overloading of the brake output due to a brake with a too high current consumption.</p> <p>Electronic fault in SE-48 device, cannot be rectified oneself.</p> <p>Return servo-positioning controller to sales partner.</p>	< 5ms	X		
13	5210	Fault in offset current metering	<p>Fault cannot be corrected oneself.</p> <p>Return servo-positioning controller to sales partner.</p>	< 5ms	X		
14	2320	Overcurrent / intermediate circuit / output stage	<p>Motor defect, i.e. coil overloaded and charred, short circuit between coil and housing?</p> <p>Short circuit in cable between two phases or between phase and shield?</p> <p>Isolation of the motor phase connections?</p> <p>Defect in SE-48 (Output stage or isolation defect – insulating foil)</p>	< 10µs	X		
15	3220	Undervoltage of intermediate circuit	<p>Intermediate circuit power supply too low?</p> <p>Intermediate circuit power supply fails under high load, e.g. when accelerating with full current?</p> <p>Check the configuration of the intermediate circuit monitoring, where required adjust to between 50% to 70% of the nominal voltage.</p>	< 1ms	X	X	X
16	3210	Overvoltage in intermediate circuit	<p>Intermediate circuit voltage > 70V.</p> <p>Intermediate circuit power supply too high when idle?</p> <p>Check dimensioning.</p> <p>Braking energy too high when braking the axes</p> <p>Capacity in intermediate circuit too low, install additional capacitor (approx. 10 000 µF / per 10 A motor current)</p>	< 1ms	X		
17	7385	Fault in Hall encoder	<p>Angle transmitter connected?</p> <p>Angle transmitter cable defective?</p> <p>Angle transmitter faulty?</p> <p>Check configuration of angle transmitter interface</p>	< 5ms	X		
19	2312	Fault in I ² t motor (I ² t at 100%)	<p>Angle transmitter, number of pole pairs and transfer direction set correctly – automatic motor identification conducted?</p>	< 100ms	X	X	X

Fault No.	CAN fault code	Meaning	Possible cause / course of action	Release time	Reaction		
					C	F	W
			Motor blocked? Check the dimensioning of the drive package in respect of power				
20	2311	Fault in I ² t controller (I ² t at 100%)	See fault 19	< 100ms	X	X	X
26	2380	I ² t at 80%	Motor blocked? Check the power dimensioning of the drive package	< 100ms	X	X	X
27	4380	Motor temperature 5°C under maximum	Check the dimensioning of the drive package in respect of the power	< 100ms	X	X	X
28	4280	Temperature of the output stage 5°C under maximum	Check the dimensioning of the drive package in respect of the power Heating of the SE-48 via the motor? Thermal decoupling of SE-48 as required Check / improve mounting and cooling conditions	< 100ms	X	X	X
29	8611	Position lag monitoring	Motor blocked? Controller optimally adjusted, in particular the internal control circuit for the current and the rotational speed? Parameterisation of acceleration too big? Tolerance window set too small - enlarge	< 5ms	X	X	X
31	8612	Fault in position switch	Is the position switch wired correctly? Position switch defect? Check the configuration of the end switch.	< 1ms	X	X	X
35	6199	Time out with rapid stop	Angle transmitter fault occurred? Motor identification not carried out successfully? Parameterisation of acceleration too big?	< 5ms	X		
36	8A80	Fault in reference run	Reference run couldn't be completed successfully. Check the configuration of the reference run. Parameterisation of the controller including the angle transmitter settings OK?	< 5ms	X	X	X
40	6197	Fault: Motor and angle transmitter identification	Angle transmitter connected? Angle transmitter cable defective? Angle transmitter faulty? Check configuration of angle transmitter interface	< 5ms	X		
43	6193	Path program: unknown command	Please contact the Technical Support	< 5ms	X	X	
44	6192	Path program:	The digital inputs for START1 & START2	< 5ms	X	X	

Fault No.	CAN fault code	Meaning	Possible cause / course of action	Release time	Reaction		
					C	F	W
		invalid jump destination	have been set simultaneously. An invalid jump destination / an invalid target position is to be addressed.				
55	8100	Fault in the CAN communication	Communication is disturbed: Check the installation in respect of EMC. Check the baud rate setting. Check the node number setting – node appears twice in the network?	< 5ms	X	X	X
56	7510	Fault in the RS232 communication	Communication is disturbed: Check the installation in respect of EMC.	< 5ms	X	X	X
57	6191	Fault in the position dataset	Conflict between acceleration and the set travelling speed. Please contact the Technical Support	< 5ms	X		
58	6380	Faulty operating mode	Change in operating mode with output stage switched on.	< 5ms	X	X	X
60	6190	Fault in the advance calculation of the positioning	Internal error. Please contact the Technical Support	< 5ms	X		
62	6180	Stack overflow	Internal error. Please contact the Technical Support	< 5ms	X		
63	5581	Check sum error	Internal error. Please contact the Technical Support	< 5ms	X		
64	6187	Initialisation error	Internal error. Please contact the Technical Support	< 5ms	X		



The servo positioning regulator internally administrates the faults from No.1 to No. 64.

If your device displays a fault number that is described as an “Unknown fault” in the fault diagnosis chart, please contact your sales partner.

It is possible that this fault number has been assigned additional monitoring functions in the course of firmware updates or in the case of customer specific firmware versions.

8 Start-up sequence

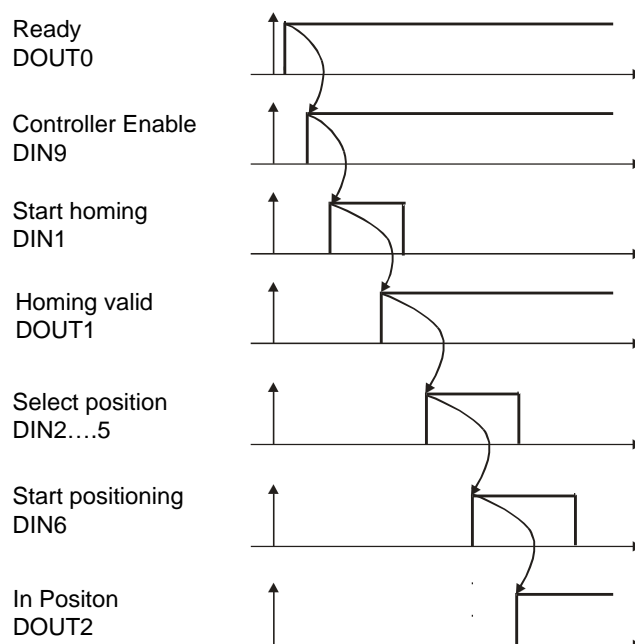
The times listed in the chart have a tolerance of +/- 100 µs. This tolerance must be taken into account in addition to the times given in the timing diagram!



The positioning regulator SE-48 is equipped with a sequential control system with a time base of 1.6 ms. The condition of the digital inputs and outputs are monitored, i.e. updated cyclically.

The cycle time of the PLC or controller must be **< (1.6 ms – 100 µs) = 1.5 ms** in order for the PLC to collect all the messages from the SE-48. On the other side, all the control signals from the PLC must be **> (1.6 ms + 100 µs) = 1.7 ms** in order to ensure that the SE-48 correctly recognises these signals.

Example: SPS with $t_{\text{Cycle}} = 1 \text{ ms}$ → Actuation of the PLC outputs for at least $2 \times t_{\text{Cycle}} = 2 \text{ ms}$



8.1 Electrical installation of the SE-48 in the system

8.1.1 Connection to the power supply and the controller

The servo positioning regulator is connected to the 48V intermediate circuit power supply and the 24V logic power supply. A common reference potential is used (GND). The utilisation of a central star point near the mains adapter for all GND connections reduces the “ground bouncing” effect between the controllers.

A separate plug connector, X5, is provided for the SE-48 serial service interface.

The signals for the digital IOs, DINx and DOUTx do not require a shield in order to protect them from interference caused by irradiation. However a shielded cable between the servo positioning regulator SE-48 and the controller improves the EMC characteristics within the system as a whole, especially in respect of radiated interference. Between the PLC and the controller, the control signals DIN9 (controller enable) and DOUT0 (operational) are wired.

The servo positioning regulator SE-48 must be completely connected before the power supply for the intermediate circuit and the logic are turned on. If the connections for the power supply are reverse poled, the power supply is too high or the connection from the intermediate circuit and the logic are exchanged, the servo positioning regulator SE-48 can be destroyed.

8.1.2 Emergency off / Emergency stop

The diagram on the following page displays an example of a system composed of one or more SE-48s, the mains adapter with the mains connection, a controller and the switching elements for the realisation of the EMERGENCY STOP function in accordance with EN 60204-1, stop category 1.

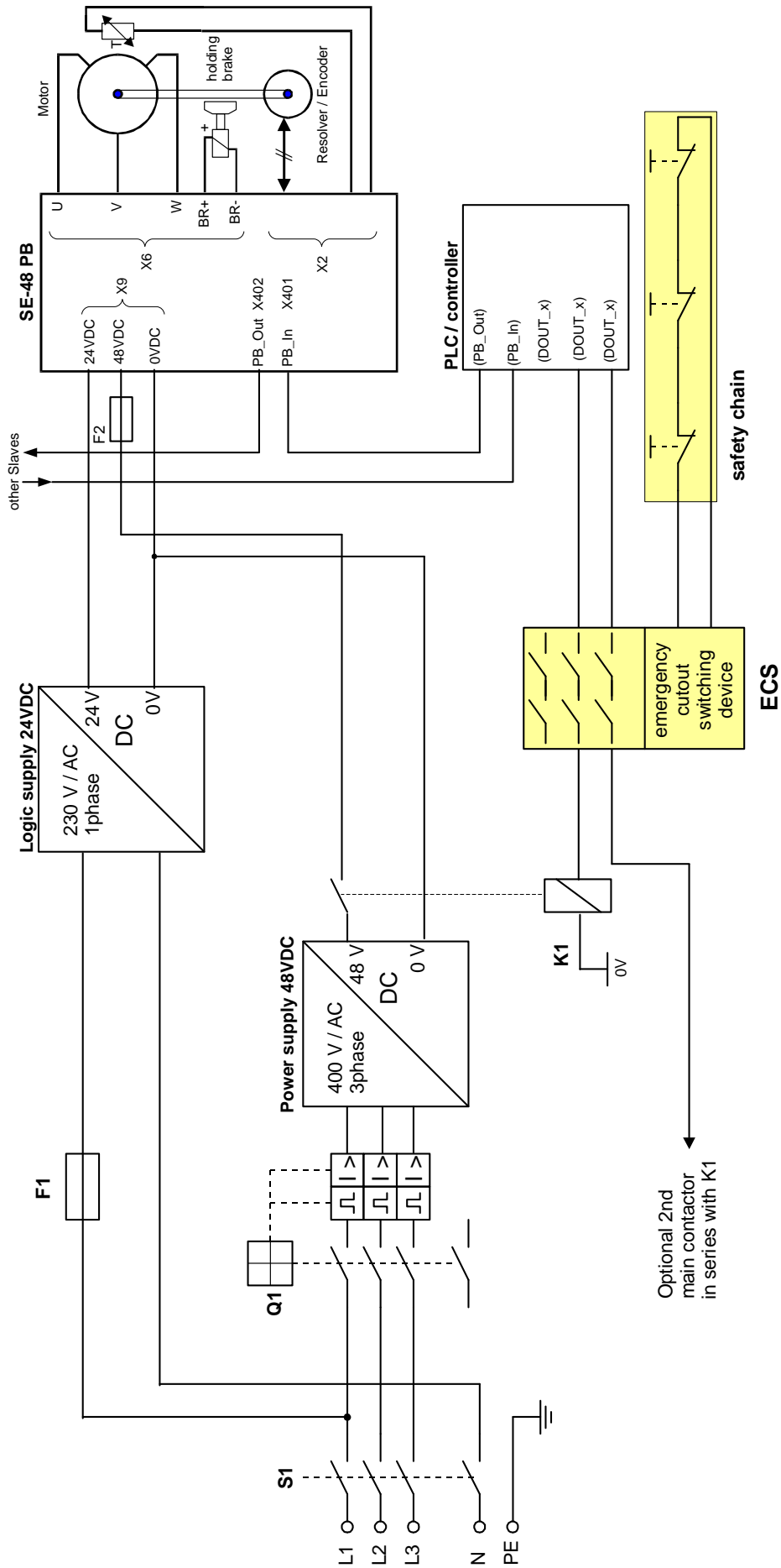
The system is composed of the following components:

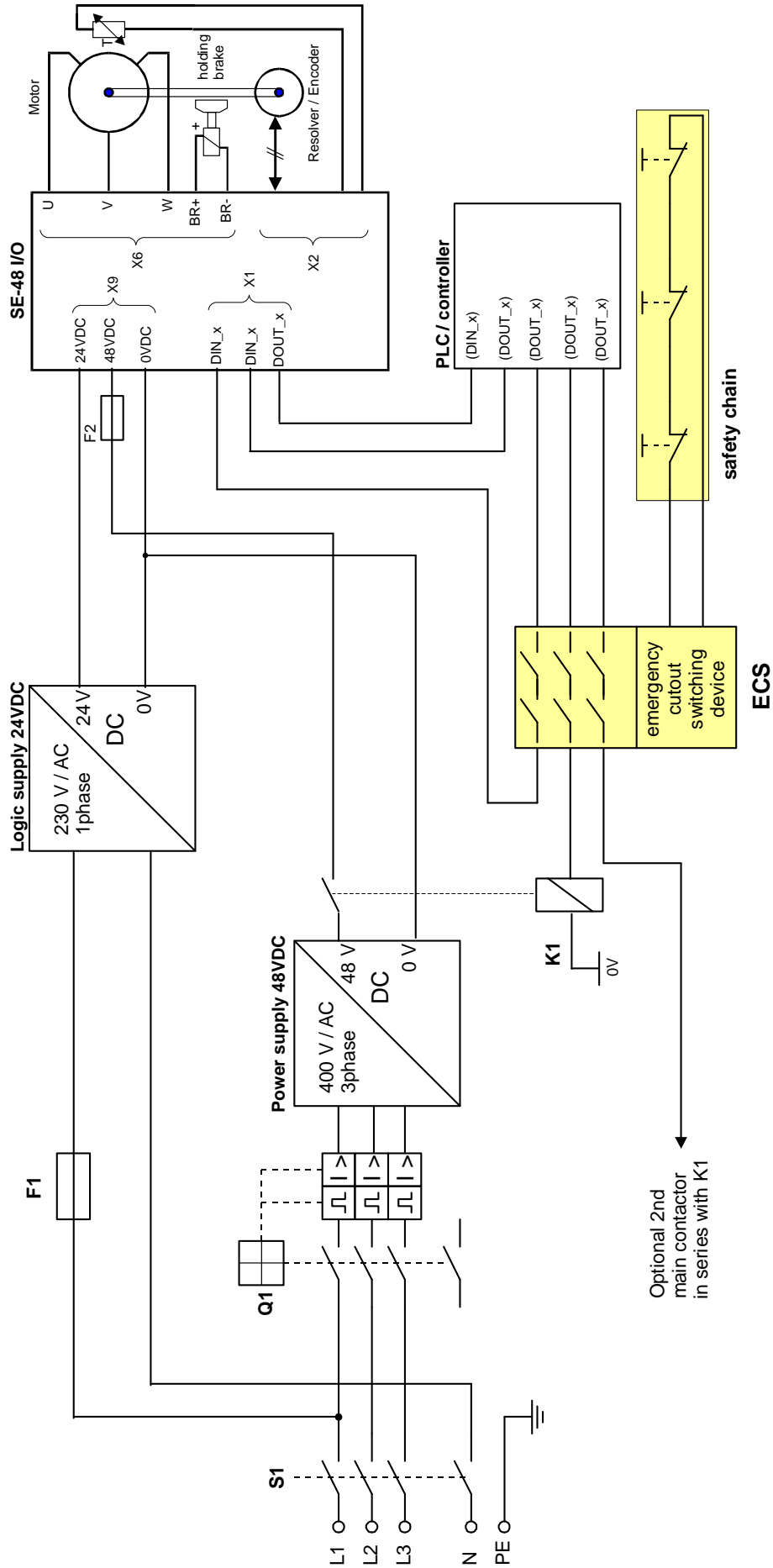
- S1 Mains switch
- F1 Fuse for the 24 V logic power supply
The logic power supply is fed line-side with 230 V AC via L1 and N.
- Q1 3 phase overcurrent protection switch, the dimensioning is dependent on the number of SE-48s and the requirements of the mains adapter.
- K1 Mains contactor
- F2 Fuse in the + 48 V power section supply, this fuse is required separately for all SE-48s
- ECS EMERGENCY STOP switching device, a safety chain is attached
- PLC PLC on industry PC, deployed for controlling the system.

In normal operation the switching contacts in the ECS are closed. The PLC activates the mains contactor K1 via a digital output.

Each SE-48 registers its operational readiness with the PLC via DOUT0. For each SE-48 a digital input on the PLC is required. Via an additional digital output, the PLC controls the controller enable DIN9 of all connected SE-48 devices. This common enable signal is also routed via the ECS. In the event of a fault (EMERGENCY OFF, EMERGENCY STOP), the power supply for the intermediate circuit as well as the controller enable is switched off.

The choice of a suitable ECS is dependent on the concrete application. In the simplest case, an ECS is not required. Instead multipolar switching contacts are employed in the safety chain.





8.2 Instructions for safe and EMC compatible installation

8.2.1 Explanations and terminology

Electromagnetic compatibility (EMC) or EMI (electromagnetic interference) includes the following requirements:

an adequate interference resistance of an electrical system or electrical device in respect of external electrical, magnetic or electromagnetic interference transmitted via lines or radiation.

a sufficiently low level of emitted electrical, magnetic or electromagnetic interference by an electrical system or electrical device to other devices in the vicinity, whether via lines or radiation.

8.2.2 General information on EMC

The interference emission and interference resistance of a servo positioning regulator is always dependent on the overall design of the drive. The drive is composed of the following components:

Power supply

Servo positioning regulator

Motor

Electromechanics

Realisation and type of wiring

Higher level controller



The servo positioning regulator SE-48 complies with the current product norm for electrical drives EN 61800-3

In the vast majority of cases no external filter measures are required (see below).

The declaration of conformity for the EMC directive 89/336/EWG is available from the manufacturer.

8.2.3 EMC categories: first and second environments

The servo positioning regulator SE-48, when correctly installed and connected, complies with the regulations of the corresponding product norm EN 61800-3. In this norm, reference is no longer made to “limiting value classes”, but to so called environments. The “first” environment covers electricity networks servicing residential buildings, the second environment covers electricity networks exclusively servicing industrial enterprises.

8.2.4 Connection between SE-48 and motor

When the servo positioning regulator SE-48 is mounted directly on the motor, the cables are situated inside the housing and are only a few cm long. In this case no shielding is required.

When the SE-48 is mounted separately from the motor, the following wiring guidelines should be followed:

Only use shielded cables, the encoder cable should have an inner and an outer shield.

Use separate cables for the motor phases and the angle transmitter.

Optional: Use a combined cable for the motor and the angle transmitter with separate shielding.

Connect all (outer) shields with the SE-48 housing.

Connect the shield of the motor cable with the motor housing.

Connect the inner shield of the encoder cable to PIN 1 from X2.

Ensure a “good” PE connection between the motor and the SE-48.



A “good” PE connection has a small impedance even at high interference frequencies. An optimal PE connection is obtained when the SE-48 is mounted directly on the motor. When the SE-48 and the motor are mounted separately, they should be attached to the same (metal) machine part. In this case, the surface of the machine part should consist of non-coated aluminium or galvanised plate.

8.2.5 Connection between SE-48 and mains adapter

Use cable with a cross section large enough to reduce “ground bouncing” in the intermediate circuit power supply.

2.5 mm² (AWG13) should be sufficient for a cable length of up to 5 m between the mains adapter and the SE-48.

Use a star shaped cabling when a number of SE-48s are connected to the mains adapter. The star point of the reference potential should be as close to the mains adapter as possible.

The mains adapter should be fitted with a Y capacitor of at least 100 nF between the intermediate circuit voltage and PE as well as between GND and PE.

Ensure a “good” PE connection between the mains adapter and the SE-48. It is important to have a good refeed of the high frequency leakage current, generated by the chopper in the SE-48 in combination with the winding capacity between the motor phase and the PE in the motor.

In order to ensure that the limit value for the emitted radiation is not exceeded a shielded cable should be used.



A “good” PE connection has a small impedance even at high interference frequencies. The mounting of the SE-48 and the voltage supply on the same (metal) machine part is usually sufficient in the majority of cases. If this is not the case, employ a flexible, approx. 10 mm wide copper strip or a connection cable with a cross-section of at least 6 mm² Cu in order to establish a PE connection.



Danger!

For safety reasons, all PE conductors must be connected before commissioning.

The EN 50178 regulations for the protective earthing must be complied with during installation.



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