#502-PD-RS-001-00

# *INSTALLATION MANUAL*

***FOR***

## *PosiDrive™ Series RS*

## DIGITAL SERVO MOTOR CONTROL & AMPLIFIER


**Force Control Industries, Inc.**

**WARNING – Read this manual before attempting any installation of the *PosiDrive* Digital Servo Motor Control and Amplifier.**

## Record of Manual Revisions

| ISSUE NO. | DATE | BRIEF DESCRIPTION OF REVISION |
|---|---|---|
| 00 | 03/02 | Initial release |



## Copyright Information



## NOTICE:

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# Safety Instructions

Only qualified personnel are permitted to transport, assemble, operate, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, maintenance and operation of motors, and who have the appropriate qualifications for their jobs. The qualified personnel must know and observe the following standards and regulations:

IEC 364 resp. CENELEC HD 384 or DIN VDE 0100
IEC report 664 or DIN VDE 0110
National regulations for safety and accident prevention or VBG 4

Read all available documentation before assembling and using. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information regarding installation requirements.

It is vital to ensure that all system components are connected to earth ground. Electrical safety is provided through a low-resistance earth connection.

The ***PosiDrive Series RS*** product contains electrostatically sensitive components that can be damaged by incorrect handling. Avoid contact with high insulating materials (artificial fabrics, plastic film, etc.). Place the product on a conductive surface. Ground yourself (discharge any possible static electricity build-up) by touching an unpainted, metal, grounded surface before touching the equipment.

Keep all covers and cabinet doors shut during operation. Otherwise, potential hazards could cause severe personal injury or damage to the product.

Be aware that during operation, the product has electrically charged components and hot surfaces. Control and power cables can carry a high voltage, even when the motor is not rotating.

Never disconnect or connect the product while the power source is energized to avoid electric arcing and hazards to personnel and electrical contacts.

After removing the power source from the equipment, wait at least 10 minutes before touching or disconnecting sections of the equipment that normally carry electrical charges (e.g., capacitors, contacts, screw connections). To be safe, measure the electrical contact points with a meter before touching the equipment.

The safety-alert symbols indicate a potential for personal injury or equipment damage if the recommended precautions and safe operating practices are not followed. Read and be familiar with the safety notices in this manual before attempting installation, operation, or maintenance to avoid serious bodily injury, damage to the equipment, or operational difficulty. They are:

"**Warning**" identifies hazards that could result in personal injury or death.

"**Caution**" identifies hazards that could result in personal injury or equipment damage.

"**Note**" identifies information critical to your understanding or use of the equipment.

# Directives and Standards

The ***PosiDrive Series RS*** product series has been successfully tested and evaluated to meet UL/cUL 508C for U. S. and Canadian markets. This standard outlines the minimum requirements for electrically operated power conversion equipment (frequency converters and servo amplifiers), which are intended to eliminate the risk of fire, electric shock, or injury to persons, being caused by such equipment.

# CE Mark Conformance

Servo drives are incorporated in electrical plants and machines for industrial use. When the servo drives are built into machines or plants, the operation of the drive is prohibited until the machine or plant meets the requirements of the EC Directive on Machines 89/392/EEC and the EC Directive on EMC (89/336/EEC). EN 60204 and EN 292 must also be met.

In connection with the Low Voltage Directive 73/23/EEC, the harmonized standards of the EN 50178 series are applied to the amplifiers, together with EN 60439-1, EN 60146 and EN 60204.

The manufacturer of the machine or plant is responsible for ensuring that they meet the limits; which are required by the EMC regulations. Advice on the correct installation for EMC - such as shielding, grounding, arrangement of filters, treatment of connectors and the lay out of cabling can be found in this documentation.

Conformance with the EC Directive on EMC 89/336/EEC and the Low Voltage Directive 73/23/EEC is mandatory for the supply of servo drives within the European Community.

The servo drives have been tested by an authorized testing laboratory in a defined configuration with the system components; described in this documentation. Force Control is not responsible for any divergence from the configuration and installation described in this documentation and is not responsible for the performance of new measurements or ensuring that regulatory requirements are met.

Force Control's ***PosiDrive*** drives and systems have been successfully tested and evaluated to the limits and requirements of the EC Directive on EMC (89/336/EEC) and the EC Directive on Low Voltage (72/73/EEC). The product lines have been evaluated to EN50178 and EN60204 as a component of a machine and other relevant standards.

The Electromagnetic Compatibility (EMC) of a system is identified in two parts: emissions and immunity. Emissions are the generation of EMI (electromagnetic interference) and immunity is the susceptibility levels of the equipment. Limits are derived from generic standards EN55081-2 and EN55082-2 for heavy industrial environment. The ***PosiDrive*** series of drives and BUS Modules have been tested for radiated emissions, conducted emissions, EFT, ESD, surge, conducted immunity, and radiated immunity. These tests have been in accordance with EN55011, EN61000-4-2, ENV50140, IEC 1000-4-4, EN61000-4-5, and ENV50141.

Installation of the equipment is critical in designing system and machine electromagnetic compatibility (EMC). The user must apply the installation recommendations in this manual. See the sections on Installation Practices and CE Filtering when mounting and installing the drive system for CE conformance.

**UL 508C** describes the fulfillment by design of minimum requirements for electrically operated power conversion equipment, such as frequency converters and servo amplifiers, which is intended to eliminate the risk of fire being caused by such equipment.

**UL 840** describes the fulfillment by design of air and insulation creepage spacing for electrical equipment and printed circuit boards.

# General Information

This manual describes the digital servo amplifiers of the ***PosiDrive®* Series RS** (standard version). You can find information about:

Technical Data of the Servo Amplifier
Installation
Interfaces
Operating the Servo Amplifier
Accessories
Transport, Storage, Maintenance, Disposal of The Servo Amplifier

A more detailed description of the expansion cards are currently available and the digital connection to automation systems can be found on our Web Site “www.forcecontrol.com” in Acrobat-Reader format (system requirements: WINDOWS 95 with Internet browser, Acrobat Reader 5.0) in English, German, Italian, Spanish and French versions. You can print this documentation on any standard printer. A printed copy of the documentation is available from us at an extra cost.

The abbreviations used in this manual are explained in the table below

| Abbr. | Meaning | Abbr. | Meaning |
|---|---|---|---|
| Analog Ground | Analog ground | Digital In 4 | Digital Input 4 |
| Ready Output | Ready to operate | PC-AT | Personal computer with 80x86 Processor |
| CE | Communité Européenne (EC) | PELV | Protected low voltage |
| CLK | Clock signal | PGND | Ground for the interface |
| COM | Serial interface for a PC-AT | Digital In 3 | Digital Input 3 |
| Digital Ground | Digital ground | PWM | Pulse-width modulation |
| DIN | German Institute for Standards | RAM | Volatile memory |
| Disk | Magnetic storage (hard disk) | Rregen | Regen resistor |
| EEPROM | Electrically erasable programmable memory | Rbext | External regen resistor |
| EMV | Electromagnetic compatibility | Rbint | Internal regen resistor |
| EN | European standard | RES | Resolver |
| ESD | Electrostatic discharge | PLC | Programmable logic controller |
| IEC | International Electrotechnical Commission | SRAM | Static RAM |
| IGBT | Insulated Gate Bipolar Transistor | SSI | Synchronous serial interface |
| INC | Incremental Interface | SW/SETP. | Setpoint |
| ISO | International Standardization Organization | UL | Underwriters Laboratory |
| LED | Light-emitting diode | VAC | AC voltage |
| MB | Megabyte | VDC | DC voltage |
| MS-DOS | Operating system for PC-AT | VDE | Verein deutscher Elektrotechniker |
| NI | Zero pulse | XGND | Ground for the 24V supply |
| E-Stop | Emergency Stop | | |

Function Keys on the servo amplifier panel :

▲ **press once** : move up one menu item, increase number by one
**press twice in rapid succession** : increase number by ten

▼ **press once** : move down one menu item, decrease number by one
**press twice** in rapid succession : decrease number by ten

▲▼ **hold right key pressed, and then press left key as well** :to enter number, “Return” function

# USE AS DIRECTED

Servo amplifiers are components that are built into electrical equipment or machines, and can only be operated as integral components of such equipment. The manufacturer of the machine must generate a hazard analysis for the machine, and take appropriate measures to ensure that unforeseen movements cannot cause injury or damage to any person or property.

The family of servo amplifiers is to be used only on grounded, three-phase industrial main supply networks ( TN-system, TT-system with grounded neutral point, not more than 5000 rms symmetrical amperes). The servo amplifiers must not be operated on power supply networks without a ground or with an asymmetrical ground.

If the servo amplifiers are used in residential areas, or in business or commercial premises, additional filter measures must be implemented. The family of servo amplifiers is only intended to drive specific brushless synchronous servomotors from the ***PosiDrive Series RS***, with closed-loop torque control, speed and/or position. The rated voltage of the motors must be at least as high as the DC-link voltage of the servo amplifier.

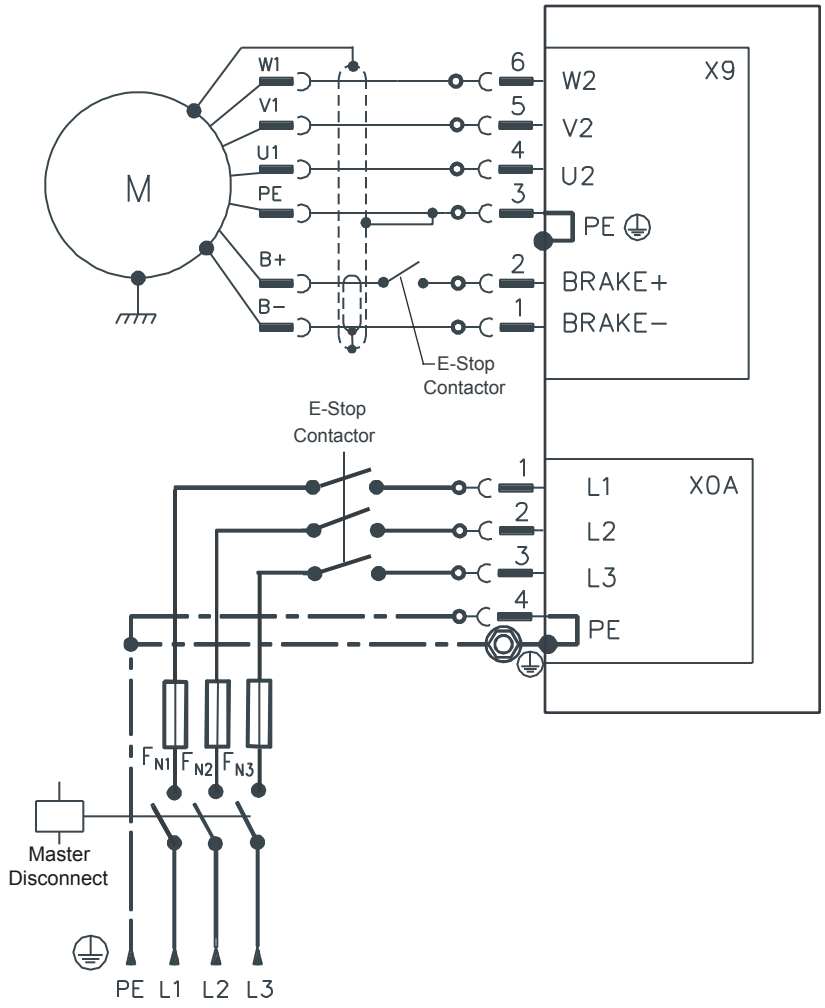
The servo amplifiers may only be operated in a closed switch gear cabinet, taking into account the defined ambient conditions. Ventilation or cooling may be necessary to prevent enclosure ambient from exceeding 45°C (113°F).

Use only copper wire. Wire size may be determined from EN 60204 (or table 310-16 of the NEC 60°C (140°F) or 75°C (167°F) column for AWG size).

Force Control only guarantees the conformance of the servo amplifiers with the standards for industrial areas, if the components (motors, cables, amplifiers etc) are delivered by Force Control Industries, Inc.

# EMERGENCY STOP (E-STOP) - *PosiDrive*.

The following drawing shows a typical circuit for an **Emergency Stop Condition**. The motor power is cut, which will totally disable the motor. The power is also cut to the brake (If Equipped). The motor must be allowed to come to a complete stop before anyone enters the machine. Drives with a suspended load must have an additional mechanical device to hold the load before anyone enters the machine.



# NAMEPLATE & MODEL NUMBER

The nameplate depicted below is attached to the side of the servo amplifier. The information described below is printed in the individual fields.


## *PosiDrive* Series RS CONTROL MODEL NUMBER

01-59- [R] [S] [-] [1] [2] [3] [4] [5] [6] [7] [8] [9]

SERIES RS

ENGINEERING (8, 9) REVISION

AMPS (1, 2)

| | | |
|---|---|---|
| 0 | 3 | = 3 Amps |
| 0 | 6 | = 6 Amps |
| 1 | 0 | = 10 Amps |
| 1 | 4 | = 14 Amps |
| 2 | 0 | = 20 Amps |
| 4 | 0 | = 40 Amps |
| 7 | 0 | = 70 Amps |

FEEDBACK (3)

| | |
|---|---|
| R | = Resolver |
| E | = Encoder, Incremental |

VOLTAGE (4)

| | |
|---|---|
| 3 | = 230-460 VAC |

OPTIONS (6)

| | |
|---|---|
| N | = None |
| E | = Extended I/O |

CONFIGURATION (5)

| | |
|---|---|
| S | = Standard |

# PRODUCT

When you order a ***PosiDrive Series RS*** Servo Control and Amplifier, you will receive:

— ***PosiDrive Series RS***

— Mating connectors X3, X4, X0A, X0B, X7, X8

***The mating SubD connectors and motor connector X9 are not part of the package!***

— Installation and Operation Instructions

**Accessories** (must be ordered separately, if required)

— Servomotor ***PosiDrive***

— Preassembled motor cable or both motor connectors separately with motor cable as cutoff length

— Preassembled feedback cable or both feedback connectors separately, with feedback cable as length (see Application Note, *Cables and Connectors*)

— Motor choke for cable length above 25m (see page 67)

— Communications cable to the PC (page 44) or Y-adapter (page 52) for setting parameters of up to 6 servo amplifiers from one PC

— External Regen resistor

— Power cable, control cables, fieldbus cables (as lengths)

# *Digital Servo Amplifiers*

**Standard Version**

6 current ratings (1.5 A, 3 A, 6 A, 10 A, 14 A, 20 A)
three instrument widths : 70 mm for 1.5A up to 10A rated current
100 mm for 14A rated current
120 mm for 20A rated current
wide range of rated voltage (3x208V –10% to 3x480V +10%)
shield connection directly at the servo amplifier
two analog setpoint inputs
integrated CANopen (default 500 kBaud), for integration into CANbus systems and for setting parameters for several amplifiers via the PC-interface of one amplifier
integrated pulse-direction interface

**Options**

I/O expansion card, see p. 57
PROFIBUS DP expansion card, see p. 61
SERCOS expansion card, see p. 63
-2CAN- Expansion module, separated connectors for CAN bus and RS232, see p. 65

**Open Architecture**

open hardware and software architecture
slot for an expansion card
integrated macro language, including compiler
prepared for all conceivable customer-specific extensions

# *Operating Directly From Supply*

**Electrical Supply**

Directly off grounded 3 phase system,
230V-10% to 480V+10%, 50 Hz,
208V-10% to 480V+10%, 60 Hz
TN-system or TT-system with grounded neutral point, not more than 5000 rms symmetrical amperes
Fusing (e.g., fusible cutout) provided by the user
single-phase supply (e.g., for operation or setting-up) is possible

**Auxiliary Supply Voltage 24VDC**

Electrically isolated, from an external 24VDC psu, (e. g., with insulating transformer)

**Power Input Filter**

Interference suppression filter for the supply input (to Class A) is integrated
Interference suppression filter for the 24V aux. supply (to Class A) is integrated

# *Digital Servo Amplifier Concept*

**Operation and Parameter Setting**

The amplifier can be configured and monitored with the *PosiDrive* HMI (Human Machine Interface)

With the comfortable setup software through the serial interface of a PC

Direct operation by means of two keys on the servo amplifier and a 3-character LED display for status display in case there is no PC available

Fully programmable via RS232 interface

**Power Section**

Power supply: B6 rectifier bridge, directly off 3-phase earthed supply system, integral power input filter and inrush circuit

All shielding connections directly on the amplifier

Output stage: IGBT- module with isolated current measurement

Regen circuit: with dynamic distribution of the regen power between several amplifiers on the same DC-link circuit. Internal regen resistor as standard, external regen resistors if required

DC-link voltage 260VDC to 900VDC, can be paralleled

**Complete Digital Control**

Digital current controller (space vector pulse-width modulation, 62.5 µs)

Freely programmable digital speed controller (250 µs)

Integral position controller with adaptation possibilities for customer needs (250 µs)

Pulse direction interface integrated for connection of a servomotor to a stepping- motor control

Evaluation of the resolver signals or sine-cosine signals of a high-resolution encoder

Encoder emulation (incremental ROD 426-compatible or SSI)

**Auxiliary Functions**

Adjustable setpoint ramps

2 analog monitor outputs

4 programmable digital inputs (normally, two are defined as limit-switch inputs)

2 programmable digital outputs

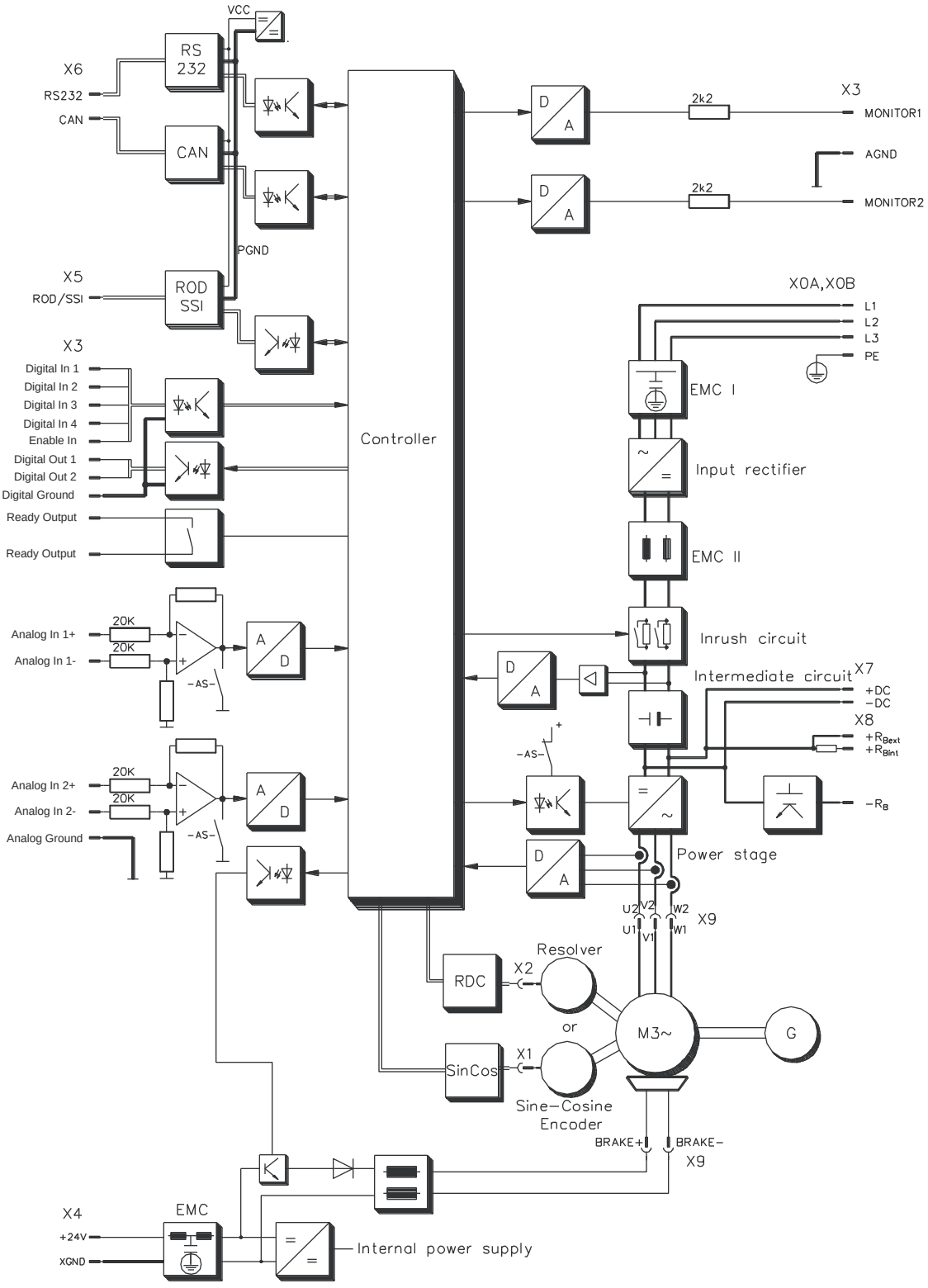
Freely programmable combinations of all digital signals

**Integrated Safety**

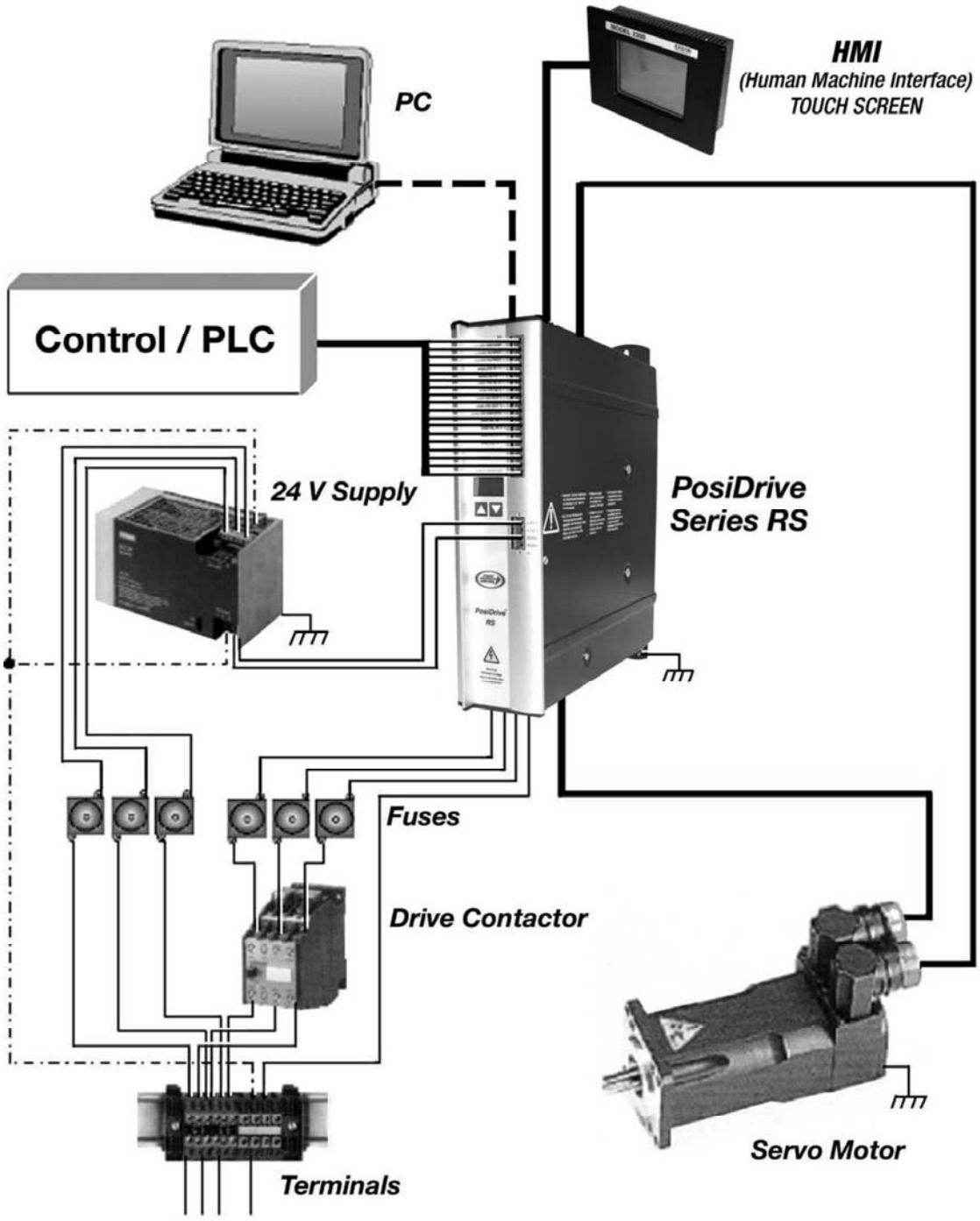
Safe electrical separation to EN 50178 between the power input / motor connections and the signal electronics, provided by appropriate insulation/creepage distances and complete electrical isolation

Soft-start, overvoltage recognition, short-circuit protection, phase-failure monitoring

# BLOCK DIAGRAM



# SERVO SYSTEM COMPONENTS



# *PosiDrive Series RS* Technical Data

| | | *PosiDrive* | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Rated data** | **DIM** | **RS-01** | **RS-03** | **RS-06** | **RS-10** | **RS-10-30** | **RS-14** | **RS-20** |
| Rated supply voltage | V~<br>V~ | 3 x 230V-10% ... 480V+10%, 50 Hz<br>3 x 208V-10% ... 480V+10%, 60 Hz | | | | | | |
| Rated installed load for S1 operation | kVA | 1 | 2 | 4 | 7 | 7 | 10 | 14 |
| Rated DC-link voltage | V= | 260 to 675 | | | | | | |
| Rated output current (rms value, ± 3%) | Arms | 1.5 | 3 | 6 | 10 | 10 | 14 | 20 |
| Peak output current (max. ca. 5s, ± 3%) | Arms | 3 | 6 | 12 | 20 | 30 | 28 | 40 |
| Clock frequency of the output stage | kHz | 8 | | | | | | |
| Technical data for regen circuit | — | See page 19 | | | | | | |
| Overvoltage protection threshold | V | 450 to .900 | | | | | | |
| Form factor of the output current (at rated data and min. load inductance) | — | 1.01 | | | | | | |
| Bandwidth of subordinate current controller | kHz | > 1.2 | | | | | | |
| Residual voltage drop at rated current | V | 5 | | | | | | |
| Quiescent dissipation, output stage disabled | W | 15 | | | | | | |
| Dissipation at rated current (incl. power supply losses, without regen dissipation) | W | 30 | 40 | 60 | 90 | 90 | 160 | 200 |
| **Internal fusing (external fusing see page 16)** | | | | | | | | |
| Auxiliary supply 24V | — | internal 3.15 AT | | | | | | |
| Regen resistor | — | internal, electronic | | | | | | |
| **Inputs** | | | | | | | | |
| Setpoint 1/2, resolution 14bit/12bit | V | ±10 | | | | | | |
| Common-mode voltage max. | V | ±10 | | | | | | |
| Input resistance | kW | 20 | | | | | | |
| Digital inputs | V | low 0 to 7 / high 12 to 36 | | | | | | |
| | mA | 7 | | | | | | |
| Digital outputs, open collector | V | max. 30 | | | | | | |
| | mA | 10 | | | | | | |
| Ready Output, relay contacts | V | DC max. 30, AC max. 42 | | | | | | |
| | mA | 500 | | | | | | |
| Aux. power supply, electrically isolated without brake | V | 24 (-0% +15%) | | | | | | |
| | A | 1 | | | | | | |
| Aux. power supply, electrically isolated with brake (consider voltage loss!) | V | 24 (-0% +15%) | | | | | | |
| | A | 3 | | | | | | |
| Max. output current, brake | A | 2 | | | | | | |
| **Connections** | | | | | | | | |
| Control signals | — | Combicon 5.08 / 18 pole , 2.5mm | | | | | | |
| Power signals | — | Power Combicon 7.62 / 4x4 + 1x6-pole, 4mm | | | | | | |
| Resolver input | — | SubD 9pole (socket) | | | | | | |
| Sine-cosine encoder input | — | SubD 15pole (socket) | | | | | | |
| PC-interface, CAN | — | SubD 9pole (plug) | | | | | | |
| Encoder emulation, ROD/SSI | — | SubD 9pole (plug) | | | | | | |
| **Mechanical** | | | | | | | | |
| Weight | kg | 4 | | | | | 5 | 7.5 |
| Height without connectors | mm | 275 | | | | | | |
| Width | mm | 70 | | | | | 100 | 120 |
| Depth without connectors | mm | 265 | | | | | | |

## *External Fusing*

| **Fusible cutouts or similar (Fuse UL time delay)** | ***PosiDrive*** **RS-01/RS-03** | ***PosiDrive*** **RS-06/RS-10** | ***PosiDrive*** **RS-14/RS-20** |
|---|---|---|---|
| AC supply FN1/2/3 | 6 AT (FRx-6) | 10 AT (FRx-10) | 20 AT (FRx-25) |
| 24V supply FH1/2 | max. 16 AF (max. FRx-16) | | |
| Regen resistor FB1/2 | 4 A (FRS-6) | 6 A (FRS-6) | 6 AF(FRS-10) |

(x = S or S-R for 480V applications x = N or N-R for 230V applications)

# *Ambient Conditions, Ventilation, Mounting Position*

| | |
|---|---|
| **Storage temperature/humidity, storage duration** | See Appendix |
| **Transport temperature / humidity** | See Appendix |
| **Supply voltage tolerances**<br>Input power<br><br>Aux. power supply | min 3x 230V-10% AC / max 3x 480V+10%, 50 Hz<br>min 3x 208V-10% AC / max 3x 480V+10%, 60 Hz<br><br>24VDC (-0% +15%) |
| **Ambient temperature in operation** | 0°C (32°F) to +45°C (113°C) at rated data<br>+45°C (113°F) to +55°C (131°F) with power derating 2.5%/°C |
| **Humidity in operation** | relative humidity 85%, no condensation |
| **Site altitude** | up to 1000m a.m.s.l. without restriction<br>1000 to 2500m a.m.s.l. with power derating 1.5%/100m |
| **Pollution level** | Pollution level 2 to EN60204/EN50178 |
| **Enclosure protection** | IP 20 |
| **Mounting position** | generally vertical. See Appendix |
| **Ventilation *PosiDrive Series RS*** | RS-01 thru RS-20 built-in fan |
| **Make sure that there is sufficient forced ventilation within the switchgear cabinet.** | |

# *Conductor Cross-Sections*

The following EN 60204 (for AWG: table 310-16 of the NEC 60°C (140°F) or 75°C (167°F)column), are recommended for single-axis systems:

| | | |
|---|---|---|
| AC connection | ***PosiDrive*** RS-01 thru RS-10 : 1.5 mm (14 awg)<br>***PosiDrive*** RS-14 thru RS-20 : 4 mm (12 awg) | 600V,105°C, twisted |
| DC-link | ***PosiDrive*** RS-01 thru RS-10 : 1.5 mm (14 awg)<br>***PosiDrive*** RS-14 thru RS-20 : 4 mm (12 awg) | 600V,105°C, shielded for lengths > 20 cm |
| Motor cables up to 25 m length | ***PosiDrive*** RS-01 thru RS-10 : 1.5 mm (14 awg)<br>***PosiDrive*** RS-14 thru RS-20 : 4 mm (12 awg) | 600V,105°C, shielded, capacitance <150pF/m |
| Motor cables 25 to 100 m length, with motor choke 3YL-20 **(consult our applications department** | ***PosiDrive*** RS-01 thru RS-10 : 1.5 mm (14 awg)<br>***PosiDrive*** RS-14 thru RS-20 : 4 mm (12 awg) | 600V,105°C,shielded, capacitance <150pF/m |
| Resolver, thermostat-motor | 4x2x0.25 mm (22awg) twisted pairs, shielded, max.100m, capacitance <120pF/m | |
| Encoder, thermostat-motor | 7x2x0.25 mm (22 awg) twisted pairs, shielded, max.50m, capacitance <120pF/m | |
| Setpoints, monitors, Analog Ground | 0.25 mm (22 awg) twisted pairs, shielded | |
| Control signals, Ready Output, Digital Ground | 0.5 mm (20 awg) | |
| Holding brake (motor) | min. 0.75 mm (18 awg), 600V,105°C, shielded, check voltage drop | |
| +24 V / XGND | max. 2.5 mm (14 awg), check voltage drop | |
| **For multi-axis systems, please note the special operating conditions in your installation** | | |

# *Recommended Torque*

| Connector | Recommended Torque |
|---|---|
| X3, X4 | 0.3 Nm(2.25 in lb) |
| X0A, X0B, X7, X8, X9 | 1.3 Nm (12 in lb) |
| Earth bolt | 3.5 Nm (31 in lb) |

# *LED Display*

A 3-character LED display shows the amplifier status after switching on the 24V supply (see page 54). In operating the amplifier via the keys on the front panel, the parameter and function numbers (see page 55) are displayed, as well as the numbers of any errors, which occur (see page 56).

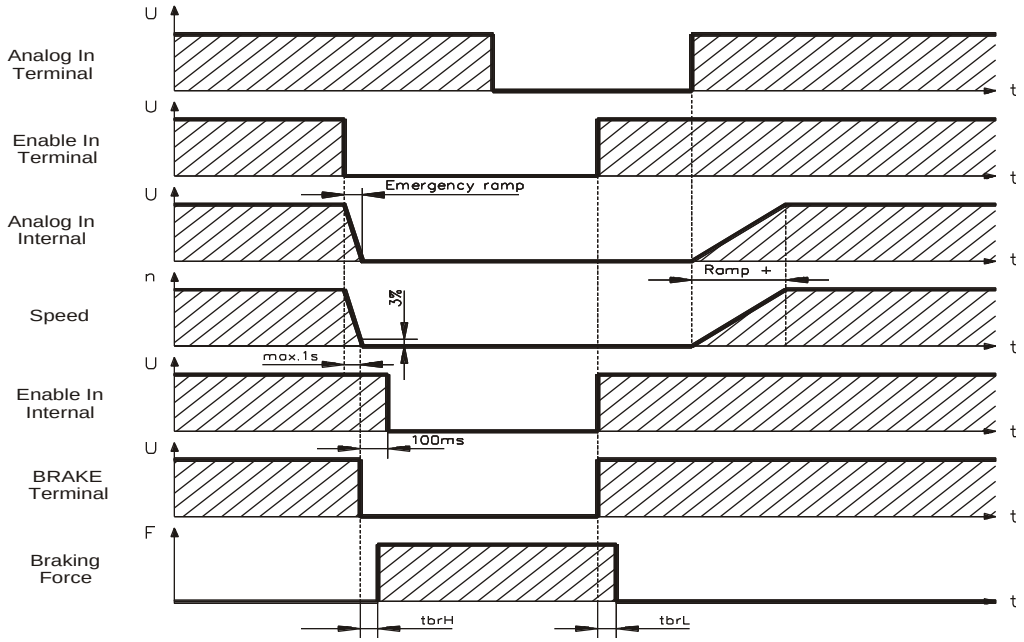
# GROUNDING SYSTEM

**Analog Ground** — ground for analog inputs/outputs, internal analog ground
**Digital Ground** — ground for digital inputs/outputs, optically isolated
**XGND** — ground for external 24V aux. voltage, optically and inductively isolated
**PGND** — ground for encoder emulation, RS232, CAN, optically isolated

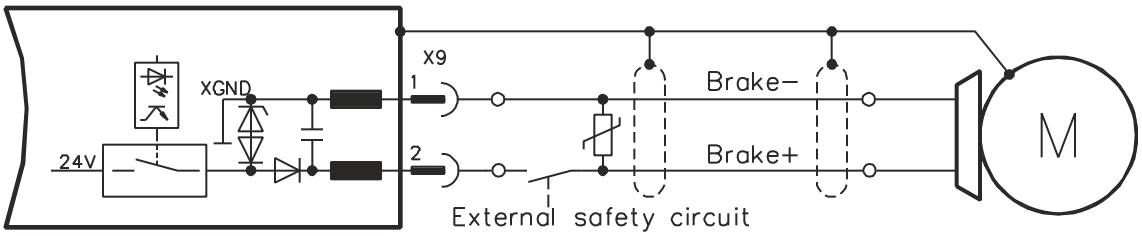
The potential isolation is shown in the block diagram (see page 14).

# CONTROL FOR MOTOR-HOLDING BRAKE

A 24V max. 2A holding brake in the motor can be controlled directly by the servo amplifier. **This function does not ensure personnel safety!** The brake function must be enabled through the BRAKE parameter (setting: WITH). In the diagram below, you can see the time and functional relationships between the Enable In signal, speed setpoint, speed and braking force.




During the internal Enable In delay time of 100ms the speed setpoint of the servo amplifier is internally driven down a 10ms ramp to 0V. The brake output is switched on when 3% of the final speed is reached. The rise (fbrH) and fall (fbrL) times of the holding brake, which is built into the motors, are different for the various types of motor (see motor manual). A description of the interface can be found on page 36. A safe (for personnel) operation of the holding brake requires an additional "make" (n.o.) contact in the brake circuit and a suppressor device (varistor) for the recommended brake circuit diagram:



# REGEN CIRCUIT

During motor-aided braking, energy is fed back to the servo amplifier. This energy is converted into heat in the regen resistor. The regen circuits (thresholds) are adjusted to the supply voltage using the setup software. Our applications department can help you calculate the required regen power. A description of the interface can be found on page 35.

**Internal regen resistor**: ***PosiDrive*** RS-01 and RS-03 Amp Drive ..... 66 Ω
***PosiDrive*** RS-06 thru RS-20 Amp Drive ..... 33 Ω
**External regen resistor**: ***PosiDrive*** RS-01 thru RS-20 Amp Drive ..... 33 Ω
**Functional description**:

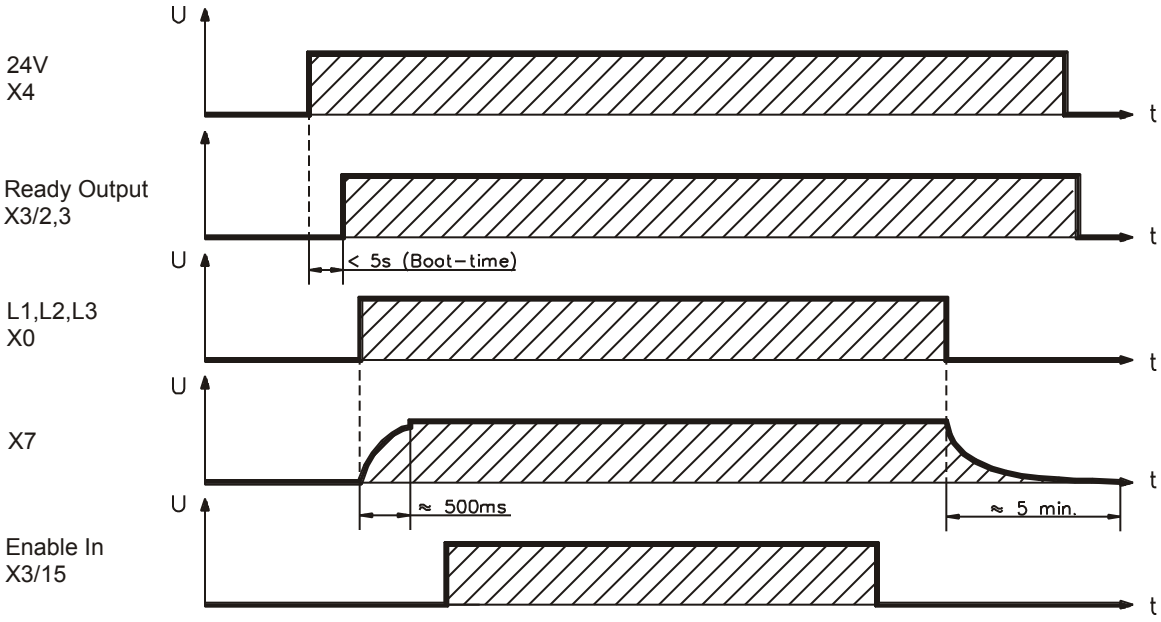
1. Individual amplifiers, not coupled through the DC-link (DC+, DC-). The circuit starts to respond at a DC-link voltage of 400V, 720V or 840V (depending on the supply voltage). If the energy which is fed back from the motor (as an average over time or as a peak value) is higher than the preset regen power, the servo amplifier outputs the status "regen power exceeded" and the regen circuit is switched off. At the next internal check of the DC-link voltage (after a few ms), an overvoltage is detected and the Servo amplifier is switched off with the error message, "Overvoltage" (page 55). The Ready Output contact (terminal X3/2,3) is opened at the same time (page 41)

2. Several servo amplifiers coupled through the DC-link circuit (DC+, DC-). The built-in regen circuit with its patented w-characteristic, several amplifiers (even with different current ratings) can be operated off a common DC-link. This is achieved by an automatic adjustment of the regen thresholds (which vary, because of tolerances). The regen energy is distributed equally among all the amplifiers. The combined power of all the amplifiers is always available, as continuous or peak power. The switch-off takes place as described above for the servo amplifier with the lowest switch-off threshold (resulting from tolerances). The Ready Output contact of this amplifier (terminals X3/2,3) is opened at the same time (page 41).

| **Regen circuit: technical data** | | | ***PosiDrive*** | |
|---|---|---|---|---|
| **Supply Voltage** | **Rated data** | **DIM** | **RS-01 to RS-03** | **RS-06 to RS-20** |
| 3 x 230 V | Upper switch-on level of regen circuit | V | 400 to 430 | |
| | Switch-off level of regen circuit | V | 380 to 410 | |
| | Continuous power of regen circuit (RBint) | W | 80 | 200 |
| | Continuous power of regen circuit (RBext) max. | kW | 0.25 | 0.75 |
| | Pulse power, internal (RBint max. 1s) | kW | 2.5 | 5 |
| | Pulse power, external (RBext max. 1s) | kW | 5 | |
| | External regen resistor | Ohm | 33 | |
| 3 x 400 V | Upper switch-on level of regen circuit | V | 720 to 750 | |
| | Switch-off level of regen circuit | V | 680 to 710 | |
| | Continuous power of regen circuit (RBint) | W | 80 | 200 |
| | Continuous power of regen circuit (RBext) max. | kW | 0.4 | 1.2 |
| | Pulse power, internal (RBint max. 1s) | kW | 8 | 16 |
| | Pulse power, external (RBext max. 1s) | kW | 16 | |
| | External regen resistor | Ohm | 33 | |
| 3 x 480 V | Upper switch-on level of regen circuit | V | 840 to 870 | |
| | Switch-off level of regen circuit | V | 800 to 830 | |
| | Continuous power of regen circuit (RBint) | W | 80 | 200 |
| | Continuous power of regen circuit (RBext) max. | kW | 0.5 | 1.5 |
| | Pulse power, internal (RBint max. 1s) | kW | 10.5 | 21 |
| | Pulse power, external (RBext max. 1s) | kW | 21 | |
| | External regen resistor | Ohm | 33 | |

# SWITCH-ON AND SWITCH-OFF BEHAVIOR

The diagram below illustrates the correct functional sequence for switching the servo amplifier on and off.




## *Stop Function to EN 60204 (VDE 0113)*

If a fault occurs (page 55), the output stage of the servo amplifier is switched off and the Ready Output contact is opened. In addition, a global error signal is given at one of the digital outputs (terminals X3/16 and X3/17) (see online help for the setup software). These signals are used by the higher-level control to either finish the current PLC cycle or to shut down the drive (with additional brake or similar.).

Instruments equipped with a selected “Brake” function use a special sequence for switching off the output stage (page 18).

The Stop functions are defined in EN 60204 (VDE 0113), Para. 9.2.2, 9.2.5.3. There are three categories of Stop functions:

- Category 0: Shut down by immediately switching off the supply of energy to the drive machinery (i.e, an uncontrolled shut-down);
- Category 1: A controlled shut-down, during which the supply of energy to the drive machinery is maintained to perform the shut-down, and where the energy supply is only interrupted when the shut-down has been completed;
- Category 2: A controlled shut-down, where the supply of energy to the drive machinery is maintained.

Every machine must be equipped with a Stop function to Category 0. Stop functions to Categories 1 and/or 2 must be provided if the safety or functional requirements of the machine make this necessary.

You can find additional information and implementation examples in our application note “Stop and Emergency Stop Functions with ***PosiDrive Series RS***.”

# *Emergency Stop (E-Stop) Strategies*

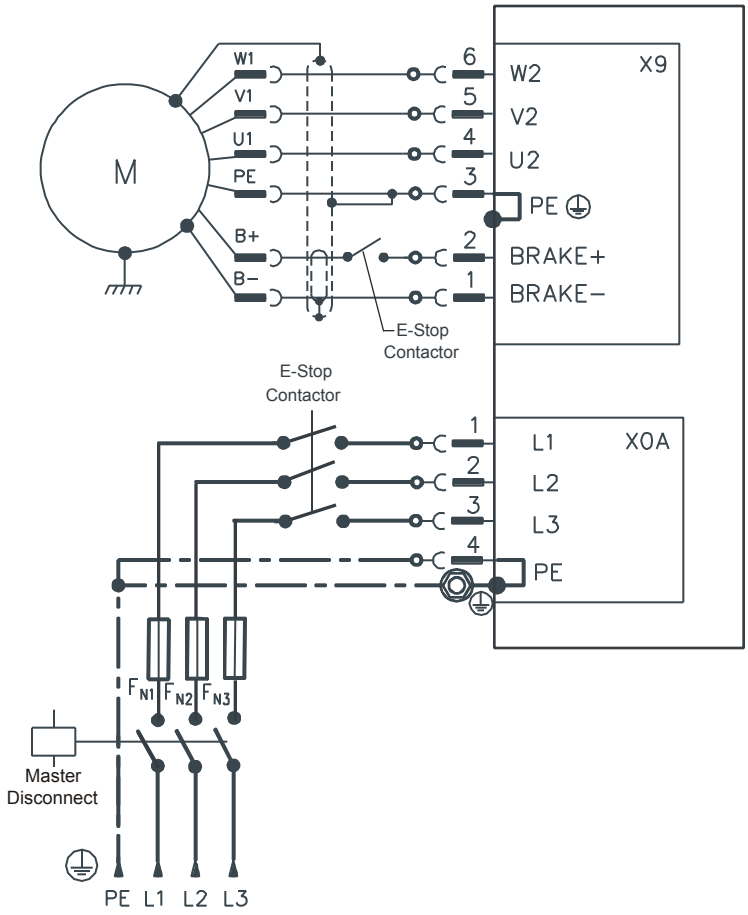
The following drawing shows a typical circuit for an **Emergency Stop Condition**. The motor power is cut, which will totally disable the motor. The power is also cut to the brake (If Equipped). The motor must be allowed to come to a complete stop before anyone enters the machine. Drives with a suspended load must have an additional mechanical device to hold the load before anyone enters the machine.

The Emergency Stop function is defined in EN 60204 (VDE 0113), Para. 9.2.5.4.

**Category 0:**

The controller is switched to "disable" and the electrical supply (400VAC) is disconnected. An electromagnetic holding device (brake) holds the drive.

In multi-axis systems with connected DC-link bus (intermediate circuit), the motor leads must be disconnected by a changeover switch (contactor, e.g., Siemens 3RT1516-1BB40) and short-circuited by resistors connected in a star configuration.




**Category 1:**

If hazardous conditions result from an emergency stop switch-off with an unbraked run-down, the drive can be switched off by a controlled shut-down. Stop Category 1 permits electromotive braking with a switch-off when zero speed has been reached. Safe shut-down is achieved when the loss of the main power supply is not rated as a fault and the control takes over the disabling of the servo amplifier. In normal situations, only the power supply is switched off. The 24V auxiliary supply remains switched on.

# INSTALLATION INSTRUCTIONS

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

Check the combination of servo amplifier and motor. Compare the rated voltage and current of the units. Wire according to the connection diagram on page 25.

Make sure that the maximum allowable rated voltage at the terminals L1, L2, L3 or +DC, –DC is not exceeded by more than 10%, even in the most unfavorable case see EN 60204-1 Section 4.3.1). An excessive voltage on these terminals can lead to damage of the regen circuit and the servo amplifier. Use the servo amplifiers only on a grounded 3-phased supply system.

Install the fusing of the AC supply input and the 24V supply (page 16).

Take care that the servo amplifier and motor are grounded properly. Do not use painted, (non-conductive) mounting plates.

Route power and control cables separately. We recommend a separation of at least 8" (20cm.) This improves the interference immunity required by EMC regulations. If a motor power cable is used that includes cores for brake control, the brake control cores must be separately shielded. Ground the shielding at both ends (page 27).

Install all heavy-current cables with an adequate cross-section, as per EN 60204. (page 17).

Wire the Ready Output contact in series into the safety circuit of the installation to ensure monitoring of the servo amplifier.

Install all shielding with large area (low impedance), metallic connector housings or shield connection clamps, where possible. Notes on connection techniques can be found on page 30 and in the application note "Cables and connectors".

Install in an area that has minimal vibration. Excessive vibration will destroy internal components.

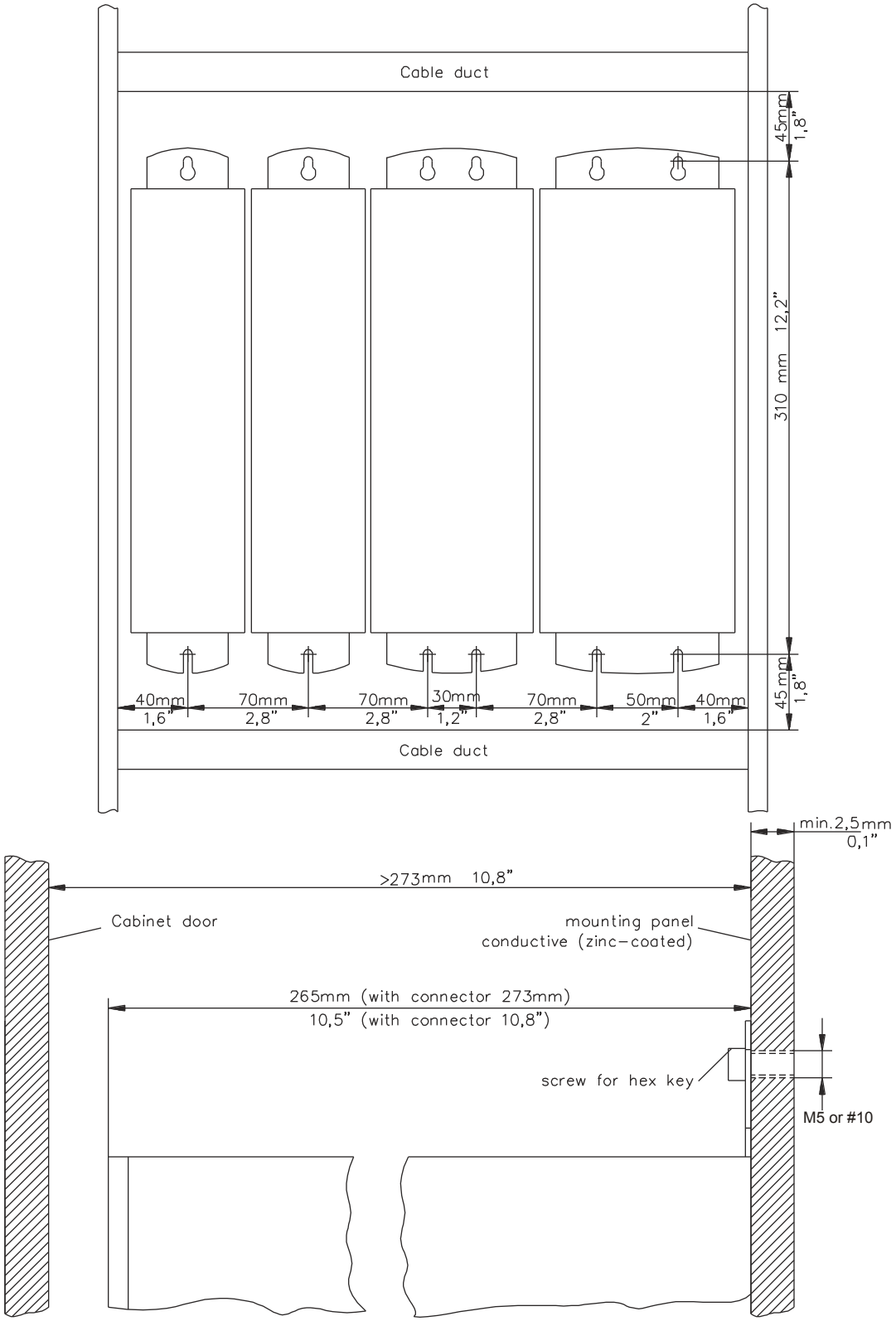
Ensure that there is an adequate flow of cool, filtered air into the bottom of the switchgear cabinet. See page 17.

You can alter the servo amplifier settings by using the setup software. **Any other alterations invalidate the warranty.**

***Never disconnect the electrical connections to the servo amplifier while it is live. In some circumstances, this can result in destruction of the electronics. Residual charges in the capacitors can have dangerous levels up to 300 seconds after switching off the main power supply voltage. Measure the bus voltage at the DC-link pins (+DC/-DC), wait until the voltage has fallen below 40V. Control and power connections can still be live, even when the motor is not running.***

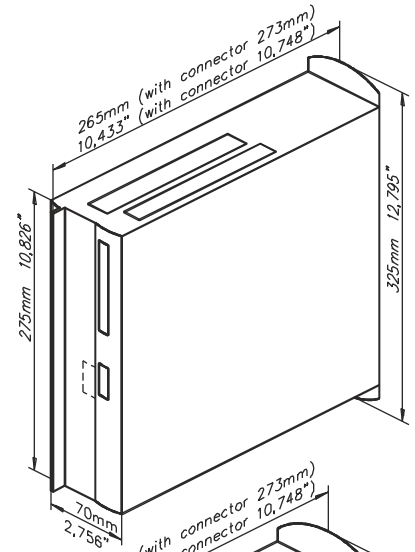
# ASSEMBLY

Material : 2 or 4 hexagon socket screws M5 or #10

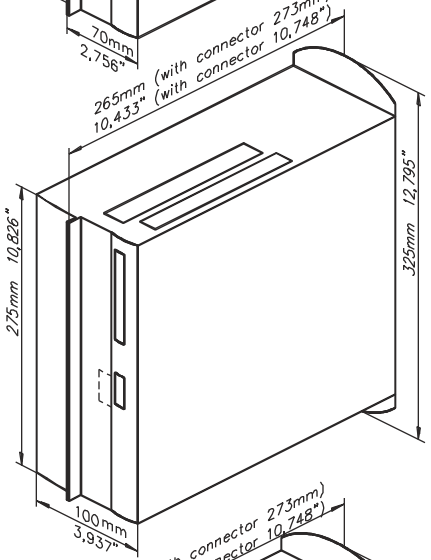


# *PosiDrive Series RS Dimensions*

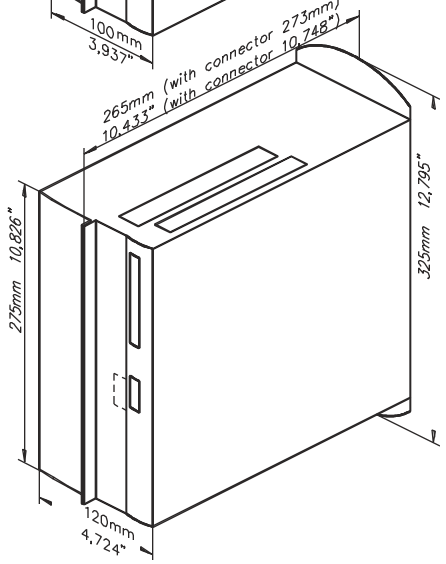
*PosiDrive* RS-03, RS-06, RS-10




*PosiDrive* RS-14




*PosiDrive* RS-20



# WIRING

**Only professional staff qualified in electrical engineering are allowed to install the servo amplifier.**

The installation procedure is described as an example. A different procedure may be required, depending on the application of the equipment. Force Control provides further information through **training courses**.

***Only install and wire the equipment when both the main power supply and the 24V auxiliary voltage is disconnected and when the operating voltages of any other connected equipment has been switched OFF.***

The ground symbol,  , which you find in all the wiring diagrams, indicates that you must provide an electrically-conducive connection with the largest possible area between the unit indicated and the mounting plate in the switchgear cabinet. This connection is for the effective grounding of HF interference and must *not* be confused with the PE symbol,  (a protective measure for EN 60204).

Use the following connection diagrams:

The following notes should help you install the equipment without overlooking anything important.

**Site**

In a closed switchgear cabinet (see page 17), the site must be free from vibration and conductive or corrosive materials. For mounting position in the cabinet, see page 23.

**Ventilation**

Make sure that the ventilation of the servo amplifier is unimpeded and keep within the permitted ambient temperature (page 17). Keep the required space clear above and below the servo amplifier.

**Assembly**

Assemble the servo amplifier and power supply close together on the conductive, **grounded** mounting plate in the cabinet.

**Cable Selection**

Select cables according to EN 60204 (page 17).

**Grounding Shielding**

EMC-compliant shielding and grounding (page 28) includes grounding the mounting plate, motor housing, and CNC-GND of the controls. Notes on connection techniques are on page 30.

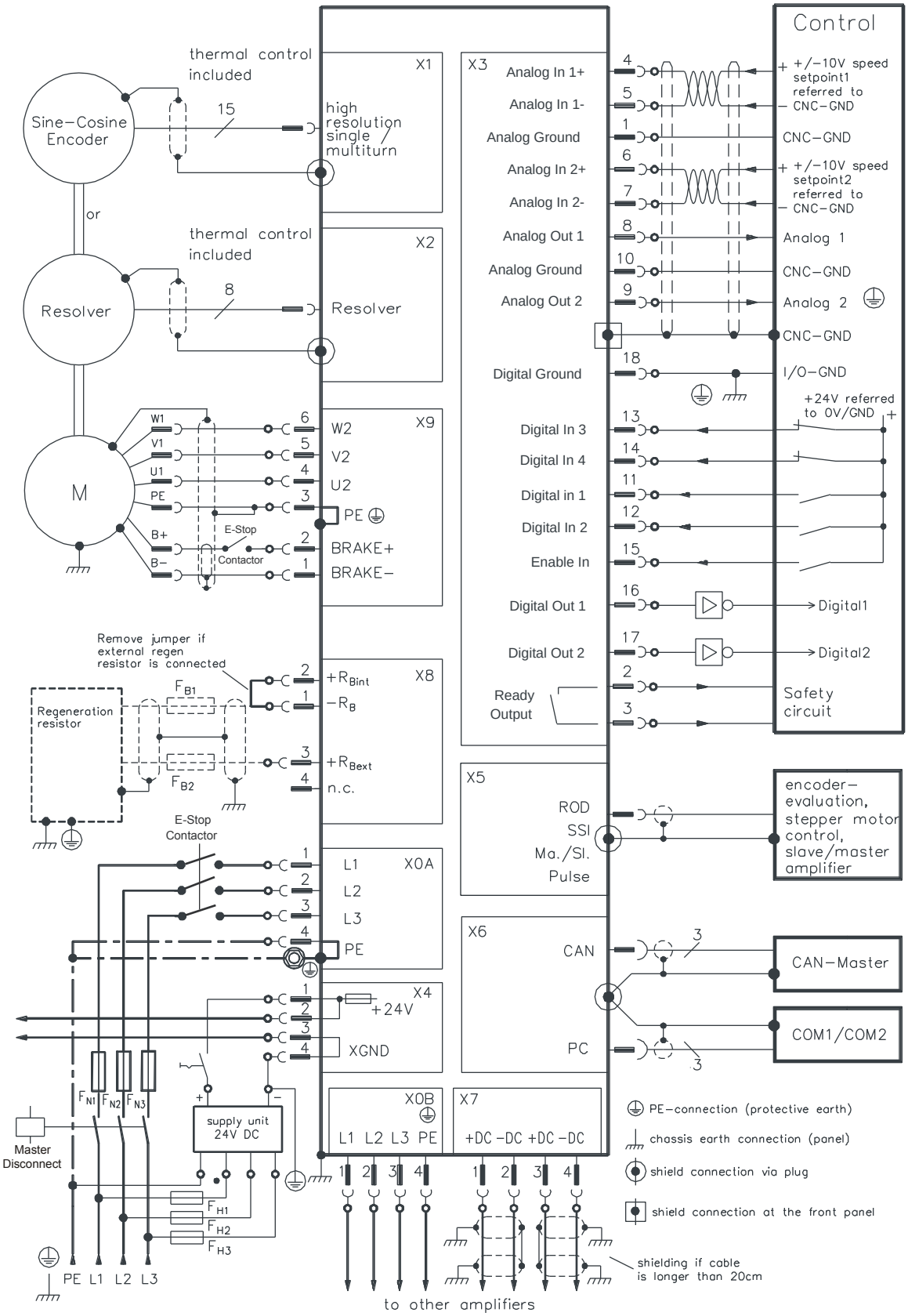
**Wiring**

- ¾ **Route power leads and control cables separately**
- ¾ **Wire the Ready Output contact in series into the safety loop of the installation**
- ¾ Connect the digital control inputs to the servo amplifier.
- ¾ Connect the Analog Ground.
- ¾ Connect the Analog Inputs, if required.
- ¾ Connect the feedback unit (resolver or encoder).
- ¾ Connect the encoder emulation, if required
- ¾ Connect the expansion card.
- ¾ Connect the motor leads.
  Connect shielding to EMC connectors at both ends.
  Use motor chokes for lead lengths > 25m.
- ¾ Connect motor-holding brake, connect shielding to EMC connectors at both ends.
- ¾ Connect the external regen resistor (with fusing), if required.
- ¾ Connect auxiliary supply (see page 17 for maximum allowable voltage values.
- ¾ Connect the main power supply (see page 17 for maximum allowable voltage values.
- ¾ Connect PC or HMI (page 44).

**Final Check**

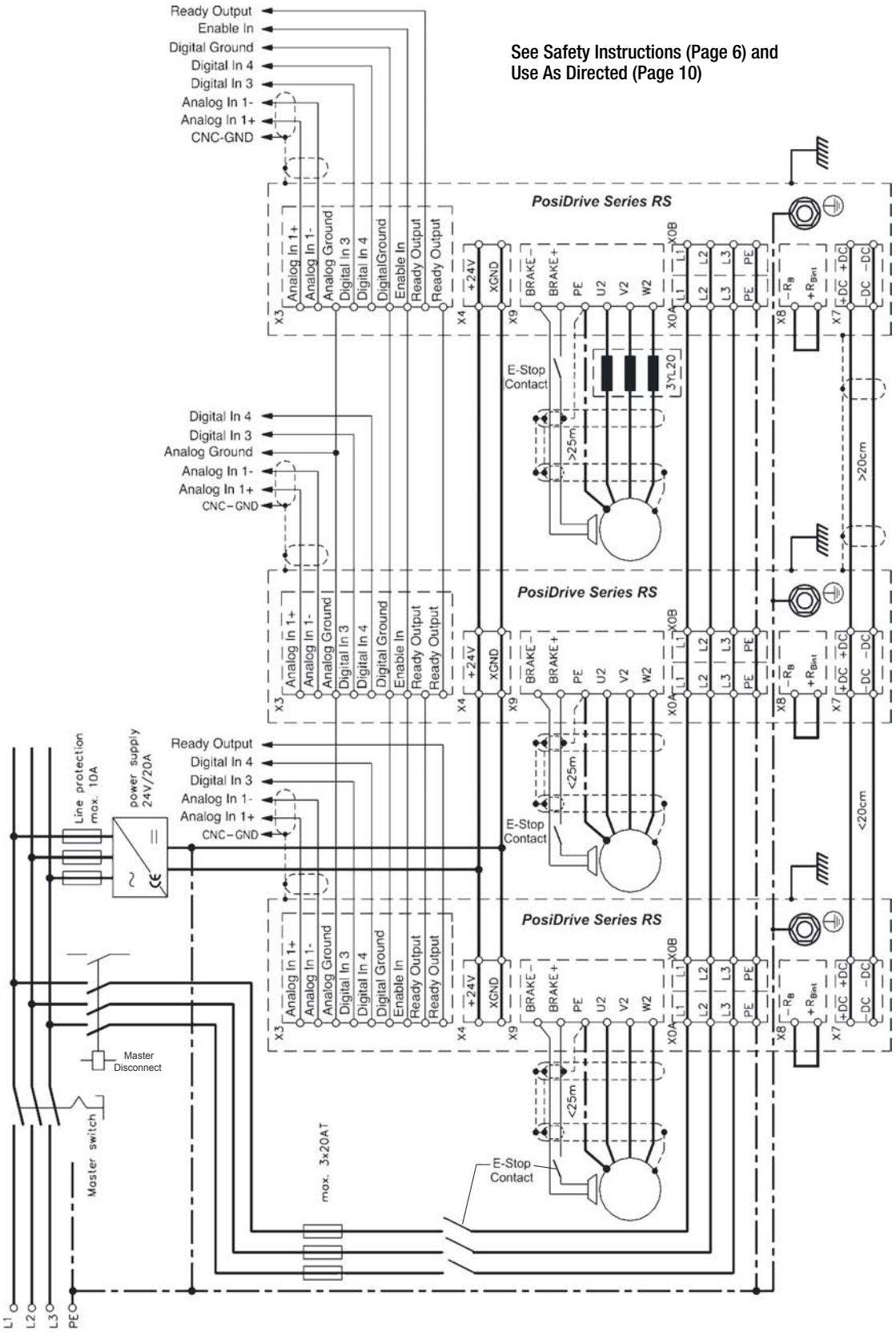
- ¾ Final check of the implementation of the wiring, according to the wiring diagrams which have been used.

# *PosiDrive Series RS Connection Diagram*

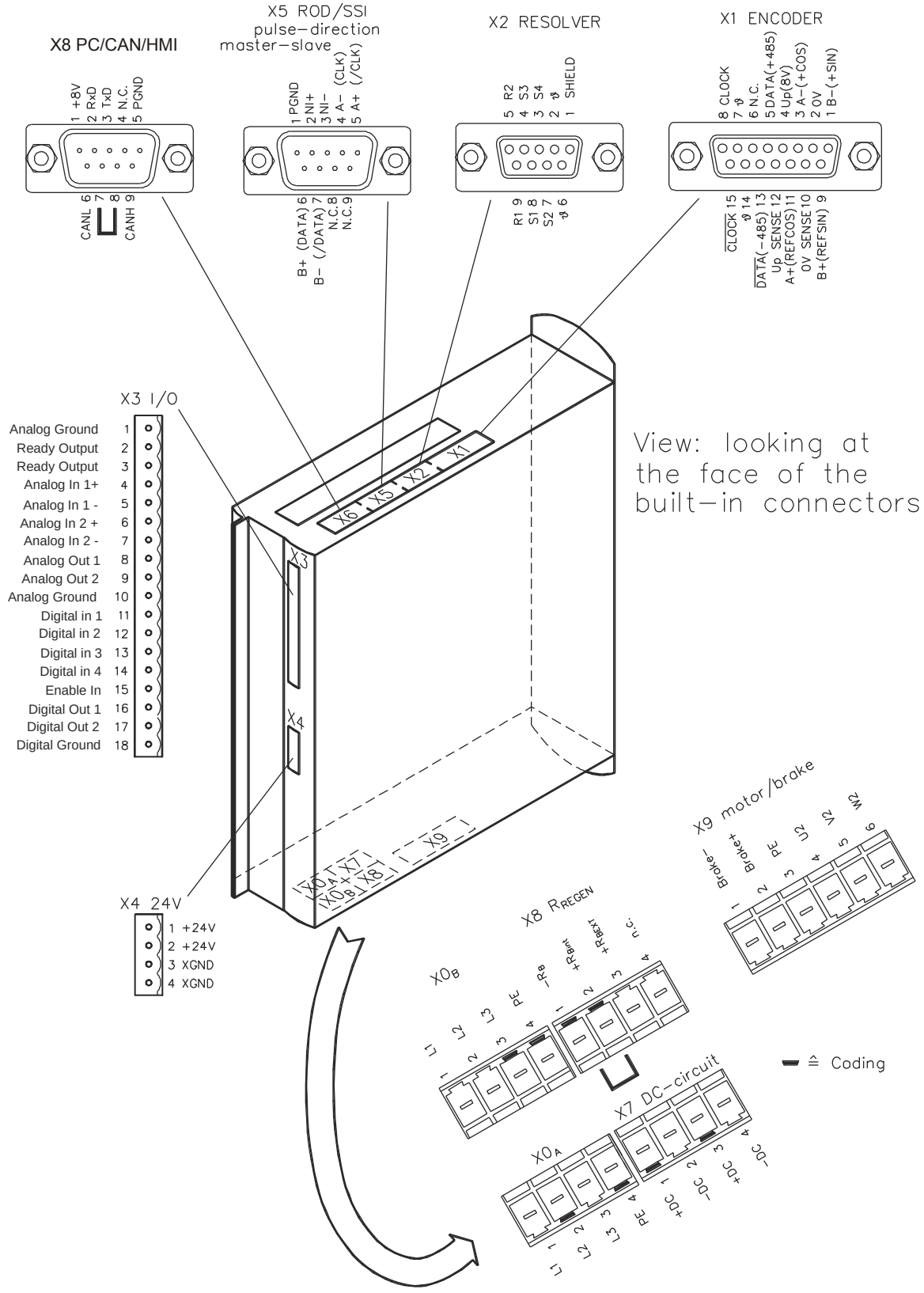


# *Multi-Axis System Connection Example*

See Safety Instructions (Page 6) and
Use As Directed (Page 10)



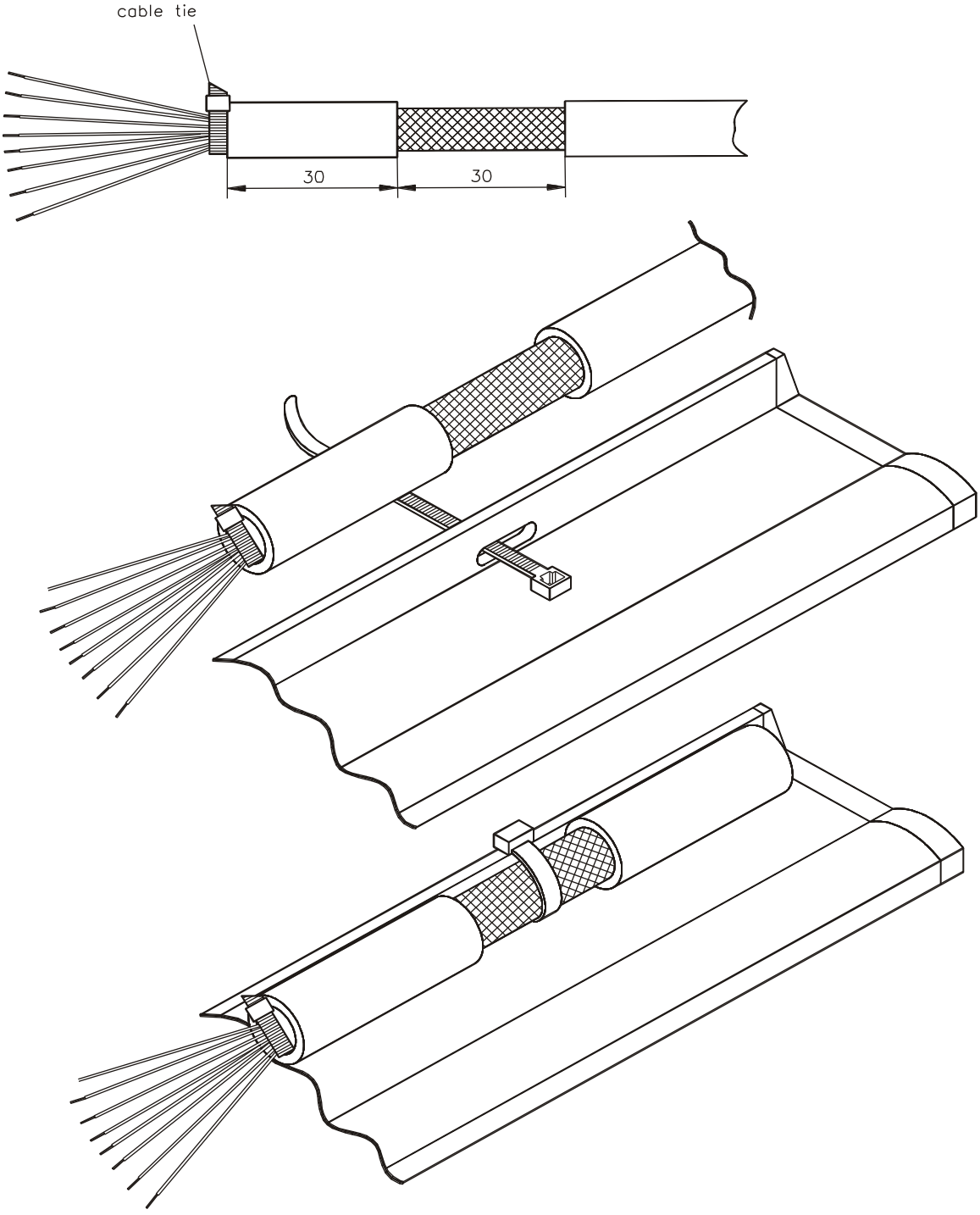
# *PosiDrive Series RS Pin Assignments*



# *Notes On Connection Techniques*

Please review the Application Note, *Cables and Connectors.*

## Front Panel Shielding



## TECHNICAL DATA FOR CONNECTING CABLES

Additional information on the chemical, mechanical, and electrical characteristics of the cables can be obtained from our applications department.

**Insulation Material**

Sheathing ¾ PUR (polyurethane, code 11Y)
Core insulation ¾ PETP (polyesteraphtalate, code 12Y)

**Capacitance**

Motor cable ¾ less than 150 pF/m
RES-/Encoder cable ¾ less than 120 pF/m

**Technical Data**

¾ The brackets in the cable designation indicate the shielding.
¾ All cables are suitable for use as trailing cables.
¾ The technical data refer to the use as moveable cables.
Operating life: 1 million bending cycles

| Cores ($mm^2$) | Coretype | Operation Temperature Range | Outside Diameter (mm) | Bending Radius (mm) | Remarks |
|---|---|---|---|---|---|
| (4x1.0) | Color | -30 / +80 | 10 | 100 | |
| (4x1.5) | Letter | -30 / +80 | 10.5 | 105 | |
| (4x2.5) | Number | -5 / +70 | 12.6 | 125 | |
| (4x4) | Number | -5 / +70 | 12.8 | 130 | |
| (4x1.0+(2x0.75)) | Color | -30 / +80 | 10.5 | 100 | |
| (4x1.5+(2x0.75)) | Letter | -10 / +80 | 11.5 | 120 | |
| (4x2.5+(2x1) | Letter | -30 / +80 | 12.5 | 125 | |
| (4x2x0.25) | Color | -30 / +80 | 6.9 | 60 | Twisted pairs |
| (7x2x0.25) | Color | -30 / +80 | 9.9 | 80 | |
| 10x2x0.14 | Color | -30 / +80 | 8.8 | 80 | |

The assignments of servo amplifier types, motor types and cables can be found in the Appendix.

# SOFTWARE SETUP

This section describes the installation procedures for the setup software DRIVE.EXE for the ***PosiDrive Series RS*** digital servo amplifiers. Force Control offers training and familiarization courses on request.

## *Use As Directed*

The setup software is intended to be used for setting up and storing the operating parameters for the ***PosiDrive Series RS*** series of servo amplifiers. The attached servo amplifier is operated with the assistance of the software – during this process, the drive is controlled directly by the service functions.

***Only professional personnel who have the relevant expertise described on page 6 are permitted to carry out online parameter setting for a drive that is running. Sets of data stored on media are not safe against unintended alteration by other persons. After loading a set of data, check all parameters thoroughly before enabling the servo amplifier.***

## *Software Description*

The servo amplifiers must be adapted to the requirements of your installation. Usually, you will not have to perform parameter setting on the amplifier, but on a PC with the assistance of the setup software. The PC is connected to the servo amplifier by a null-modem cable. The setup software provides the communication between ***PosiDrive Series RS*** and the PC. You will find the setup software on the accompanying CD-ROM.

With very little effort, you can alter parameters and instantly observe the effect on the drive, since there is a continuous (online) connection to the amplifier. Simultaneously, important actual values are read out from the amplifier and displayed on the PC monitor (oscilloscope function).

Any interface modules (expansion cards) that may be built into the amplifier are automatically recognized and the additional parameters required for position control or motion-block definition are made available. Sets of data can be stored on data media (archived) and loaded again. The data stored on data media can be printed.

We supply you with motor-specific default sets of data for all the reasonable combinations of servo amplifier and motor. In most applications, you are able to use these default values to get your drive running without any problems.

## *Hardware Requirements*

The PC interface (X6, RS232) of the servo amplifier is connected to the serial interface of the PC by a null-modem cable (**not a null-modem link cable** page 44).

***Connect or disconnect the interface cable only when the supply is switched off for both the PC and the servo amplifier.***

The interface in the servo amplifier is electrically isolated by an optocoupler and is at the same potential as the CANopen interface.

**Minimum Requirements For The PC:**

| | | |
|---|---|---|
| Processor | : | 80486 or higher |
| Operating system | : | WINDOWS 95(c) / 98 / 2000, WINDOWS NT 4.0 |
| Graphics adapter | : | Windows compatible, color |
| Drives | : | 3.5" diskette drive |
| | | hard disk with at least 5 MB free space |
| | | CD-ROM drive for online documentation |
| Main memory | : | at least 8MB |
| Interface | : | one free serial interface (COM1:, 2:, 3: or COM4:) |

### WINDOWS 95(C) / WINDOWS98 / WINDOWS 2000 / WINDOWS NT

DRIVE.EXE is an executable file under Windows95(c), Windows98, Windows 2000, and Windows NT 4.0. the help system is **not** available under Windows95(a) or 95(b).

### WINDOWS FOR WORKGROUPS 3.XX, DOS, OS2

DRIVE.EXE is not executable under Windows 3.xx, DOS, or OS2. In an emergency, operation is possible through an ASCII terminal emulation (without user-interface). Interface settings: 9600 bps, no parity, and no handshake.

### UNIX, LINUX

The software function has not been tested with UNIX or LINUX.

# INSTALLATION

Only for Windows95/98/2000/NT, an installation program (SETUP.EXE) is found on the CD-ROM that makes it easy to install the setup software on your PC.

1. Connect the interface cable to a serial interface on your PC and the PC interface (X6) of the ***PosiDrive Series RS*** (page 44).
2. Switch on your PC-AT and the monitor. After the start phase (boot-up) is finished, the Windows user-interface appears on the screen.

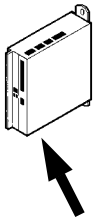
Click on **START** (Taskbar), then **Run**. Enter the program call in the entry window: ***x*:\setup.exe** (with *x*= the correct drive letter for CD-ROM drive). Click **OK** and follow the instructions

# Interfaces

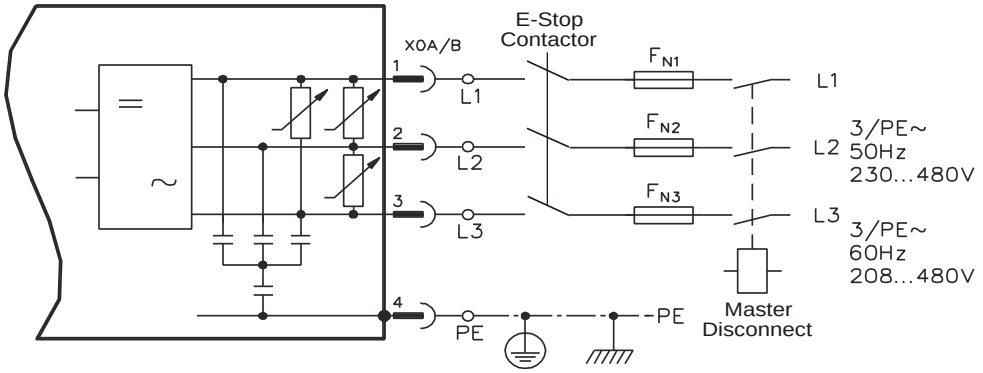
All important interfaces are shown in this section. The precise location of the connectors and terminals are seen on page 29.

## POWER SUPPLY

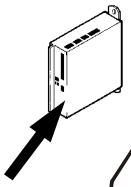
### *Main Power Supply Connection (X0)*



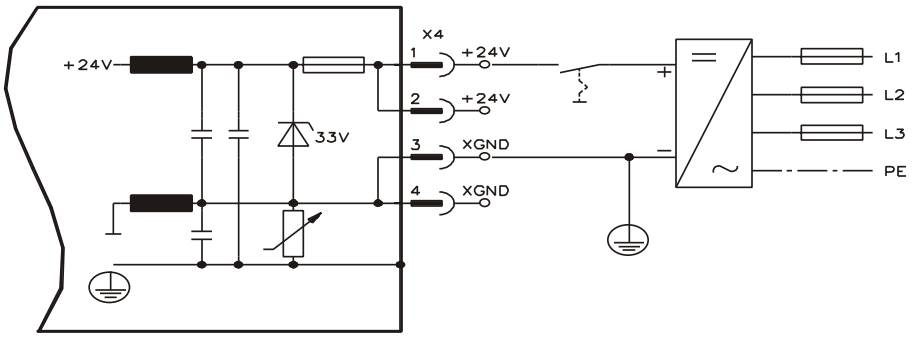
-- Directly to grounded 3~supply, integrated filter.
-- Fusing (e.g., fusible cut-outs) provided by the user. (Page 16)



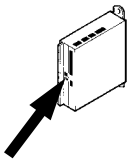

### *24V Auxiliary Power Supply (X4)*



-- Electrically-isolated, external 24VDC supply (e.g., with insulating transformer.
-- Required current rating (Page 16).
-- Integrated EMC filter for the 24 V auxiliary supply.

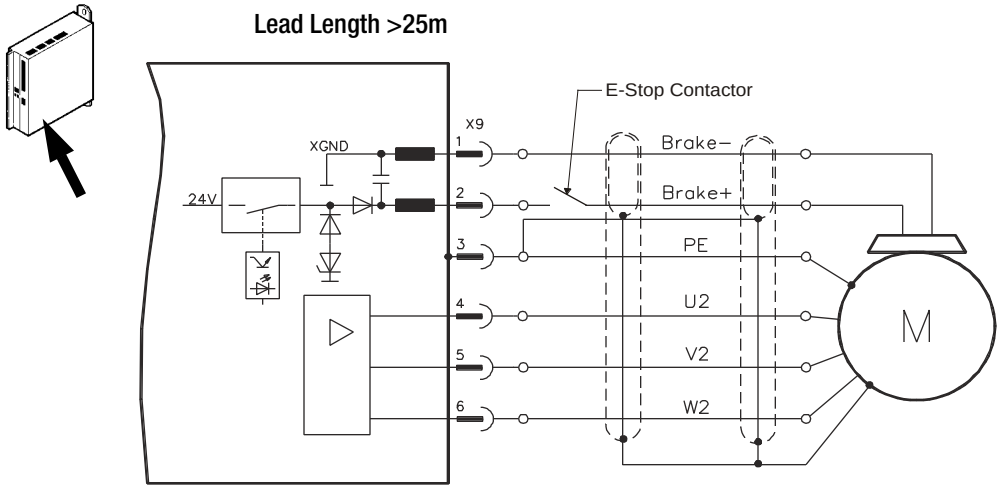


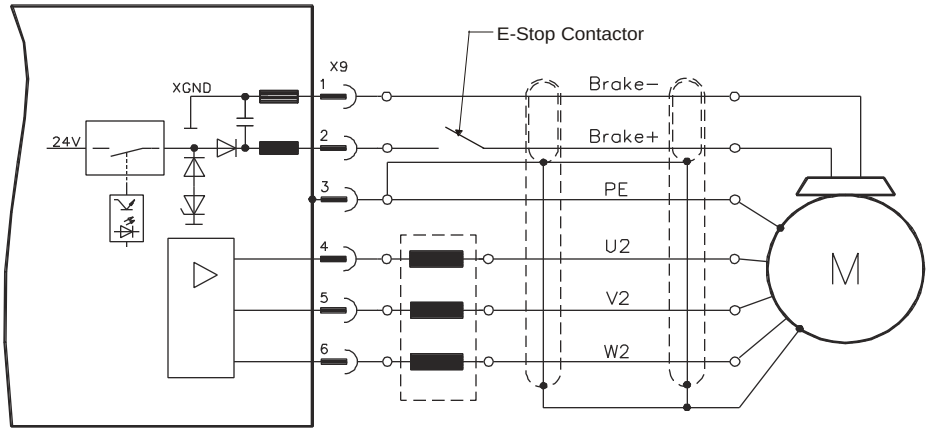

### *DC-Link (X7)*



Can be connected in parallel. A patented circuit distributes the regen power among all the amplifiers connected to the same DC-link circuit (see connection example on page 28).

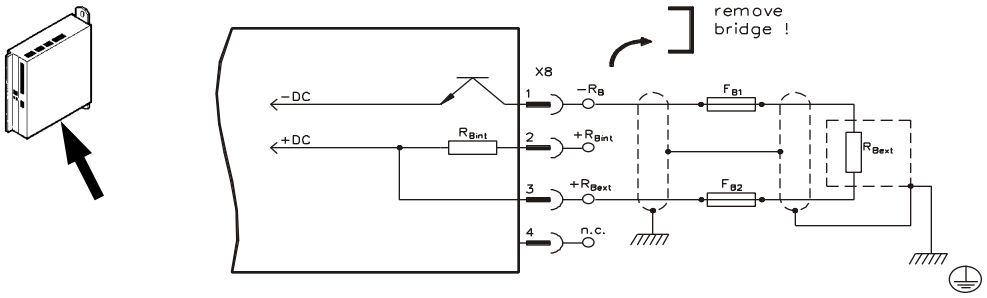
# MOTOR CONNECTION WITH BRAKE (X9)



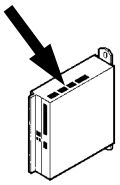

# EXTERNAL REGEN RESISTOR (X8)

Remove the plug-in link between the terminals X8/1 ($-R_B$) and X8/2 ($+R_{bint}$).

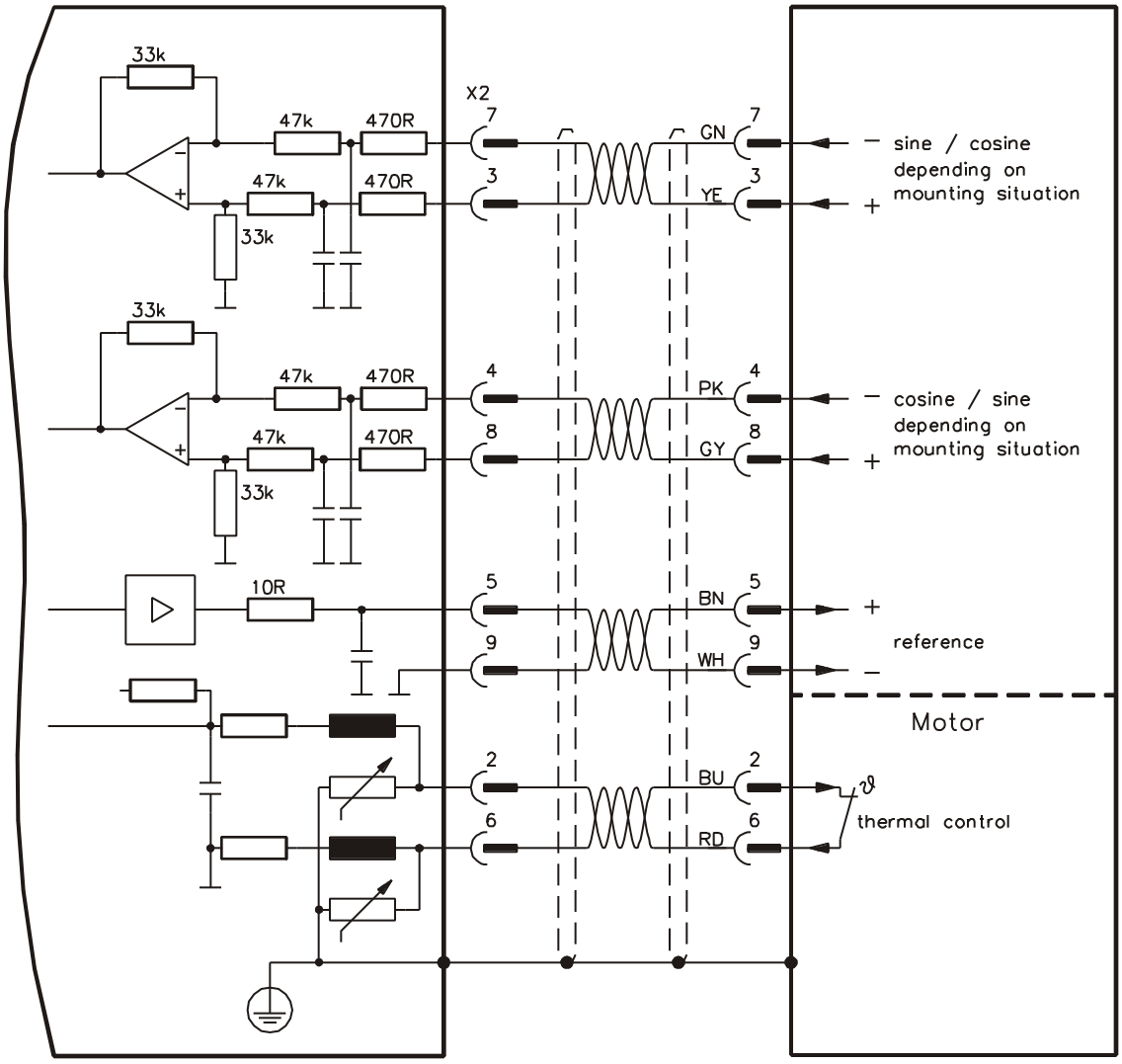


# FEEDBACK

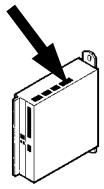
## *Resolver Connection (X2)*



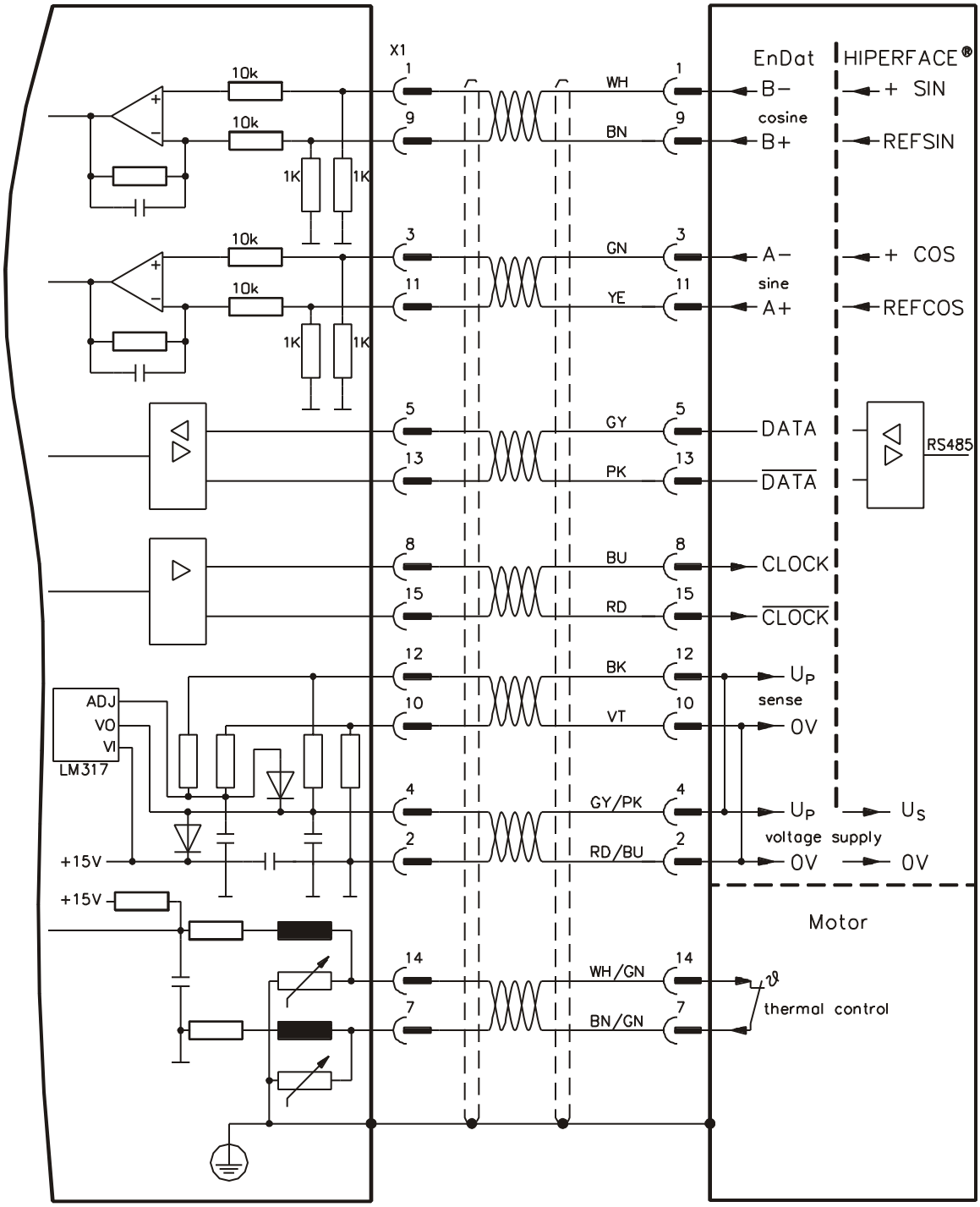
The ***PosiDrive***. motors have 2-pole hollow-shaft resolvers built in as a standard. It is possible to connect 2- to 36-pole resolvers to the ***PosiDrive Series RS***. If lead lengths of more than 100m are planned, please contact our application department. The thermostat contact in the motor is connected via the resolver cable to the ***PosiDrive Series RS*** and evaluated there.



# *Encoder (X1)*

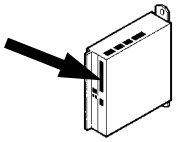


As an option, the ***PosiDrive*** motors can be fit with a single-turn or multi-turn sine-cosine encoder. This encoder is used by the ***PosiDrive Series RS*** as a feedback device for drive tasks requiring highly precise positioning or extremely smooth running. If lead lengths of more than 50m are planned, please consult our applications department. The thermostat contact (If Required) in the motor is connected via the encoder cable to the ***PosiDrive Series RS*** and evaluated there.



# CONTROL AND MONITOR SIGNALS

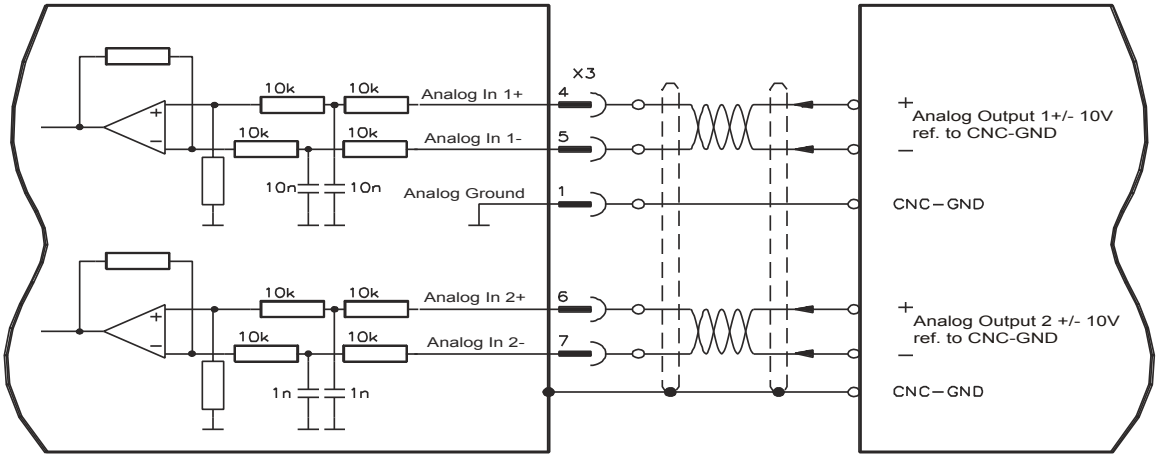
## *Analog Inputs (X3)*



The servo amplifier is equipped with two differential inputs for analog setpoints that are **freely programmable** (with the aid of the macro-language, consult our applications department). Analog Ground (X3/1) must always be joined to the CNC-GND of the controls as a ground reference.

**Technical characteristics**

- ¾ Differential input voltage max. ±10V
- ¾ Resolution 1.25mV
- ¾ Ground reference : Analog Ground, terminal X3/1
- ¾ Common-mode voltage range for both inputs ±10V




**Input Analog In 1 (Terminals X3/4-5)**
Differential input voltage max. ± 10 V, resolution 14-bit, scalable
Standard setting: speed setpoint

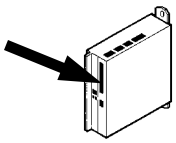
**Input Analog In 2 (Terminals X3/6-7)**
Differential input voltage max. ± 10 V, resolution 12-bit, scalable
Standard setting: torque setpoint

**Application Examples For Setpoint Input Analog In 2:**
- — adjustable external current limit
- — reduced-sensitivity input for setting-up/jog operation
- — pre-control / override

**Fixing The Direction Of Rotation**
Standard setting: clockwise rotation of the motor shaft (looking at the shaft end)
- — Positive voltage between terminal X3/4 (+) and terminal X3/5 ( - ) or
- — Positive voltage between terminal X3/6 (+) and terminal X3/7 (-)

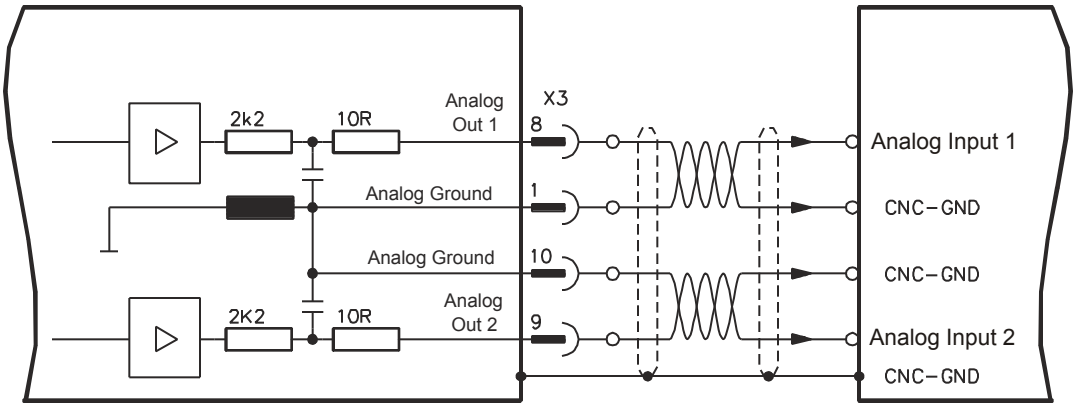
To reverse the direction of rotation, swap the connections to terminals X3/4-5 and. X3/6-7 or change the ROT. DIRECTION parameter in the “Speed controller” screen.

# *Analog Outputs (X3)*



**Technical Characteristics**

— Reference ground is Analog Ground (Terminals X3/1 and X3/10)
— Output resistance : 2.2kΩ
— Output voltage ±10V
— Resolution : 10 bit



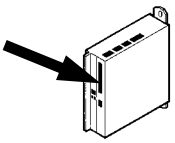

**Programmable Analog Outputs Analog Out 1 / Analog Out 2**
The terminals X3/8 (Analog Out 1) or X3/9 (Analog Out 2) can have the following analog signals assigned to them:

You can use the terminals X3/8 (Analog Out 1) or X3/9 (Analog Out 2) to output converted analog values for digital measurements which are contained in the servo amplifier. You will find a list of pre-programmed measurements in the *SETUP SOFTWARE* manual.

**Standard Setting:**
**Analog Out 1**: Tachometer voltage VTA (speed)
The output delivers ±10V at the preset limit speed.
**Analog Out 2**: Current setpoint IDC (torque)
The IDC-monitor delivers ±10V at the preset peak current (effective r.m.s. value).

A list of pre-programmed functions can be found in the online help.

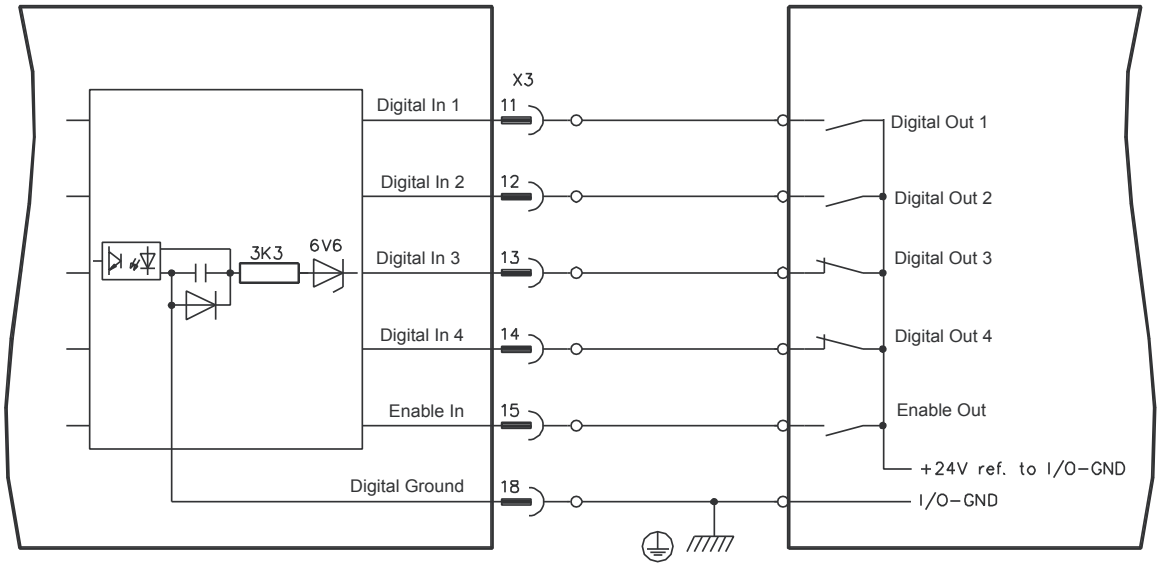
# *Digital Control Inputs (X3)*



All digital inputs are electrically isolated through optocouplers.

**Technical Characteristics**

— Reference ground is Digital Ground (Terminal X3/18)
— The logic is dimensioned for +24V / 7mA (PLC-compatible)
— H-level of +12V to 36V / 7mA, L-level of 0V to 7V / 0 mA




**Enable In Input**

The output stage of the servo amplifier is activated by the enable signal (terminal X3/15, input 24V, active-high). In the inhibited state (low signal) the attached motor has no torque.

**Programmable Digital Inputs:**

You can use the digital inputs Digital In 1 / Digital In 2 / Digital In 3 and Digital In 4 to initiate pre-programmed functions that are stored in the servo amplifier. You will find a list of the pre-programmed functions in the online-help. If an input is freshly assigned to a pre-programmed function, the data set must be stored in the EEPROM of the servo amplifier and the 24V auxiliary supply of the servo amplifier must be switched off and on again (to reset the amplifier software).

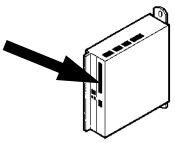
**Limit-Switches Digital In 3 / Digital In 4**

Terminals X3/13 and X3/14 are normally programmed for the connection of limit switches. If these inputs are not needed for the connection of limit switches, they are programmable for other input functions. Limit-switch positive/negative (Digital In 3 / Digital In 4, terminals X3/13 and X3/14), high level in normal operation (fail-safe for a cable break). A low signal (open) inhibits the corresponding direction of rotation; the ramp function remains effective.

**Digital In 1 / Digital In 2**

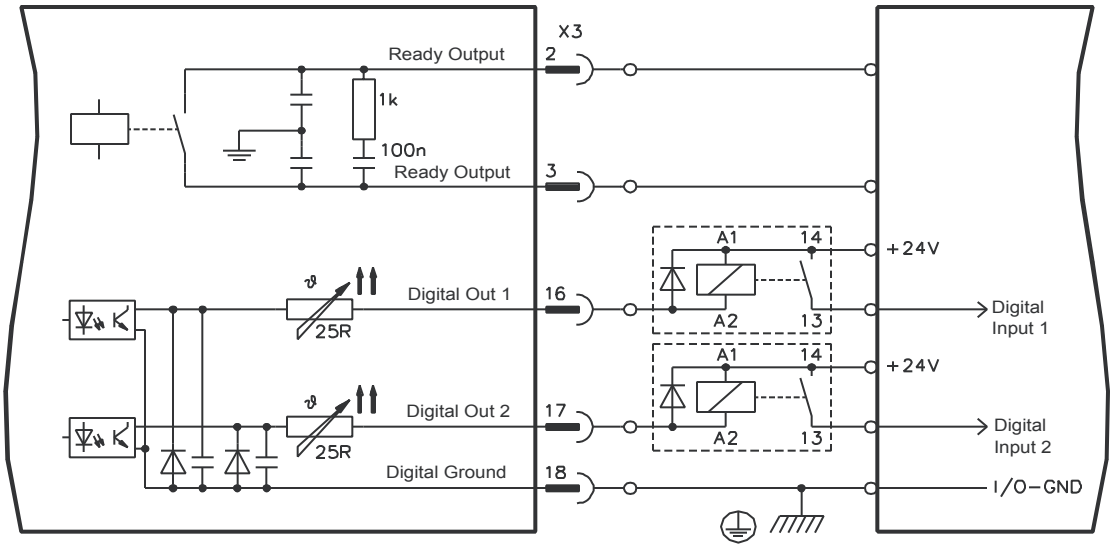
The digital inputs on terminal X3/11 (Digital In 1) or terminal X3/12 (Digital In 2) can be logically combined in a pre-programmed function.

# *Digital Control Outputs (X3)*



**Technical Characteristics**

— Reference ground is Digital Ground (Terminal X3/18)
— All digital outputs are floating
— Digital Out 1 and 2 : Open collector, max. 30VDC, 10 mA
Ready Output : Relay output, max. 30VDC or 42VAC, 0.5A




**Ready-To-Operate Contact: Ready Output**
Operational readiness (terminals X3/2 and X3/3) is signaled by a floating relay contact. The contact is closed when the servo amplifier is ready for operation. The signal is not influenced by the enable signal, the $I^2t$- limit, or the regen threshold.

All faults cause the Ready Output contact to open and the switch-off of the output stage. A list of the error messages can be found on page 55.

**Programmable Digital Outputs: Digital Out 1 / 2:**
You can use the digital outputs Digital Out 1 (terminal X3/16) and Digital Out 2 (terminal X3/17) to output messages from pre-programmed functions stored in the servo amplifier. A list of the pre-programmed functions is contained in the online help.

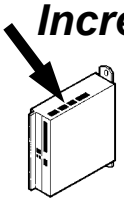
If an input is freshly assigned to a pre-programmed function, the data set must be stored in the EEPROM of the servo amplifier and the 24V auxiliary supply of the servo amplifier must be switched off and on again (to reset the amplifier software).

Evaluate the outputs via inverting interface relays (see connection diagram), for example, Phoenix DEK-REL-24/I/1 (turn-on delay 6 ms, turn-off delay 16ms).

***The described logic in the SETUP SOFTWARE manual and the online help refers to the output of the inverting interface relays. Consider the delay of the applied relay!***

# ENCODER EMULATIONS

## *Incremental Encoder Interface (X5)*



The incremental encoder interface is part of the supplied package. Select the encoder function ROD (screen page "Encoder").

In the servo amplifier, the position of the motor shaft is calculated from the cyclic-absolute signals of the resolver or encoder.
Incremental encoder compatible pulses are generated from this information. Pulses are output on the SubD connector, X5, as two signals: A and B (with 90°-phase difference and a zero pulse).

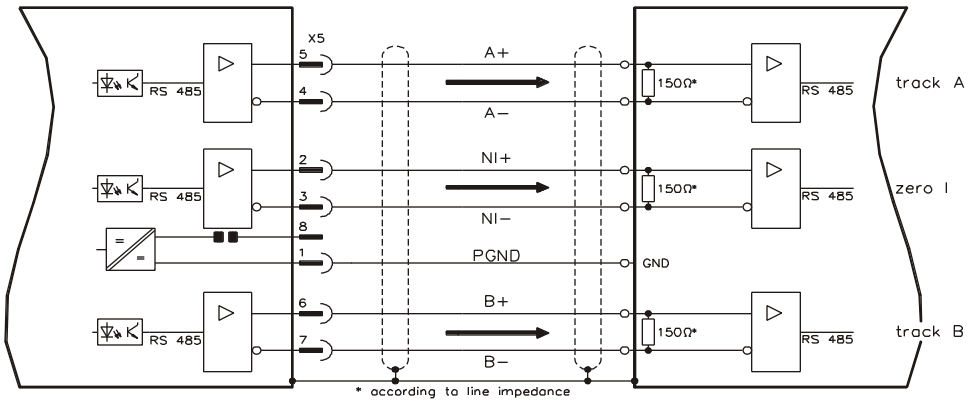
The resolution can be changed with the RESOLUTION parameter:

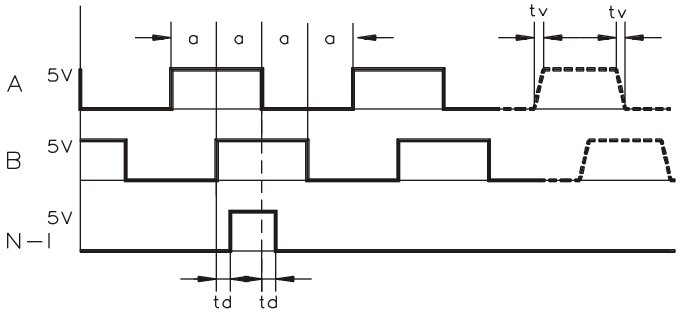
| | |
|---|---|
| 256/512/1024 | pulses per turn for Feedback=Resolver |
| 2048/4096 | pulses per turn for Feedback=EnDat or HIPERFACE |
| 8192 | pulses per turn for Feedback=EnDat or HIPERFACE up to 3000 rmp |
| 16384 | pulses per turn for Feedback=EnDat or HIPERFACE up to 1500 rmp |

You can also adjust and store the position of the zero pulse within one mechanical turn (parameter NI-OFFSET). Because of the compatibility with normal commercial pulse encoders, you can only set the zero pulse when A=B=1.

The drivers are supplied from an internal supply voltage. **PGND must always be connected to the controls.**

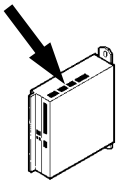
**Connections And Signal Description For Incremental Encoder Interface:**




Edge spacing a ≥ 8 µs
$U_H$ ≥ 2,0V/−20mA
$U_L$ ≤ 0,5V/+20mA
Edge steepness tv ≤ 0.1 µs
Delay N−I−td ≤ 0.1 µs
Scanning frequency > 160kHz
Limit speed 6000 rpm

# *SSI Interface (X5)*



The SSI interface (synchronous serial absolute-encoder emulation) is part of the delivered package. Select the encoder function SSI (screen page “Encoder”).

In the servo amplifier, the position of the motor shaft is calculated from the cyclic-absolute signals of the resolver or encoder. A position output is generated from this information, compatible with the data format of normal commercial SSI absolute encoders. This synchronous, serial, cyclic-absolute 12-bit information is output on the SubD-connector X5.

24 bits are transmitted. The upper 12 bits are fixed at zero; the lower 12 bits contain the position information. Exception: If a SinCoder (Stegmann) is used as a feedback device, the upper 12 bits are held at 1 (invalid data!) until a reference traverse has been carried out, and then they are set to ZERO (valid data!).

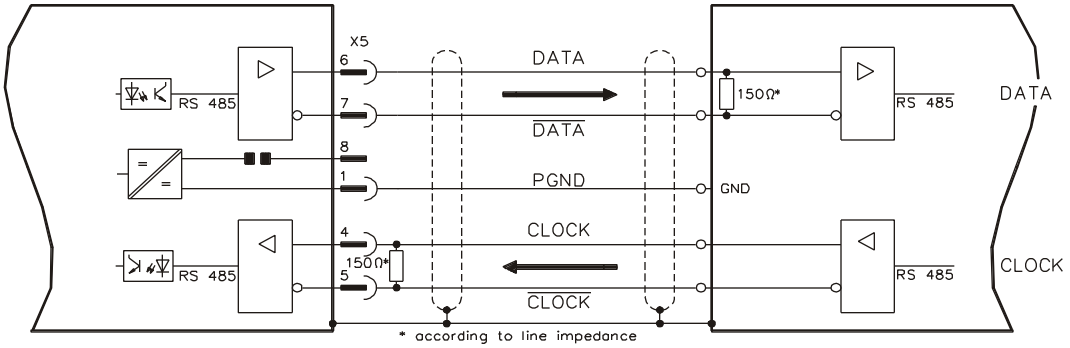
The interface must be read in as a multi-turn encoder, but delivers valid single-turn data. The signal sequence can be output in Gray code (standard) or in binary code (parameter SSI-CODE).

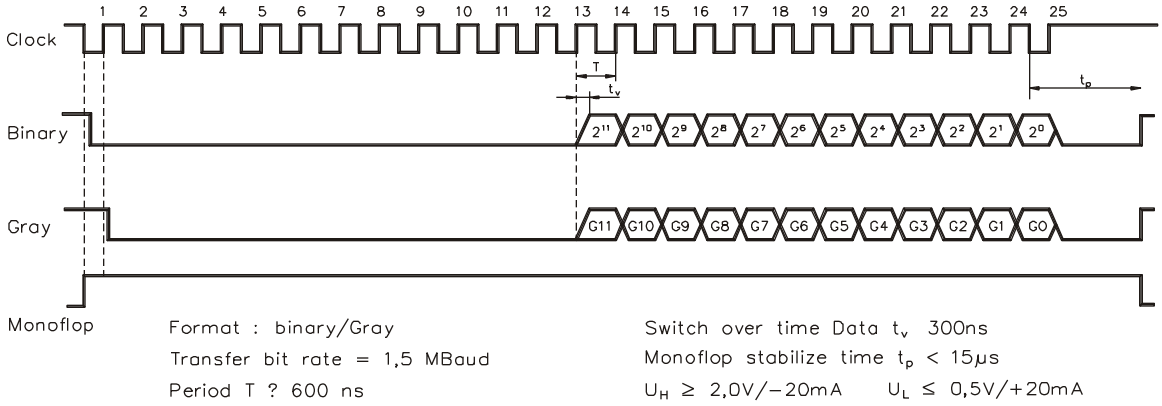
A serial signal is read out from the control, with a synchronous clock frequency of max. 1.5 MHz. The servo amplifier is adjusted to the clock frequency of your SSI-evaluation with the SSI-TAKT parameter (200 kHz or 1.5MHz and inverted).

The drivers are supplied from an internal supply voltage. PGND must always be connected to the controls.

**Connection And Signal Description For SSI Interface:**

The count direction for the SSI interface is upwards when the motor shaft is rotating clockwise (looking at the shaft end).

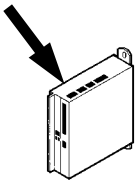



Format : binary/Gray
Transfer bit rate = 1,5 MBaud
Period T ? 600 ns

Switch over time Data $t_v$ 300ns
Monoflop stabilize time $t_p$ < 15µs
$U_H \geq 2{,}0V/-20mA$ $U_L \leq 0{,}5V/+20mA$

# RS232 INTERFACE, PC CONNECTION (X6)



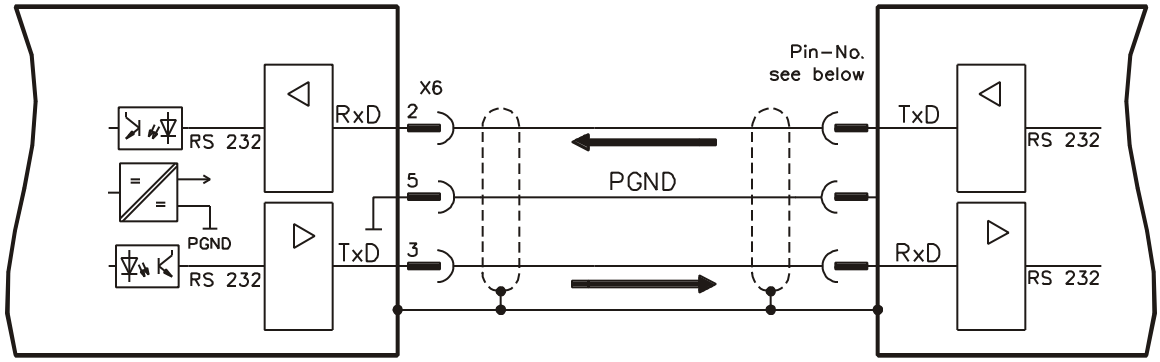
The setting of the operating, position control, and motion-block parameters can be carried out with an ordinary commercial PC.

Connect the PC interface (X6) of the servo amplifier **while the supply to the equipment is switched off** via a normal commercial 3-core null-modem cable to a serial interface on the PC.

**Do not use a null-modem link cable!**

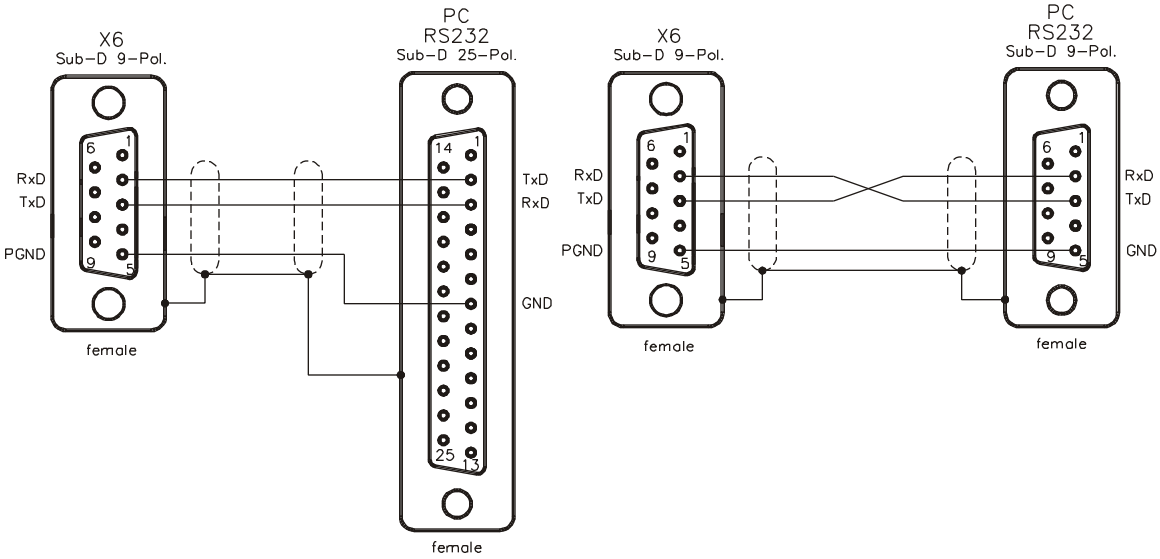
The interface is electrically isolated through an optocoupler, and is at the same potential as the CANopen interface. The interface is selected and set up in the setup software. Further notes can be found on page 32.

With the optional expansion card, 2CAN, the two interfaces for RS232 and CAN, which otherwise use the same connector X6, are separated on two connectors (see page 65.).

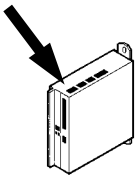



**Interface Cable Between The PC And Servo Amplifiers Of The *PosiDrive Series RS*:**

(View: looking at the face of the built-in SubD connectors, this corresponds to the solder side of the SubD sockets on the cable)



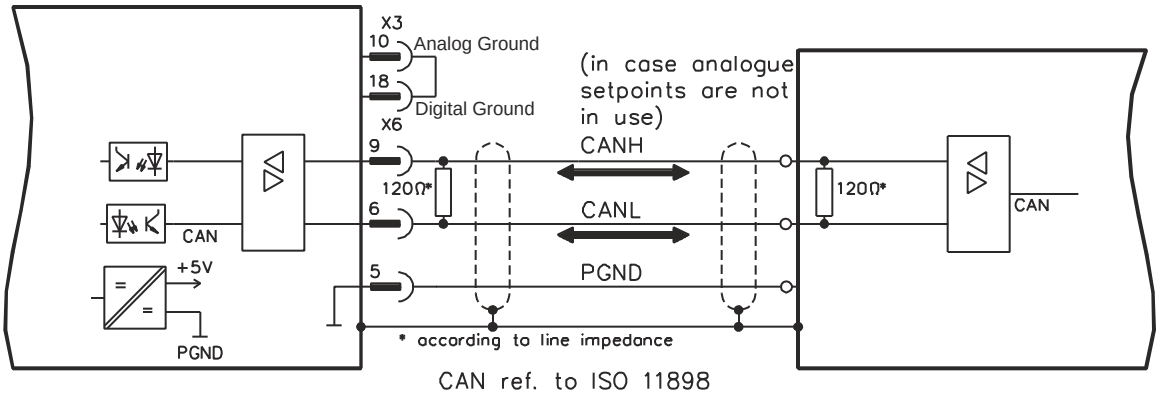
# CANOPEN INTERFACE



The interface for connecting to the CAN bus (default 500 kBaud). The integrated profile is based on the communication profile CANopen DS301 and the drive profile DSP402. The following functions are available in connection with the integrated position controller: Jogging with variable speed, reference traverse (zeroing), start motion task, start direct task, digital setpoint provision, data transmission functions and many others.

Detailed information can be found in the CANopen manual. The interface is electrically isolated by optocouplers and is at the same potential as the RS232 interface. The analog setpoint inputs can still be used. With the optional expansion card, 2CAN, the two interfaces for RS232 and CAN, which otherwise use the same connector X6, are separated on two connectors (see page 65).

**If the analog setpoint inputs are not used, Analog Ground and Ground (terminal X3) must be connected!**




**CAN Bus Cable**

To meet ISO 11898, use a bus cable with characteristic impedance of 120 Ω. The maximum usable cable length for reliable communication decreases with increasing transmission speed. As a guide, use the following values, but do not take them as assured limits:

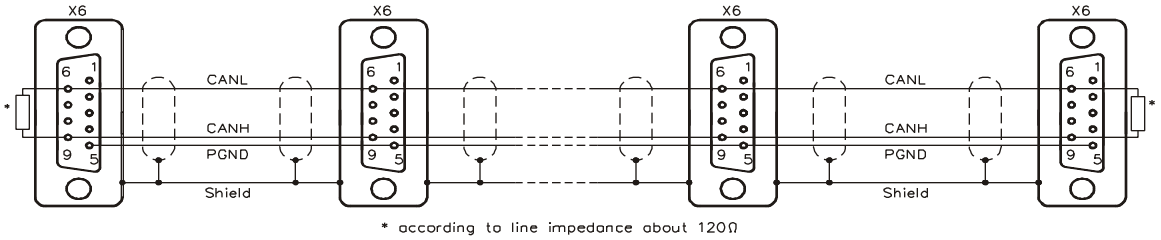
**Cable Data:** Characteristic impedance: 100 Ω to 120 Ω
Cable capacitance: max. 60 nF/km
Lead resistance (loop): 159.8 Ω/km

**Cable Length, Depending On The Transmission Rate**

| Transmission Rate (Kbaud) | Maximum Cable Length (m) |
|---|---|
| 1000 | 20 |
| 500 | 70 |
| 250 | 115 |

Lower cable capacitance (max. 30 nF/km) and lower lead resistance (loop, 115 Ω/km) make it possible to achieve greater distances. (Characteristic impedance 150 ± 5Ω terminating resistor 150 ± 5Ω). For EMC reasons, the SubD connector housing must have:

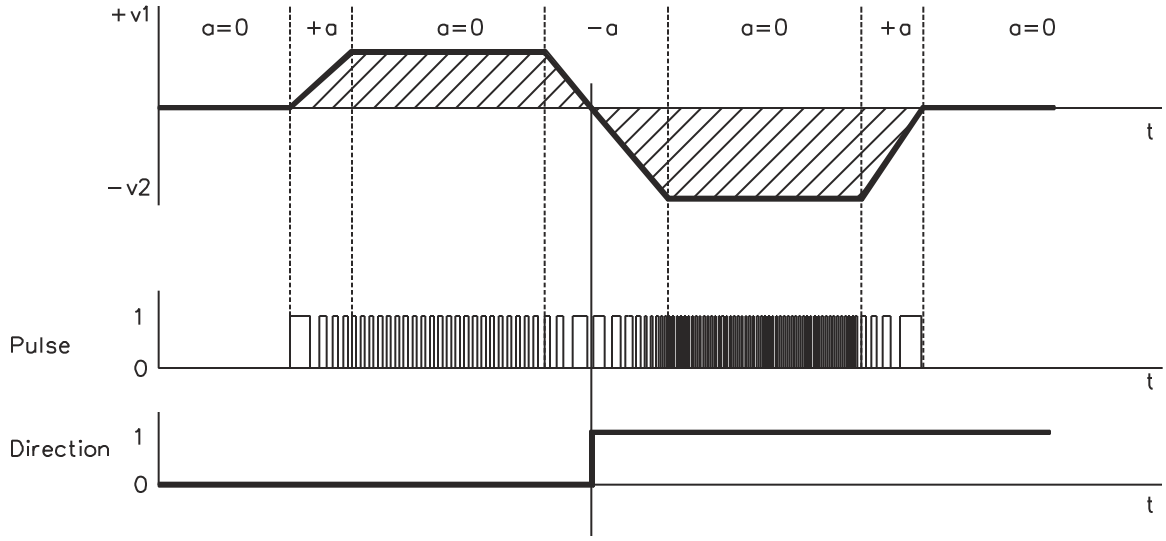
metal or metallized housing
provision for cable shielding connection in housing, large-area connection



# INTERFACE FOR STEPPER-MOTOR CONTROLS (PULSE DIRECTION)

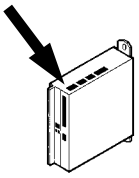
This interface is used to connect the servo amplifier to a third-party stepper-motor controller. The parameters for the servo amplifier are set up with the aid of the setup software (electrical gearing). The number of steps can be adjusted so the servo amplifier is adjusted to the pulse-direction signals of any stepper-motor controller. Various monitoring signals can be output. The analog setpoint inputs are out of action. Analog Ground and Digital Ground (terminal X3) must be connected!

**Speed Profile and Signal Diagram**




Derivatives:
Distance traversed s —— no. of pulses
Velocity v —— pulse frequency
Acceleration a —— change of pulse frequency

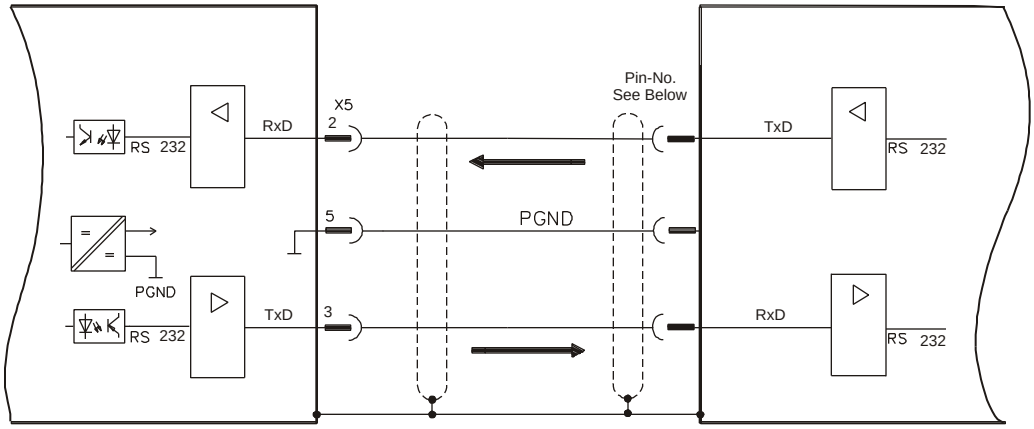
# *Connection To Stepper-Motor Controller With 5V Signal Level (X5)*



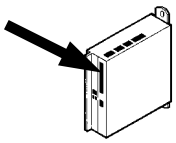
This interface is used to connect the servo amplifier to a stepper-motor controller with 5V-signal level. The connector X5 must be used.

Edge frequency: 1MHz

**Analog Ground and Digital Ground (terminal X3) must be connected!**



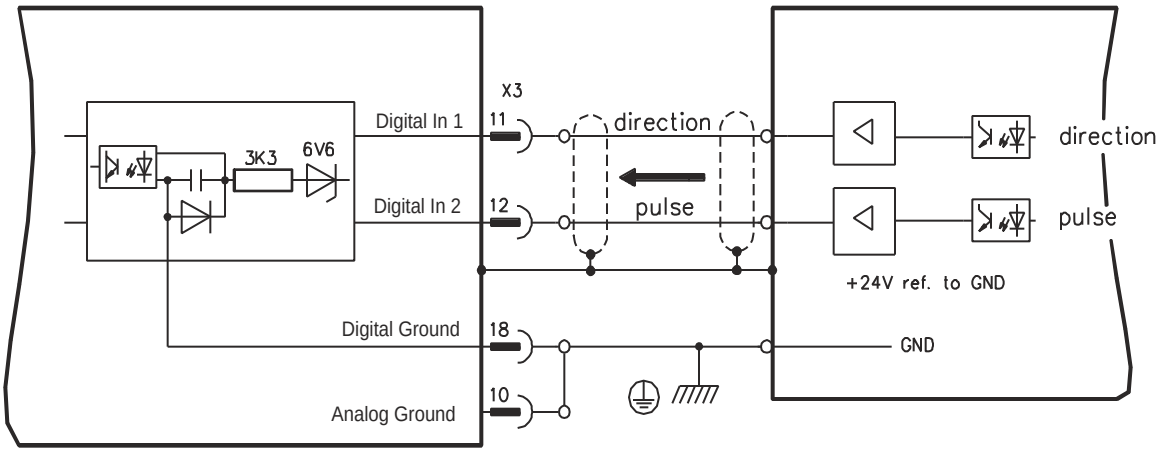

# *Connection To Stepper-Motor Controller With 24V Signal Level (X3)*



This interface is used to connect the servo amplifier to a stepper-motor controller with 24V-signal level. The digital inputs DIGITAL-IN 1 and 2 at connector X3 must be used.

Edge frequency: 100 kHz

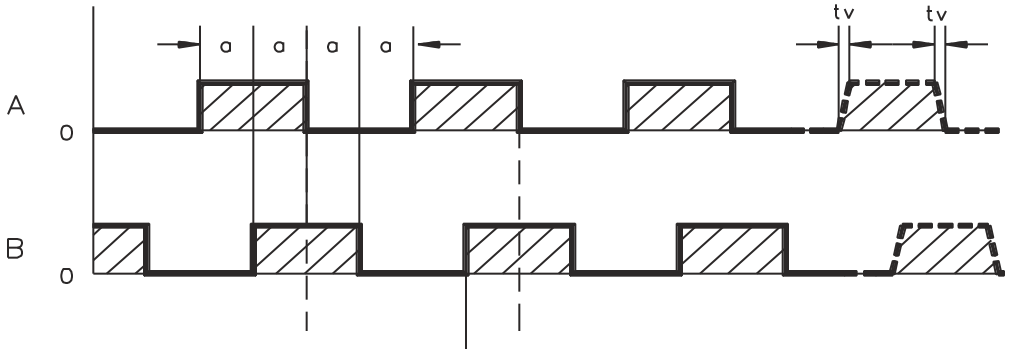
**Analog Ground and Digital Ground (terminal X3) must be connected!**



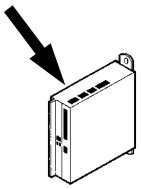
# INTERFACE FOR MASTER-SLAVE OPERATION, ENCODER FOLLOWER

This interface is used to link several amplifiers together in master-slave operation. The parameters for the slave amplifiers are set up with the aid of the setup software. The resolution (no. of pulses/turn) can be adjusted. The analog setpoint inputs are out of action.
**Analog Ground and Digital Ground (terminal X3) must be connected!**

**Signal Diagram (For Encoders With RS422 Or 24V Output)**



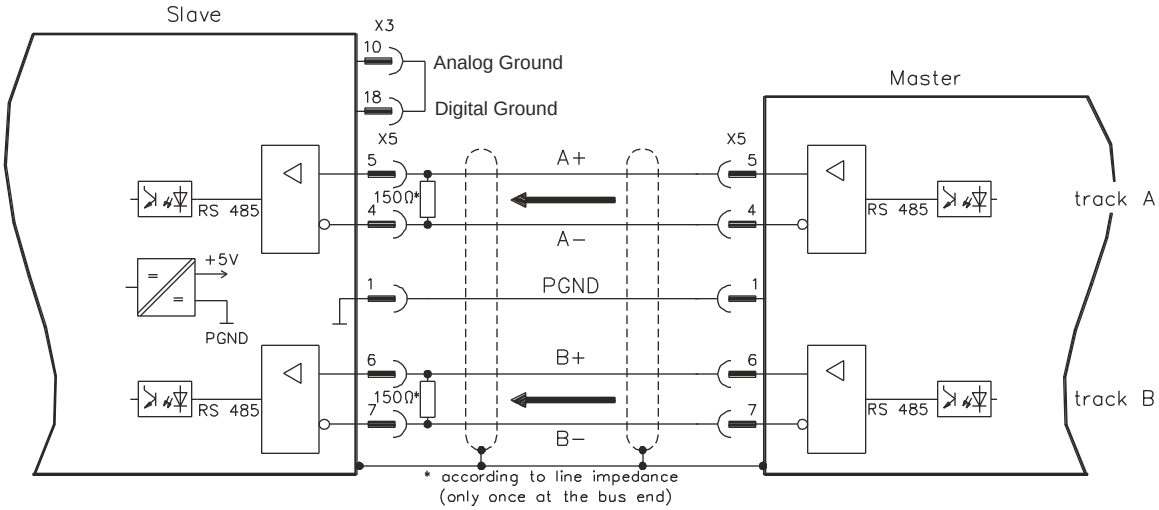

## *Connection To* A ***PosiDrive Series RS*** *Master, 5V Signal Level (X5)*



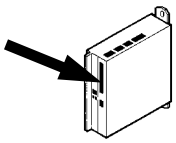
This interface is used to link several amplifiers together in master-slave operation. Up to 16 slave amplifiers can be controlled by the master via the encoder output. The connector X5 must be used.

Edge frequency: 1MHz, slew rate tv ≤ 0,1µs

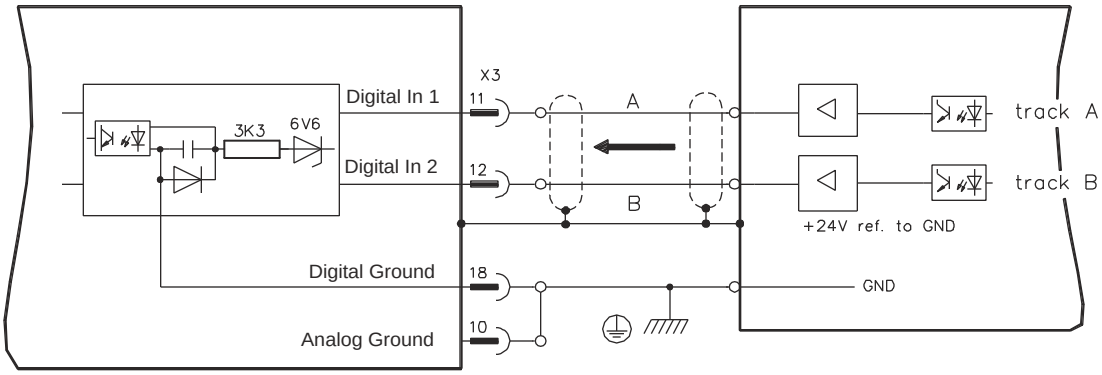
**Analog Ground and Digital Ground (terminal X3) must be connected!**



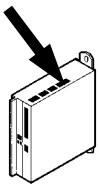
# *Connection To Encoders With 24V Signal Level (X3)*



This interface is used to operate the ***PosiDrive Series RS*** as a slave, mastered by an encoder with 24V-signal level (master-slave operation). The digital inputs DIGITAL-IN 1 and 2 at connector X3 must be used.
Edge frequency: 100 kHz, slew rate tv ≤ 0,1µs
**Analog Ground and Ground (terminal X3) must be connected!**




# *Connection To A Sine-Cosine Encoder (X1)*

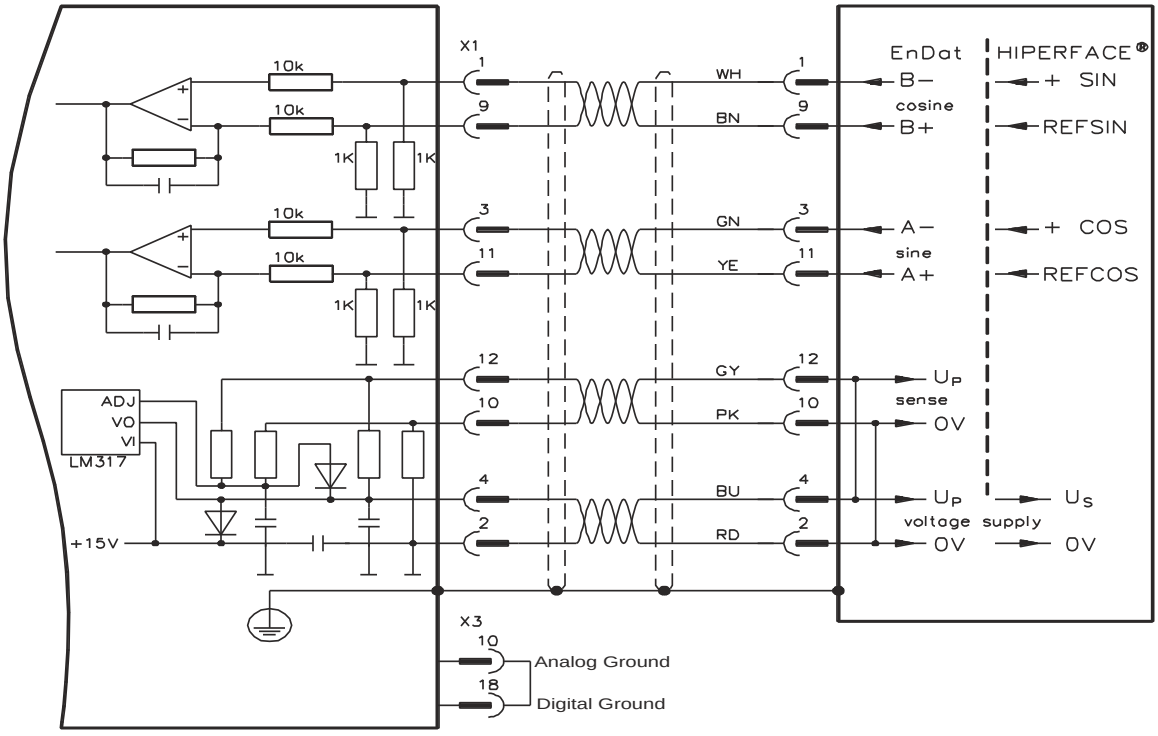


This interface is used to operate the ***PosiDrive Series RS*** as a slave, mastered by a sine-cosine encoder (master-slave operation). The connector X1 must be used.

Edge frequency: 100 kHz

**Analog Ground and Digital Ground (terminal X3) must be connected!**

The cable colors in the wiring diagram are valid for a 4x2x0, 25 mm cable.



# OPERATION

## *Important Notes*

Only professional personnel with extensive knowledge in the fields of electrical and drive technology are allowed to operate the servo amplifier. The operating procedure is described as an example. Depending on the application, a different procedure may be required.

**In multi-axis systems, operate each servo amplifier individually.**

***The manufacturer of the machine must generate a hazard analysis for the machine, and take appropriate measures to ensure that unforeseen movements cannot cause injury or damage to personnel or property.***

***Check that all live connecting elements are protected from accidental contact. Deadly voltages of up to 900V can be present. Never disconnect any electrical connections to the servo amplifier while it is live. Capacitors can have residual charges with dangerous levels up to 300 seconds after switching off the supply power. Heat sinks and front panels of the amplifier can reach a temperature of up to 80°C (176°F) in operation. Check (measure) the heat sink temperature. Wait until the heat sink has cooled down below 40°C (106°F) before touching it.***

***If the servo amplifier has been stored for longer than 1 year, the DC-link capacitors must be re-formed. To do this, disconnect all the electrical connections. Apply single-phase 230VAC to terminals L1 and L2 on the servo amplifier for about 30 minutes. This re-forms the capacitors.***

***Further information on parameters and the effects on the control loop behavior are described in the QuickStart manual . Operating the expansion card (if present) is described in the corresponding manual. We can provide further information through training courses (on request).***

The following instructions should assist you in operating the machinery without hazards to personnel or machinery.

**Check Installation**

See the *Installation* section of this manual. **Disconnect the servo amplifier from the supply.**

**Inhibit Enable Signal**

24VDC on terminal X4/1, ground on terminal X4/3. After the installation procedure (about 0.5 seconds), the status is shown on the LED display (see page 53).

**Switch On PC, Start Setup Software**

Select the interface to which the servo amplifier is connected. The parameters stored in the SRAM of the servo amplifier are transferred to the PC.

**Check Displayed Parameters. And Correct If Necessary**

***It is especially important to check the following parameters. If you do not set them properly, parts of the system can be damaged or destroyed.***

| | |
|---|---|
| Supply voltage | : set to the actual main supply voltage |
| Rated motor voltage | : at least as high as the DC-link voltage of the amplifier |
| Motor pole-no. | : must match the motor (see motor manual) |
| Feedback | : must match the feedback unit in the motor |
| $I_{RMS}$ | : maximum is the motor standstill current $I_0$ (on nameplate) |
| $I_{PEAK}$ | : maximum is 4 x motor standstill current $I_0$ |
| Limit speed | : maximum is the rated motor speed (on nameplate) |
| Regen power | : maximum is the permitted regen resistor dissipation |
| Station address | : unique address (see *Setup Software* manual) |

**Check Safety Devices**

***Make sure any unintended movement of the drive cannot cause hazard to machinery or personnel.***

**Switch On Supply Power**

Through the ON/OFF button of the contactor control.

**Apply 0V Setpoint**

0V on terminals X3/4-5 or X3/6-7

**Enable**

(500 ms after switching on the supply power) 24VDC on terminal X3/15, motor stands with standstill torque $M_0$

**Setpoint**

Apply a small analog setpoint (about 0.5V is recommended) to terminals X3/4-5 or X3/6-7.

**If the motor oscillates, the parameter Kp in the menu page "speed controller" must be reduced – the motor is endangered!**

**Optimization**

Optimize speed, current, and position controllers.

**Operating The Expansion Card**

See operating instructions for the expansion card in the corresponding manual on the CD-ROM.

# PARAMETER SETTING

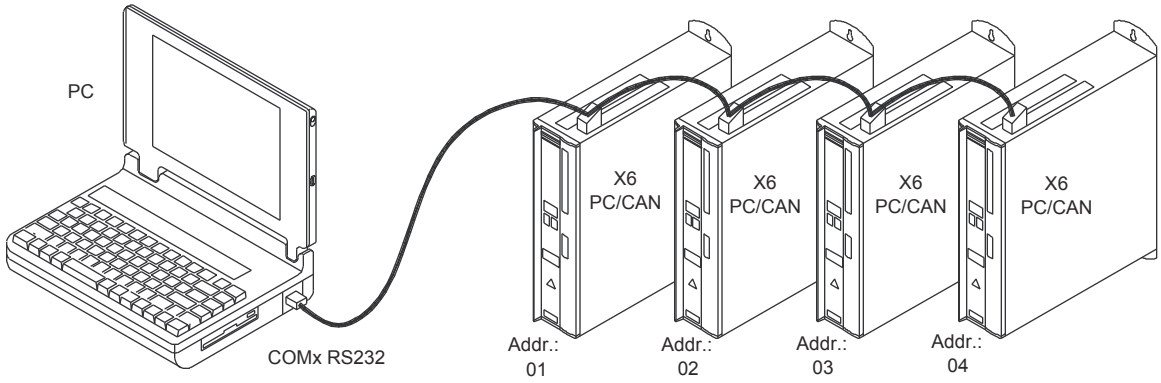
The manufacturer loads a default parameter set into your servo amplifier. This contains valid and safe parameters for the current and speed controllers.

A database for motor parameters is stored in the servo amplifier. During operation, you must select the data set for the connected motor and store it in the servo amplifier. For most applications, these settings already provide good control loop characteristics.

An exact description of all parameters and the possibilities for optimizing the control loop characteristics is found in the *Setup Software DRIVE.EXE* manual.

## Multi-Axis Systems

Using a special cable, you can connect four to six servo amplifiers together and to your PC.




Baud rate identical for all amplifiers,
See table below

With the PC connected to just one servo amplifier, you can use the setup software to select all four or six amplifiers through the preset station addresses and set up the parameters.

## Node Address For CAN-Bus

During operation, preset the station addresses for the individual amplifiers and the baud rate for communication by means of the keypad on the front panel (see page 54).

## Baud Rate For CAN-Bus

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

**Coding of the baud rate in the LED display:**

| Coding | Baud Rate In Kbit/S | Coding | Baud Rate In Kbit/S |
|---|---|---|---|
| 0 | 10 | 5 | 250 |
| 1 | 20 | 6 | 333 |
| 2 | 50 | 7 | 500 |
| 3 | 100 | 8 | 666 |
| 4 | 125 | 9 | 800 |
| | | 10 | 1000 |

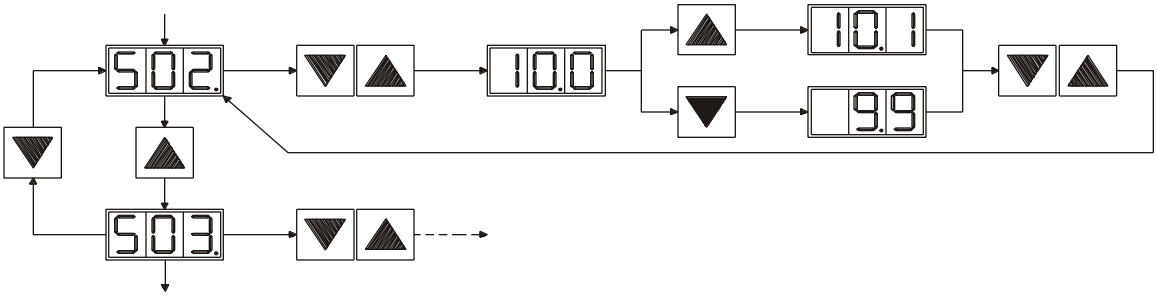
# *Key Operation/LED Display*

There are two possible operation menus and the use of the keys in the front panel. Normally, the ***PosiDrive Series RS*** only places the standard menu at your disposal. If you want to access the amplifier via the detailed menu, you must keep the right key pressed while switching on the 24V-supply.

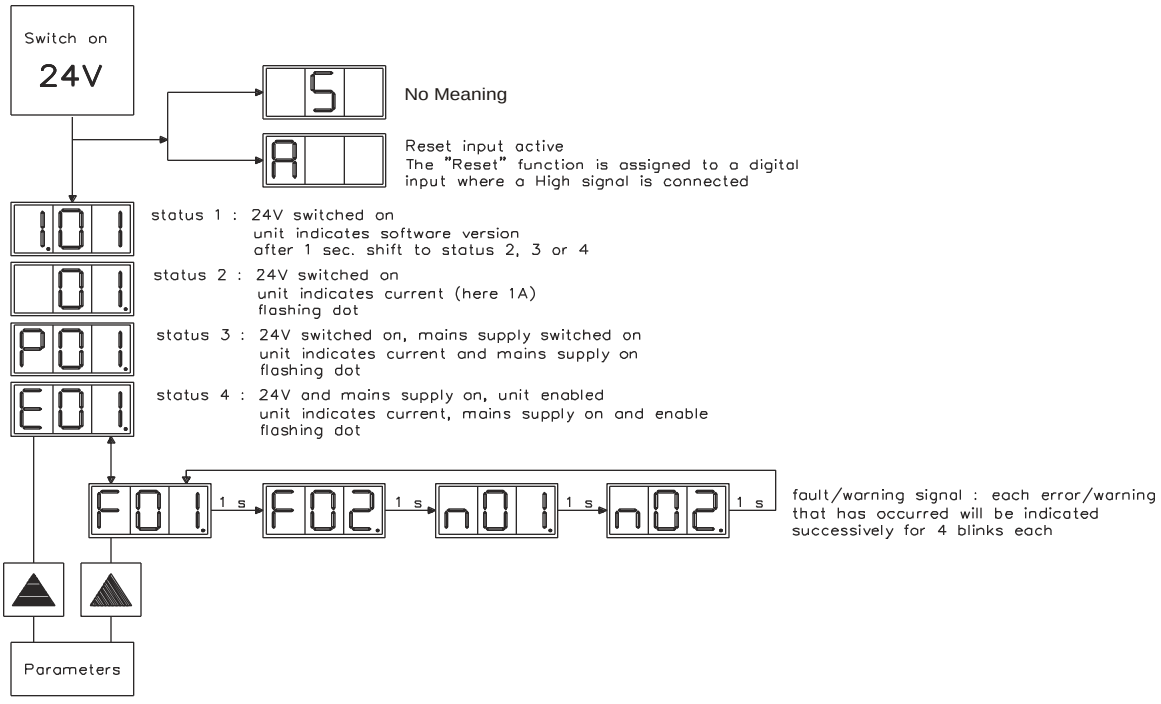
## KEY OPERATION

### Two keys are used to perform the following

| Key Symbol | Functions |
|---|---|
| ▲ | **press once** : go up one menu item, increase number by one<br>**press twice in rapid succession** : increase number by ten |
| ▼ | **press once** : go down one menu item, decrease number by one<br>**press twice in rapid succession** : decrease number by ten |
| ▲ ▼ | **press and hold right key, then press left key as well**<br>:enter a number, return function **name** |

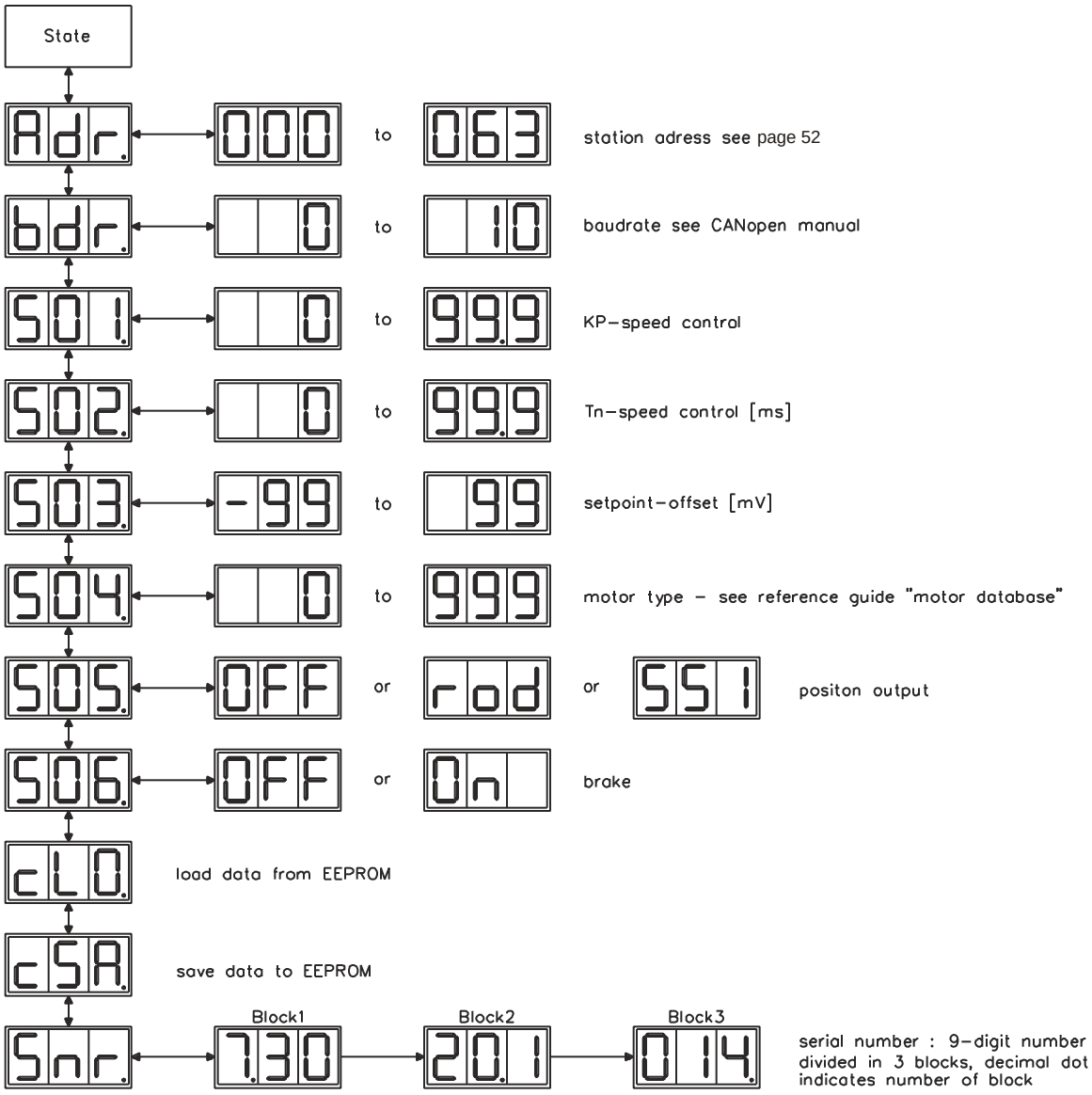



## STATUS DISPLAY



## STANDARD MENU STRUCTURE


## EXTENDED MENU STRUCTURE



# ERROR MESSAGES

An error number in the LED display shows errors in coded form on the front panel. All error messages result in the Ready Output contact being opened, and the output stage of the amplifier being switched off (motor loses all torque). If a motor-holding brake is installed, it is activated.

| Number | Designation | Explanation |
|---|---|---|
| **F01*** | heat sink temperature | heat sink temperature too high limit is set by manufacturer to 80°C |
| **F02*** | overvoltage | overvoltage in DC-link limit depends on the mains supply voltage |
| **F03*** | following error | message from the position controller |
| **F04** | feedback | cable break, short circuit, short to ground |
| **F05*** | undervoltage | undervoltage in DC-link limit is set by manufacturer to 100V |
| **F06** | motor temperature | motor temperature too high limit is set by manufacturer to145°C |
| **F07** | aux. voltage | internal aux. voltage not OK |
| **F08*** | overspeed | motor running away, speed is too high |
| **F09** | EEPROM | checksum error |
| **F10** | Flash-EPROM | checksum error |
| **F11** | brake | cable break, short circuit, short to ground |
| **F12** | motor phase | motor phase missing (cable break or similar) |
| **F13*** | internal temperature | internal temperature too high |
| **F14** | output stage | fault in the output stage |
| **F15** | $I^2t$ max | $I^2t$ max. value exceeded |
| **F16*** | supply - Ready Output | 2 or 3 phases missing in the supply feed |
| **F17** | A/D converter | error in the analog-digital conversion |
| **F18** | regen | regen circuit faulty or incorrect setting |
| **F19** | supply phase | a supply phase is missing (can be switched off for 2-phase operation) |
| **F20** | Slot fault | Hardware fault of the expansion card |
| **F21** | Handling fault | Software fault of the expansion card |
| **F22** | Short circuit to earth | 640/670 only: short circuit to earth |
| **F23** | CAN Bus off | CAN Bus total communication error |
| **F24** | Warning | Warning displays as error |
| **F25** | Commutation error | Encoder systems only |
| **F26** | Limit switch | Homing error (hardware limit switch reached) |
| **F27** | Reserved | Reserved |
| **F28** | Reserved | Reserved |
| **F29** | SERCOS | SERCOS error |
| **F30** | Emerg. Stop Timeout | Emerg. Stop Timeout |
| **F31** | reserved | reserved |
| **F32** | system error | system software not responding correctly |

***** These error messages can be cancelled by the ASCII command, CLRFAULT, without making a reset. If only these errors are present, and the RESET button or the I/O-function RESET is used, the CLRFAULT command is also all that is carried out.

# WARNING MESSAGES

Faults which occur, but which do not cause a switch-off of the amplifier output stage (Ready Output contact remains closed), are indicated in the LED display on the front panel by a coded warning number.

| Number | Designation | Explanation |
|---|---|---|
| **n01** | $I^2t$ | $I^2t$ threshold exceeded |
| **n02** | regen power | preset regen power reached |
| **n03*** | S_fault | exceeded preset contouring error |
| **n04*** | response monitoring | response monitoring (fieldbus) is active |
| **n05** | supply phase | supply phase missing |
| **n06*** | Sw limit-switch 1 | passed software limit-switch 1 |
| **n07*** | Sw limit-switch 2 | passed software limit-switch 2 |
| **n08** | motion task error | a faulty motion task was started |
| **n09** | no reference point | no reference point set at start of motion task |
| **n10*** | Digital In 3 | Digital In 3 limit-switch activated |
| **n11*** | Digital In 4 | Digital In 4 limit-switch activated |
| **n12** | default values | only HIPERFACE® : motor default values were loaded |
| **n13*** | expansion card | expansion card not functioning correctly |
| **n14** | HIPERFACEÒ-reference mode | Attempt to reset while HIPERFACEÒ-reference mode was active |
| **n15** | Table error | Velocity current table INXMODE 35 error |
| **n16-n31** | reserved | reserved |
| **n32** | Firmware beta version | The firmware is not a released beta version |
| **A** | Reset | RESET is active at Digital In x |

***** These warning messages lead to a controlled shut-down of the drive (braking with the emergency ramp)

# Expansion Card –I/O–

## *(Part Number: 09-5B-RS-00001)*

This section describes the ***PosiDrive Series RS*** I/O-expansion card. It only describes the additional features that the expansion card makes available for the ***PosiDrive Series RS***. If you ordered the expansion card with the servo amplifier, it is delivered already inserted securely into the expansion slot of the servo amplifier.

The Expansion Card provides you with 14 additional digital inputs and 8 digital outputs. The functions of the inputs and outputs are fixed. They are used to initiate the motion tasks stored in the servo amplifier and evaluate signals from the integrated position control in the higher-level control.

The functions of the inputs and signal outputs correspond exactly to the functions that can be assigned to the digital-I/O on connector X3 of the ***PosiDrive Series RS***.

The 24VDC supply for the expansion card is taken from the controller. All inputs and outputs are electrically isolated from the servo amplifier by an optocoupler.

# FITTING THE EXPANSION CARD

If you want to retrofit the I/O expansion card into a ***PosiDrive Series RS***, follow these steps:

Use a suitable screwdriver to remove the cover of the option slot.
Take care that no small items (such as screws) fall into the open option slot.
Push the expansion card carefully into the guide rails that are provided, without twisting it.
Press the expansion card firmly into the slot, until the front cover touches the fixing lugs to ensure that the connectors make good contact.
Screw the screws on the front cover into the threads in the fixing lugs.

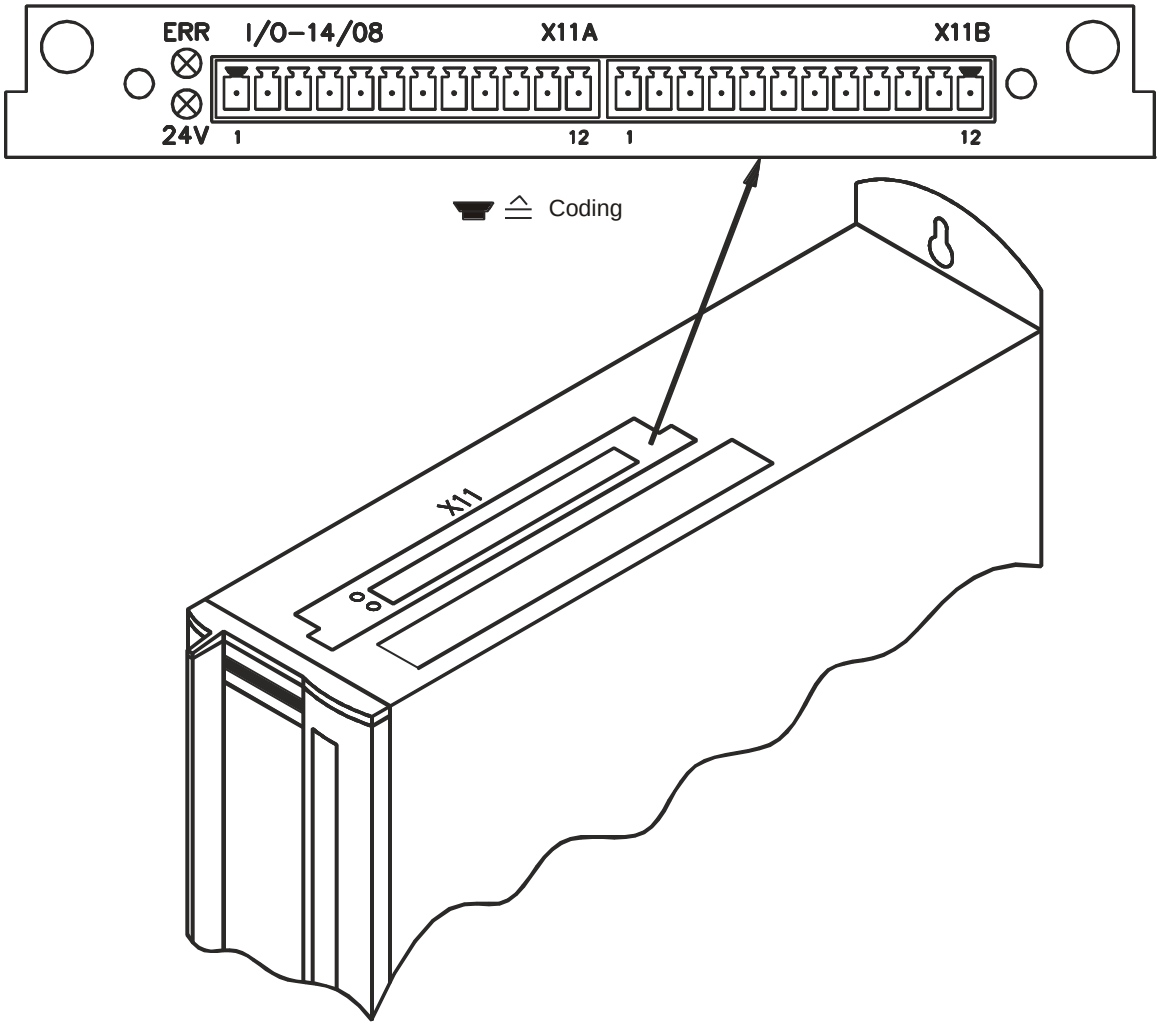
# TECHNICAL DATA

| | |
|---|---|
| Control inputs | 24V / 7mA, PLC-compatible |
| Signal outputs | 24V / max. 500mA, PLC-compatible |
| Supply inputs, to IEC 1131 | 24V (18 to 36V) / 100mA plus total current of the outputs (depends on the input wiring of the controls) |
| Fusing (external) | 4 AT |
| Connectors | MiniCombicon, 12-pole, coded on PIN1 and 12 respectively |
| Cables | Data – up to 50m long : 22 x 0.5mm_, unshielded<br>Supply – 2 x 1mm_, check voltage drop |
| Waiting time between 2 motion tasks | depends on the response time of the control system |
| Addressing time (min.) | 4ms |
| Starting delay (max.) | 2ms |
| Response time of digital outputs | max. 10ms |

# LIGHT EMITTING DIODES (LEDS)

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

# POSITION OF THE CONNECTORS



# CONNECTOR ASSIGNMENTS

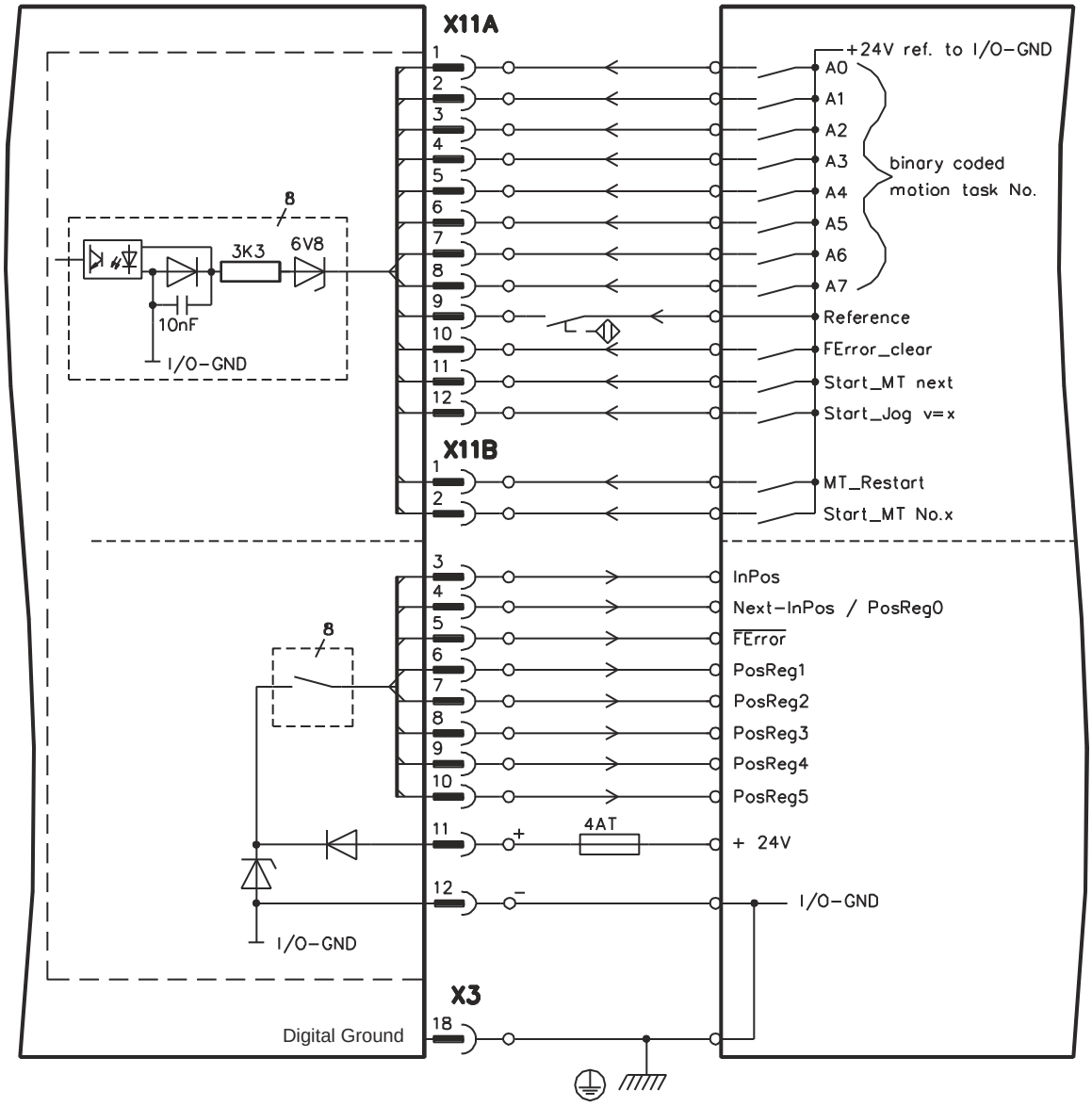
| **Connector X11A** | | | |
|---|---|---|---|
| **Terminal** | **Function** | **Description** | |
| 1 | In | A0 | Motion task no., LSB |
| 2 | In | A1 | Motion task no., 21 |
| 3 | In | A2 | Motion task no., 22 |
| 4 | In | A3 | Motion task no., 23 |
| 5 | In | A4 | Motion task no., 24 |
| 6 | In | A5 | Motion task no., 25 |
| 7 | In | A6 | Motion task no., 26 |
| 8 | In | A7 | Motion task no., MSB |
| 9 | In | Reference | Polls the reference switch. If a digital input on the basic unit is used as a reference input, then the input on the I/O expansion card will not be evaluated. |
| 10 | In | FError_clear | Clear the warning of a following error or the response monitoring. |
| 11 | In | Start_MT Next | The following task that is defined in the motion task by "Start with I/O" is started. The target position of the present motion task must be reached before the following task can be started. The next motion block can also be started by an appropriately configured digital input on the basic unit. |
| 12 | In | Start_Jog v=x(1) | Start of the setup mode "Jog Mode" with a defined speed. After selecting the function, you can enter the speed in the auxiliary variable "*x*". The sign of the auxiliary variable defines the direction. A rising edge starts the motion; a falling edge cancels the motion. |

| **Connector X11B** | | | |
|---|---|---|---|
| **Terminal** | **Fn** | **Description** | |
| 1 | In | MT_Restart | Continues the motion task that was previously interrupted. The motion task can also be continued by an appropriately configured digital input on the basic unit. |
| 2 | In | Start_MT No. x(2) | Start of the motion task that has the number that is presented, bit-coded, at the digital inputs (A0 to A7). The digital function with the same name, in the basic unit, starts the motion task with the address given by the digital inputs on the basic unit. |
| 3 | Out | InPos | When the target position for a motion task has been reached (the InPosition window), this is signaled by the output of a HIGH signal. A cable break will not be detected |
| 4 | Out | Next-InPos | The start of each motion task in an automatically executed sequence of motion tasks is signaled by an inversion of the output signal. The output produces a Low signal at the start of the first motion task of the motion task sequence. Using ASCII commands can vary the form of the message. |
| | | PosReg0 | Can only be adjusted by ASCII commands. |
| 5 | Out | FError | Contouring-error (low active). |
| 6 | Out | PosReg1 | The preset function of the corresponding position register is indicated by a HIGH signal. |
| 7 | Out | PosReg2 | |
| 8 | Out | PosReg3 | |
| 9 | Out | PosReg4 | |
| 10 | Out | PosReg5 | Can only be adjusted by ASCII commands. |
| 11 | Sup. | 24V DC | auxiliary supply voltage |
| 12 | Sup. | I/O-GND | Digital-GND for the controls |

# SELECT MOTION TASK NUMBER

| **Motion Task No. (Decimal)** | **Motion Task No. (Binary)** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **A7** | **A6** | **A5** | **A4** | **A3** | **A2** | **A1** | **A0** |
| 174 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |

# CONNECTION DIAGRAM

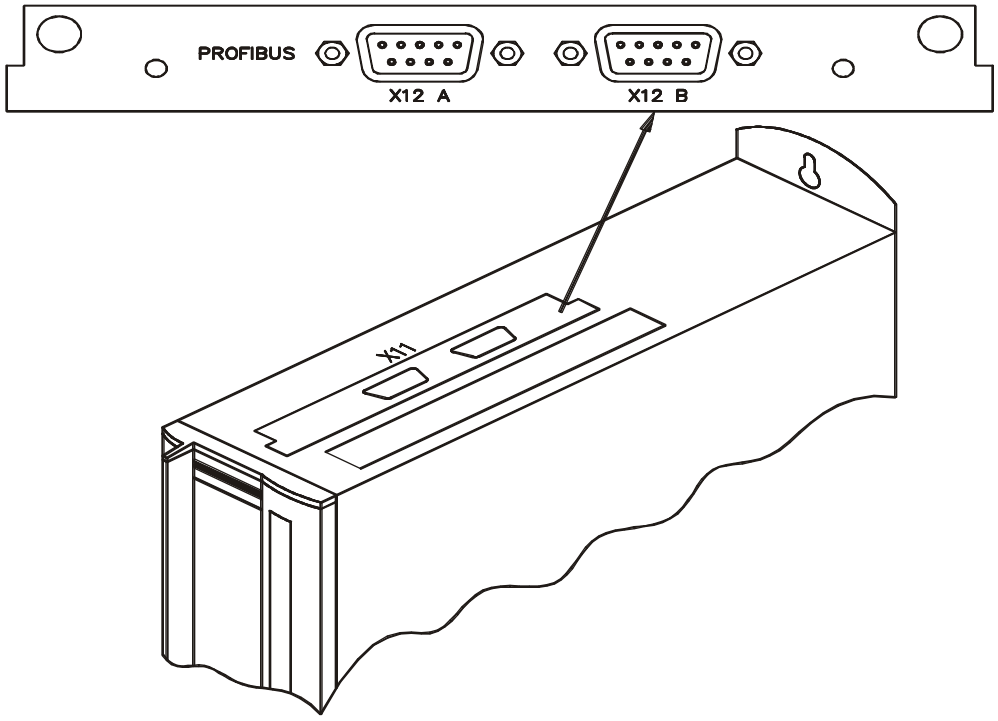


# Expansion Card –Profibus–

This section describes the PROFIBUS expansion card for the ***PosiDrive Series RS***. Information on the range of functions and the software protocol can be found in the "Communication profile **PROFIBUS DP**" section.

If you ordered the expansion card with the servo amplifier, the expansion card is already securely placed in the slot when the servo amplifier is delivered. The PROFIBUS expansion card has two 9-pin SubD sockets wired in parallel. The servo amplifier provides the supply voltage for the expansion card.

## POSITION OF THE CONNECTORS




## FITTING THE EXPANSION CARD

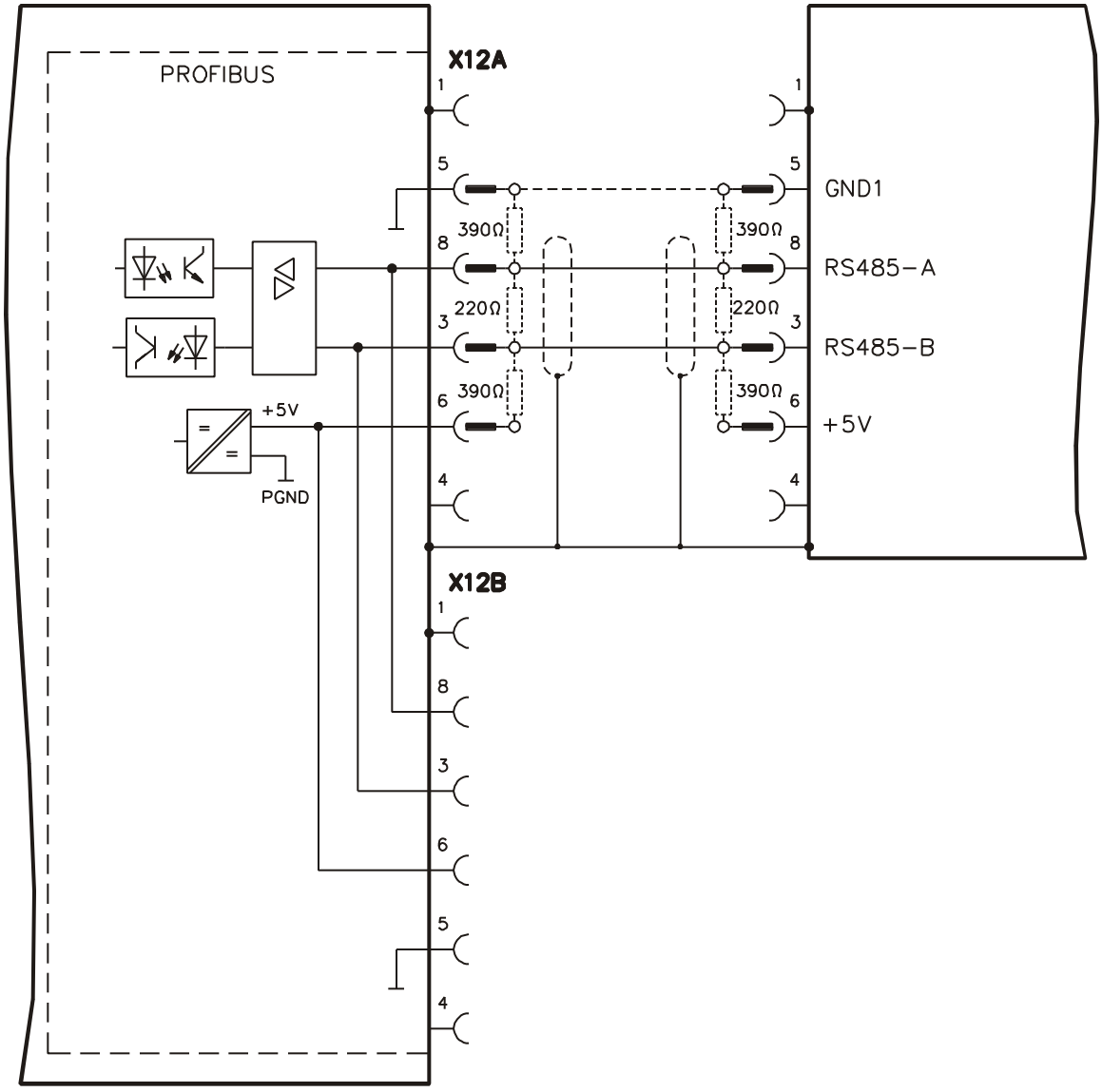
If you want to retrofit the I/O expansion card into a ***PosiDrive Series RS***, follow these steps:

Use a suitable screwdriver to remove the cover of the option slot.
Take care that no small items (such as screws) fall into the open option slot.
Push the expansion card carefully into the guide rails that are provided, without twisting it
Press the expansion card firmly into the slot, until the front cover touches the fixing lugs to ensure that the connectors make good contact.
Screw the screws on the front cover into the threads in the fixing lugs.

# CONNECTION TECHNOLOGY

Cable selection, routing, shielding, bus connector, bus termination and transmission times are all described in the *Installation Guidelines for PROFIBUS-DP*/, Order No. 2.111, from PNO, the PROFIBUS user organization.

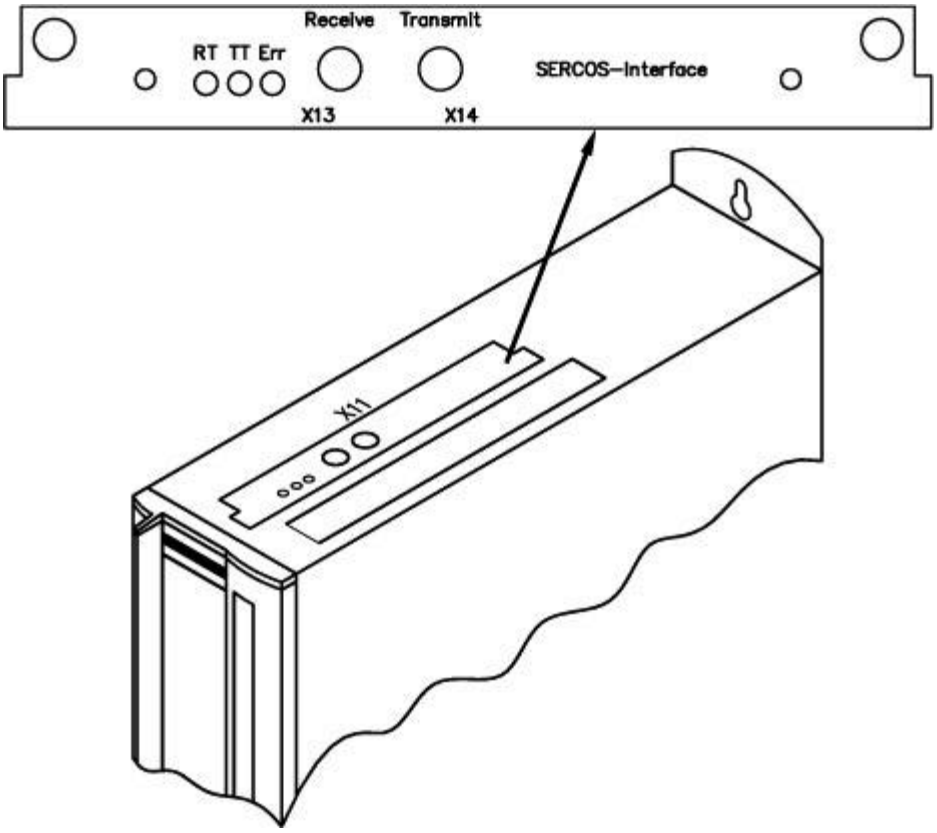
# CONNECTION DIAGRAM



# Expansion Card –SERCOS–

This section describes the SERCOS expansion card for the ***PosiDrive Series RS***. Information on the range of functions and the software protocol can be found in the *IDN Reference Guide SERCOS*. If you ordered the expansion card with the servo amplifier, the expansion card is already securely installed into the slot when the servo amplifier is delivered.

## POSITION OF THE CONNECTORS




## FITTING THE EXPANSION CARD

The expansion card can be retrofitted from firmware version 4.30. Proceed as follows:

Use a suitable screwdriver to remove the cover of the option slot.
Take care that no small items (such as screws) fall into the open option slot.
Push the expansion card carefully into the guide rails that are provided, without twisting it.
Press the expansion card firmly into the slot, until the front cover touches the fixing lugs to ensure that the connectors make good contact.
Screw the screws on the front cover into the threads in the fixing lugs.

# LIGHT EMITTING DIODES (LEDS)

**RT**: indicates whether SERCOS telegrams are being correctly received. In Communication Phase 4, this LED should flicker, since cyclical telegrams are being received.

**TT**: indicates that SERCOS telegrams are being transmitted. In Communication Phase 4, this LED should flicker since cyclical telegrams are being transmitted. Check the station addresses for the controls and the servo amplifier if:

- the LED never lights up in SERCOS Phase 1 or
- the axis cannot be operated, although the RT LED is lighting up cyclically

**Err**: indicates that SERCOS communication is faulty or has interference. If this LED is very bright, communication has strong interference, or is non-existent. Check the SERCOS transmission speed for the controls and the servo amplifier (BAUDRATE) and the fiber-optic connection. If this LED flickers, this indicates a low level of interference for Sercos communication or the optical transmitting power is not correctly adjusted to suit the length of cable. Check the transmitting power of the (physically) previous SERCOS station. The transmitting power of the servo amplifier can be adjusted on the SERCOS screen page, by altering the LWL length parameter for the cable length.

# CONNECTION TECHNOLOGY

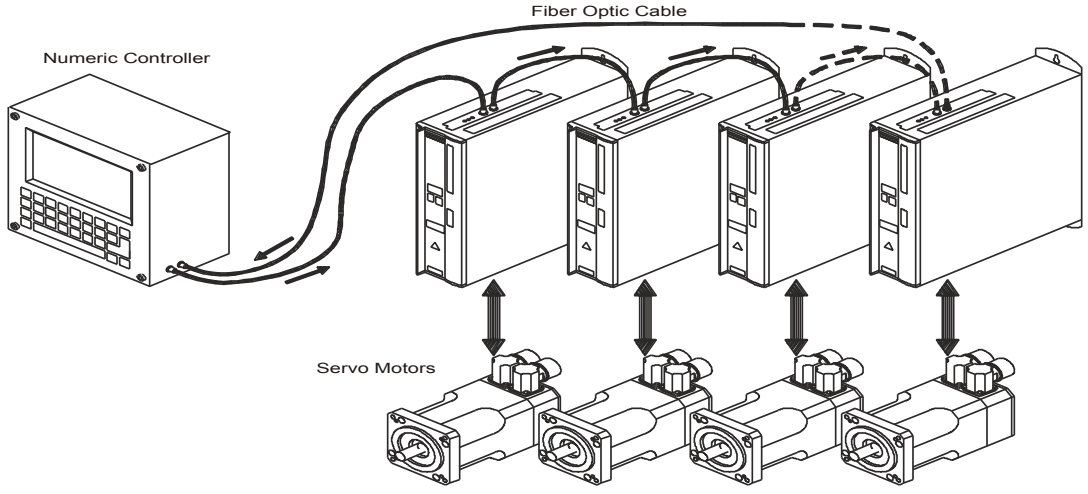
For the optical fiber (LWL) connection, use only SERCOS components to the SERCOS Standard IEC 61491.

**Receive data**: The optical fiber carrying receive data for the drive in the ring structure is connected to X13 with an FSMA connector.

**Transmit data**:Connect the optical fiber for the data output to X14 with an FSMA connector.

# CONNECTION DIAGRAM

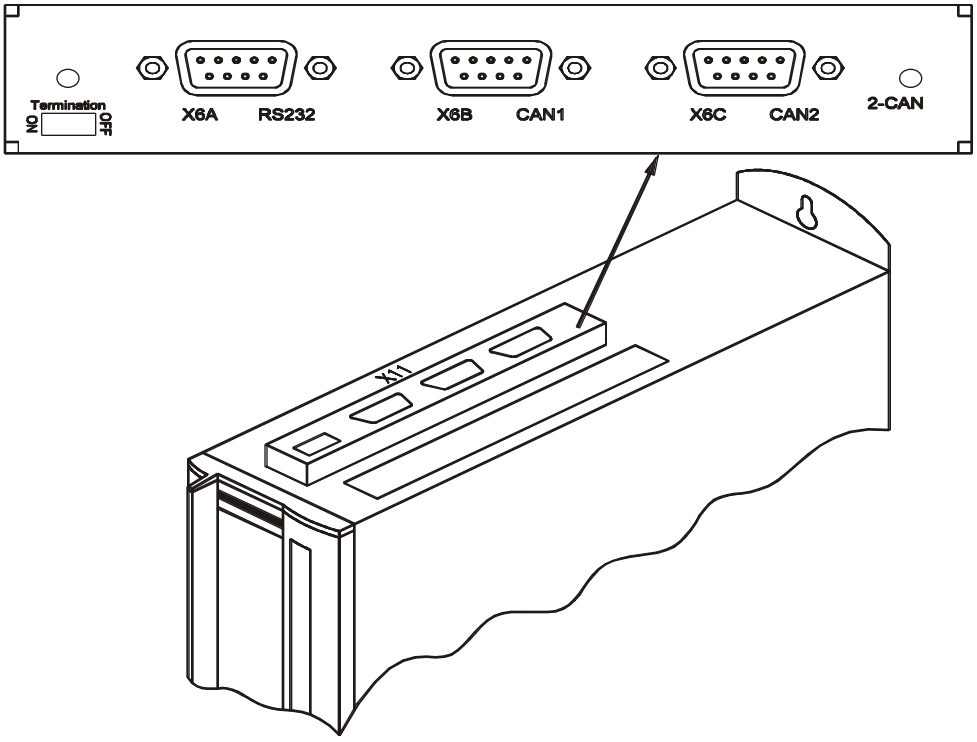
Layout of the SERCOS bus system in ring topology, with optical fiber cables (schematic).



# Expansion Module –2CAN–

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

## POSITION OF THE CONNECTORS




## FITTING THE EXPANSION MODULE

If you want to retrofit the –2CAN– expansion module into a ***PosiDrive Series RS***, proceed as follows:

Use a suitable screwdriver to remove the cover of the option slot.
Take care that no small items (such as screws) fall into the open option slot.
Screw the distance pieces into the fixing lugs of the option slot.
Place the expansion module onto the option slot.
Screw the screws into the threads of the distance pieces.
Plug the SubD9 socket into connector X6 on the ***PosiDrive Series RS***.

# CONNECTION TECHNOLOGY

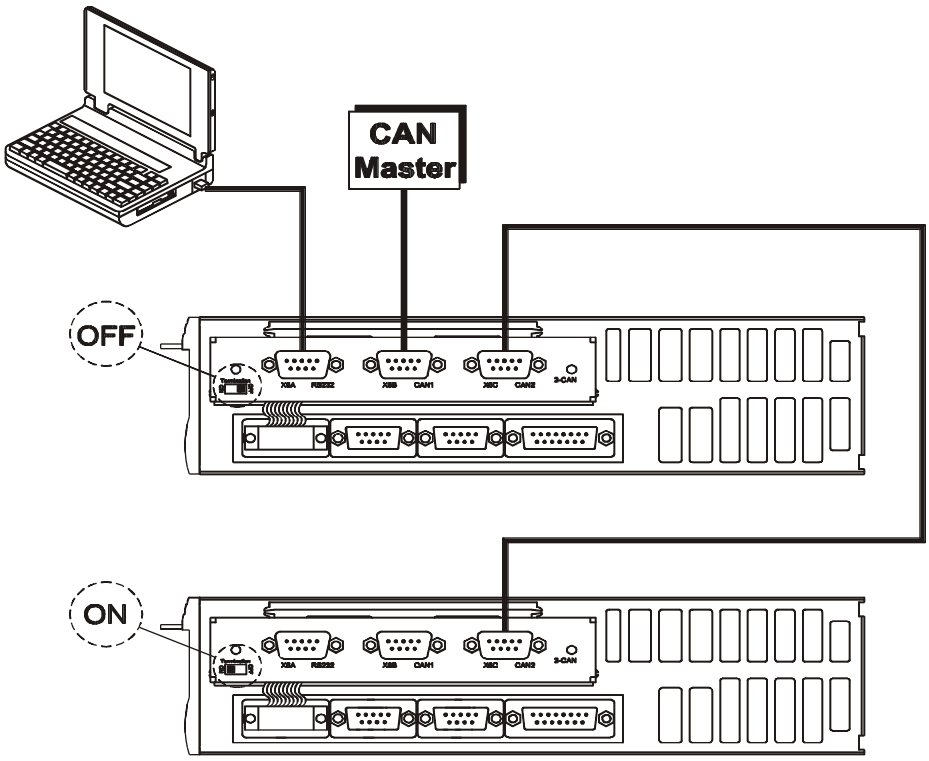
Standard shielded cables can be used for the RS232 and CAN interface.

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

# CONNECTOR ASSIGNMENTS

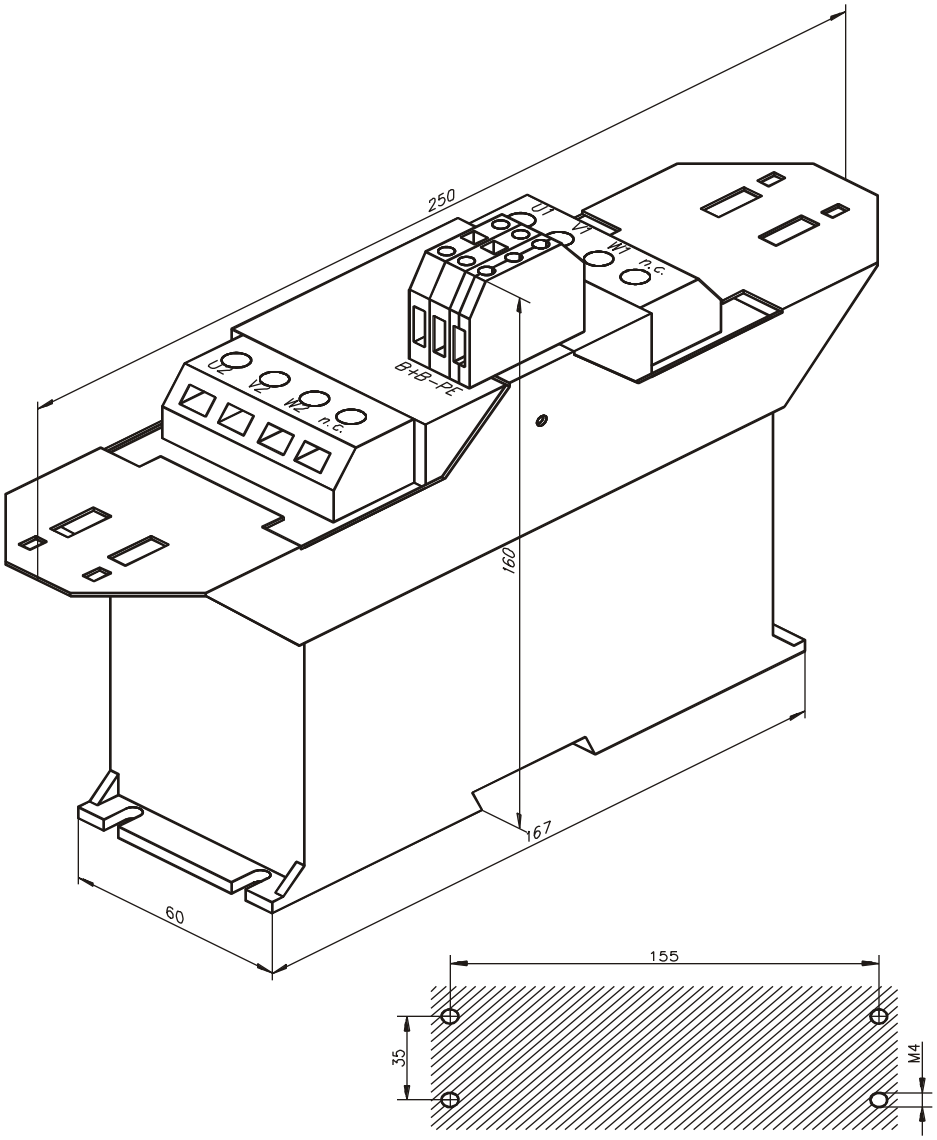
| **RS232** | | **CAN1=CAN2** | |
|---|---|---|---|
| **X6A Pin** | **Signal** | **X6B=X6C Pin** | **Signal** |
| 1 | Vcc | 1 | |
| 2 | RxD | 2 | CAN-Low |
| 3 | TxD | 3 | CAN-GND |
| 4 | | 4 | |
| 5 | GND | 5 | |
| 6 | | 6 | |
| 7 | | 7 | CAN-High |
| 8 | | 8 | |
| 9 | | 9 | |

# CONNECTION DIAGRAM



# Accessories

## MOTOR CHOKE BOX




| Technical data: | | | |
|---|---|---|---|
| **Nom. data** | **Sym** | **DIM** | **Rating** |
| Rated current | $I0_{rms}$ | A | Max. 3 x 20 |
| Frequency | $f_{max}$ | kHz | 8.3 |
| Inductance | L | mH | 1.2 |

# Appendix

## TRANSPORT, STORAGE, MAINTENANCE, DISPOSAL

**Transport** :

— only by qualified personnel

— only in the manufacturer's original recyclable packaging

— avoid shocks

— temperature –25°C to +70°C , max. 20°C / hour rate of change
(-13°F) (+158°F) (68°F)

— humidity max. 95% relative humidity, no condensation

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

— if the packaging is damaged, check the unit for visible damage. If there is damage, inform the shipper and the manufacturer.

**Storage** :

— only in the manufacturer's original recyclable packaging

— the servo amplifiers contain electrostatically-sensitive components that can

— be damaged by incorrect handling. Ground yourself before touching the servo amplifier. Avoid contact with highly insulating materials (artificial fabrics, plastic films etc.). Place the servo amplifier on a conductive surface.

— max. stacking height 8 cartons
— storage temperature –25°C to +55°C, max. 20°C/hr. rate of change
(-13°F) (+131°F) (68°F/hr)
— humidity relative humidity max. 95%, no condensation
— storage duration < 1 year without restriction
> 1 year : capacitors must be re-formed before the servo amplifier is operated. To re-form, remove all electrical connections, and supply the servo amplifier for about 30 min. from 230VAC , single-phase, on terminals L1 / L2.

**Maintenance** :

— the instruments do not require any maintenance
— opening the enclosure invalidates the warranty

**Cleaning** :

— if the casing is dirty, clean with Isopropanol or similar cleaning agent
***Do not immerse or spray.***
— dirt inside the unit must be cleaned by the manufacturer
— dirty protective grill (fan) may be cleaned with a dry brush

**Disposal** :

— the servo amplifier can be reduced to its principal components by removing the screws (aluminum heat sink and front panel steel housing sections, electronics boards)
— a certified disposal company should carry out disposal.
— We can give you suitable addresses

# REMOVING FAULTS

The table below should be regarded as a "First-aid" box. Depending on the conditions in your installation, there may be a wide variety of reasons for the fault. In multi-axis systems there may be further hidden causes of a fault. Our applications department can provide further assistance with problems.

| Fault | Possible Causes | Measures To Remove The Cause Of The Fault |
|---|---|---|
| **message: communication fault** | — wrong cable used<br>— cable plugged into wrong position in servo amplifier or PC<br>— wrong PC interface selected | — use null-modem cable<br>— plug cable into the correct sockets on the servo amplifier and PC<br>— select correct interface |
| **message: undervoltage** | — supply voltage not present or too low when servo amplifier is enabled | — only enable the servo amplifier when the mains supply voltage has been switched on delay > 500 ms |
| **message: overvoltage** | — regen power is insufficient. regen power limit was reached and the regen resistor was switched off. This causes excessive voltage in the DC-link circuit.<br>— supply voltage too high | — shorten the braking time RAMP or use an external regen resistor with a higher power rating and adjust the regen power parameter<br>— use mains transformer |
| **message: mains Ready Output** | — enable was applied, although the supply voltage was not present.<br>— at least 2 supply phases are missing | — only enable the servo amplifier when the mains supply voltage has been switched on<br>— check electrical supply |
| **message: brake** | — short-circuit in the supply cable for the motor-holding brake<br>— motor-holding brake is faulty<br>— fault in brake cable<br>— no brake connected, although the brake parameter is set to "WITH" | — remove short-circuit<br>— replace motor<br>— check shielding of brake cable<br>— brake parameter set to "WITHOUT" |
| **message: output stage fault** | — motor cable has short-circuit/ground short<br>— motor has short-circuit/ground short<br>— output module is overheated<br>— output stage is faulty<br>— short-circuit/short to ground in the external regen resistor | — replace cable<br>— replace motor<br>— improve ventilation<br>— return the servo amplifier to the manufacturer for repair<br>— remove short-circuit / ground short |
| **message: heat sink temperature** | — permissible heat sink temperature exceeded | — improve ventilation |
| **message: aux. voltage** | — the aux. voltage produced by the servo amplifier is incorrect | — return the servo amplifier to the manufacturer for repair |
| **message: feedback unit** | — feedback connector not properly inserted<br>— feedback cable is broken, crushed or otherwise damaged | — check connector<br>— check cable |
| **message: internal temperature** | — permissible internal temperature exceeded | — improve ventilation |

| Fault | Possible Causes | Measures To Remove The Cause Of The Fault |
|---|---|---|
| **message: motor temperature** | — motor thermostat has been activated<br>— feedback connector is loose or break in feedback cable | — wait until motor has cooled down, then check why it became so hot<br>— tighten connector or use new feedback cable |
| **motor does not rotate** | — servo amplifier not enabled<br>— break in setpoint cable<br>— motor phases swapped<br>— brake not released<br>— drive is mechanically blocked<br>— no. of motor poles set incorrectly<br>— feedback set up incorrectly | — apply enable signal<br>— check setpoint cable<br>— correct motor phase sequence<br>— check brake control<br>— check mechanism<br>— set no. of motor poles<br>— set up feedback correctly |
| **motor runs away (overspeed)** | — motor phases swapped<br>— feedback set up incorrectly | — correct motor phase sequence<br>— set up correct offset angle |
| **motor oscillates** | — gain too high (speed controller)<br>— shielding in feedback cable has a break<br>— Analog Ground not wired up | — reduce Kp (speed controller)<br>— replace feedback cable<br>— join Analog Ground to CNC-GND |
| **drive reports following error** | — $I_{rms}$ or $I_{peak}$ is set to low<br>— setpoint ramp is too long | — increase $I_{rms}$ or $I_{peak}$ (keep within motor data!)<br>— shorten setpoint ramp ± |
| **motor overheating** | — $I_{rms}/I_{peak}$ set too high | — reduce $I_{rms}/I_{peak}$ |
| **drive too soft** | — Kp (speed controller) too low<br>— Tn (speed controller) too high<br>— PID-T2 too high<br>— T-Tacho too high | — increase Kp (speed controller)<br>— use motor default value for Tn (speed controller)<br>— reduce PID-T2<br>— reduce T-Tacho |
| **drive runs roughly** | — Kp (speed controller) too high<br>— Tn (speed controller) too low<br>— PID-T2 too low<br>— T-Tacho too low | — reduce Kp (speed controller)<br>— use motor default value for Tn (speed controller)<br>— increase PID-T2<br>— increase T-Tacho |
| **axis drifts at setpoint = 0V** | — offset not correctly adjusted for analog setpoint provision<br>— Analog Ground not joined to the CNC-GND of the controls | — adjust setpoint-offset (analog I/O)<br>— join Analog Ground and CNC-GND |

## *Customer Support*

Force Control Industries, Inc. is committed to quality customer service. In order to serve in the most effective way, please contact your local sales representative for assistance. If you are unaware of your local sales representative, please contact us. Visit our web site at http://www.forcecontrol.com for user interface software upgrades, application notes, technical publications, and the most resent version of our product manuals.

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# Glossary

| | | |
|---|---|---|
| **C** | Clock | Clock signal |
| | Common-mode voltage | The maximum amplitude of a disturbance (on both inputs), which a differential input can eliminate |
| | CONNECT- modules | Modules built into the servo amplifier, with integrated position control, which provide special versions of the interface for the connection to the higher-level control |
| | Continuous power of regen circuit | Mean power that can be dissipated in the regen circuit |
| | Counts | Internal count pulses, 1 pulse = 1/220 turn-1 |
| | Current controller | Regulates the difference between the current setpoint and the actual value to 0 Output : power output voltage |
| **D** | DC-link | Rectified and smoothed power voltage |
| | Disable | Removal of the enable signal (0V or open) |
| **E** | Enable | Enable signal for the servo amplifier (+24V) |
| **F** | Final speed | Maximum value for speed normalization at ±10V |
| | Fieldbus interface | CANopen, PROFIBUS, SERCOS etc. |
| **G** | GRAY-code | Special method of representing binary numbers |
| **H** | Holding brake | Brake in the motor, that can only be used when the motor is at a standstill |
| **I** | $I^2t$ threshold | Monitoring of the actually required r.m.s. current |
| | Input drift | Temperature and age-dependent alteration of an analog input |
| | Incremental encoder interface | Position signaling by 2 signals with 90° phase difference, not an absolute position output |
| | $I_{peak}$, peak current | The effective value of the peak current |
| | $I_{rms}$, effective current | The r.m.s. value of the continuous current |
| **K** | Kp, P-gain | Proportional gain of a control loop |
| **L** | Limit-switch | Switch limiting the traverse path of the machine; implemented as N.C. (break) contact |
| **M** | Machine | The complete assembly of all connected parts or devices, of which at least one is movable |
| | Motion-block | Data packet with all the position control parameters which are required for a motion task |
| | Multi-axis system | Machine with several independently-driven axes |
| **N** | Natural convection | Free movement of air for cooling |
| **O** | Optocoupler | Optical connection between two electrically independent systems |
| **P** | P-controller | Control loop with purely proportional behavior |
| | Phase shift | Compensation for the lag between the electromagnetic and magnetic fields in the motor |

| | | |
|---|---|---|
| | PID-controller | Control loop with proportional, integral and differential behavior |
| | PID-T2 | Filter time constant for the speed controller output |
| | Position controller | Regulates the difference between the position setpoint and the actual position to 0 Output : speed setpoint |
| | Potential isolation | Electrically decoupled |
| | Power contactor | System protection device with phase monitoring |
| | Pulse power of the regen circuit | Maximum power that can be dissipated in the regen circuit |
| **R** | Regen circuit | Converts superfluous energy, which is fed back during braking, into heat in the regen resistor |
| | Reset | New start of the microprocessor |
| | Resolver-digital converter | Conversion of the analog resolver signals into digital information |
| | Reversing mode | Operation with a periodic change of direction |
| | Ring core | Ferrite rings for interference suppression |
| | ROD-Interface | Incremental position output |
| **S** | Servo amplifier | Control device for regulating the position of a servomotor |
| | Setpoint ramps | Limits for the rate of change of the speed setpoint |
| | Short to ground | Electrically conductive connection between a phase and PE (protective earth) |
| | Short-circuit | here: electrically conductive connection between two phases |
| | Speed controller | Regulates the difference between the speed setpoint and the actual value to 0 Output : current setpoint |
| | SSI-interface | Cyclic-absolute, serial position output |
| | Supply filter | Device to divert interference on the power supply cables to PE |
| **T** | T-tacho, tachometer time constant | Filter time constant in the speed feedback of the control loop |
| | Tachometer voltage | Voltage proportional to the actual speed |
| | Thermostat | Temperature-sensitive switch built into the motor winding |
| | Tn, I-integration time | Integral section of a control loop |
| **Z** | Zero pulse | Output once per turn from incremental encoders, used to zero the machine |

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