KOLLMORGEN

Seidel

Analog Servo Amplifiers

65WKS and 66WKS Series

CE

Assembly / Installation / Commissioning

Edition 10/99

Previous editions

Edition	Comments
03 / 91	First edition
04 / 93	SSI and 24V-modification removed, transformer spec. added, drawings updated
07 / 96	Corrections, wiring diagrams for CE-conformance, glossary, index, fault-finding, layout, new arrangement, valid for the following instruments: Amplifier 65WKS from serial no. 0650230000 Amplifier 66WKS from serial no. 0660215000 Mains PSU 66WKS-P from serial no. 0660222000
10 / 99	Layout, dimensions mains filters

Technical changes to improve the performance of the equipment may be made without prior notice !

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Safety instructions

Warning signs : you must observe the important instructions in the text, which are indicated by the following symbols :


hazard from electricity and its effects


general warning general instructions

- **Only properly qualified personnel are permitted to perform activities such as transport, installation, commissioning and maintenance. Properly qualified persons are those who are familiar with the transport, assembly, installation, commissioning and operation of the product and who have the appropriate qualifications for their job. The qualified personnel must know and observe the following standards and directives:**
  IEC 364 and CENELEC HD 384 or DIN VDE 0100
  IEC-Report 664 or DIN VDE 0110
  national accident prevention regulations or VBG 4

- **Read the available documentation before carrying out installation and commissioning. Incorrect handling of the servo amplifier can lead to injury to persons or material damage.**
  It is vital that you keep to the technical data and information on installation requirements (nameplate and documentation).

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

- **During operation, keep all covers and cabinet doors shut. Otherwise there are deadly hazards with the possibility of severe danger to health or material damage.**

- **In operation, depending on the degree of enclosure protection, servo amplifiers can have bare components which are live, and hot surfaces. Control and power cables can carry a high voltage even when the motor is not rotating.**

- **Never pull out or plug in the servo amplifier while the system is live. There is a danger of electric arcing and danger to persons and contacts.**

- **After disconnecting the servo amplifier, wait at least two minutes before touching live sections of the equipment or undoing connections (e.g. contacts, screwed connections). Capacitors can still carry dangerous voltages after the supply voltage has been switched off. To be safe, measure the DC-link voltage, and wait until it has fallen below 40 V.**

Directives and standards

Servo amplifiers are components which are intended to be incorporated into electrical machines and plant.

When the servo amplifiers are built into machines or plant, the intended operation is forbidden until it has been shown that the machine or plant fulfills the requirements of the EC Directive on Machines (89/392/EEC), the EC Directive on EMC (89/336/EEC) and the EC Low-Voltage Directive (73/231/EEC).
EN 60204 and EN 292-2 must also be observed.

In connection with the Low-Voltage Directive 73/231/EEC, the harmonised standards of the EN 50178 series are applied to the servo amplifiers, together with EN 60439-1, EN 60146 and EN 60204.

The manufacturer of the plant or machine is responsible for ensuring that the plant or machine meets the limits which are laid down in the EMC regulations. Advice on the correct installation for EMC – such as shielding, grounding, filter arrangement, treatment of connectors and cable layout – can be found in this documentation.

CE- Conformance

Conformance to the following directives is mandatory for the supply of servo amplifiers within the European Community:

since 1 January 1996 : EC EMC Directive 89/336/EEC
since 1 January 1997 : EC Low-Voltage Directive 73/231/EEC

The servo amplifiers of the 65WKS and 66WKS series have been tested in an authorised testing laboratory, in a defined configuration with the components shown in Chapter II.

Any divergence from the assembly and installation described in the documentation means that you will be responsible for the performance of new measurements to ensure that the regulatory requirements are met.

Only on condition that the components which we have specified in Chapter II are used and the installation rules are followed can we guarantee that the servo amplifier conforms to the following standards for industrial areas:
EC EMC Directive 89/336/EEC
EC Low-Voltage Directive 73/231/EEC

I General

I.1 Preface

This manual describes installation, commissioning, adjustment and adaptation of the 65WKS-M310/xx-PB (abbreviated: 65WKS) and 66WKS-M310/xx-0 (abbrev. 66WKS) servo amplifiers. The manual is divided into 6 Chapters:

Chapter 1:	General Information
Chapter 2:	Installation and Commissioning
Chapter 3:	Functions and Options
Chapter 4:	Peripheral Eqpt. with Mains Supply 66WKS-P310/90-B (abbrev. 66WKS-P)
Chapter 5:	Drawings
Chapter 6:	Appendix with Glossary, Index and Fault-Finding

Transport	***:***	***only by personnel with knowledge of the handling of electrostatically-sensitive components.***
Installation	***:***	***only by electrically qualified personnel***
Commissioning	***:***	***only by qualified personnel with extensive knowledge of electrical engineering and drive technology***

We offer training and familiarisation courses on request.

We can only guarantee the functionality of the servo amplifier plus servo motor if our isolating transformers and SMR-series motors are used.

I.2 Prescribed usage of the servo amplifiers

The servo amplifiers are exlusively intended for driving brushless synchronous servo motors from the SMR series under speed or torque control. The servo amplifiers are installed as components in electrical equipment or machines, and may only be operated as integral components of such equipment.
The 65WKS-M310/xx-PB series of servo amplifiers are supplied via an isolating transformer from the industrial 3-phase mains supply.
The 66WKS-M310/xx-0 series of servo amplifiers are run off the 66WKS-P310/90-B mains power supply unit (PSU).
The 66WKS-P310/90-B mains supply unit is connected to the industrial 3-phase mains supply via an isolating transformer.
The servo amplifiers are not suitable for continuous braking operation (e.g. in unreeling).
The maximum permissible ratio is 1:1 for braking / driving.
The servo amplifiers can only be operated in an closed steel switchgear cabinet, observing the ambient conditions defined in Chapter I.8.3.
The equipment must be plugged into a standard industrial 19"-casing (rack module) or in one of our compact housings, and connections must only be made via one of our module backplanes.

Only if the system components which are described in Chapter II are used and the rules for installation in this documentation are followed can we guarantee the conformance of the servo amplifiers with the following standards for industrial areas:

EC EMC Directive	***89/336/EEC***
EC Low-Voltage Directive	***73/231/EEC***

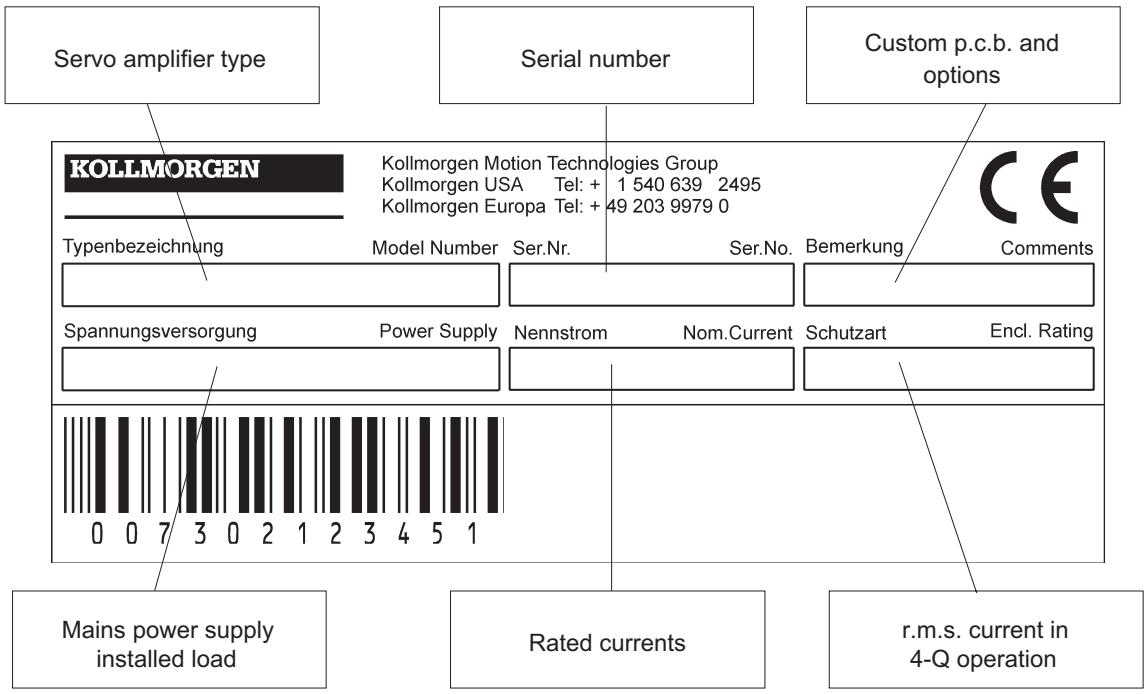
I.3 Abbreviations used in this manual

The table below explains the abbreviations which are used in this manual.

Abbrev.	Meaning	Abbrev.	Meaning
AGND	analog ground	PSTOP	limit switch input for CW rot. direction
BTB	system ready to operate (standby)	PSU	Power supply unit
CE	European Community	PWM	pulse-width modulation
CLK	clock	RAM	memory component
DGND	digital ground	$R_{Ballast}$	ballast resistor
DIN	German Standards Institute	RES	resolver
EEPROM	electrically erasable PROM	PLC	programmable logic controller
EMC	electromagnetic compatibility	PSU	power supply unit
EN	European standard	SSI	synchronous serial interface
ESD	electrostatic discharge	SW	setpoint value
IDC	analog current monitor	V AC	AC voltage
LED	light-emitting diode	V DC	DC voltage
NI	zero pulse	VDE	Assoc. of German Electrical Engineers
NSTOP	limit switch input for CCW rot. direction	VTA	analog speed monitor
PELV	protected low voltage		

I.4 Nameplate

The nameplate depicted below is mounted on the servo amplifier. The information shown below is printed in the individual fields.



I.5 Equipment description: 65WKS / 66WKS

Design

The units must always be operated under forced convection (even when unloaded or disabled) !

Plug-in modules with an aluminium front panel, 19"-system, connections via module backplane.

Unit size

Unit	Format	Hight	Width
65WKS (servov amp.)	double-Eurocard	6HE (233.4mm)	12 TE (approx. 61mm)
66WKS-P (mains unit)	double-Eurocard	6HE (233.4mm)	10 TE (approx. 51 mm)
66WKS (servo amp.)	double-Eurocard	6HE (233.4mm)	18 TE (approx. 91.5 mm)

Options

-24V-	electronics supply from external 24V power supply
-01-	limit-switch logic and ramp generator
-65/426-	incremental position output
-65/SSI-	synchronous-serial position output

Function

The servo amplifiers of the 65WKS and 66WKS series in 310V-technology are set up for driving the SMR-series of synchronous servo motors with resolver feedback and sine-wave commutation. The power section is implemented as a 3-phase, pulse-modulated transistor stage. The almost sinusoidal output currents and motor speed are evaluated in a resolver measurement system which is built into the motor and controlled by PI-controllers.

Custom p.c.b.

All the adjustments and parameters which can be altered by the user are put onto a plug-in custom p.c.b. and are accessible from the front. For series production, we can replace the potentiometers which are provided as standard by selected fixed resistors.

Variants

Amplifier 65WKS-M310/xx-**PB**	: - power feed via 3-phase isolating transformer - PSU, ballast circuit and ballast resistor are integrated
Amplifier 65WKS-M310/xx-**P0**	: - power feed via PSU type 66WKS-P... - without ballast circuit or ballast resistor
Amplifier 66WKS-M310/xx-**0**	: - power feed via PSU type 66WKS-P... - without PSU, ballast circuit and ballast resistor
PSU 66WKS-P310/90-**B**	: - power feed via 3-phase isolating transformer - integral ballast circuit, external ballast resistor

If individual high-power axes are used for drives with a high external moment of inertia, suspended loads or 1-quadrant operation, then you must use the servo amplifier type 65WKS-M310/xx-P0 with a PSU type 66WKS-P310/90-B.

F backplanes :	Unit connections on the rear face: via plug-in terminals for the control signals and terminals/studs for the power connections
R backplanes :	Unit connections: plug-in terminals, accessible from the front, for control signals, and terminals/studs for the power connections

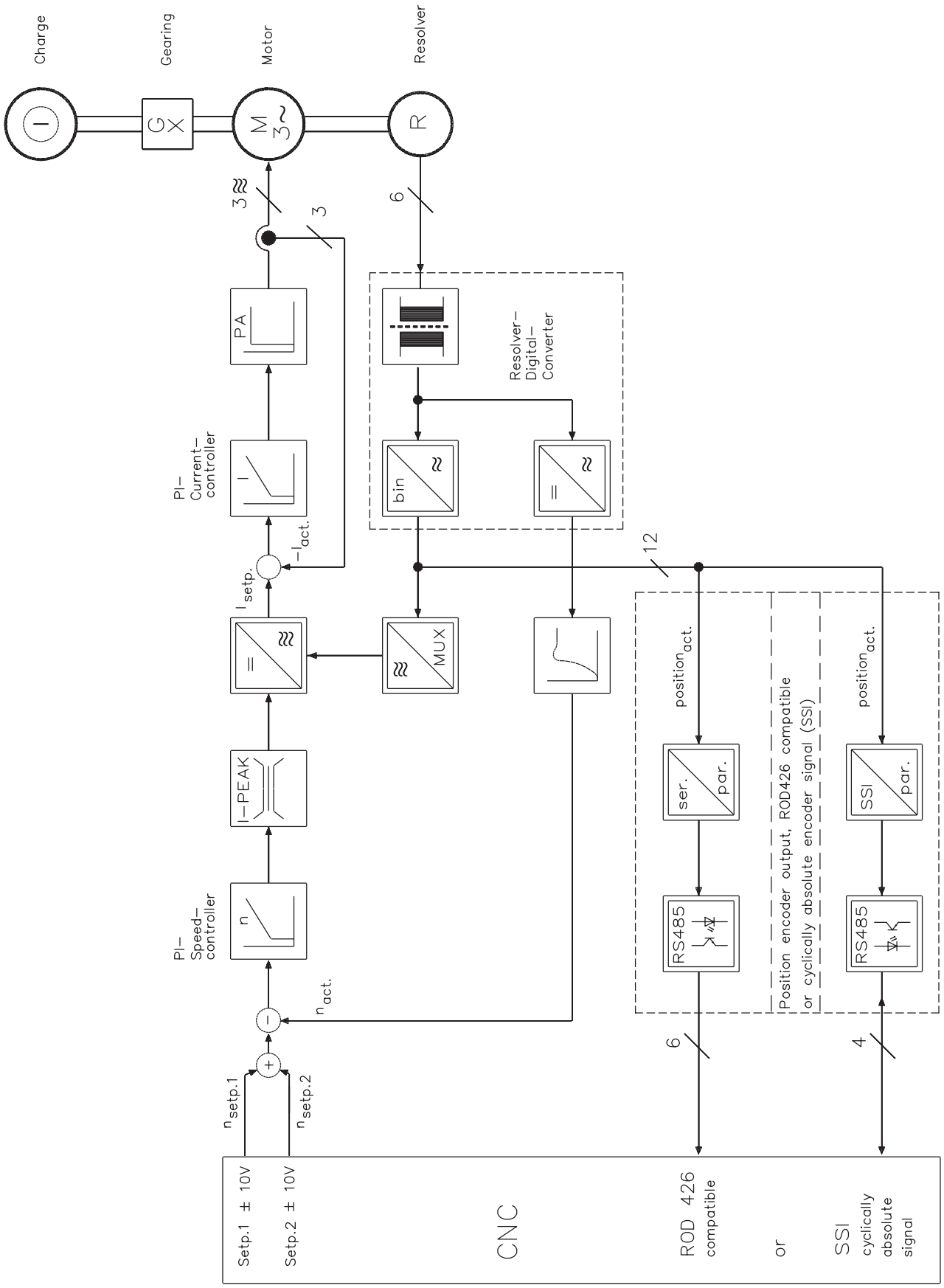
I.5.1 Function groups 65WKS / 66WKS

- 3-phase power supply unit with smoothing capacitors **(66WKS without PSU)**
- Ballast circuit with **-w-** characteristic **(66WKS without ballast circuit)**
- Auxiliary supply to generate aux. voltages from the DC-link voltage (alternatively, an external 24V-supply, Option -24V-)
- 3-phase output stage for 4-Q operation
- 2 differential inputs for setpoints, setpoint 2 is adjustable
- Enable input
- Limit-switch inputs (Option -01-)
- PI / current / speed controller
- Trimmer potentiometer and fixed components for all the important operating parameters on the plug-in custom p.c.b.
- Expansion slot for Option p.c.b. -01- with limit-switch logic and ramp generator
- Resolver conversion for commutation and speed acquisition
- Incremental position output (ROD426-compatible) or synchronous-serial (Options -65/426- or -65/SSI-)
- Ready/standby relay with isolated contact for fault signalling (overvoltage, undervoltage, overcurrent etc.)
- 24V logic with isolated optocouplers for control signals, PLC-compatible
- LEDS for all important operating states
- ±15 V auxilliary voltage outputs

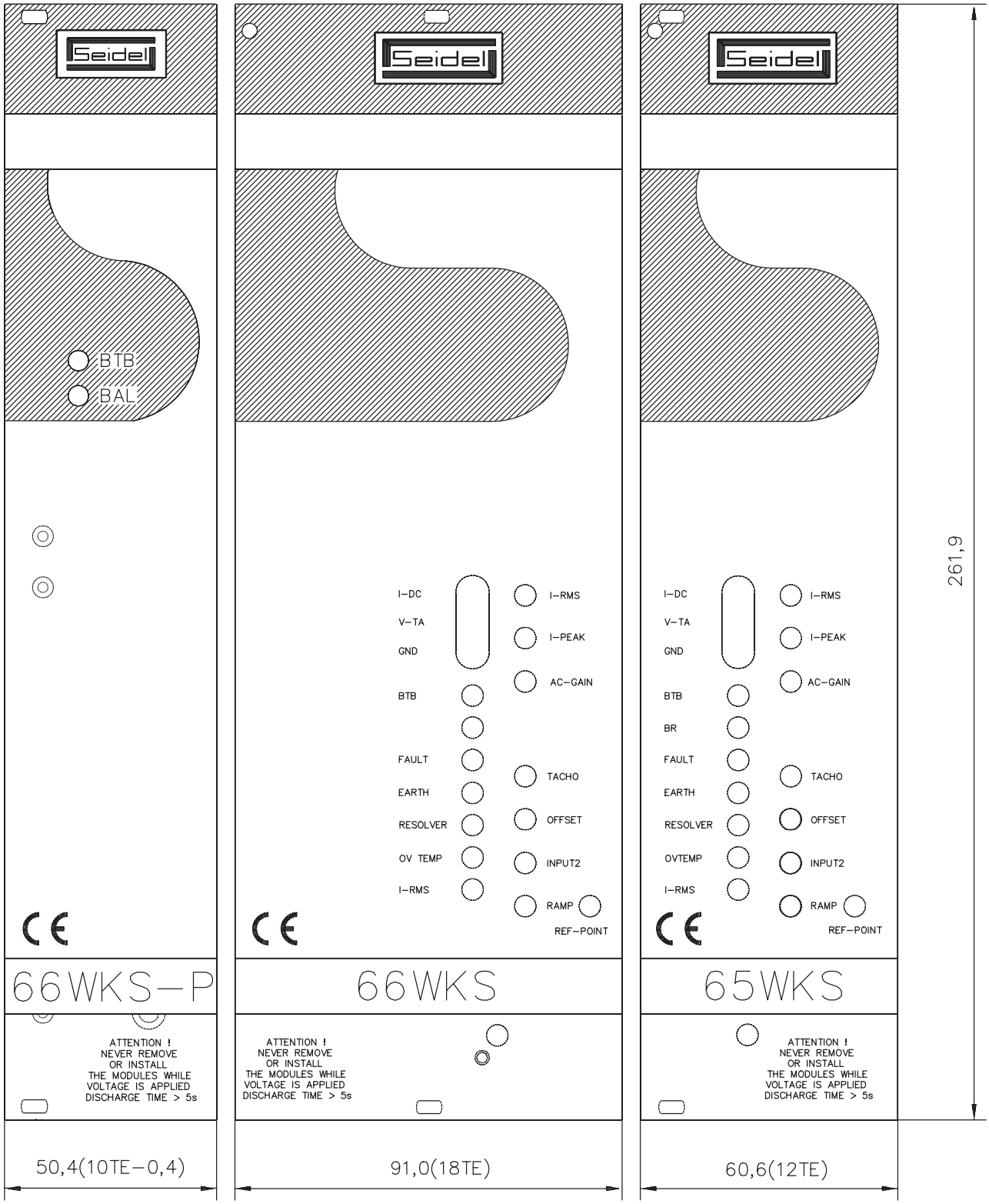
Protection and monitoring functions

- Fuses for the DC-link and auxiliary power supply
- Short-circuit / earth-fault protection at the motor connection terminals
- Short-circuit protection of the 15V auxiliary voltage
- Undervoltage monitoring
- Overvoltage monitoring
- I^2t effective current monitoring
- Temperature monitoring of output transistors and surroundings
- Resolver monitoring

I.6 Block diagram



I.7 Frontal view 65WKS, 66WKS, 65WKS-P



I.8 Technical Data 65WKS / 66WKS

I.8.1 65WKS-M310/xx-PB

		65WKS-M310/				
Rated data	**DIM**	**3-PB**	**6-PB**	**12-PB**	**22-PB**	**26-PB**
Rated supply voltage	V~	3 x 80—220 / 50...60Hz +max. 10 %				
Installed load at rated current *	kVA	0.6	1.3	2.6	4.8	5.6
Rated DC-link voltage	V=	310				
Rated output current for 4-Q operation, peak value at standstill	A	3	6	12	22	26
Peak output current (max. approx. 5 s)	A	7.5	15	30	50	50
AC fusing, maximum	AM	3 x 20				
Switch-on threshold of the ballast circuit	V	385				
Switch-off threshold of the ballast circuit	V	365				
Pulse power of the ballast circuit	kW	5.4				
Continuous power of the ballast circuit	W	200				
Overvoltage switch-off threshold	V	410				
Form factor of the output current (rated conditions, with min. load inductance)	—	1.01				
Minimum motor inductance	mH	8	5	3	1,5	1,2
Bandwidth of the subordinate current control loop	kHz	1				
Clock frequency of the output stage	kHz	8.6				
Voltage drop at rated current	V	4.5				
Quiescent dissipation, output stage disabled	W	12				
Dissipation at rated current (incl. PSU losses, without ballast dissipation)	W	35	50	90	150	190
Aux. voltage outputs (Ri=330 Ω)	V	±15				
	mA	±20				
Inputs						
Setpoint 1, fixed setting	V	±10				
Setpoint 2, adjustable 0 — 100 %	V	±10				
Common mode voltage max.	V	±10				
Input resistance	kΩ	150				
Input drift max.	µV/K	±15				
24V auxiliary suppply (Option -24V-)	V	24 (20 ... 30)				
referred to 0V/GND	A	1.2				
Connections						
Servo amplifier						
control signals		DIN 41612—C64 (plug connector)				
power leads		DIN 41612—D32 (plug connector)				
Backplane board						
control signals		Combicon 5.08/20-pin (or 2x12-pin)				
power leads		4mm² terminals				
resolver		SubD 9-pin (socket)				
position output		10-pin pin header				
Mechanical						
Weight	kg	2				
Dimensions (double Eurocard, 12 TE-units)	mm	220 x 233.4 x 60				

* maximum value in operation with motors of the SMR series

I.8.2 66WKS-M310/xx-0

		66WKS-M310/	
Rated data	**DIM**	**35-0**	**45-0**
Installed load at rated current *	kVA	7.5	9.6
Rated DC-link voltage	V=	310 + max.10%	
Rated output current for 4-Q operation, peak value at standstill	A	35	45
Peak output current (max. approx. 5 s)	A	75	100
Overvoltage switch-off threshold	V	410	
Form factor of the output current (rated conditions, with min. load inductance)	—	1.01	
Minimum motor inductance	mH	1	0,8
Bandwidth of the subordinate current control loop	kHz	1	
Clock frequency of the output stage	kHz	8.6	
Voltage drop at rated current	V	5	
Quiescent dissipation, output stage disabled	W	15	20
Dissipation at rated current (incl. PSU losses)	W	260	330
Aux. voltage outputs (Ri=330Ω)	V	±15	
	mA	±20	
Inputs			
Setpoint 1, fixed setting	V	±10	
Setpoint 2, adjustable 0 — 100 %	V	±10	
Common mode voltage max.	V	±10	
Input resistance	kΩ	150	
Input drift max.	µV/K	±15	
24V auxiliary supply (Option -24V-)	V	24 (20 ... 30)	
referred to 0V/GND	A	1.2	
Connections			
Servo amplifier			
control signals		DIN 41612—C64 (plug connector)	
power leads		DIN 41612—E48 (plug connector)	
Backplane board			
control signals		Phoenix MSTBW 2,5 20-pin	
power leads		studs M6, terminals 10 mm²	
resolver		SubD 9-pin (socket	
position output		10 pol. pin header	
Mechanical			
Weight	kg	2.8	
Dimensions (double Eurocard, 18 TE-units)	mm	220 x 233.4 x 91	

* maximum value in operation with motors of the SMR series

I.8.3 Permissible ambient conditions, ventilation, mounting position

Transport temperature/humidity	see Chapter VI.1
Storage temp./humidity/time	see Chapter VI.1
Supply voltage tolerances **mains power** **aux. supply (Option -24V-)**	 min. 3x80V AC / max. 3x220V AC + 10 % resp. 310V DC + 10 % min. 20V DC / max. 30V DC referred to 0V/GND
Ambient temp. in operation	0 ... +45 °C at rated data +45 ... +55 °C with power derating 2.5 % / °C
Humidity in operation	5 ... 85 % rel.humidity, no condensation
Site altitude	up to 100 m above mean sea level without restriction 1000 ... 2500 m a.m.s.l. with derating 1.5 % / 100 m
Pollution level	pollution level 2 to EN60204/EN50178
Protection class	IP 00 (protected against touching in the area of the power connections)
Mounting / position	normally vertical in a closed switchgear cabinet
Ventilation	normally forced ventilation (even when unloaded or disabled). Take care that the ventilators are switched on at the mains (220 V AC) and running, either previously or, at the latest, simultaneously with the supply for the modules. Ensure that the intake air is dust-free and that there is an adequate supply of cooling air to the cabinet.

I.8.4 Cable cross-sections

In accordance with EN 60204, and taking account of the operating conditions for multi-axis systems, we recommend the following minimum cross-sections:

Amplifier type	**65WKS**			**66WKS**	
Peak value I_{rated}	**3/6 A**	**12 A**	**22/26 A**	**35 A**	**45 A**
Dimensions	**[mm²]**	**[mm²]**	**[mm²]**	**[mm²]**	**[mm²]**
AC supply	4i x 1.5	4i x 2.5	4i x 4	—	—
DC-link	3i x 1.5	3i x 2.5	3i x 4	3i x 10	3i x 10
Motor leads	4i x 1.5	4i x 2.5	4i x 4	4i x 10	4i x 10
Resolver	3 x 2 x 0.25 (twisted pairs, shielded)				
Setpoints	2 x 0.14 (stranded, shielded)				
Control signals BTB	0.5				
Brake	2 x 1.0				
Thermal cutout	2 x 0.5				
+24 V / GND	1.0 (Option -24V-)				

I.8.5 Fuse protection

65WKS			**3A**	**6A**	**12A**	**22A**	**26A**
AC supply		external	power contactor for system protection, characteristic C or D (motor or tacho), set to 0.5 X rated amplifier current				
aux. supply	(F1)	internal	1 AT (2 AT only for option -24V-)				
DC-link	(F2)	internal	10 AT	10 AT	15 AT	30 AT	30 AT
Ballast board	(F3)	internal	4 AT				

66WKS			**35A**	**45A**
aux. supply	(F1)	internal	1 AT(2 AT only with option -24V-)	
DC-link	(F3,F4)	internal	2x20 AM	2x25 AM

I.9 Interference suppression

If interference occurs in the CNC or the analog or digital path measuring systems, the additional measures listed here may be applied:

- additional ferrite rings around the motor leads
- installation of armature chokes (please use the types supplied by us)
- HF filter in the setpoint output of the CNC (RC of 1 kΩ/10 nF)
- use of double-screened cable for the resolver lead

In each case, you will have to test which measures eliminate the interference.

I.10 Ballast circuit (65WKS and PSU 66WKS-P)

When the motor is braked, energy is fed back to the servo amplifier. This energy is dissipated as heat in the ballast resistor. The ballast resistor is switched into the circuit by the ballast circuit.

Servo amplifier **65WKS-M310/xx-PB** : integral ballast circuit and ballast resistor (power 200W), soft characteristic.

The servo amplifiers are not suitable for continuous braking operation (e.g. in unreeling). The maximum permissible ratio is 1:1 for braking / driving.

Servo amplifier **66WKS-M310/xx-0** : no integral ballast circuit - braking energy is absorbed by the ballast circuit of the PSU.

Mains PSU **66WKS-P310/90-B** : integral ballast circuit (power 5 kW max.), external ballast resistor must be connected.

Please contact our applications department for assistance in dimensioning the necessary ballast power for your system.

Possible combinations of units for multi-axis systems:

- several 65WKS-M310/xx-PB servo amplifiers
  — connect up the DC-link circuits, ballast power is distributed among all servo amps.
- several 65WKS-M310/xx-P0 servo amplifiers with 66WKS-P310/90-B PSU and external ballast resistor
  — amplifiers are supplied by the PSU via the DC-link, the ballast power of all the servo amplifiers is dealt with by the ballast circuit in the PSU.
- mixed system 66WKS-M310/xx-0 servo amplifiers and type 65WKS-M310/xx-P0 and 66WKS-P310/90-B PSU with external ballast resistor
  — amplifiers are supplied by the PSU via the DC-link, the ballast power of all the servo amplifiers is dealt with by the ballast circuit in the PSU.

II Installation and commissioning

II.1 Important instructions

- Check the conformance of the servo amplifier and the motor. Compare the rated voltage and current of the equipment. Implement the wiring according to the wiring diagram in Chapter II.2.4.1 ff. For correct EMC wiring follow the connection diagrams in Chapter II.2.1 resp. II.2.2 .
- Lay out all cables which carry a high current with an adequate cross-section in accordance with EN 60204. A tabular summary of the recommended cross-sections can be found in Chapter I.8.4.
- Make sure that, even under worst-case conditions, the rated voltage on the terminals U1, V1, W1 resp. Ucc, 0V/GND is not exceeded by more than 10 %. An excessive voltage on these terminals can cause destruction of the ballast circuit. We recommend using the upper transformer tap (420V).
- Make sure that the supply voltages and the ballast resistor are adequately protected by fusing. Use the values recommended in Chapter I.8.5 as a guide.
- Contact all shielding with large areas (low impedance), using metallised connector housings where possible (see Chapter II.2.1 / II.2.2).
- Loop the BTB contact into the safety circuit of the system. Only so can the monitoring of the servo amplifier be ensured.
- Loop the temperature monitoring into the safety circuit of the system.
  Overheating of the motor can lead to its destruction.
- The ±15V auxiliary voltages must not be led out of the switchgear cabinet.
  This is to prevent capacitively or inductively induced interference.
- Ensure an adequate supply of filtered cool air in the switchgear cabinet, fed from below. Refer to Chapter I.8.3.
- At the front of the modules, protection against contact is only ensured if the modules are inserted into a 19" rack unit and secured with the screws which are provided. After inserting the modules, fix the front panel with the fixing screws. This is vital to ensure good contact in the plug connectors. Poor contact can burn out the connector contacts.

Caution
Never attach or remove the servo amplifier when it is live. In unfavourable cases this could result in destruction of the electronics.
Residual charge in the capacitors can still have a dangerous level up to 120 seconds after switch-off . Measure the voltage in the DC-link circuit and wait until the voltage has dropped below 40 V.
Even when the motor is standing still, control and power leads can still be live.

II.2 Installation

Only electrically qualified personnel are allowed to install the servo amplifier.

The installation procedure is described in examples. Depending on the application, a different procedure may be necessary or appropriate.

More detailed knowledge can be acquired through our training courses (on request).

Warning !

Protect the servo amplifier from inadmissible loading.
In particular, components must not be bent or isolation clearances changed during transport and handling.
Avoid touching electronic components and contacts.

Caution !

Only install and wire up the equipment in a de-energised state, i.e. neither the mains supply nor the operating voltages of any other connected equipment may be switched on.
Make sure that the switchgear cabinet is safely disconnected (barrier, warning signs etc.). The voltages will only be switched on for the first time during commissioning.

Note !

The ground symbol , which is found in all the wiring diagrams,
indicates that you must provide an electrically conductive connection with as large an area as possible between the designated unit and the mounting plate in your switchgear cabinet.
This connection is for the suppression of HF interference and must not be confused with the PE-symbol ⏚ (which is a safety measure to EN 60204).

The following instructions should help you to follow a sensible installation sequence without overlooking any important steps.

Location

19" module or compact housing, in closed switchgear cabinet. Observe Chapter I.8.3 . The location must be free from conductive or corrosive substances.

Ventilation

Ensure the unhindered ventilation of the servo amplifier and observe the permitted ambient temperature, see Chapter I.8.3.

Assembly

Install the 19" module and the peripheral equipment close together on an **earthed** mounting plate in the switchgear cabinet (see II.2.1/II.2.2).

Cable selection

Select cables according to EN 60204 and our requirements, as in Chapter I.8.4.

Grounding Shielding

See Chapter II.2.1/II.2.2 for correct EMC shielding and grounding.

Ground the mounting plate, motor casing, mains filter, isolating transformer and CNC-GND of the control (see Chapter II.2.1/II.2.2).

Wiring

— **Run power and control cables separately**

— **Wire the BTB contact into the safety loop of the system**

— Connect the digital control inputs of the servo amplifier

— Connect the setpoint input and AGND

— Connect the resolver, shielding connected to terminals or EMC-connectors at both ends

— Connect the motor leads, using ring cores close to the servo amplifier, shielding to terminals or EMC-connectors at both ends

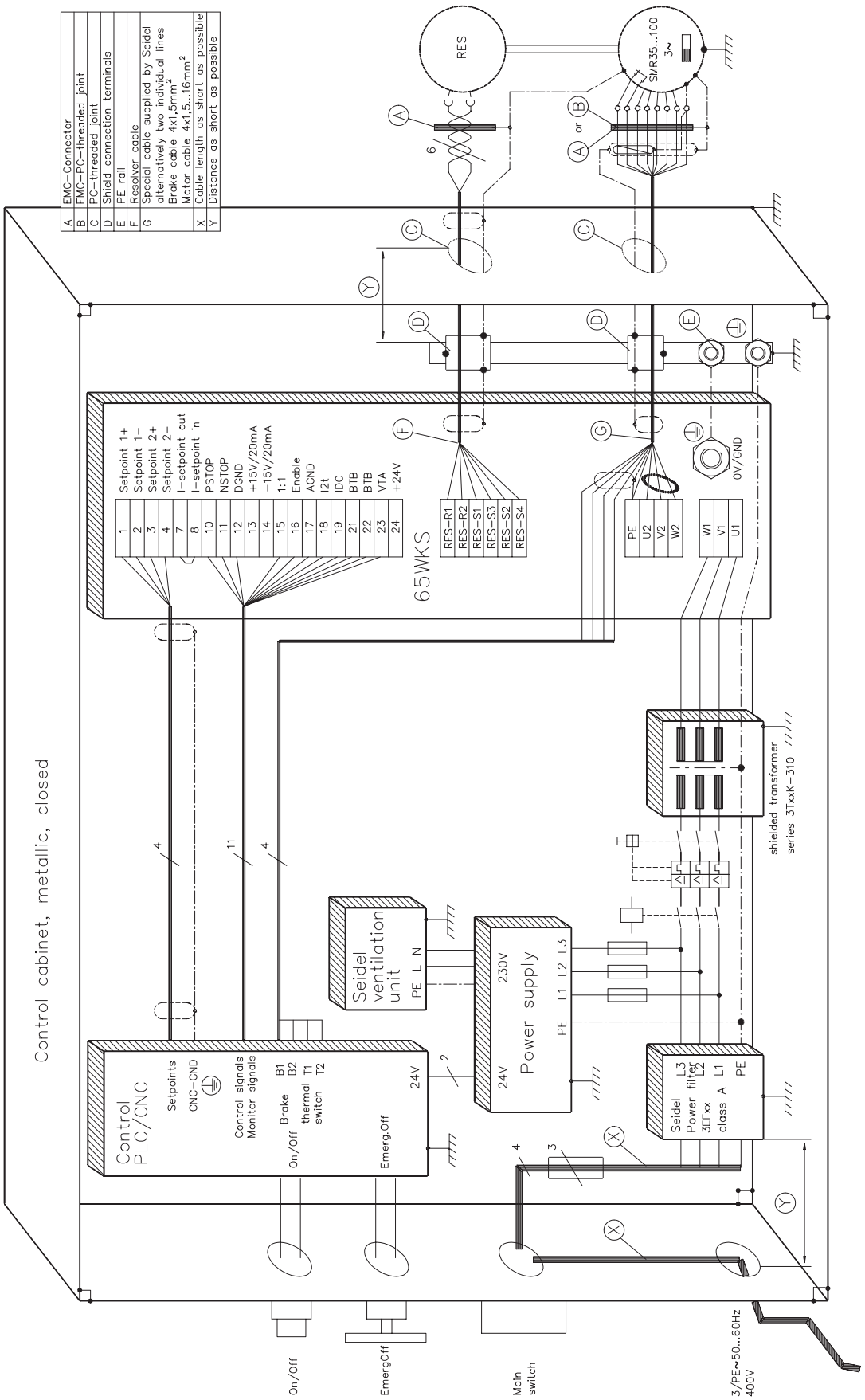
— Connect the motor holding brake. Shielding to PE at both ends.

— Connect the mains supply (for max. permissible voltages see Chapter I.8.3, use Seidel isolating transformer 3Txx and Seidel mains filter 3EFxx)

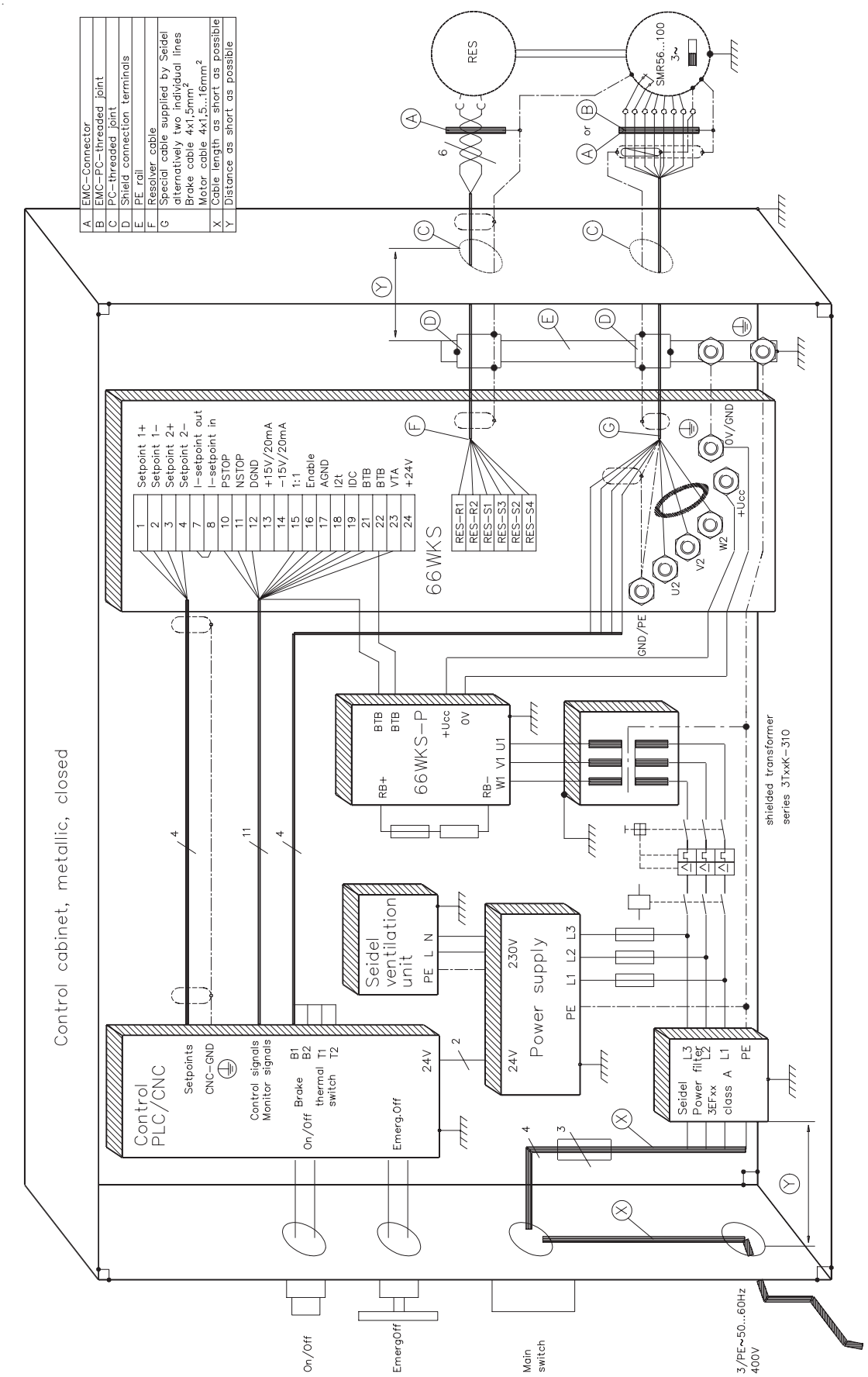
Check

Final check of the wiring which has been installed, referring to the wiring diagrams which have been used.

II.2.1 CE - correct wiring 65WKS, general diagram



II.2.2 CE - correct wiring 66WKS with 66WKS-P, general diagram



II.2.3 Module backplanes F/R65WKSMB and F/R66WKSMB

Types: F65WKSMB for amplifier 65WKS, connections at back
R65WKSMB for amplifier 65WKS, connections at front
F66WKSMB for amplifier 66WKS, connections at back
R66WKSMB for amplifier 66WKS, connections at front

The module backplanes are fixed into the 19"-modules from behind. The amplifiers are pushed into the module casing and plugged into the module backplanes. The electrical signals are made accessible on the backplane by means of terminals, studs and plug connectors.

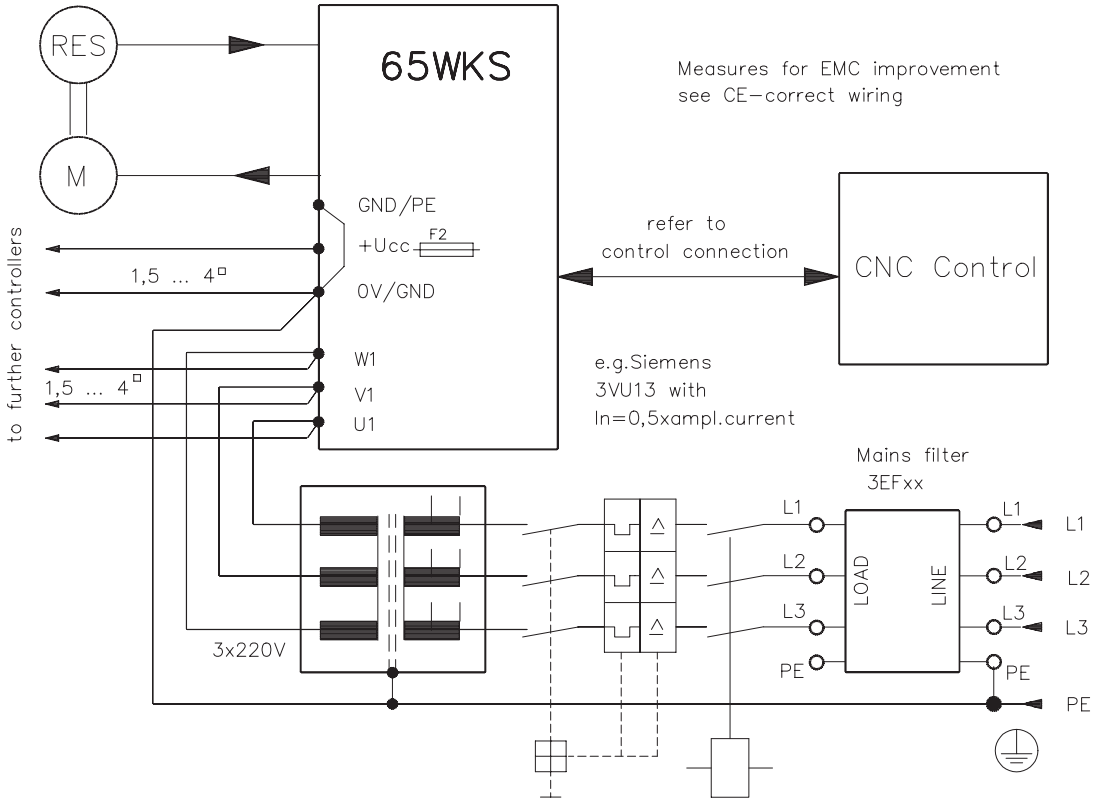
The F/R65WKSMB and F/R66WKSMB backplanes differ in the width and the no. of pins in the DIN41612 power connector.

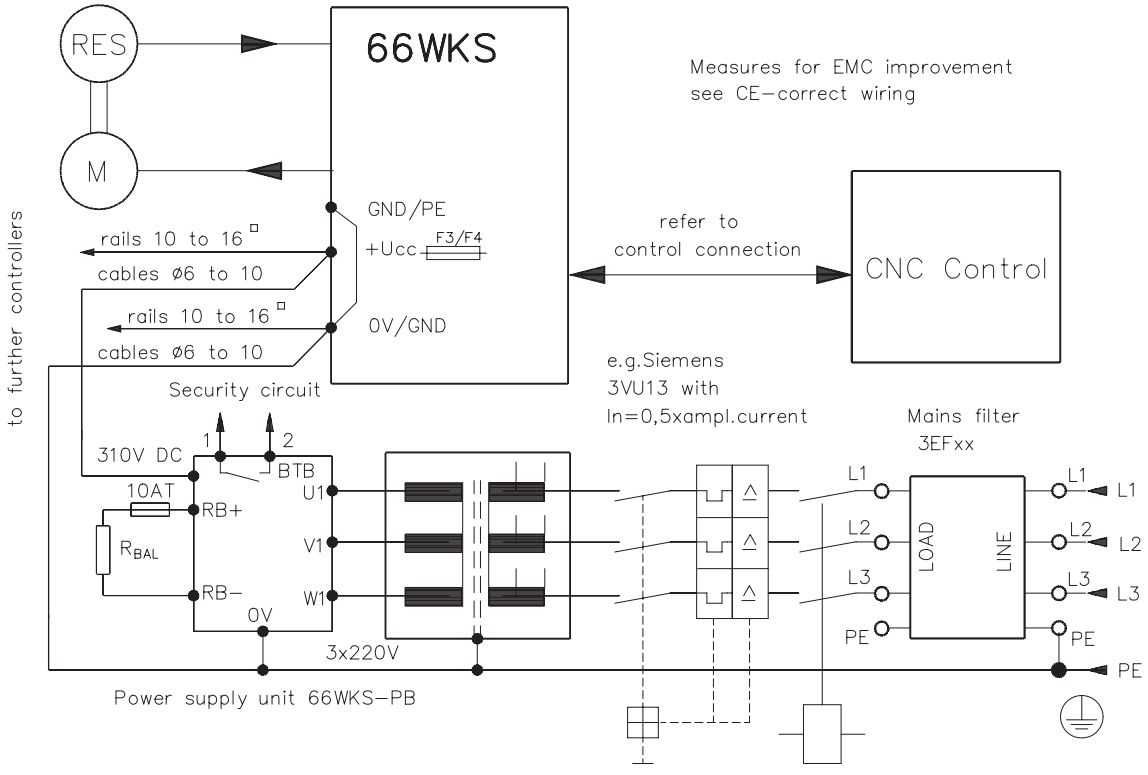
The table below shows the signal assignments for the connectors.

	Power signals		**Control signals**		**Resolver signals**
Signal designation	65WKS socket D32	66WKS socket E48	65/66WKS socket C64	65/66WKS plug XST404 MSTBW20	65/66WKS socket XST402 SubD9
+Ucc	2-4ac	28-32ace	—	—	—
U1(~)	6-8ac	—	—	—	—
V1(~)	10-12ac	—	—	—	—
W1(~)	14-16ac	—	—	—	—
0V/GND/PE	18-20ac	20-26ace	—	—	—
U2	22-24ac	2-6ace	—	—	—
V2	26-28ac	8-12ace	—	—	—
W2	30-32ac	14-18ace	—	—	—
Analog-GND AGND	—	—	2 / 32 ac	17	—
Digital-GND DGND	—	—	4ac	12	—
BTB-contact	—	—	7ac	21	—
BTB-contact	—	—	8ac	22	—
Enable	—	—	10a	16	—
I^2t signal	—	—	10c	18	—
I-setpoint out	—	—	12a	7	—
I-setpoint in	—	—	12c	8	—
Setpoint 1—	—	—	14a	2	—
Setpoint 1+	—	—	14c	1	—
Setpoint 2—	—	—	15a	4	—
Setpoint 2+	—	—	15c	3	—
1:1 (Integral-off)	—	—	16c	15	—
Limit switch -	—	—	17a	11	—
Limit switch +	—	—	17c	10	—
Current monitor IDC	—	—	19a	19	—
Res-R1	—	—	19c	—	9
Res-S1	—	—	20a	—	8
Res-S2	—	—	20c	—	7
Tacho monitor V-TA	—	—	22a	23	—
Res-R2	—	—	22c	—	5
Res-S3	—	—	23a	—	4
Res-S4	—	—	23c	—	3
+15V aux. voltage	—	—	26ac	13	—
–15V aux. voltage	—	—	28ac	14	—
+24V supply	—	—	30ac	24	—

II.2.4 Wiring diagrams

II.2.4.1 Power wiring 65/66WKS

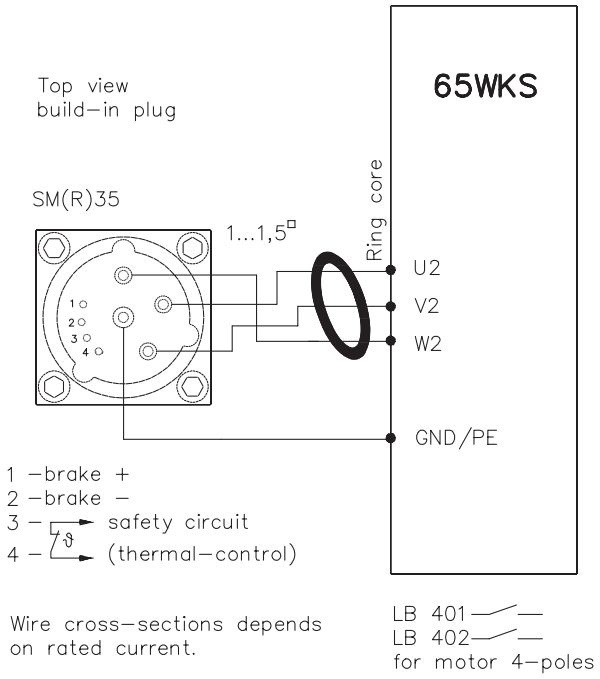




II.2.4.2 Motor wiring 65/66WKS

Measures for EMC improvement see CE–correct wiring

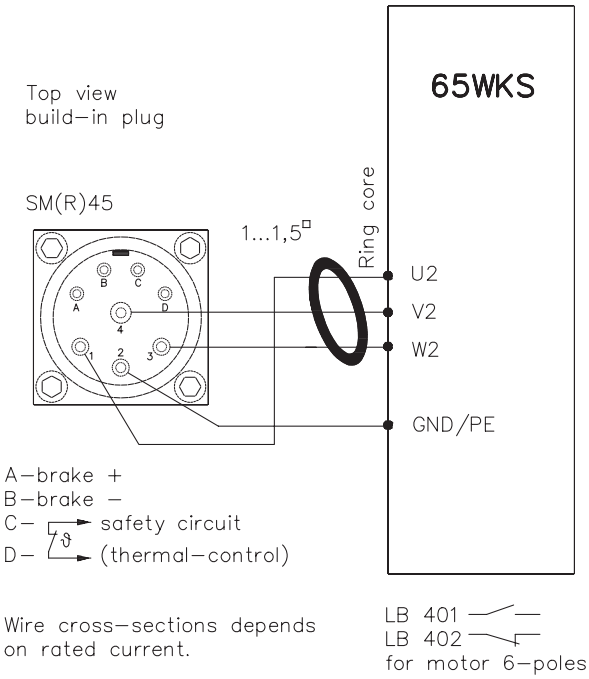
Wiring diagram SM(R)35



Wire cross–sections depends on rated current.

LB 401
LB 402
for motor 4–poles

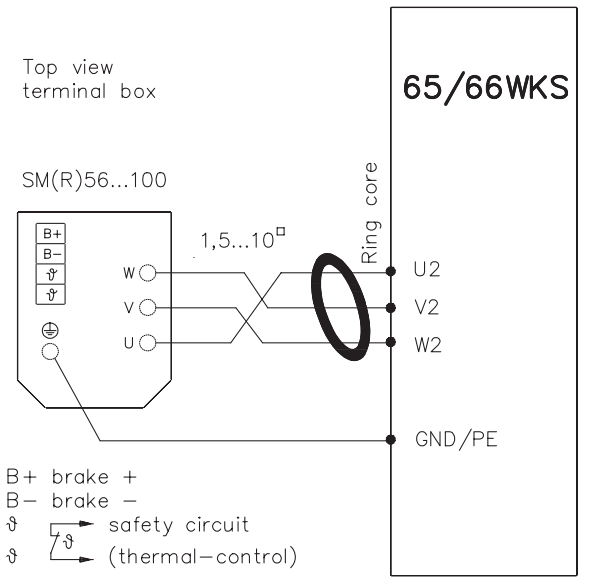
Wiring diagram SM(R)45



Wire cross–sections depends on rated current.

LB 401
LB 402
for motor 6–poles

Wiring diagram SM(R)56...100

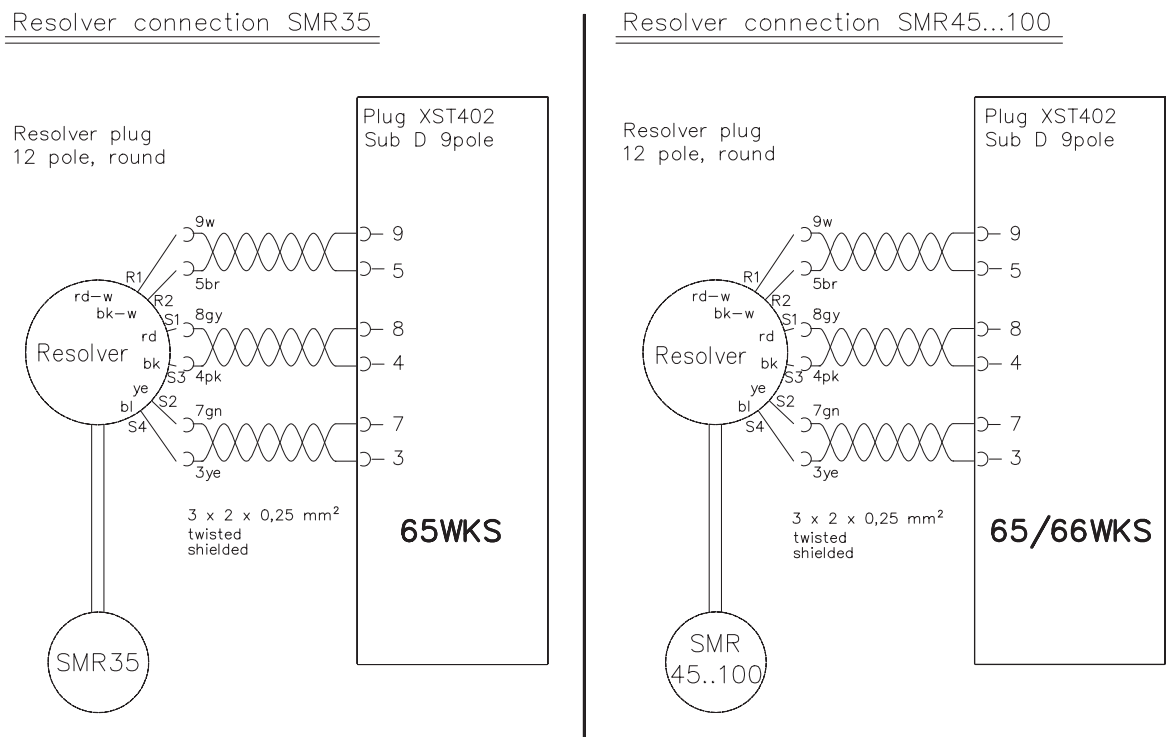


Wire cross–sections depends on rated current.

LB 401
LB 402
for motor 6–poles

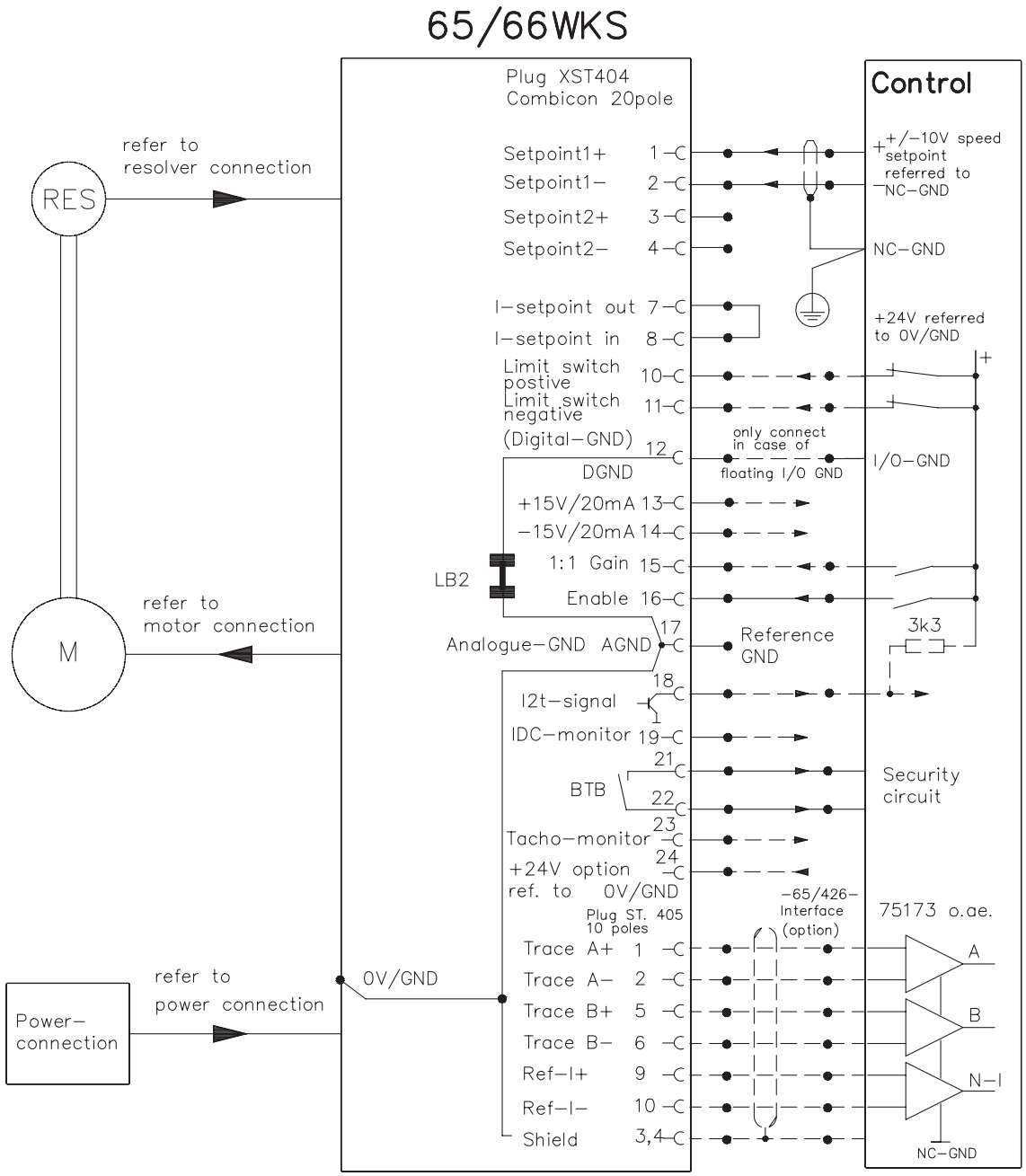
II.2.4.3 Resolver wiring 65/66WKS

Measures for EMC improvement see CE–correct wiring



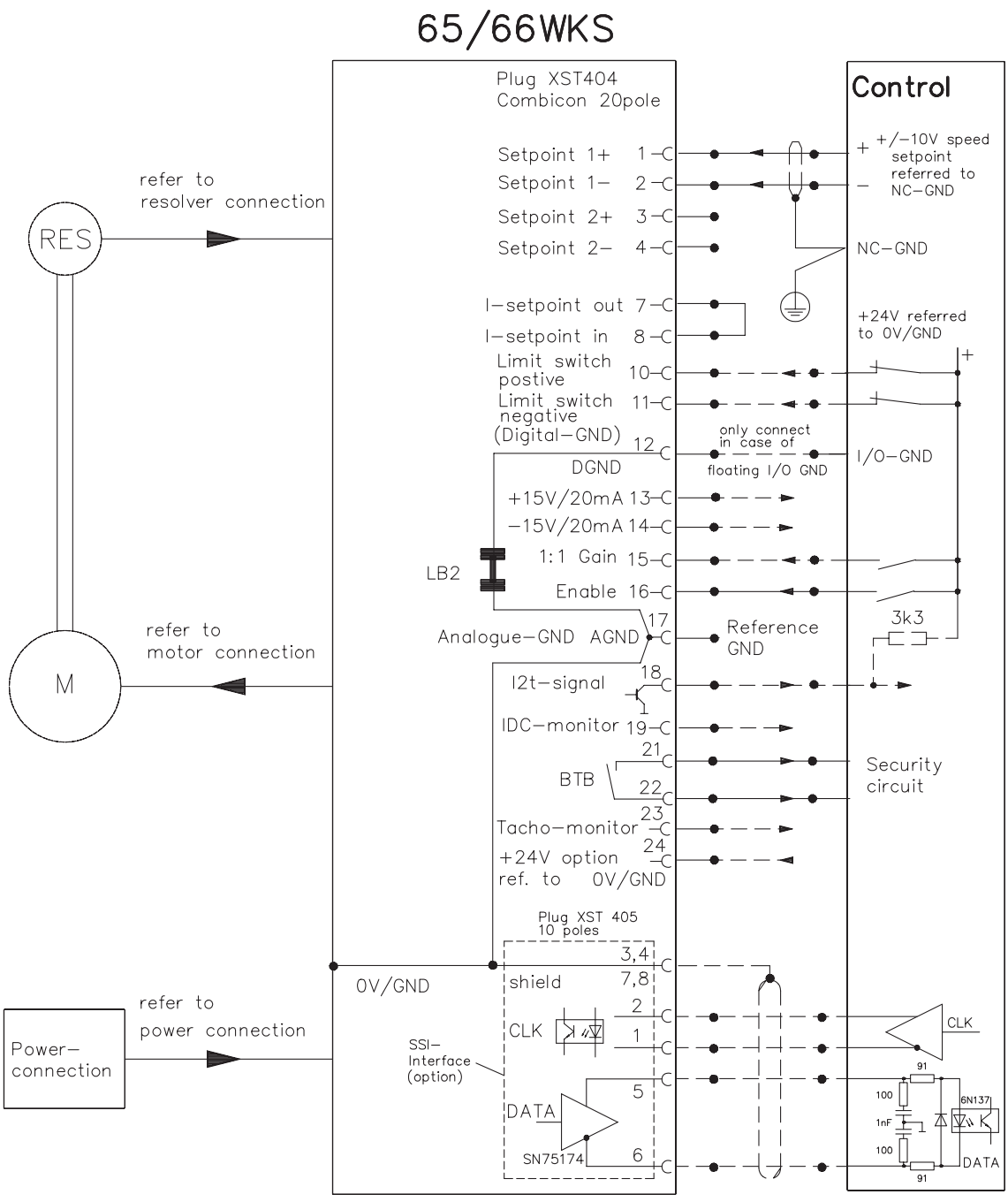
II.2.4.4 Wiring the 65/66WKS control with an incremental-encoder interface

Measures for EMC improvement see CE–correct wiring

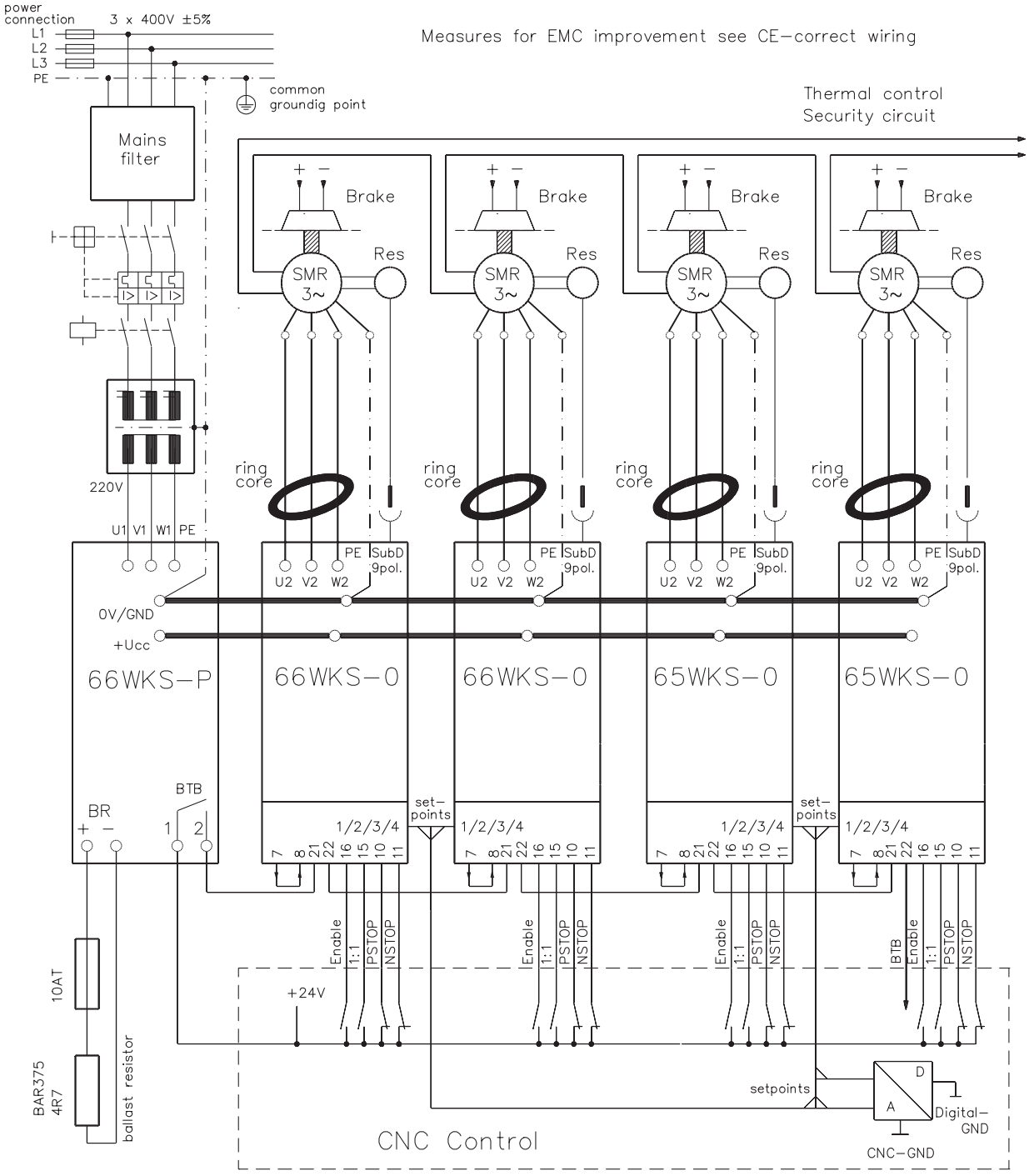


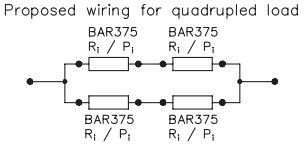
II.2.4.5 Wiring the 65/66WKS control with an SSI interface

Measures for EMC improvement see CE–correct wiring



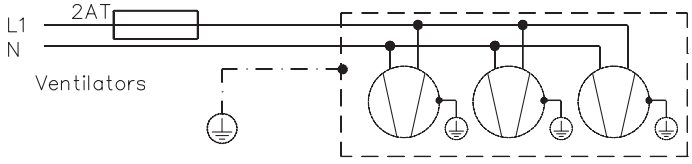
II.2.4.6 Wiring example: multi-axis system





$R_i = R_{ges} / P_i = 375W / P_{ges} = 1500W$

Attention ! Change R616 at power supply to 2,2MΩ !



II.3 Commissioning

II.3.1 Important notes

- Check that the instructions in Chapter II.1 have been followed
- A correct step-by-step sequence of commissioning helps you to avoid damage.
  If you require further information, please contact our applications department.
- Permitted are: adjustment of the servo amplifier settings on the custom p.c.b., optimisation and use of circuit blocks by means of the soldered links LB2, LB3 LB401...404 .
  Any other alteration will invalidate the guarantee.
- **Never plug in or remove the modules when they are live**
  This is vital to avoid burnt out connector contacts, the destruction of entire boards of the servo amplifier, and danger to personnel from charged capacitors.
  Residual charges in the capacitors can still have dangerous levels more than 5 seconds after switching off the mains.
  Insert and remove the plug-in modules **only** when the voltage has fallen below the low voltage limit.
  Measure the DC-link voltage with a voltmeter. Wait until the voltage has fallen below 40V.
  The plug-in modules can now be inserted or removed.
- After the plug-in modules have been inserted, fix them in position by using the screws provided in the front panel, to ensure a good contact for the connectors. Poor contact causes the contacts to burn out.

II.3.2 Notes on commissioning

The commissioning procedure is only described briefly here. Further know-how can be provided in our **training courses** (on request).

In multi-axis systems, commission each servo amplifier individually.

Caution !
Check that all live connection components are protected against accidental contact.
Dangerous voltages can occur, up to 410V.
Never disconnect the electrical connections of a live servo amplifier.
The residual charge in the capacitors can still have a dangerous level up to 120 seconds after switching off the mains supply.

The heat sink temperature of the amplifier can reach 80 °C in operation. Check (measure) the temperature of the heat sink. Wait until it has cooled down to below 40 °C before touching it.

Warning !
If the servo amplifier has been stored for longer than 1 year, the DC-link capacitors must first be re-formed.
This is done by applying, at most, half the operating voltage to the units (possibly via a series resistor).

Please ask our applications department about the exact process of capacitor formation.

The following notes should help you to carry out the commissioning in a sensible sequence, without endangering personnel or machinery.

Check the installation

Check the installed wiring against the wiring diagram (transformer and resolver connections, grounding, motor connection, control signals)

Check the equipment – nameplates (rated current, rated voltage) special adjustments – if required.

Test the emergency stop switch before the first switch-on.

Set up safe values

Reduce the gain (AC-GAIN pot. hard left) and the peak curent (IPEAK pot near the left stop) for safety.

Start up the transformer

Remove all modules. Switch on the mains supply, check the secondary AC voltage. Switch of the supply. Switch on the ventilation.

Start up the mains PSU

Insert and fix the mains PSU in position. Switch on the mains supply. Check the D-link voltage. Switch off the mains supply.

Wait until the DC-link is almost completely discharged.
Measure the DC-link voltage with a voltmeter.
The voltage must sink down to below 40VDC.

Check normalisation

Check the setting of the no. of pole pairs and the speed on the resolver board (LB401 ... 404).

Secure the system

Insert and fix a servo amplifier. Inhibit the enable signal and secure the emergency stop function.

Caution !
Make sure that any unintended movement of the drive cannot create a danger for persons or machinery.

Switch on supply

Switch on the mains supply.

Apply setpoint, Enable

Move the axis by switching the enable signal while a low setpoint value is applied.

Optimise

Adjust the axis (AC-GAIN, OFFSET, TACHO) – if it is not preset .

Switch off supply

Switch off. Measure the voltage in the DC-link.
Wait until the voltage has sunk below 40V.

Secure the system

Plug in / fix and commission further servo amplifiers.

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III Functions and Options

Chapter III describes the 65WKS and 66WKS servo amplifiers.
The function descriptions are valid for both types. Any differences which may exist are given separately, according to type.

III.1 Important notes

Alterations to the servo amplifier may only be carried out by properly qualified personnel.

The setting and optimisation of the servo amplifier, and the use of circuit elements by means of the solder links LB2, LB3, LB401 ... 404 are all permitted.
Any other alterations will invalidate the guarantee.

After every alteration which is carried out, the servo amplifier must be commissioned again, observing the commissioning and safety instructions.

III.2 Description of the functions

III.2.1 Input functions

III.2.1.1 Setpoint inputs SW1, SW2

The servo amplifier is equipped with two decoupled, additive differential inputs for the setpoint values.
Input 1 has a fixed setting for differential input voltages of max. ± 10 V.
Input 2 is equipped with an adjustable attenuator (P302),
Range of adjustment 0 ... 100 %.

— Clockwise rotation increases the speed (effect increases)
— A positive voltage on terminal 1 compared to terminal 2, or terminal 3 compared to terminal 4, produces clockwise rotation of the motor shaft (looking toward the shaft end).

The common-mode voltage range (important in avoiding earth loops) is additionally ± 10 V for both inputs, the input resistance is 150 kΩ.

III.2.1.2 Digital control inputs

All inputs are **isolated** and coupled by optocouplers. The ground reference is **Digital**-GND (DGND, terminal 12). The logic is designed for +24V/10mA (**PLC compatible**), logic high level is +12...30 V. If required, control by +15 V (terminal 13) is possible. In this case Digital-GND (terminal 12) must be connected to Analog-GND (terminal 17).
As delivered, AGND and DGND are connected by the solder link LB2 on the amplifier board.

Enable input E

The output stage of the amplifier is enabled by the Enable signal (terminal 16, enable 24 V, **active high**, logic level 12 V ... 30 V / 10 mA referred to Digital-GND terminal 12, floating).
In the inhibited state the motor which is connected has no torque, the integrator sections of the speed and current controllers are also inhibited.

When the Option -01- option board is used the following functions are also available:

- **1:1 / Integral-off** (1:1, terminal 15), **high level** to switch over the speed controller to **current control**.
- Limit switch positive/negative (**PSTOP / NSTOP**, terminals 10 / 11)**, high level in normal operation** (safe in case of cable break). If an input signal disappears (limit switch open) the corresponding direction of rotation is blocked.

The digital input circuits PSTOP/NSTOP are mounted on the option board -01- and **can only be used when an option board -01- is available.** In this case the solder link **LB3 on the amplifier board** must also be opened.

A 1:1 connection of the servo amplifier can also be achieved without using an option board -01- , by altering the custom board.

III.2.2 Output functions

III.2.2.1 Armature current, setpoint monitor output IDC, terminal 19

The output provides ± 10V referred to AGND for ± **peak instrument current**.
The output is the average value DC of all three phases, which is approximately **proportional** to the **motor torque** which is produced.
The output resistance is 1 kΩ.
This signal can also be utilised as **current** setpoint signal for a second, 1:1 connected (slave-) servo amplifier in a tandem drive.

III.2.2.2 Tacho monitor output VTA, terminal 23

The output provides 10 V / 3000 resp. 6000 min^{-1} referred to AGND with standard normalisation. The normalisation is not affected by the tacho potentiometer P304. The changeover of the normalisation is made by the solder links LB403 and LB404 on the resolver board, see Chapter III.4.3.1 .
The output resistance is 1kΩ.

III.2.2.3 Ready / standby contact BTB

Readiness for operation (**BTB**, terminals 21,22 , 24 V / 0.1 A DC) is signalled via a **floating** relay contact (max. 100 V / 0.1 A DC).

The contact is **closed** when the servo amplifier is ready for operation, the signal is **not** affected by the enable signal or the I^2t limiting.

If the Option -24 V- is used, then the BTB signal also appears when the mains power supply is switched off (and the 24 V supply is switched on).

III.2.2.4 Measurement points

- **Armature current monitor (IDC)**, normalisation ± 10 V for ± **peak instrument current**, The measurement point provides the same signal as described under III.2.2.2. Output impedance 1 kΩ, reference point is Analog-GND.
- **Tacho monitor (VTA)**, the voltage is the tachometer voltage, with reference point Analog-GND.
  The measurement point provides the same signal as described under III.2.2.2.
  Output impedance 1 kΩ, reference point is AGND.
  The normalisation is determined by the setting of the solder links **LB 403, 404** on the **resolver board**, see Chapter III.4.3.1 .

III.2.3 Setting functions

III.2.3.1 Ramp potentiometer P301

When the option board -01- is plugged in, the desired rise time for a setpoint step can be adjusted by potentiometer P301 (effective only for setpoint input 2).
With the standard assembly of the custom board (C306 = 10 nF) the hard left position of P301 corresponds to a rise time of approx. 100ms.
When P301 is **hard right** the remaining delay time of **10ms** is practically meaningless. If required, C306 can be reduced to a minumum of 1 nF.

III.2.3.2 Setpoint potentiometer P302

Potentiometer P302 can be used to attenuate the setpoint input SW2.
Turning P302 clockwise increases the speed.
(range of adjustment 0 ... 100 %)

III.2.3.3 Offset potentiometer P303

The offset potentiometer P303 is used to compensate for error voltages of the operational amplifier or the setpoint voltage source (controller) which are present at setpoint = 0V.
Adjust the compensation while the amplifier is active (enabled) and the setpoint voltage = 0V so that the motor is at standstill.
(range of adjustment ±10 mV)

III.2.3.4 Tacho potentiometer P304, normalisation LB403/404

This potentiometer is used for the fine adjustment of the tachometer.
The range of adjustment is ±30 %.
The range of adjustment can be altered by changing R310 (15 k) on the custom board.

The solder links **LB403** and **LB404** on the resolver board determine the normalisation **independently** of the type of motor used. As delivered, the solder links are closed (normalisation for a motor speed of ±3000 min^{-1}).

III.2.3.5 AC-gain potentiometer P305

The proportional gain of the **PI** speed controller can be increased by turning P305 clockwise (the control becomes stiffer). When P305 is hard left, then R307 fixes the gain at about 10.
The integral component is fixed by C304 and R307 to 0.1 μF x 100 kΩ for the servo amplifier 65WKS and 0.22 μF x 100 kΩ for type 66WKS.
Reducing C304 can improve the response of the amplifiers, but increases the tendency to oscillation. The standard values only need to be changed is very few cases.
Adjust P305 while the amplifier is active and the motor is at stillstand (setpoint voltage = 0V) by turning it clockwise until oscillation begins (which can be seen very well on an oscilloscope attached to the current monitor) and then turned back to a position clearly below the oscillation threshold.

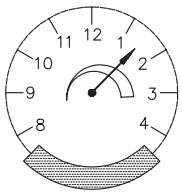
R309 limits the amplification of the I-component to about 500 for very low frequencies.

III.2.3.6 Peak current I_{PEAK}, P306

Turning P306 to the left reduces the peak instrument current I_{PEAK} .
The range of adjustment (linear) is 0 ... 100 %.
The end value can alternatively be reduced by means of a fixed resistor.
As delivered, P306 is set hard right (max.) and covered.
The following **table** provides information for the **rough setting** of I_{PEAK} and I_{RMS} for commissioning.
An **exact** setting – especially for low currents – is only possible by using the methods described in **Chapter III.2.3.7.**

Drawing of potentiometer with built–in controller, front view

65WKS–M310/3/6/12/22/26
66WKS–M310/35/45



Potentiometer P306 and P307 I_{PEAK} and I_{RMS}

Position	P306 IPEAK/A 65WKS 3A	6A	12A	22A	26A	66WKS 35A	45A	P307 IRMS/A 65WKS 3A	6A	12A	22A	26A	66WKS 35A	45A
cw	7,5	15	30	50	50	75	100	3	6	12	22	26	35	45
4	7	14	28	47	47	70	95	2,7	5,5	11	20	23	33	42
3	6,5	13	26	42	42	64	84	2,4	5	10	18	21	30	38
2	6	12	22	36	36	55	73	2,1	4,5	9	16	19	27	34
1	5	10	18	31	31	46	62	1,8	4	8	14	17	24	30
12	4	8	15	25	25	37	50	1,5	3,5	7	12	14	21	26
11	3	6	12	19	19	28	39	1,2	3	6	10	11	18	22
10	2	4	8	14	14	19	28	0,9	2,5	5	8	9	15	18
9	1	2	4	8	8	11	17	0,6	2	4	6	6	11	14
8	–	1	2	3	3	6	8	–	–	3	4	4	7	9
ccw	0	0	0	0	0	0	0	0	0	0	0	0	0	0

As–delivered state
cw–stop (4h30)

III.2.3.7 Effective current I_{RMS}, I^2t limit

The servo amplifiers have the capability to deliver the peak instrument current I_{PEAK} for a maximum of 5 sec, after which the current is limited to I_{RMS}, the preset rated current.

Counter-clockwise (left) rotation of P307 reduces I_{RMS}, the range of adjustment (non-linear) is 0 ... 100 %. The centre position of the potentiometer corresponds to about 70 % of the rated current.

The time t, during which the pulse current can be delivered, varies in accordance with the setting which is selected for I_{RMS} and I_{PEAK} :

$$t = \frac{I_{RMS}^{\ 2} \cdot 20s}{I_{PEAK}^{\ 2}}$$

As an alternative, I_{RMS} can also be set by two fixed resistors. The setting can be made when the motor is stalled by hard braking. Start the adjustment with a low value of current I_{RMS} (P307 close to the left stop). When the enable signal is activated the amplifier current will initially rise to the preset peak current I_{PEAK} and then, after reaching the I^2t limit, sink back to the value of I_{RMS}. Adjust the current to the required value by turning P307 step by step to the right (clockwise).

Measure by using an oscilloscope or voltmeter connected between the measurement point **IDC** (current-setpoint monitor) and AGND. The table in Chapter III.2.3.6 can be used to make a simple (rough) setting.

As delivered, P307 is set hard right (max. current).

III.2.4 Other functions

III.2.4.1 Frequency response of the servo amplifier

The setting of the current controller has been adapted to match the intended type of motor.
A change of this basic setting should only be contemplated in exceptional cases, and after consultation.

III.2.4.2 I^2t monitoring

When the current reaches the preset limit for effective current (I_{RMS}, I^2t limit, see Chapter III.2.3.7) the pulse current is limited until the effective load sinks.
The BTB signal is not affected by this behaviour.
A response of the I^2t limiting is displayed by the yellow LED 7 and signalled by an floating optocoupler at the I^2t signal output (terminal 18).
In normal operation the output is actively held down to 0V (low level). If required, a pull-up resistor with a minimum value of 2.2 kΩ can be externally wired to +15 ... 30 (24) V .

III.2.4.3 Displays

LED 1 green for ready / standby [BTB]

The green LED lights up when the auxiliary power supply is functioning correctly.
The servo amplifier is ready for operation when the green LED is lit up **and no red LED** is lit up.
The BTB contact (floating, normally open, **100V / 0.1A DC**, terminals 21,22) is closed when the servo amplifier is ready for operation.

LED 3 red for instrument fault [FAULT]

The top red LED lights up on :
- overcurrent or short circuit
- overvoltage
- overtemperature of the heat sink (output stage)

LED 4 red for ground/earth fault [EARTH]

This red LED lights up on ground/earth fault in a motor lead.

LED 5 red for resolver fault [RESOLVER]

This red LED lights up on a resolver fault (erroneous signals caused by incorrect matching, cable break or short circuit). This fault signal is not stored.

LED 6 red for overtemperature [OVTEMP]

The bottom red LED lights up on overtemperature of the heat sink (output stage) or excessive ambient temperature.

In all cases, when a red LED lights up the BTB signal is interrupted (fault signal).
After the cause of the fault has been removed, you can clear the fault signal by switching the mains (or the 24V auxiliary supply) off and on again.

LED 7 yellow for effective (r.m.s.) current limit [I-RMS]

The yellow LED lights up when the preset effective current limit I-RMS is reached.
At the same time, a signal is made on terminal 18, see Chapter III.2.4.2 . The BTB signal is **not** affected.

LED 2 yellow for ballast circuit [BR]

A flickering of the yellow LED shows that the ballast circuit has been activated.
A weakly lit LED indicates that the ballast circuit is faulty (Overload of the ballast circuit).
A LED which is already flickering when the connected motor is **at standstill** indicates that the mains supply voltage is excessive.
The upper yellow LED is inactive for amplifiers of the 66WKS series, since these servo amplifiers do not have a ballast circuit.

III.3 Options

III.3.1 Option board -01-

In order to activate the option board -01- you **must open** the solder link **LB3** on the amplifier board (accessible from above when the option board is pulled out) before inserting the board. The limit switch inputs must **always** be wired up, even if you only use the ramp generator. As delivered, the option board -01- is not plugged in.

III.3.1.1 Ramp generator, RAMP

When the option board -01- is plugged in, potentiometer P301 can be used to set the rise time for a setpoint step.

Only effective for setpoint input 2

With C306, the maximum rise time when the potentiometer is at the **left stop** can be set at about 10 ms per nF for a setpoint step of 10 V.
This option can make a significant improvement in the control-loop stability if it is optimally set (i.e. rise time **smaller** than the mechanical time constant of the control loop), without noticeably reducing the speed of the control-loop.
The standard value for C306 is 10 nF , corresponding to 100 ms with P301 at the left stop.
The range of adjustment is 10 ... 100 ms.

III.3.1.2 1:1 control

The speed controller can be switched over to **current control** by application of the 1:1-signal (input 24 V, active high, terminal 15). In this case the **P**-gain is set to **1** , the **I**-component of the controller is **bridged** and the **tachometer signal** is internally **switched off**.

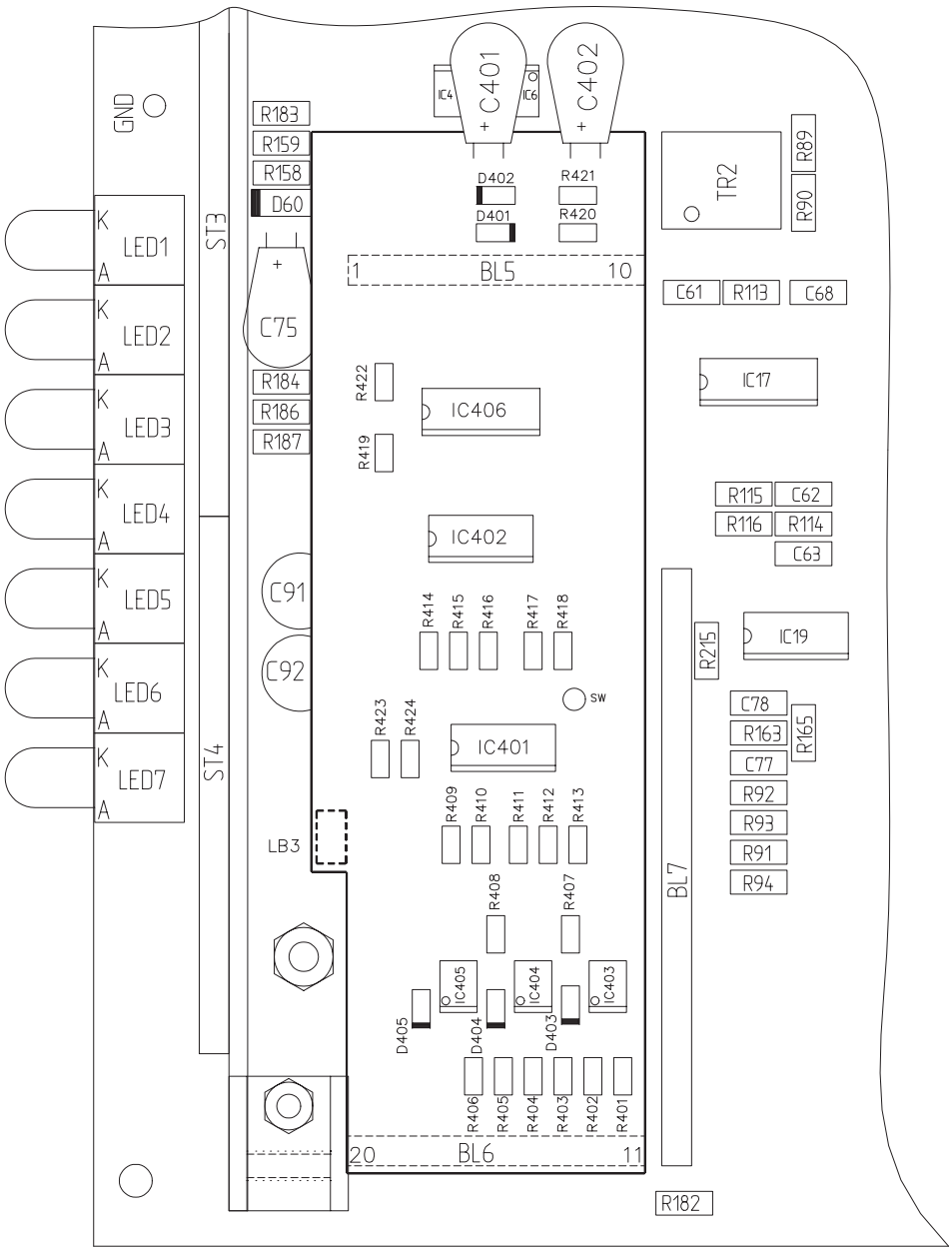
Effective for both setpoints

III.3.1.3 Limit switch PSTOP, NSTOP

If a signals is missing (inputs 24 V, active high), the corresponding direction of rotation is **inhibited** and the drive is braked. In this case, the I-component of the controller is bridged, in order to limit the motor current when driving up to a fixed stop.
PSTOP (terminal 10) inhibits counter-clockwise rotation, NSTOP (terminal 11) inhibits clockwise rotation.
If **both** signals are missing the drive brakes down to standstill, regardless of the direction and speed (this can, for instance, be used for an emergency stop function).

Only effective for setpoint input 2

III.3.1.4 Mounting position and component layout plan: option board -01-



III.3.2 Option -24V-, external 24 V - auxiliary voltage

As delivered, the auxiliary power supply is fed from the DC-link voltage.

If the option -24V- is built into the servo amplifier, then the auxiliary supply can be fed from an external 24 V DC source.

Advantages :
- BTB signal is available independently of the mains power supply.
- ROD/SSI signals are available independently of the mains power supply, provided that the option -65/ROD- or -65/SSI- is built in.
- Fault signals remain stored, even after the mains power supply to the servo amplifier has been switched off.
- The supply for the DC-link can be made from any suitable, lower voltage which meets the requirements for control-loop stability (e.g a 48 V battery). This can be advantageous, for example in setting-up operations

Disadvantage : Additional power supply required.

Warning !
The -24V- option must be built in if you want to supply the servo amplifier from an external 24 V DC supply !

If you want to **retrofit** the servo amplifier with an external 24 V DC supply, then several alterations are necessary. Please contact us in this case.

The supply is provided between terminal 24 and **0V/GND**, not terminals 12/17.

If you order the servo amplifier with the -24V- option, then the necessary changes have already been implemented during manufacture.

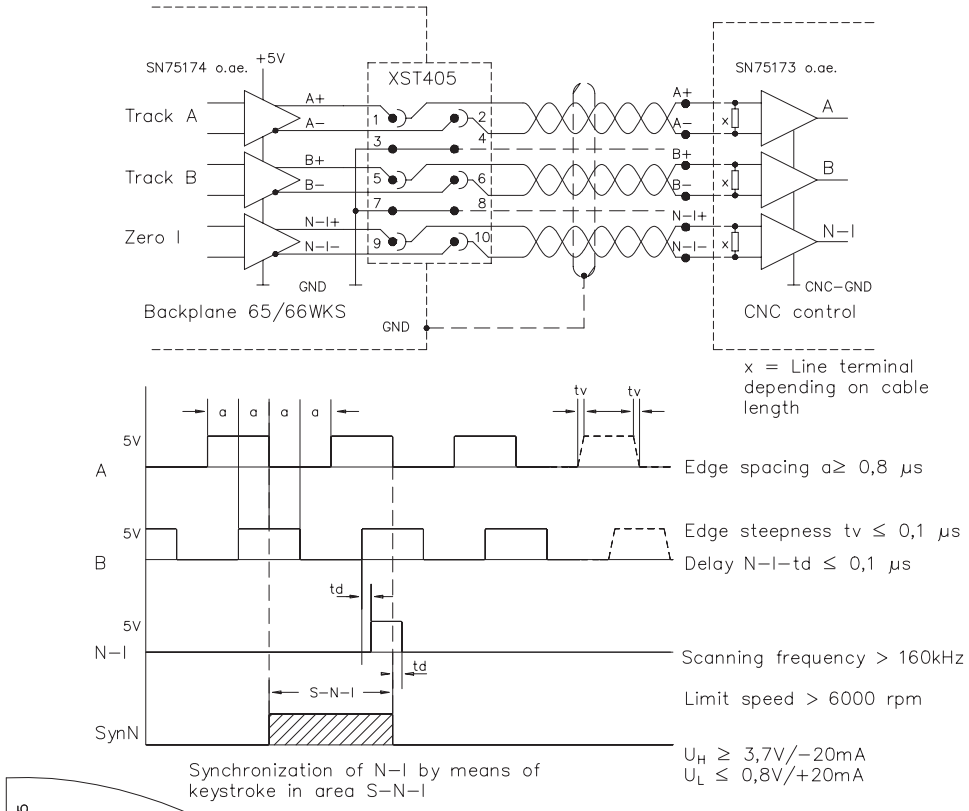
III.3.3 Incremental encoder interface: Option -65/426-

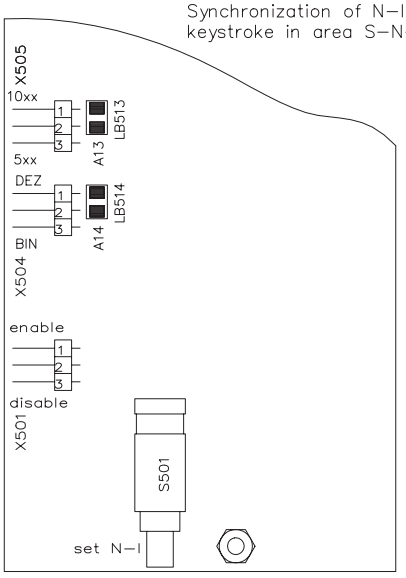
III.3.3.1 General

A plug-in expansion card is available with the designation **option board -65/426-** , which provides a ROD426-compatible incremental encoder signal to the back-panel plug XST405.
The number of steps is selectable between 1024 / 1000 / 512 / 500 steps per motor turn.
The position of the zero pulse is adjustable.

III.3.3.2 Signal sequence (clockwise rotation)

Incremental sensor interface, with presentation of signal patterns (cw rotation)





Setup the Interface–board by using either the solder straps or the jumpers.

Attention:

If the jumpers are used, the solder straps A13, A14 have to be open.

If the solder straps are used, the jumpers X504/X505 have to be in position 2–3

inkr/rpm	A14(LB514)	A13(LB513)	or	X504	X505
500	closed	open		1–2	2–3
512	open	open		2–3	2–3
1024	open	closed		2–3	1–2
1000	closed	closed		1–2	1–2

Disable for SynN–Key	
SynN	X501
disabled	2–3
enabled	1–2

As–delivery–state :

1000 Inkr./rpm
SynN–Key enabled

III.3.4 Synchronous serial interface: Option -65/SSI-

III.3.4.1 General

A plug-in expansion daughter card is available with the designation **option -65/SSI-** , which provides a cyclically absolute, synchronous-serial encoder signal to the plug XST405 of the back panel F/R65(66)WKSMB. 4096 steps per motor turn are provided.

All the supply voltages (also for the interface with RS485 drivers) are made available via the daughter board.

A serial signal is read out by the control with a synchronous clock frequency of 250 kHz. The signal sequence can be produced in GRAY-code (standard) or in binary code (change over by using the solder link on the daughter board).

24 bits are transmitted, of which the upper 12 bits are fixed at zero, and the lower 12 bits contain the position information. The interface must be read in like a multi-turn encoder, but delivers a valid single-turn data. The count direction of the interface is set to count up for clockwise rotation of the motor axis (looking at the shaft end).

If reversal of the count direction or a different transmission rate are required, please ask us for technical support.

Sequence of the serial transmission:

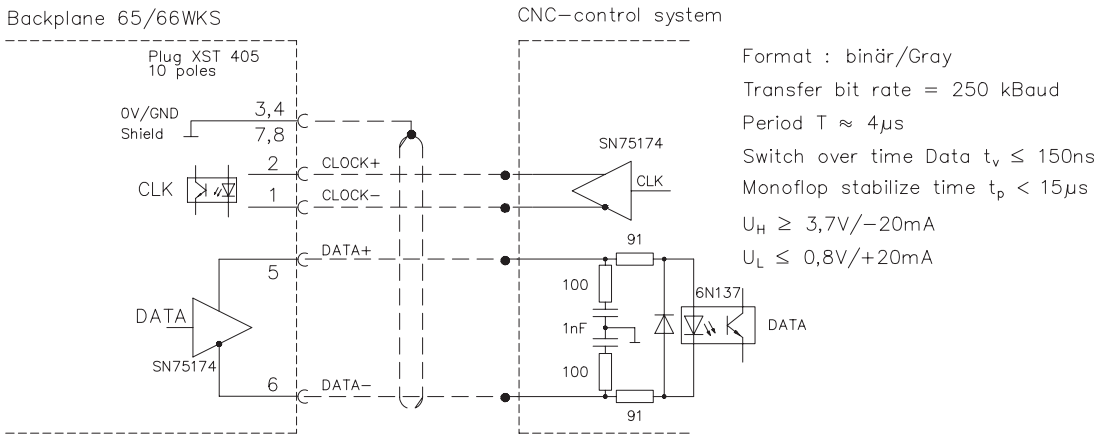
— the resolver-digital converter continuously presents the position data to the inputs of a parallel-serial converter.

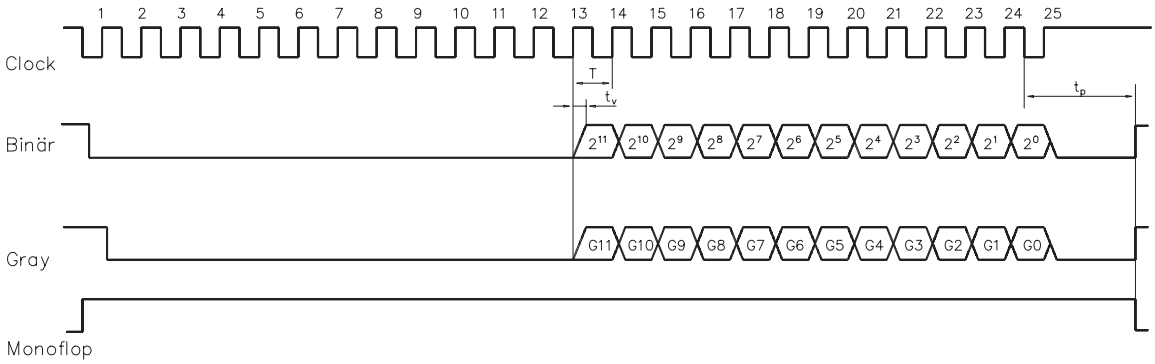
— the data are read out by the controller, by transmitting a sequence of clock pulses to the interface.

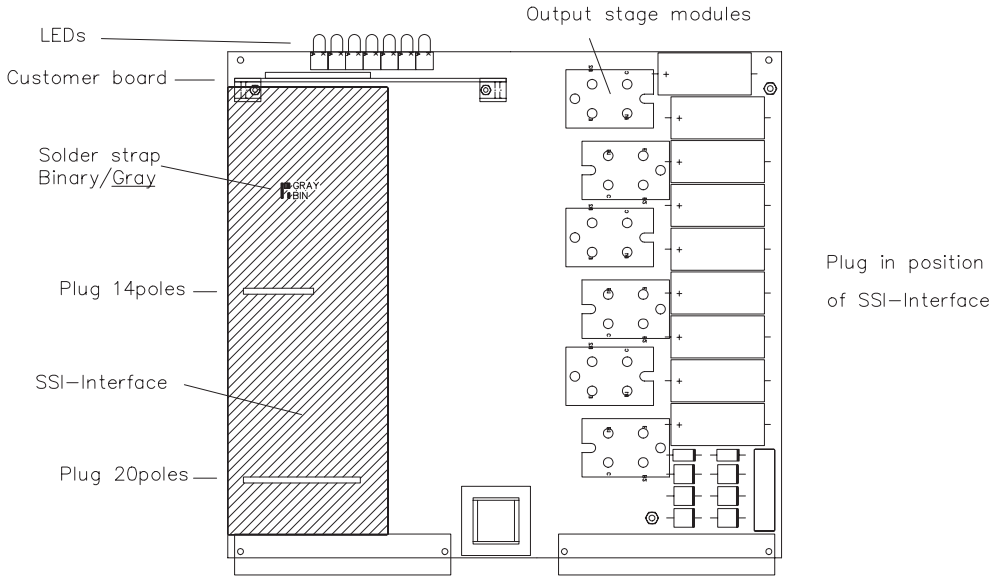
— the first high-low transition of the clock triggers a monostable, and the value present at the parallel-serial converter is accepted. The high level of the monostable prevents the acceptance of new data from the resolver-digital converter during the data transmission to the control. Every succeeding low-high transition retriggers the monostable.

— the first low-high transition transfers the most significant bit (MSB) of the position value to the control, every succeeding low-high transition transfers the next lower bit.

III.3.4.2 Signal sequence







III.4 Solder links

III.4.1 Main board 65WKS

III.4.1.1 Digital-GND, Analog-GND, LB2

As delivered, solder link **LB2** on the main board is **closed**. This means that AGND and DGND are connected. To achieve electrical separation of DGND (terminal 12) and AGND (terminal 17) it is necessary to open LB2.

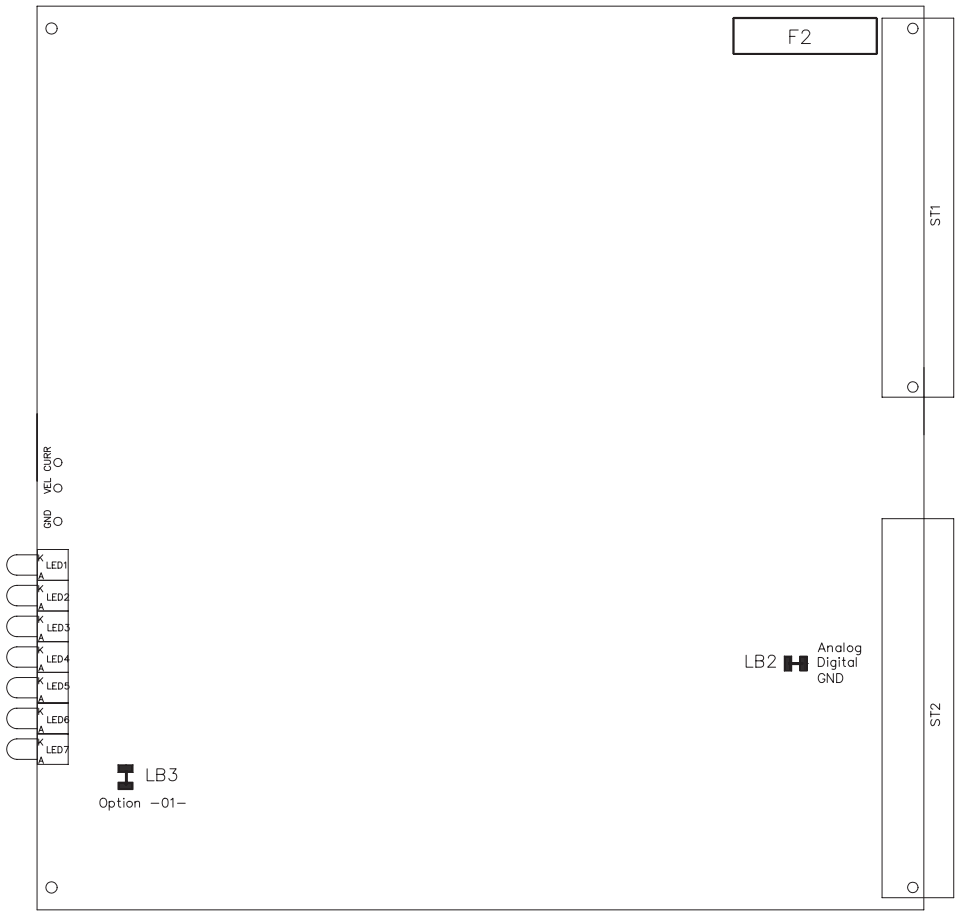
III.4.1.2 Option board -01-, LB3

As delivered, solder link **LB3** on the main board is **closed**.
If you want to use Option board -01- it is necesary to open LB3.

III.4.1.3 Other solder links

All other solder links, apart from LB2 and LB (above) can only be altered by the manufacturer.

III.4.1.4 Position of the solder links: main board 65WKS



View of mounted side

III.4.2 Resolver converter

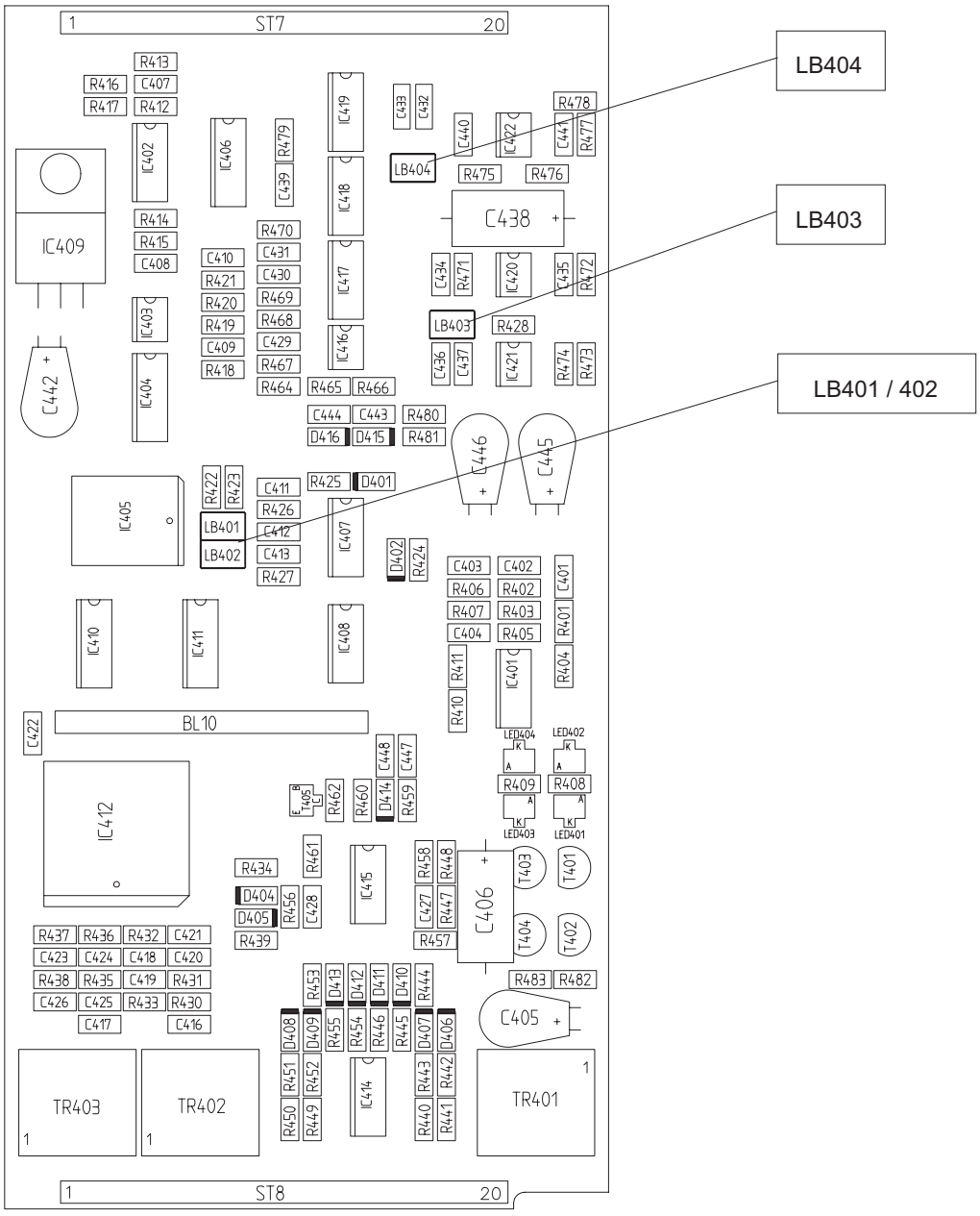
III.4.2.1 No. of motor poles and speed normalisation, LB401...404

As delivered, the solder links on the resolver card are set for 3000 min^{-1} and 6-pole motors of the SMR45...SMR100 series.
The coding is made according to the following table (bold: condition as delivered):

No. of motor poles	4-pole	**6-pole**	8-pole	10-pol
LB401	open	**open**	closed	closed
LB402	open	**closed**	open	closed

Speed	**3000 min^{-1}**	6000 min^{-1}
LB403	**closed**	open
LB404	**closed**	open

III.4.2.2 Position of the solder links, component layout: resolver converter



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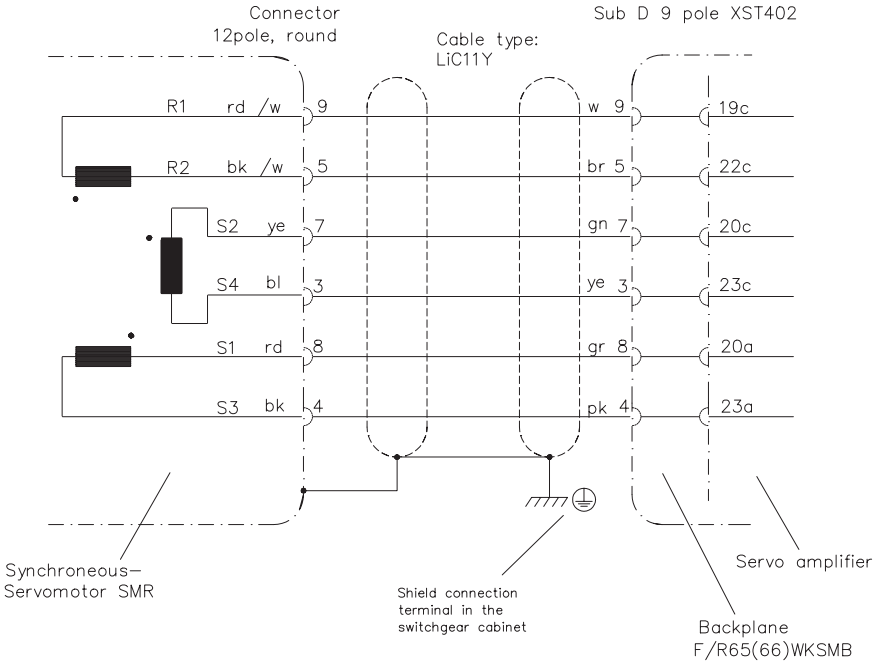
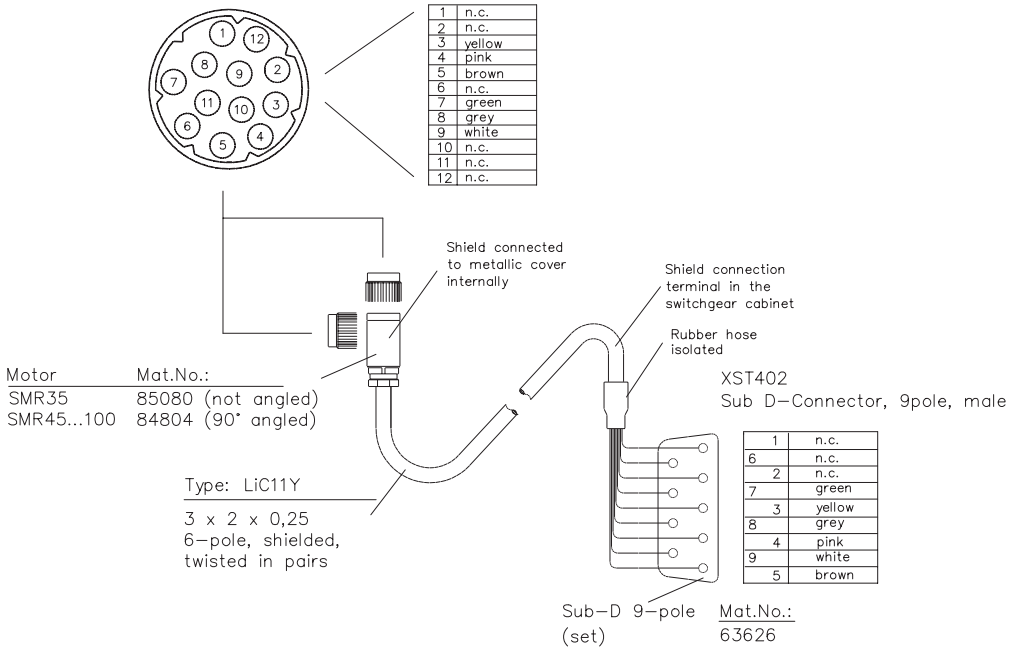
IV Peripheral equipment

IV.1 Resolver

IV.1.1 Type selection, connection

The standard servo amplifiers are intended for operation of synchronous servo motors with resolver feedback. The type of resolver is fixed (independently of motor type, frame size and no. of poles) as the following 2-pole hollow shaft version: manufacturer Litton, type SSBH-15-E-5. The resolver signal designations and resolver lead-core colours are binding. Use our prefabricated resolver connection leads.





IV.2 Isolation transformers

Isolation transformers are required to operate the equipment. The isolation transformers must meet the following specification, in order to ensure that the system operates correctly and that the guarantee conditions are fulfilled

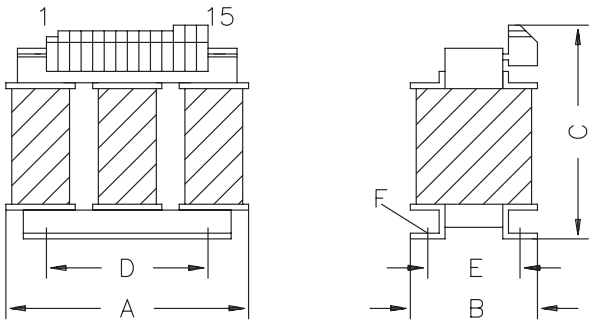
Design:	Three-phase isolation transformer, with screen winding, according to VDE 0550, connected as Y/y or Y/d.
Mains supply voltage:	400 V with tappings ±20 V for matching to other mains supply conditions. We recommend connecting to the 420 V tapping.
Secondary voltage:	for 310 V DC-link voltage: 220 V (phase-phase) **The secondary neutral point must not be earthed.**
Off-load voltage: (secondary)	The permissible off-load voltage rise is about 4 % **When off-load, the DC-link voltage of 310 V + 10 % (340 V) must not be exceeded.**
Short-circuit voltage:	The percent short-circuit voltage u_k must be about 4 %, in order to ensure protection of the rectifier diodes on switch-on and in the event of overvoltages to EN 50178. A soft-start circuit is required for transformers rated at more than 5kVA for single-axis systems or 8kVA for multi-axis systems.
Power factor:	The loading of the transformer by a 3-phase bridge rectifier results in a power factor λ of 0.8.
Overload behaviour:	The typical short-term overload operation in servo operation must not cause a voltage drop larger than the u_k value, and must not damage the transformer.

Seidel isolation transformers (3-phase, mains supply 400 V)

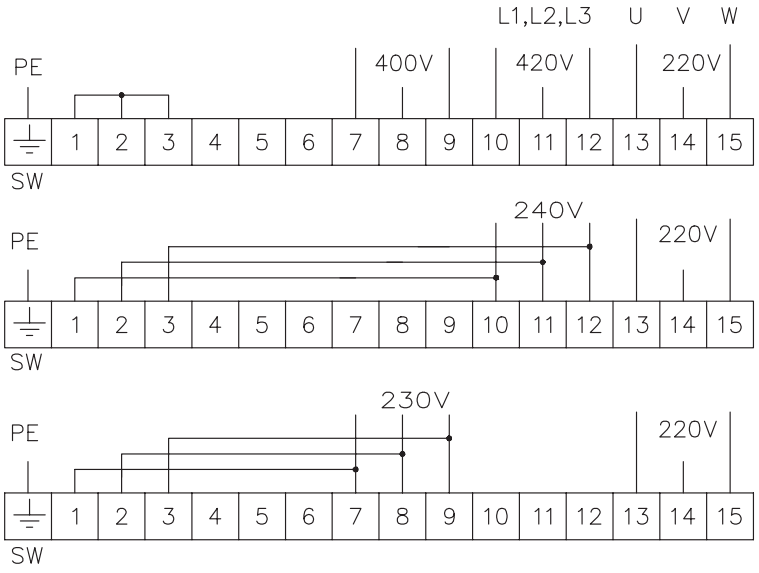
Warning !
The use of a transformer which does not meet the above specification affects the operational safety and could lead to destruction of the servo amplifier. We can only guarantee the functioning of the servo amplifier if Seidel transformers are used (see below).

Type	Power / kW	Sec. voltage / V	Order-No.
3T0,7K-310	0.7	220	71624
3T1,5K-310	1.5	220	71623
3T3,0K-310	3.0	220	70172
3T5,0K-310	5.0	220	71119
3T8,0K-310	8.0	220	70249
3T10K-310	10	220	71120

IV.2.1 Dimensions and connections of the isolation transformers



Type		Dimensions in mm						Weight
	Phase	A	B	C	D	E	F	kp
3T0,7K−310	3	180	110	195	120	86	8x12	9,2
3T1,5K−310	3	228	140	235	152	105	8x12	18,8
3T3,0K−310	3	300	155	310	200	92	10x15	35,0
3T5,0K−310	3	360	175	385	240	135	10x15	62,0
3T8,0K−310	3	450	220	440	280	165	10x15	98,0
3T10K−310	3	450	220	440	280	165	10x15	109,0



Other primary voltages available on special order

Ordering informations

3T 3,0K−310

3−phase Isolated transformer with shielding Uk=4%

Power in kVA

DC−voltage in intermediate circuit 310 means 220V secondary voltage

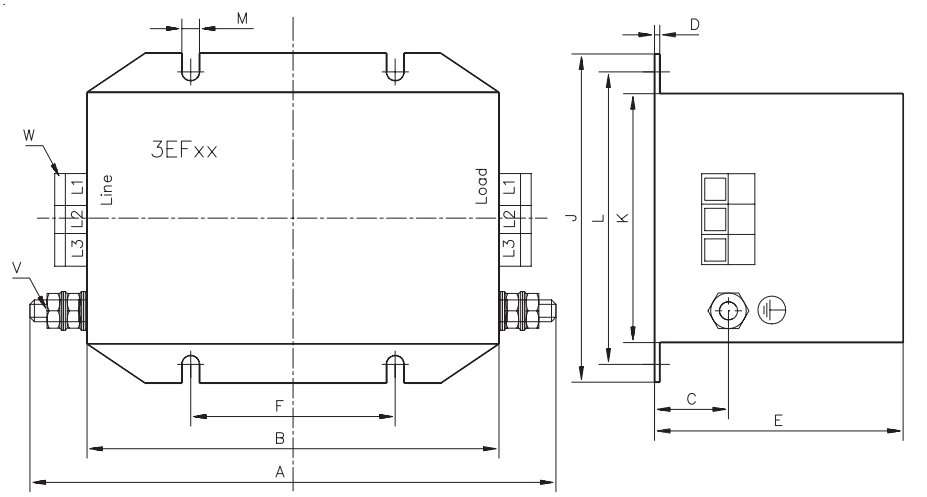
IV.3 Mains filter

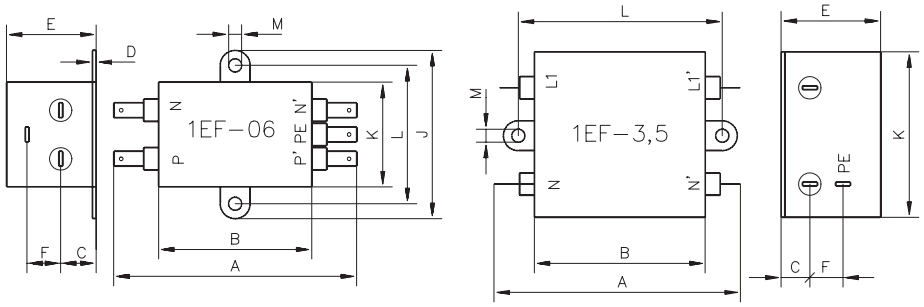
Filter dimensioning to the empirical formula : $I_{filter} \geq 2 \cdot \frac{P_{tran.}}{400V \cdot \sqrt{3}} = 2 \cdot I_{tran.}$

The table shows possible filter/transformer (tran.) combinations:

mains filter	rated voltage V	rated filter current A	suitable for transformer:	calculated I_{Trafo} A
3EF-05	400	5	3T0,7-310 / 3T1,5-310	1 / 2
3EF-08	400	8	3T3,0-310	4
3EF-16	400	16	3T5,0-310	7
3EF-50	400	50	3T8,0-310 / 3T10-310	12 / 15
3EF-80	400	80		

IV.3.1 Dimensions and connections of the mains filter





	1EF-06	1EF-3,5	3EF-05	3EF-08	3EF-16	3EF-50*	3EF-80*
Nennspannung	24V DC	230V AC	400V AC				
Nennstrom	6 A	3,5 A	5 A	8 A	16 A	50 A	80 A
A /mm	65,5	98	190	220	240	250	427
B /mm	41	75,9	150	180	200	200	350
C /mm	9,6	12	17	17	17	17	70
D /mm	0,5	–	0,75	0,75	0,75	0,75	1,13
E /mm	24,1	38,1	50	60	65	65	90
F /mm	9,1	15,5	85	115	115	115	375
J /mm	45	–	105	115	150	150	170
K /mm	28	55,6	75	85	119,5	120	
L /mm	37	87	90	100	135	135	130
M /mm	3,5	5,3	6,5	6,5	6,5	6,5	15
V			M6	M6	M6	M6	M10
W /mm^2	Faston	Faston	4	4	4	10	50
Gewicht /kg	0,065	0,3	1,1	1,8	1,8	3,1	9,5

IV.4 Power supply unit 66WKS-P310/90-B

IV.4.1 Power supply unit description: 66WKS-P

The very powerful power supply unit (PSU) type 66WK-P310/90-B, with an integral ballast circuit -B- and an external ballast resistor BAR375, is suitable for supplying the power for several servo amplifiers of type 65WKS-M310/xx-P0 (0 = without ballast circuit) and 66WKS-M310/xx-0.

	continuous rated current	pulse load capability
with convection cooling	30A	60A
with forced ventilation	90A	180A

Supply of multi-axis systems

The PSU supplies up to 90 A to the DC-link circuit, while the motors are driven by the servo amplifiers, with a much lower typical effective voltage. As a result, one PSU is able to power several amplifiers in a 19" rack system. If the simultaneity factor of the axes is <1 , then it is possible to supply 6 to 8-axis systems with a single PSU of this type.

Monitoring / protection

The mains power supply and the ballast resistor must be protected by fusing.

If an overload or undervoltage occurs then the floating BTB contact will open (terminals 1/2). Suppressor diodes are built into the instrument for protection against overvoltage.

Ballast circuit

The ballast circuits of the 65WKS-M310/xx-PB inverter must not be operated in parallel with a mains PSU of the 66WKS-P310/90-B series.

Minimum resistance value: The permissible pulse current in the ballast circuit is 90 A / 310 V. The minimum permissible value of resistance for the external ballast resistor is thus 4.7 Ohms.

Continuous load capability: The continuous load capability is basically determined by the ballast resistor, for BAR375, for example it is 375W. You can easily increase the ballast power, within the restrictions of the mimimum resistance value, by connecting more than one ballast resistor. Please note that the resistor R616 must be dimensioned according to the maximum permitted continuous power dissipation of the ballast resistor.

Fusing : In order to avoid overloading the ballast resistor by braking operations after the servo amplifier has been switched off, by mains overvoltage or an equipment failure, the ballast resistor must be protected by a 10 A slow-blow fuse.
For very high power applications, the ballast circuits of two PSUs can be clocked in parallel by connecting the synchronisation signals (terminal 3).

If there is no fusing, or excessive tolerance in the fuse value, then an overload of the ballast circuit can lead to damage to the electronics (see Technical Data).
It is therefore vital that you observe the maximum permissible values for continuous power in the ballast circuit.

Rough calculation of the ballast power (empirical formula) :

You must make a rough calculation of the expected ballast power, to avoid overloading the ballast circuit.

$$\text{peak ballast circuit power} > \frac{1}{3} \cdot \sum \text{peak power of all the amplifiers}$$

$$\text{continuous ballast circuit power} > 0{,}03 \cdot \sum \text{continuous power of all motors}$$

IV.4.2 Technical Data 66WKS-P

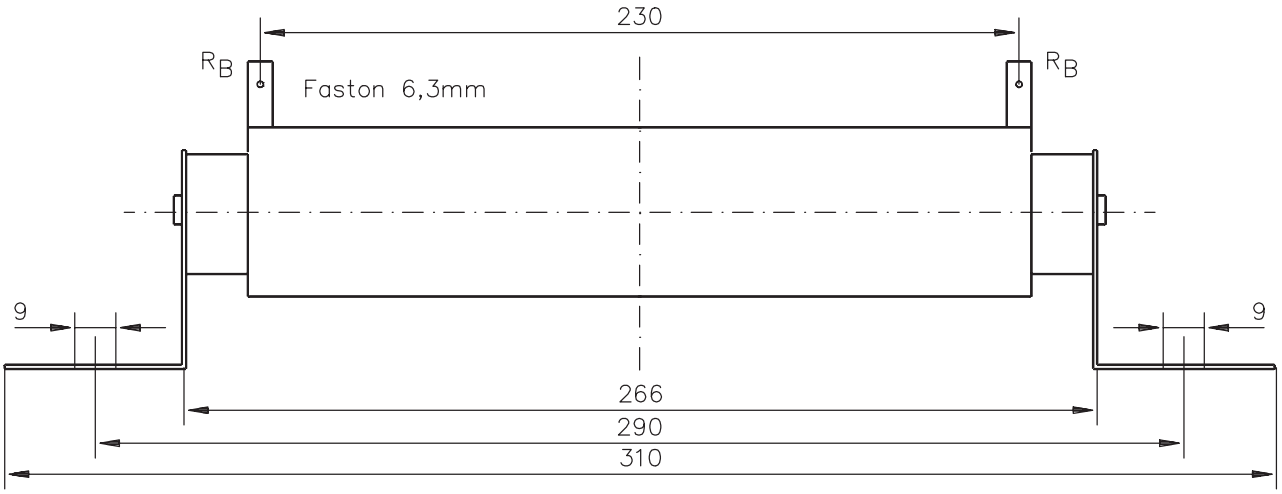
Rated data	Dim.	Power supply unit 66WKS-P310/90-PB
Rated mains supply (installation) voltage	V~	3 x 80—220 / 50 ... 60 Hz +max. 10 %
Rated installed power	kVA	25
Rated DC-link voltage	V=	310
Rated output DC, natural convection	A	30
Rated output DC, forced cooling	A	90
Peak output current (max. 5s), natural convection	A	60
Peak output current (max. 5s), forced cooling	A	180
Fusing for bridge rectifier, external	AT	3 x 63
Fusing for ballast circuit, external	AT	10
Rated capacity of the smoothing electrolytics	µF	1800
Power diss. at rated current (without ballast power)	W	250
Undervoltage threshold (BTB)	V	110
Ballast circuit BAR375		
Rated voltage	V	380
Continuous power (natural convection)	W	3000#
Continuous power (forced cooling)	W	5000#
Min. permissible ballast resistor (max. 90 A)	Ω	4.7
Pulse power for 1s	kW	30
Pulse power for 2s	kW	30
Pulse power for 5s	kW	20#
Ballast resistor external		
Continuous power (natural convection)	W	375
Continuous power (forced cooling)	W	500
Min. reistance value	Ω	4.7
Monitoring and display		
LED green for operational readiness		
LED yellow for ballast circuit		
Monitoring of ballast power / undervoltage by floating contact 100 V / 0.1 A		
Connections		
Plug-in module	-	2 plug connectors DIN 41612, type E48
Backplane undervoltage signalling	-	plug-in terminal MSTB 2,5
power signals	-	M6 studs / terminals
Ballast resistor BAR375	-	faston 6.3 mm
Mechanical		
Weight of plug-in module	kg	1.2
Dimensions (double Eurocard, 10 TE-units)	mm	220 x 233.4 x 50
Weight BAR375	kg	1
Dimensions BAR375	mm	310 x 75 x 35

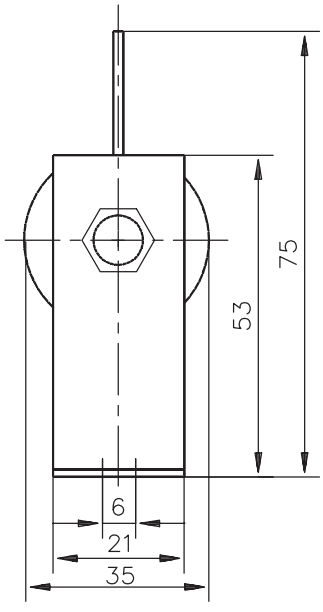
= limited in normal operation by the permitted power dissipation of the ballast resistors

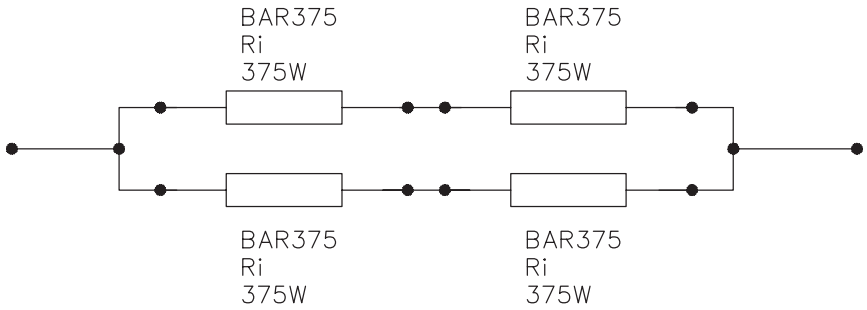
IV.4.3 Power supply unit backplane N66WKSMB/RN66WKSMB

Socket 2 E48 above	Socket 1 E48 below	Signal designation	Connector MSTBW3
2-14ace	—	DC-link voltage+Ucc	—
16-26ace, 28ac	—	DC-link voltage -/GND	—
16-26ace, 28ac	—	Ballast resistor - (RB-)	—
30-32ac	—	Ballast resistor + (RB+)	—
30,32e	—	Undervoltage signal	1,2
28e	—	Synchronisation signal	3
—	2-10ace,11e	Mains supply voltage U1 (L1)	—
—	12ac, 14-20ace, 22ce	Mains supply voltage V1 (L2)	—
—	24-32ace, 22a	Mains supply voltage W1 (L3)	—

IV.4.4 Ballast resistor BAR375

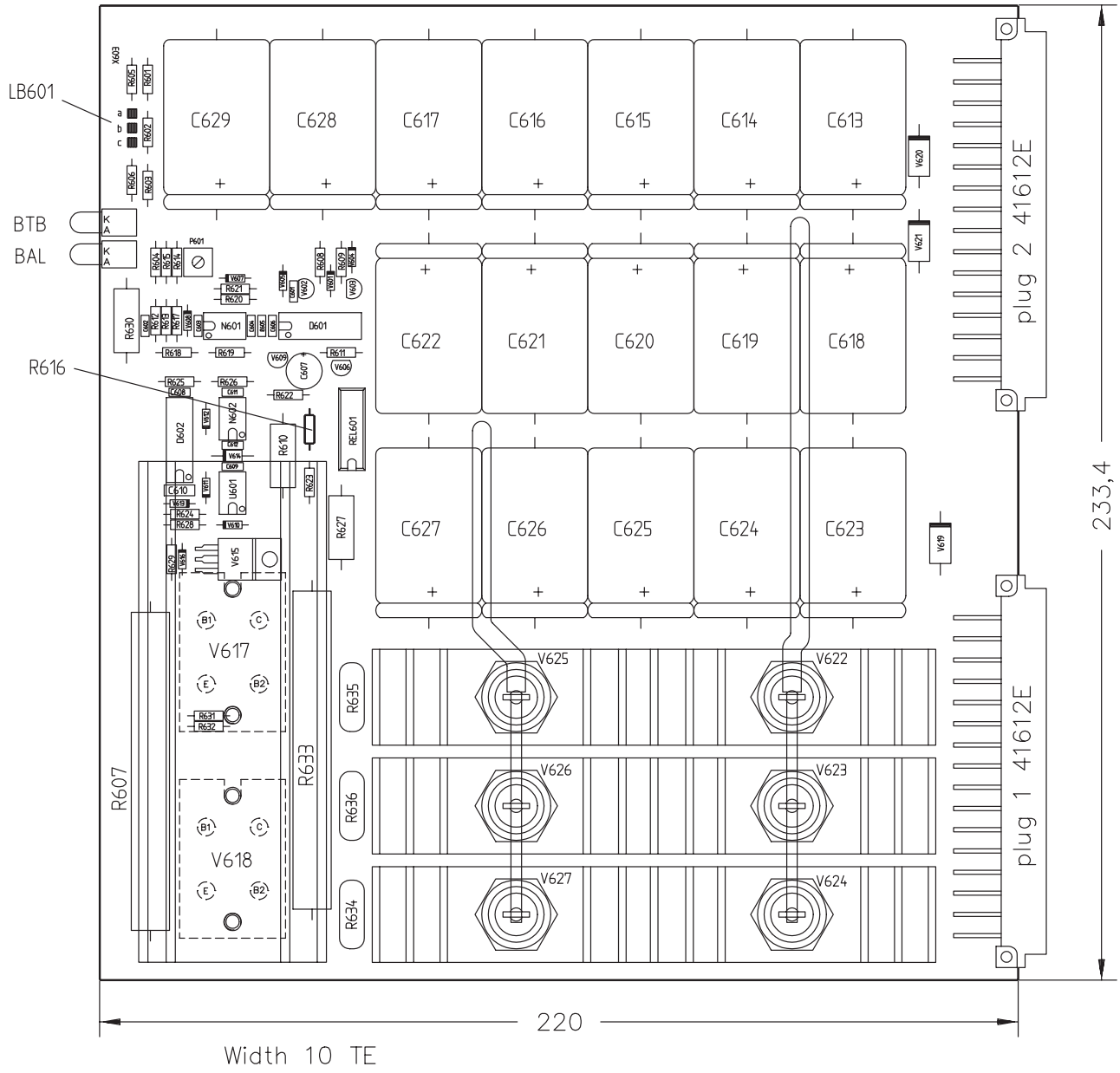






Ri = Rges
Pi = 375W
Pges = 1500W

IV.4.5 Component layout diagram 66WKS-P



LB601 open (Ucc=310V), R_{Bmin}=4,7 Ω

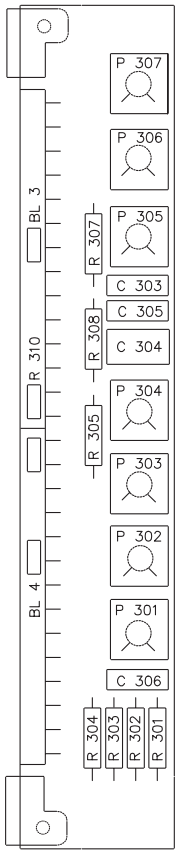
P_{BAL}	BAR 375	R616
400 W	1 x R_{Bmin}	470 kΩ
1500 W	4 x R_{Bmin}	2,2 MΩ

V Drawings

V.1 Custom board 65WKS/66WKS, form

Customer	Commission	Name	Material–No.

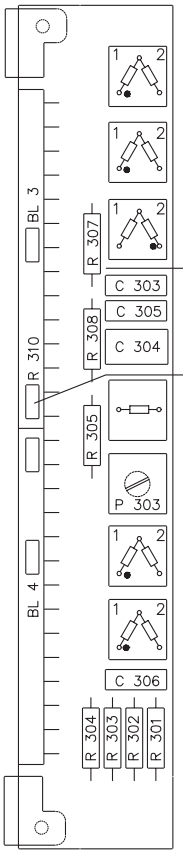
position of potentiometers



adjustment

I RMS (0...In)	= _____	A
I PEAK (0...In)	= _____	A
AC – GAIN	= _____	%
VP–(Gain)	= _____	x
TI (R307 x C304)	= _____	ms
TACHO	= _____	min^{-1}
OFFSET		
INPUT 2	= _____	V
RAMP (OPTION)	= _____	ms
T RAMP		
VTA (Tacho)		

fixed components



1 = _____ kΩ
2 = _____ kΩ
1 = _____ kΩ
2 = _____ kΩ
1 = _____ kΩ
2 = _____ kΩ
= _____ kΩ
= _____ nF
= _____ kΩ
= _____ kΩ
1 = _____ kΩ
2 = _____ kΩ
1 = _____ kΩ
2 = _____ kΩ
= _____ nF
= _____ kΩ

• reference point AGND

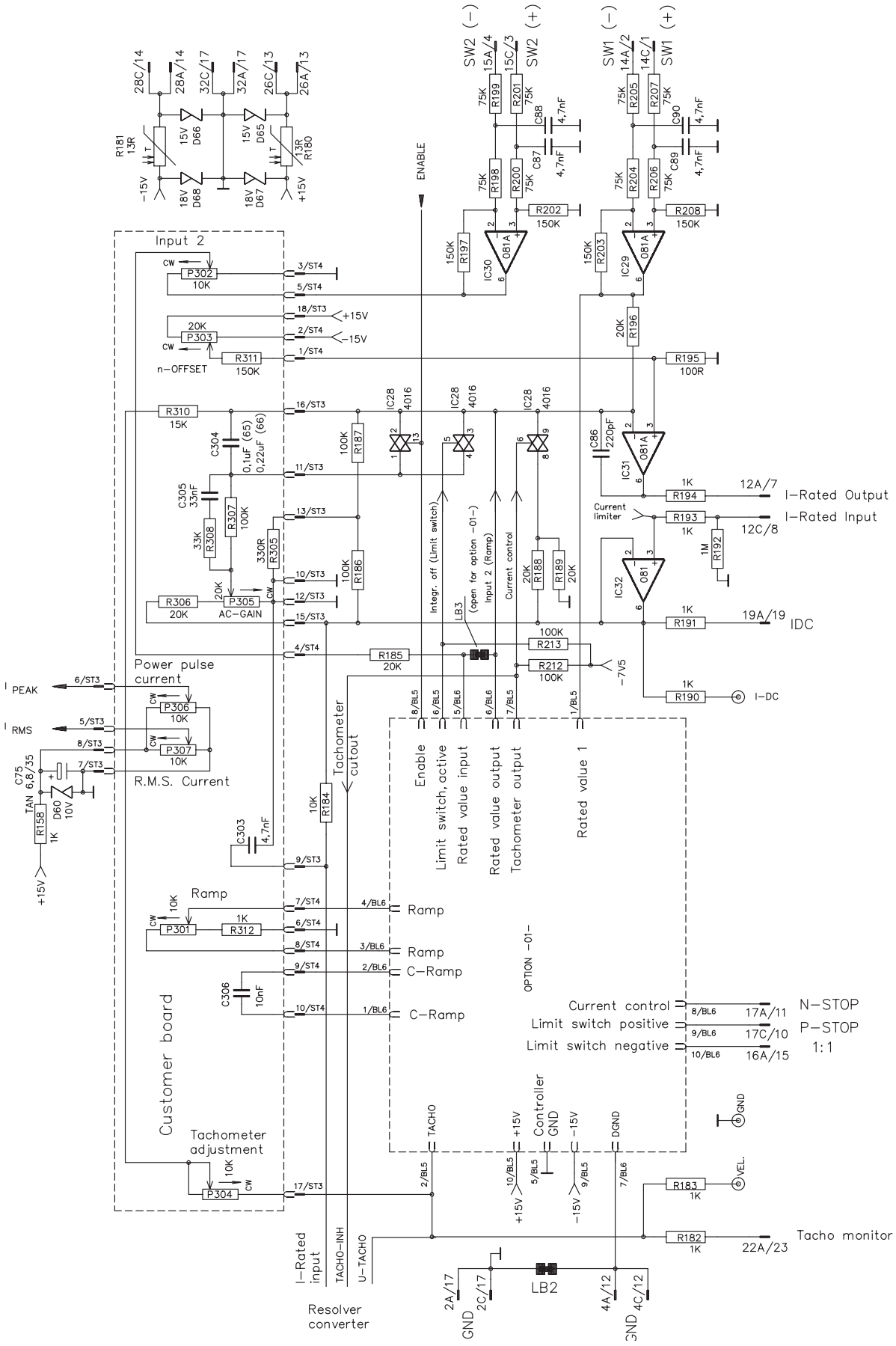
standard components

component / amplifier	R301...R304(0,5%)	C304	R307	C306	R310
65WKS	16,5k	100n	100k	10n	15k
66WKS	16,5k	220n	100k	10n	15k

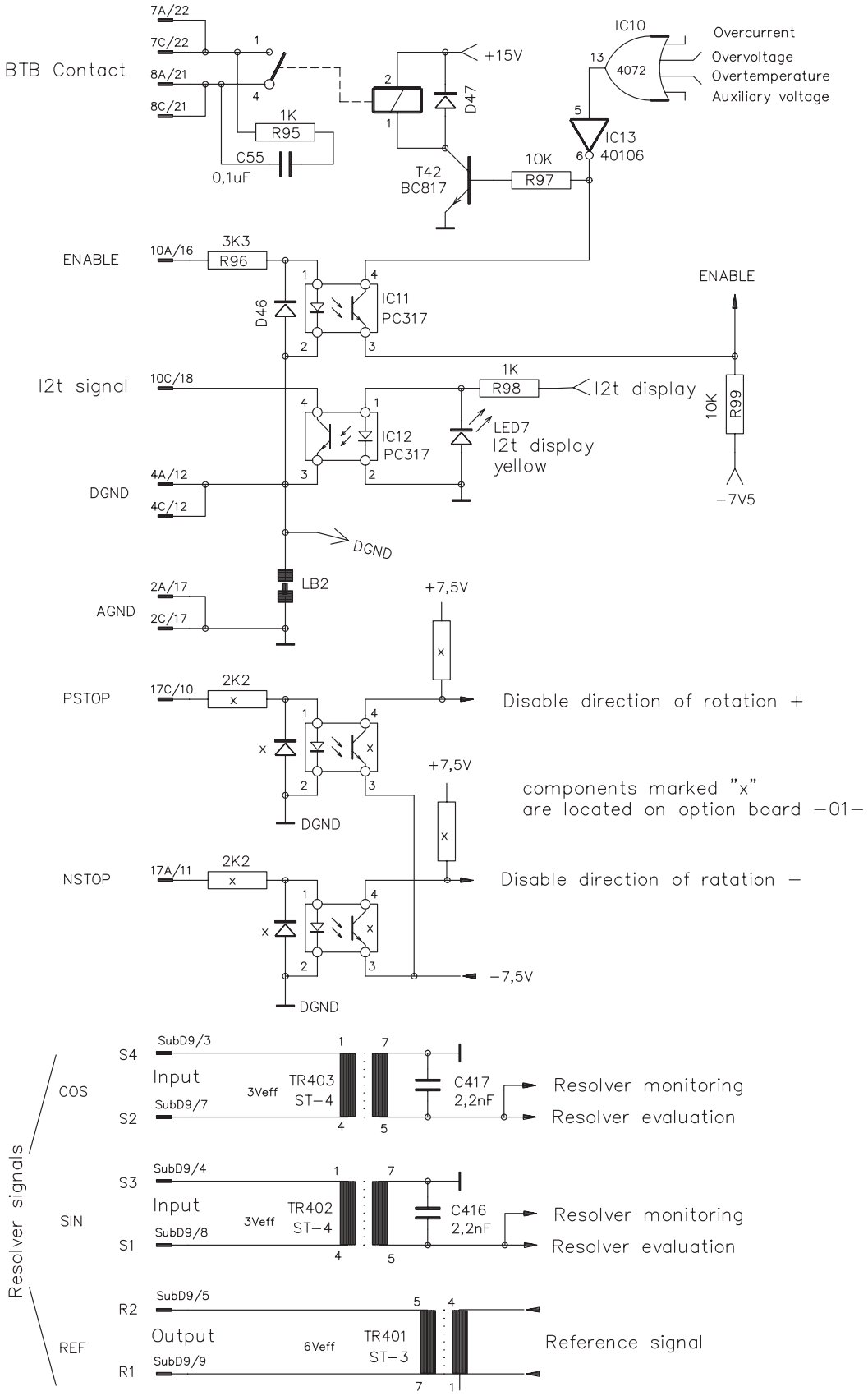
Remarks:

Date	Components	Reason

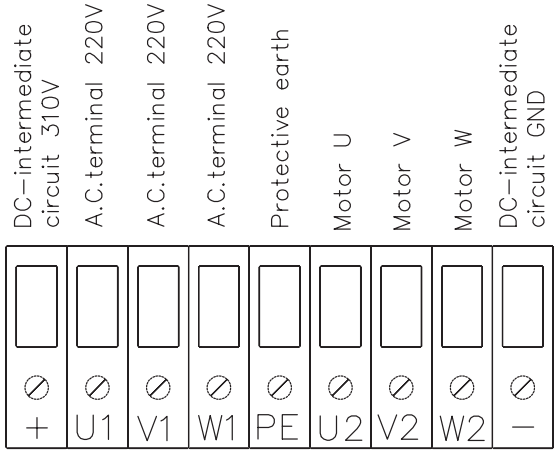
V.2 Speed control circuit 65WKS/66WKS

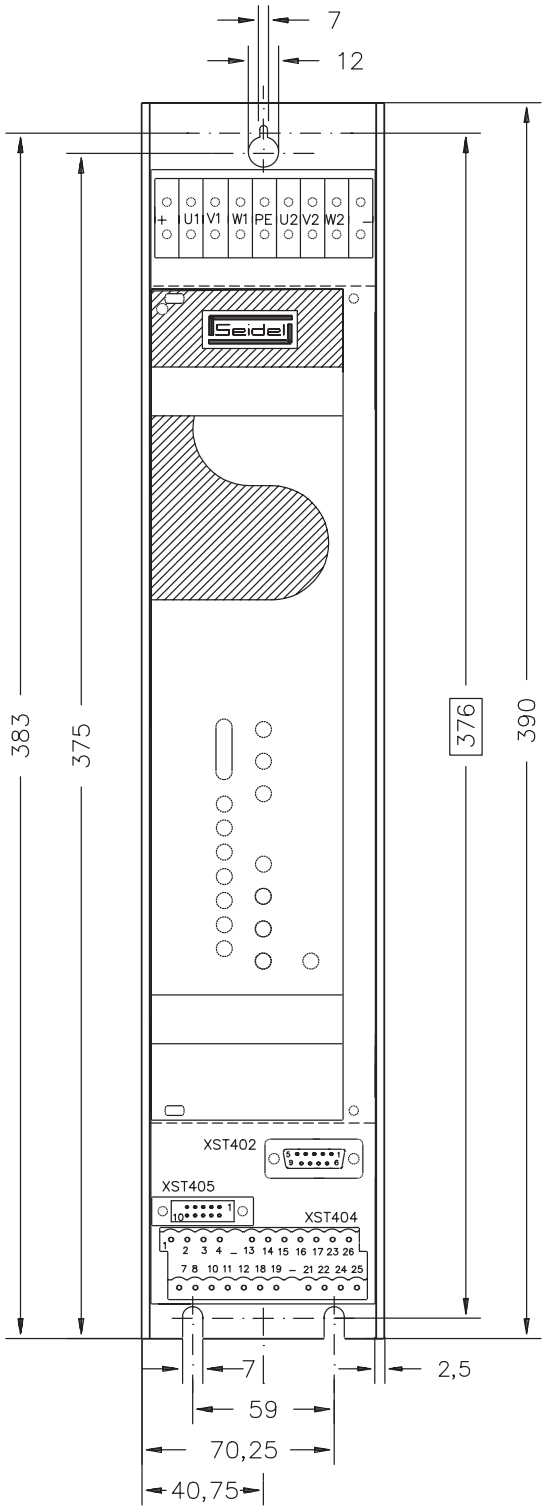


V.3 Input circuit 65WKS/66WKS

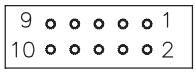


V.4 Frontal view and pin assignments for K1.1-L with 65WKS

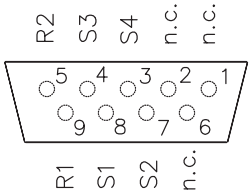




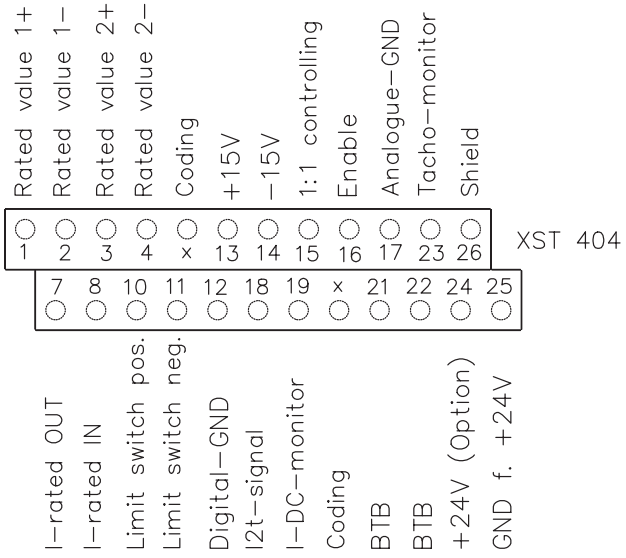
Assignment depending on interface board used (ROD426 or SSI)



10 pol. Post connector
XST 405



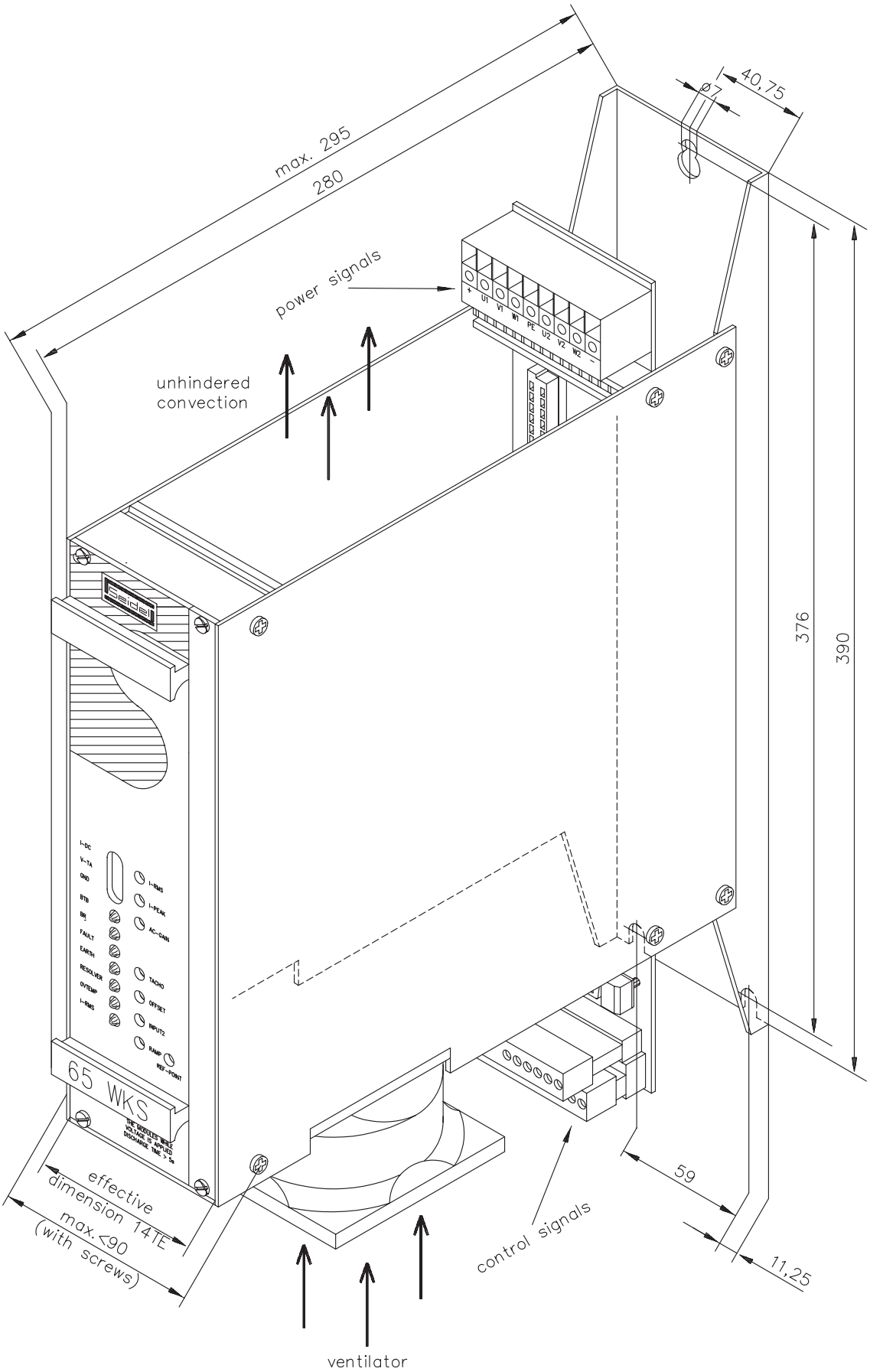
Sub D 9 pole female
XST 402



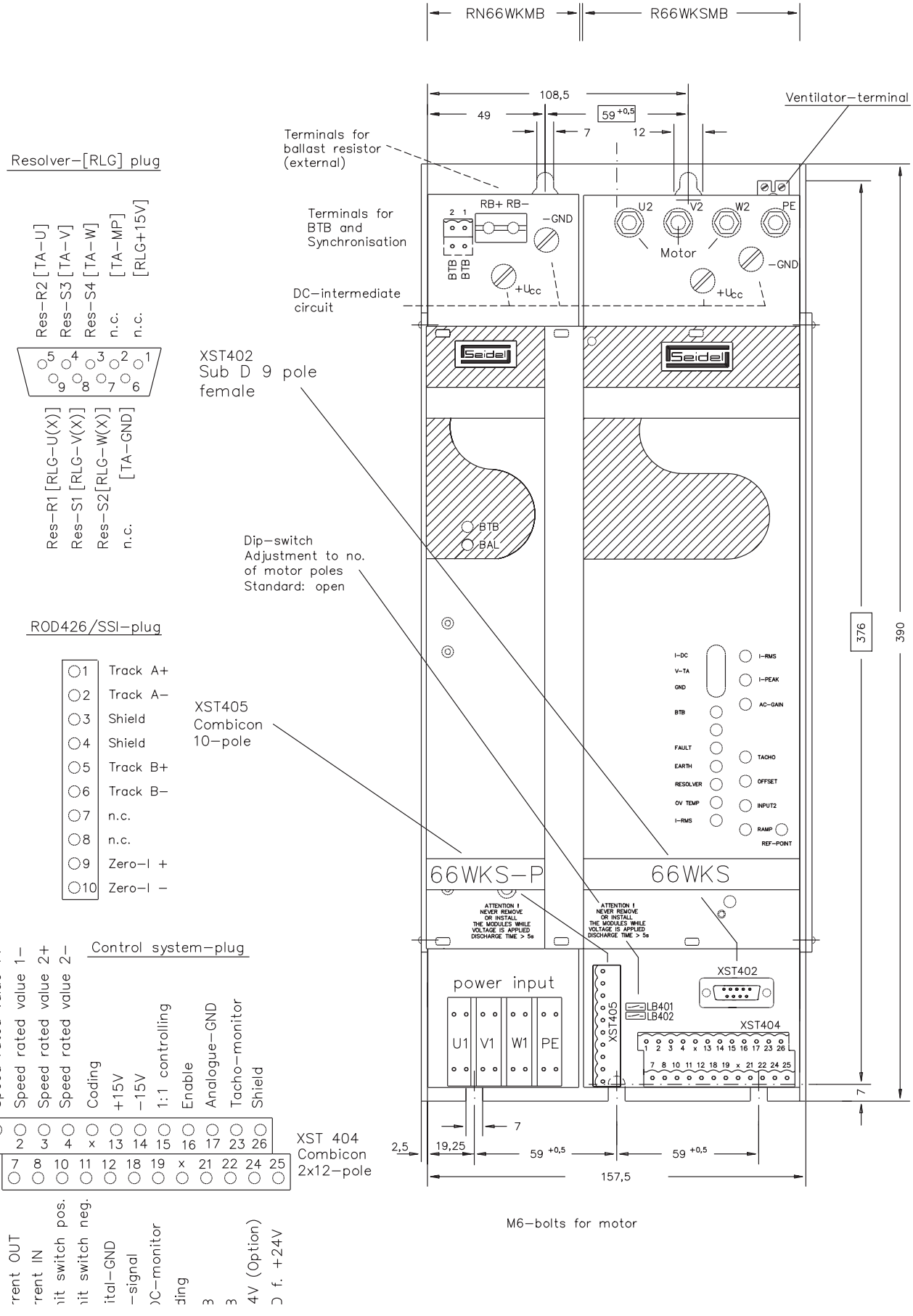
XST 404

Front view of Combicon connector

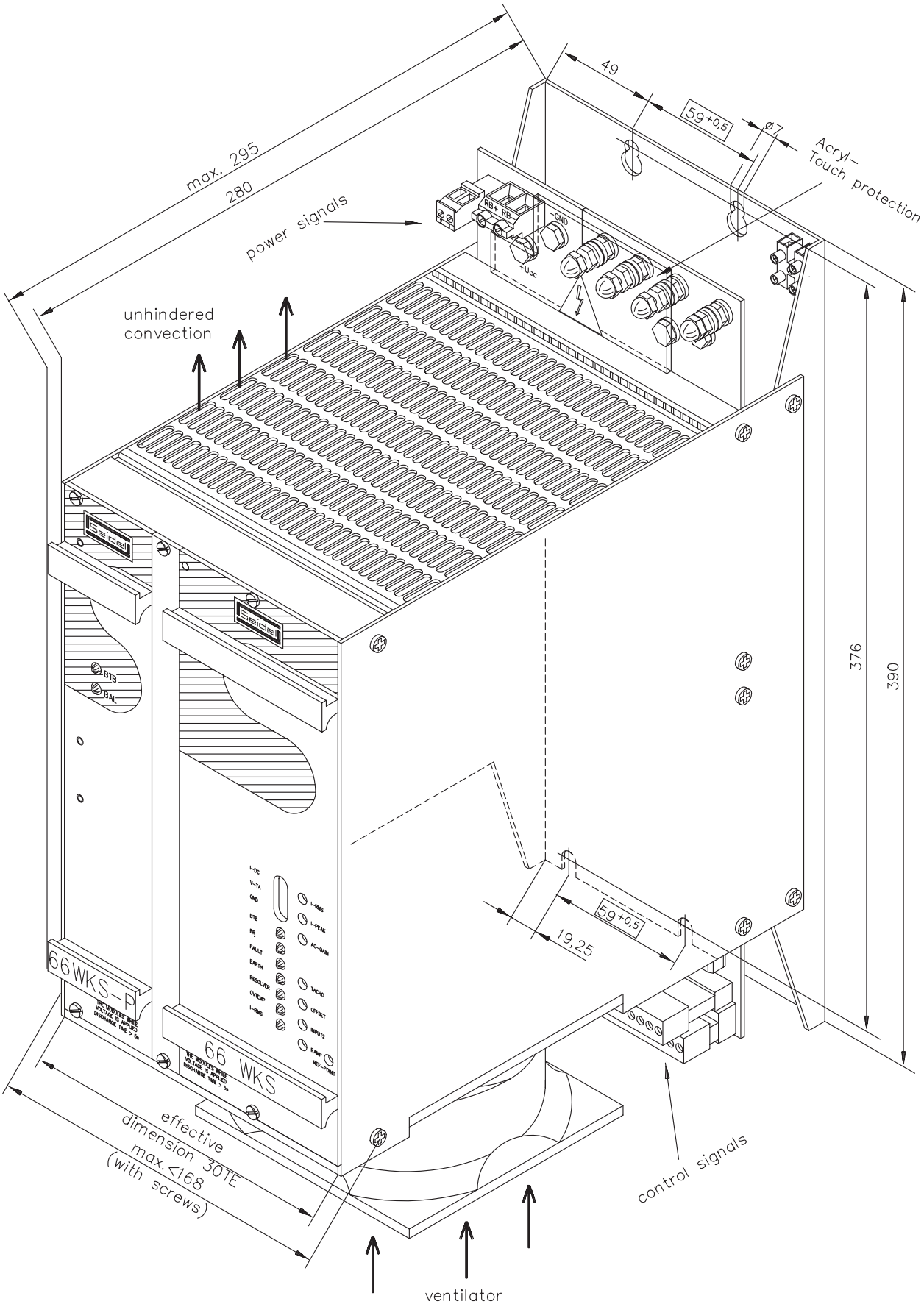
V.5 Illustration of K1.1-L with 65WKS



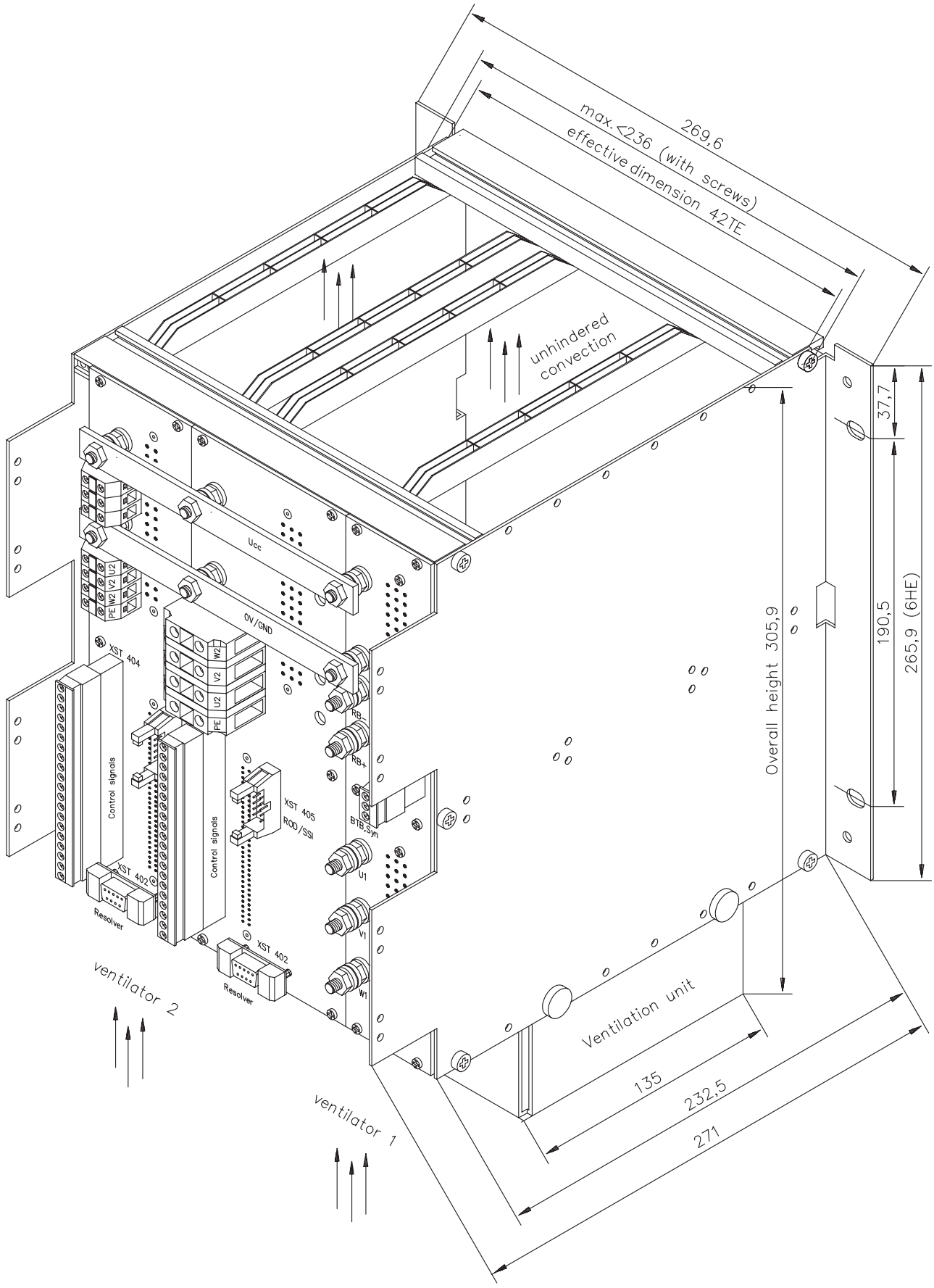
V.6 Frontal view and pin assigments for K2-L with 65/66WKS



V.7 Illustration of K2-L with 65/66WKS



V.8 19"-rack module 6B42/F+2L42 with 65/66WKS, rear view



VI Appendix

VI.1 Delivery package, transport, storage, maintenance, disposal

Delivery package :
— Servo amplifier from the 65WKS or 66WKS series
— 2 ring cores
— Installation / commissioning manual for 65/66WKS
— Accessories as ordered (back-panels, ballast resistors, 19" parts)

Transport :
— Only by qualified personnel
— Only in the manufacturer's original recyclable packaging
— Avoid shocks
— The servo amplifier contains electrostatically sensitive components, which can be damaged by incorrect handling.
Discharge yourself before touching the servo amplifier.
Avoid contact with highly insulating substances (man-made fibres, plastic sheet etc.). Place the servo amplifier on a conductive surface.
— If there is damage to the packaging, check the unit for visible damage. Inform the shipping agent and the manufacturer.

Storage :
— Only in the manufacturer's original recyclable packaging
— The servo amplifier contains electrostatically sensitive components, which can be damaged by incorrect handling.
Discharge yourself before touching the servo amplifier.
Avoid contact with highly insulating substances (artificial fabrics, plastic film etc.). Place the servo amplifier on a conductive surface.
— max. stacking height amplifier 65WKS : 15 cartons
amplifier 66WKS : 10 cartons
PSU 66WKS-P : 15 cartons
— Storage temperature –25 ... +85 °C, max. 20 °C/hour variation
— Humidity relative humidity max. 95 % no condensation
— Storage time < 1 year without restriction
> 1 year: capacitors must be **re-formed** before operating the servo amplifier.
Information about this procedure can be obtained from our service department.

Maintenance :
— The units do not require any maintenance.

Cleaning :
— If the front panel is dirty : cleaning with Isopropanol or similar
do not dip or spray
— If the unit has dirt inside : cleaning by the manufacturer

Disposal :
— The servo amplifier can be reduced to its principal components (aluminium heat sink and front panel, electronics boards) by unscrewing.
— Make sure that the disposal is carried out by a certified disposal company. Ask us for addresses.

VI.2 Fault-finding

The following table should be seen as a “First-Aid” box. There can be a large number of different reasons for a fault, depending on the conditions in your system.

In multi-axis systems there may be further hidden causes for faults.

Our applications department can give you further help with your problems.

Fault	Possible cause	Measures to remove the cause of the fault
LED1 (BTB) does not light up	— Supply voltage interrupted	— 65WKS : check U1,V1,W1 66WKS : check +Ucc, 0V/GND –24V- : check 24 V supply
	— Fuse F1, F3 or F4 blown	— replace fuse
LED 3 (FAULT) lights up	— Motor fault	— Replace motor
	— Motor cable fault	— Replace motor cable
	— Output stage too hot	— Ensure unhindered ventilation, check/clean ventilator, reduce cabinet temperature
	— Amplifier fault	— Return amplifier to manufacturer
LED 4 (EARTH) lights up	— Motor fault (earth fault)	— Replace motor
	— Motor cable fault (earth fault)	— Replace motor cable
	— Amplifier fault	— Return amplifier to manufacturer
LED 5 (RES) lights up	— Resolver connector not properly plugged in	— Check connector
	— Resolver cable is broken, crushed or similar	— Replace cabling
	— Wrong type of resolver in motor	— See Chapter IV.1.1
LED 6 (OVTEMP) lights up	— Output stage too hot	— Ensure unhindered ventilation, check/clean ventilator
	— Ambient temperature too high	— Reduce cabinet temperature
Motor doesn’t rotate, no torque on the shaft	— Enable signal missing	— Check wiring
	— DGND missing	— Check wiring, check LB2
	— P307 at left stop	— See table in Chapter III.2.3.6
	— Link XST404/7-8 missing	— Check wiring
Motor doesn’t rotate, but torque on the shaft	— Setpoint lead break	— Check setpoint lead
	— Motor phases in wrong sequence	— Connect motor phases correctly
	— Brake not released	— Check brake controls
	— Drive mechanically jammed	— Check mechanism
	— No. of motor poles set incorrectly	— Set solder links LB401/402
	— Wrong type of resolver	— See Chapter IV.1.1
Motor runs away	— Motor cable faulty	— Connect motor phases correctly
	— Resolver connection faulty	— Connect resolver correctly
	— Resolver incorrectly adjusted	— Repair the motor
Motor oscillates	— AC-gain too high	— Turn AC-gain pot. to left (CCW)
	— Shielding break in resolver lead	— Replace resolver lead
	— AGND not wired up	— Join AGND and CNC-GND

VI.3 Glossary

A	AC-gain, P-gain	proportional gain of a control loop
B	Ballast circuit	converts excess regenerative energy from the motor during braking into heat in the ballast resistor.
C	Common-mode voltage	amplitude of the disturbance which can be eliminated in an analog input
	Continuous ballast power	average power which can be dissipated by the ballast circuit
	Current controller	regulates the difference between the current setpoint and the actual current value to 0 . Output : power output voltage
D	DC-link	rectified and smoothed power DC voltage
	Disable	removal of the ENABLE signal (0V or open)
E	Earth fault (earth short)	electrically conductive connection between a phase and PE
	Enable	enable signal for the servo amplifier (+24 V)
F	Final speed	max. value of normalised speed at ±10 V
G	GRAY-code	special form of binary encoding
H	Holding brake	a brake in the motor which must only be activated at standstill
I	Input drift	temperature and age-dependent drift of an analog input
	I^2t threshold	monitoring of the actually required effective (Irms) current
	Incremental encoder interface	position signal by 2 signals with a 90° phase difference
	Ipeak, peak current	effective value of the pulse current
	Irms, effective current	effective value of the continuous current
L	Limit switch	limit switch for the traverse path of the machine; function: open
M	Machine	the sum of all components which are connected together and of which at least one is moveable
	Mains filter	external device to divert disturbances on the power supply leads to PE
	Multi-axis system	a machine with several independent drive axes
	Monitor output	output of an analog measurement value
N	Natural convection	free air movement for cooling
O	Optocoupler	optical connection between two electrically independent systems
P	P-controller	control loop with purely proportional characteristic
	Phase shift	compensation for the phase lag between the electromagnetic and magnetic fields in the motor
	PID-controller	a control loop with proportional, integral and differential characteristics
	Potential isolation	electrically decoupled
	Power contactor	system protection with phase-failure monitoring
	Pulse power of the ballast circuit	maximum power which can be dissipated by the ballast circuit
R	Resolver-digital converter	conversion of the analog resolver signals into digital information
	Reversing mode	operation with a periodic change of direction
	Ring core	ferrite ring(s) for interference suppression
S	Servo amplifier	device for controlling the speed and torque of a servo motor
	Short circuit	here: electrically conductive connection between two phases
	Speed controller	regulates the difference between the speed setpoint SW and the actual value of speed to 0. Output : current setpoint
	SSI-interface	cyclically absolute, serial positional information
	SW ramps	limitation of the rate of change of the speeed setpoint SW
T	T-Tacho, tachometer time constant	filter time constant in the speed feedback of the control loop
	Tachometer voltage	a voltage which is proportional to the actual speed value
	Thermal cut-out contact	a temperature-sensitive switch built into the motor winding
Z	Zero pulse	is produced once per turn by incremental encoders, used to establish the zero point for the machine

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