KOLLMORGEN
Seidel

Digital servo amplifier digifas™ 7200 series

Apter Power

CE

Assembly / Installation / Commissioning

Version 03/98

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I General

I.1 About this manual

This manual forms part of the complete documentation for the digifas™ 7200 series of servo amplifiers. It describes the assembly, installation and commissioning of the standard units of this series, i.e. the versions of the servo amplifier **without** a CONNECT module.
It also includes advice about transport, storage, maintenance and disposal of the equipment.

Other parts of the complete documentation of the digifas™ 7200 series:

— Installation / operation instructions for the PC-operator software:

BS7200	for digifas™ 7200 series	Order no.	83107

— technical description of the digital interfaces to automation systems:

BIT CONNECT	for digifas™ 7200-SPS series	Order no.	83108
PROFIBUS CONNECT	for digifas™ 7200-L2/DP series	Order no.	83106
PULSE CONNECT	for digifas™ 7200-STEP series	Order no.	83109
CAN CONNECT	for digifas™ 7200-CAN series	Order no.	83105

All the necessary documentation for the particular version of the unit is delivered together with the servo amplifier.

This manual makes the following demands on the technical staff:



Transport	**:**	**only by personnel with knowledge of the handling of electrostatic sensitive devices.**
Installation	**:**	**only by personnel with training in electrical engineering.**
Commissioning	**:**	**only by personnel with extensive knowledge of the fields of electrical engineering and amplifier technology.**

I.2 Prescribed usage of the servo amplifiers

Use the digifas™ 7200 series of servo amplifiers **only** on a three-phase 400V industrial earthed mains supply to amplifier a synchronous servo-motor from the 6SM series.

The servo amplifier may **only** be operated in a closed switch cabinet, taking into account the environmental requirements which are defined in Chapter I.8.1.

The digifas™ 7200 series of servo amplifiers are **exclusively** intended for driving the 6SM series of brushless synchronous servo-motors under speed or torque control.

The servo amplifiers are installed as components of electrical equipment or machines and may only be operated as integral components of such equipment.

Prepare a hazard analysis of your machine.



Only if the system components as described in Chapter VI.2 are used and the rules for installation in this documentation (Chapter II.1 ff) are followed, we guarantee the confomance of the servo amplifiers with the following standards for industrial areas:
EC EMC Directive 89/336/EEC
EC Low Voltage Directive 73/23/EEC

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I.5 Equipment description

I.5.1 The digifas™ 7200 series of digital servo amplifiers

The digifas™ 7200 series of digital servo amplifiers are available in several versions:

Standard version **digifas™ 72xx series**

4 current types, with analog speed-setpoint input, incremental positional output, controllable motor-holding brake. In this standard version there is **no position control capability** in the servo amplifier. This function must be taken over by the automation equipment.
Options* : -IL-, -BV-

BIT CONNECT version **digifas™ 72xx-SPS series**

PLC interface, connection to a simple control via 10 I/O leads, controllable motor-holding brake. Execution of the motion data sets which are stored in the servo amplifier, 4 current types, digital setpoint input from the automation equipment, **positional control** in the servo amplifier.
Option* : -BV-

PULSE CONNECT version **digifas™ 72xx-STEP series**

Pulse-direction interface, connection to a stepper-motor controller or as a slave-controller to a digifas™ 7200 master-controller with incremental position control, 4 current types, controllable motor-holding brake, digital setpoint input from the automation equipment, **positional control** (cascade control) in the servo amplifier.
Option* : -BV-

PROFIBUS CONNECT version **digifas™ 72xx-L2/DP series**

Connection to PROFIBUS-DP (SINEC-L2-DP), 4 current types, digital setpoint input from the automation equipment, **positional control** in the servo amplifier, controllable motor-holding brake.
Option* : -BV-

CAN CONNECT version, **digifas™ 72xx-CAN series**

Connection to CAN BUS, 4 current types, digital setpoint input from the automation equipment, **positional control** in the servo amplifier, controllable motor-holding brake.
Option* : -BV-

Further explanation of the CONNECT versions can be found in the corresponding Installation and Operating Instructions for the CONNECT module.

* Options : -IL- controllable torque limiting, external accessory unit, see Chapter IV.4
-BV- forced ventilation for digifas™ 7206 with ballast power > 75W

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I.5.2 Digital servo amplifier concept

Operation and parameter setting

Via the parallel interface of a PC using the special operator software BS7200

Power section

Mains supply	:	B6 bridge rectifier with current inrush limiter, directly off the 3-phase 400V mains
Output stage	:	IGBT-module with electrically isolated current measurement
Ballast circuit	:	With electronic monitoring and internal ballast resistor.

Digital functions

- Current and speed control
- Processing of the 14-bit resolver evaluation
- Position output (incremental or SSI) with analog setpoint input
- Communication with the various interface modules and positional control, if an interface module is installed

Easy-to-use functions

adjustable setpoint ramps, limit-switch function, analog monitor outputs

I.5.3 Operation directly off a 400V mains

Power supply
- Directly off a 3-phase 400V mains **without** transformer, mains filter series 3EFxx
- Fuse protection and phase-failure monitoring by the user
- Single-phase supply (only for power < 0.5kW) e.g. as a possibility during commissioning or setting-up

Aux. supply 25V DC
- Electrically isolated, from an external 24V DC- power supply **with** isolating transformer, mains filter 1EF06
- For a short time, at the instant of switching on, the power supply has to provide twice the rated current, so that the power sections can start up the servo amplifiers which are connected.

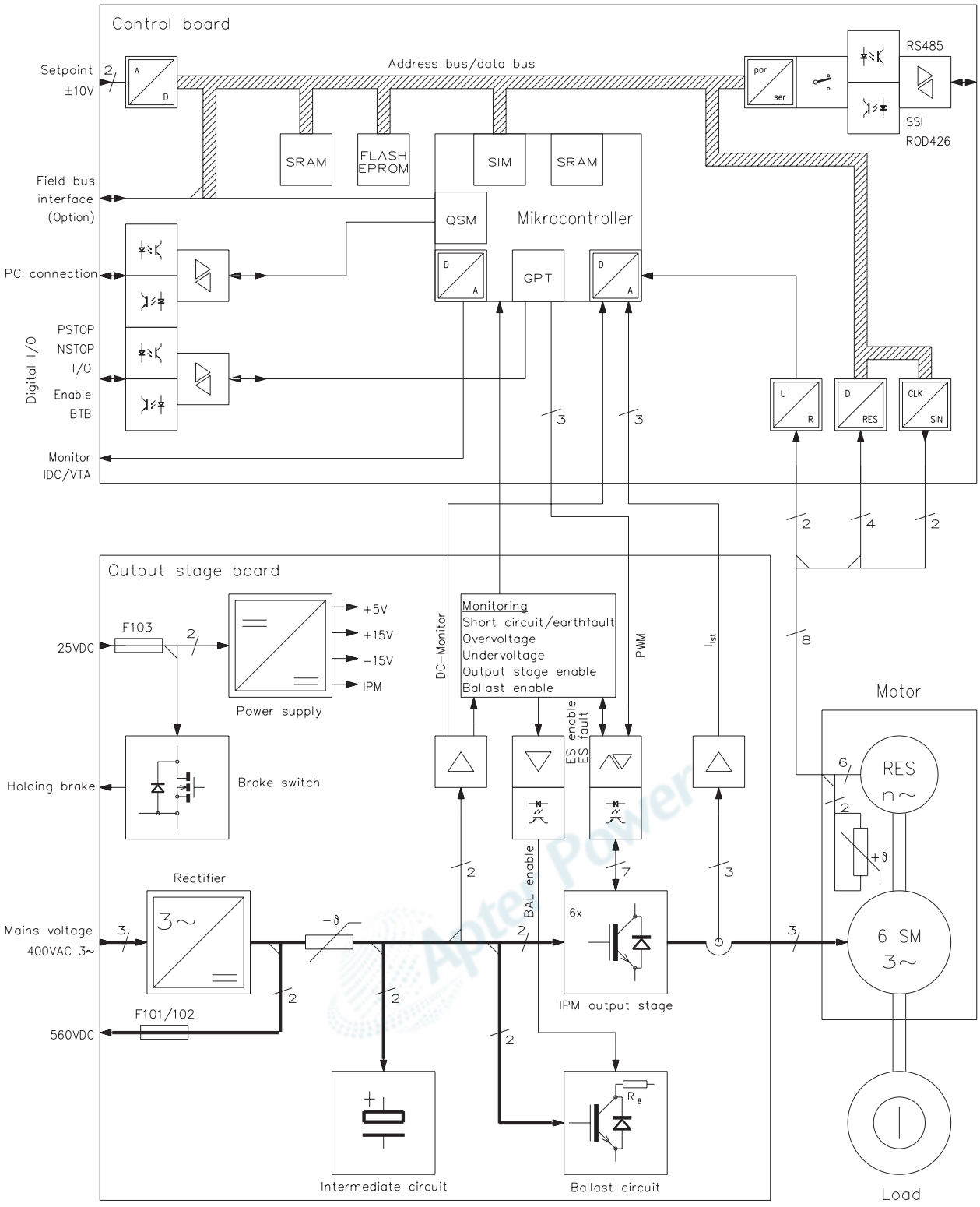
Intrinsic safety
- Electrically safe isolation to VDE 0160 (proposed EN 50178) between the mains or motor connection and the signal electronics through appropriate creepage distances and full electrical isolation.
- Soft start, overvoltage detection, short-circuit protection
- Temperature monitoring of the servo amplifier and motor (when using motors from the 6SM series with our preassembled cables)

Additional interference suppression measures
- Mains filter (see chapter V.1)
- Motor choke (see chapter I.11)

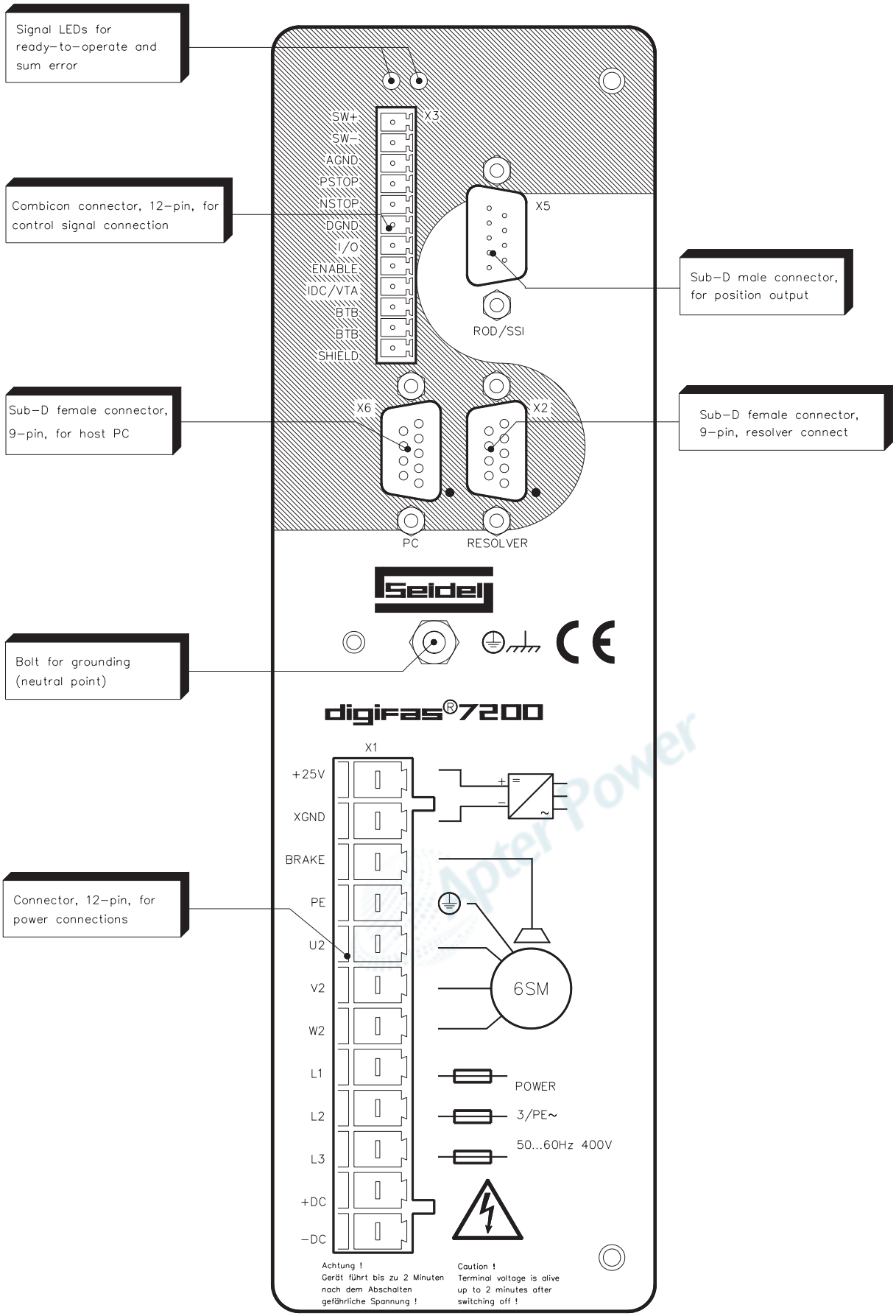
Please consult us in the event of difficulty with an application.

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I.6 Block diagram



I.7 Frontal view: digifas™ 7200 operating components and connections



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I.8 Technical data of the digifas™ 7200 series

		digifas™			
Rated specifications	**DIM**	**7201**	**7202**	**7204**	**7206**
Rated supply voltage	V~	3 x 80-400 / 50...60Hz +max. 10%			
Rated connected load for S1 operation	kVA	0.9	1.7	2.5	3.5
Rated intermediate circuit voltage	V=	560			
Rated output value (rms value, ± 5%)	A_{rms}	1.5	2.8	4.2	6
Peak output current (max. ca. 5s, ± 5%)	A_{rms}	3,0	5.6	8.4	12
Switch-on threshold of ballast circuit	V	720			
Switch-off threshold of ballast circuit	V	680			
Pulse power of ballast circuit (max. 1s)	kW	3.2			5.8
(Internal) cont. power of ballast circuit	W	75			75 (140)*
Switch-off threshold on overvoltage	V	750			
Form factor of output current (under rated specifications and min. load inductance)	—	1.01			
Min. motor inductance	mH	25	15	8	6
Bandwidth of subordinate current controller	kHz	1			
Clock frequency of output stage	kHz	8.33			
Residual voltage drop at rated current	V	5			
Quiescent power loss, output stage disabled	W	15			
Power loss at rated current (incl. loss in power supply, without ballast dissipation	W	33	45	60	60
Inputs					
Setpoint, fixed, 14-bit resolution	V	±10			
Max. common mode voltage	V	±10			
Input resistance	kΩ	20			
Max. input drift	µV/K	±30			
Digital control inputs	V	12...36			
	mA	7			
Aux. voltage supply, isolated without brake	V	18...36			
	A	1			
Aux. voltage supply, isolated with brake	V	24 +10/-5%			
	A	2			
max. output current brake	A	1			
Voltage supply option -BV-	V=	-			24 +10%
	A	-			0.1
Connections					
Control signals		Mini Combicon 3.81 / 12 pole, 1.5mm²			
Power signals		Power Combicon 7.62 / 12-pin, 2.5mm²			
Resolver		SubD 9-pin (socket)			
PC interface		SubD 9-pin (socket)			
Position output ROD/SSI		SubD 9-pin (plug)			
digifas™ - STEP PULSE CONNECT		Interface : Mini Combicon 3.81 / 12-pin, 1.5mm²			
digifas™ - SPS BIT CONNECT		Interface : Mini Combicon 3.81 / 12 pin, 1.5mm²			
digifas™ - L2/DP PROFIBUS CONNECT		Interface : SubD 9-pin (socket)			
digifas™ - CAN CAN CONNECT		Interface : SubD 9-pin (socket)			
Option -BV-		Combicon 1,5 mm²			
Mechanical					
Weight servo amplifier	kg	2.1			
Dimensions (h x w x d) servo amplifier	mm	275 x 71 x 235			
Weight option -BV-	kg	-			0,3
Dimensions (h x w x d) with option -BV-	mm	-			310x73x236

* >75W with option -BV- only

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I.8.1 Permissible ambient conditions, ventilation, mounting position

Transport temperature/humidity	see Chapter VI.1
Storage temperature/humidity/time	see Chapter VI.1
Supply voltage tolerance	
Power supply	min. 3x80V AC / max. 3x400V AC + 10%
Aux. voltage without brake	min. 18V DC / max. 36V DC
Aux. voltage with brake	24V DC +10%/-5%
Position interface supply	5V DC ± 5%
Ambient temperature at work	0 ... +45°C at rated values +45 ... +55°C with power derating 2.5% / K
Humidity at work	relative humidity 5%... 85%, no condensation
Installation altitude	up to 1000m above mean sea level (m.s.l.) without restriction 1000...2500m above m.s.l. with power derating 1.5% / 100m
Pollution level	Pollution level 2 to EN60204 / EN50178
Protection class	IP 20
Mounting position	generally vertical (observe Chapter V.7 and V.9)
Ventilation	
digifas™ 7201...7204	electronics and heat sink: natural convection
digifas™ 7206	
ballast power max. 75W	electronics and heat sink : natural convection
ballast power 75...140W	forced cooling with option -BV- (see chapter V.8 and V.9)
⚠	**Make sure that there is sufficient forced circulation inside the switchgear cabinet.**

I.8.2 Lead cross-sections

In accordance with EN60204, we recommend these cross-sections for **single-axis systems:**

AC connection, intermediate circuit	1.5...2.5 mm² , shielded in case of length > 25cm
motor leads	max. 25m, 1.5 mm², shielded 25-100m, 1.0 mm², shielded, **with motor choke box 3YL-06**
Resolver, motor with thermal protection	0.25 mm² , twisted pairs, shielded, max.100m on request
Analog setpoint, monitor signals, AGND	0.25 mm² , twisted pairs, shielded
Control signals, BTB, DGND	0.5 mm²
Holding brake (motor)	min. 0.75 mm², shielded, check voltage drop
Option -BV-	1.5 mm²
+25 V / XGND	1.5 mm², shielded, check voltage drop

⚠ **For multi-axis systems please observe the specific operating conditions of your system (please call us if you have any questions).**
If the motor cable is longer than 25m you must use a 4x1mm² cable and a motor choke-box called 3YL-06 manufactured by Seidel.

I.8.3 Fuse protection

AC supply		external power switch for system protection, C or D (motor or transformator) characteristic, set to rated current of amplifier
Aux. voltage 25V	(F103)	internal 2 AT
Intermediate circuit	(F101, F102)	internal 4 AT
Ballast resistor	internal	internal electronic
Option -BV-	internal	internal 250 mAF

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I.8.4 LED display

Green LED	equipment ready to operate / supply voltage available
Red LED	BTB-relay released, green LED is off, error signal (see Chapters II.5 and V.5), plain text message

I.9 System grounds

The following grounds are available in the system:

AGND — reference ground for analog inputs/outputs, internal analog ground
DGND — reference ground for digital inputs/outputs, optically isolated
XGND — ref. ground for external 25V aux. voltage, optically and inductively isolated
PGND — ref. ground for external supply for the position interfaces, optically isolated
GND — ground for internal electronics (also EGND), connected to AGND

I.10 Ballast circuit

When the motor is braking, energy is fed back to the servo amplifier. This energy is converted into heat in the ballast resistor. The ballast resistor is switched in by the ballast circuit.
The maximum ballast power depends on the ballast resistor which is used and the ballast power set in the software.
If you would like some help with dimensioning the ballast power required for your system, please talk to our applications department.

Functional description:

1.- Single amplifier, not coupled via the intermediate circuit (DC+, DC-)
The circuit starts to respond from a intermediate circuit voltage of 720V.
If the power which is fed back from the motor is higher than the ballast power level which is set, then the servo amplifier signals the status “Ballast power exceeded” and the ballast circuit switches itself off.
At the next internal check of the intermediate circuit voltage (a fraction of a second later) an overvoltage will be recognized and the controller will switch off with an error message “Overvoltage” (see Chapter II.5).

2.- Several servo amplifiers coupled via the intermediate circuit circuit (DC+, DC-)
The energy which is fed back into the intermediate circuit from all the motors is dealt with by all the ballast resistors which are connected. This means that the servo amplifier with the lowest ballast switch-on threshold (because of tolerances) will switch in first.
If the regenerative power is lower than the ballast power of this servo drive then the intermediate circuit voltage will not rise any further and no other servo amplifiers will be switched in.
If the ballast power is insufficient then the servo amplifier will signal the status “Ballast power exceeded”. The intermediate circuit voltage rises further and the ballast circuit with the next higher threshold will switch in and so on.
If the total regenerative power is larger than the sum of all the ballast powers, then all the servo amplifiers will signal “Ballast power exceeded”. The servo drive with the lowest overvoltage threshold (according to tolerance) will switch off with the error message “Overvoltage” and so switch off the complete system via the BTB contact.

Ballast resistor :

digifas™ 7201...7204 : 150 Ω, 75 W
digifas™ 7206 : 75 Ω, 140 W **(>75W with forced cooling, option -BV-)**

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II Installation and commissioning

II.1 Important instructions

Check the conformance of the servo amplifier and the motor. Compare the rated voltage and current of the equipment. Implement the wiring according to the wiring diagram in Chapter II.2.3 or II.2.4. For units with CONNECT modules, also refer to the connection diagram for the interface in the appropriate CONNECT operating manual.

Take care that, even under worst-case conditions, the maximum permissible rated voltage on the terminals L1, L2, L3 or +DC, –DC is not exceeded by more than 10% (see EN 60204-1, Sec. 4.3.1). Excessive voltage on these terminals can result in destruction of the ballast circuit and the servo amplifier. Use the digifas™ servo amplifier only on a three-phase 400V mains supply and only to drive a synchronous servomotor from the 6SM series.

Fuse protection of the AC mains supply and the 25V supply must be provided by the user. An unnoticed failure of a supply phase can result in an overload and possible destruction of the mains input rectifier. We therefore recommend the use of a power circuit-breaker with phase-failure monitoring (see Chapter I.8.3) .

Make sure that the servo amplifier and motor are properly earthed.

Run power and control cables separately. Recommended distance is more than 20 cm to improve compliance with the limits specified by the EMC regulations.

Install all power cables with an adequate cross-section according to EN 60204. A tabular summary of the recommended cross-sections can be found in Chapter I.8.2 . Use a motor choke box (3YL-06) and a 4x1mm² motor cable if your motor cable is longer than 25m (see chapter I.11). If a motor power cable is used with integrated brake control leads, then the brake control leads must be shielded separately. The shield must be connected at both ends (see Chapter II.2.1 ff).

Loop the BTB contact into the safety circuit of the system. Only so can the monitoring of the servo amplifier be ensured.

Carry out all shielding with large areas (low resistance), using metallised connector housings where possible (see II.2.1 ff). Notes on connection methods can be found in Chapter II.2.6 .

Ensure an adequate supply of filtered cool air in the switchgear cabinet, fed from below. Refer to Chapter I.8.1 .
If the ballast power exceeds 75W, you have to use forced cooling (digifas™ 7206, -BV-)

Alterations in the servo-amplifier settings by means of the operator software are permitted. Any additional tampering with the equipment will invalidate the guarantee.



Caution
Never remove the electrical connections of a servo amplifier which is live.
In some cases this can cause the destruction of the electronics. The residual charge in the capacitors can still have a dangerous level up to 120 seconds after the supply voltage has been switched off.
Measure the voltage in the intermediate circuit and wait until it has droppped below 40V.
Even when the motor is standing still, control and power terminals may still be live.

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II.2 Installation

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

The installation procedure is described in examples. A different procedure may be necessary or appropriate, depending on the usage of the equipment.

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

Caution!

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

Caution!

Only install and wire up the equipment in a de-energized condition, i.e. neither the mains supply voltage nor the 25 V auxiliary voltage nor the operating voltage of any other connected equipment may be switched on.
Make sure that the switchgear cabinet is safely disconnected (lock-out, warning signs etc.). The voltages must only be switched on for the first time during commissioning.

Note!

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

Use the following wiring diagrams:

- **correct EMC shielding and grounding : Chapter II.2.1**
- **Equipment without CONNECT modules**
  - **Power and control connections : Chapter II.2.3 / II.2.4**
- **Equipment with CONNECT modules**
  - **Power connections : Chapter II.2.3 / II.2.4**
  - **Control connections : wiring diagram in the CONNECT manual**
- **Multi-axis systems : example in Chap. II.2.5**

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

Location

In a closed switchgear cabinet. Observe Chapter I.8.1 .
The location must be free from conductive and agressive material.
— Installation position in the switchgear cabinet see Chapter V.7/9

Ventilation

Ensure the unhindered ventilation of the servo amplifier and observe the permitted ambient temperature, see Chapter I.8.1 .
Provide the clearance which is required above and below the servo amplifier, see Chapter V.7/9 .

Assembly

Select the assembly level according to operational conditions.
See Chapter V.6 for dimensioned diagrams.
Install the servo amplifier, power supply and mains supply filter close together on an **earthed** mounting plate in the switchgear cabinet.

Cable selection

Select cables which conform to EN 60204, see Chapter I.8.2 and I.11

Grounding Shielding

See Chapter II.2.1 for correct EMC shielding and grounding
Ground the mounting plate, motor casing, mains filter and CNC-GND of the control (see Chapter II.2.1ff).
Notes on connection methods can be found in Chapter II.2.6

Wiring

— **Run the power and control cables separately**
— **Wire in the BTB contact into the safety loop of the system**
— Connect the digital control inputs of the servo amplifier
— Connect the setpoint input and AGND as required
— Connect the resolver
— Connect ROD/SSI- or the CONNECT module (see corresponding operating manual)
— Connect the motor leads, using ring cores close to the amplifier, shielding to terminals or EMC connectors at both ends
— Connect motor holding brake (if neccessary), shielding to PE at both ends
— Connect auxiliary voltage (see Chapter I.8.1 for max. permissible voltage values, use Seidel mains filter 1EF06)
— Connect mains power voltage (see Chapter I.8.1 for max. permissible voltage, use Seidel mains filter 3EFxx)
— Connect PC (see Chapter IV.3).

Check

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

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The following instructions should help you to follow a sensible installation sequence without endangering personnel or machinery.

check installation

see Chapter II.2. **De-energize the servo amplifier.**

disable Enable Signal

0V on terminal X3/16

switch on 25V aux. voltage

24V DC on terminal X1/1 and ground on terminal X1/2
The green LED light up after the initialisation sequence (approx. 0.5s) (see Chapter I.8.4)

switch on PC start operator software

See operating manual for the operator software BS7200.
The parameters which are stored in the SRAM of the servo amplifier are transferred to the PC.



check the displayed params. and correct if necessary

Caution !
Check the parameters described below especially carefully.
If you do not observe these basic values, parts of the system may be damaged or destroyed.

no. of motor poles : must match the motor (manual for 6SM motors)
no. of res. pole pairs : must match the motor (manual for 6SM motors)
I_{RMS} : maximum is the standstill current I_0 of the motor (as per nameplate)
I_{PEAK} : maximum is 4 x the standstill current I_0 of the motor
final speed : maximum is the rated speed of the motor (as per nameplate)



check the safety devices

Caution !
Make sure that personnel or machinery cannot be endangered by any unexpected movement of the amplifier.

switch on mains power

by the ON/OFF switch on the contactor equipment

setpoint to 0V

without CONNECT module: on terminal X3/1-2,
with CONNECT module: function “const. speed” with n = 0min^{-1}

Enable

24V DC on terminal X3/16, motor is stopped with standstill torque

Setpoint

without CONNECT module installed :

- analog setpoint, recommended 0.5V on terminal X3/1-2

with CONNECT module installed :

- carry out “REVERSING MODE” function in the “SERVICE” menu, with the given default values (reversing at 100 rpm, change direction every 0.5s)

If the motor oscillates, this is dangerous for the motor !
The Kp parameter in the “Speed” must be reduced.

Optimization

for speed and current controllers, see BS7200 operating manual

start up CONNECT-module

see corresponding CONNECT operating manual

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II.4 Parameter description

A brief description of the parameters is given. Detailed explanations can be found in the operating manual for BS7200.

II.4.1 General

Motor pole no. [-]
The current setpoint entry can be adjusted for operating 2- to 12-pole motors.
Changes are only possible when the Enable signal is inactive.

Language [-]
The operator language can be selected from: English, German, French.

Resolver pole-no. [-]
Switches the no. of resolver poles to operate 2/4/6-pole resolvers. Only for amplifiers without Connect module. Changes are only possible when the Enable signal is inactive.

I/O [-]
Determines the function of the I/O terminal X3/15, see Chapter III.1.1 and III.2.2.

Ballast power [W]
Sets the ballast power.

Brake [-]
The motor holding brake can be operated from the servo amplifier.

ROD/SSI [-]
Select the type of interface or switch off the interface if position output is not in use.

NI-offset [increment]
Only accessible when the interface is set to ROD. Determines the position of the zero pulse within a turn. Input referred to zero crossing of the resolver and the preset resolution

ROD code [-]
Only accessible when the interface is set to ROD.
Determines whether the output is in decimal or binary code.

Resolution [Inkr./Umdr.]
Only accessible when the interface is set to ROD.
Determines the no. of increments per turn which are output.

SSI code [-]
Only accessible when the interface is set to SSI.
Determines whether the output is in binary or GRAY-code.

SSI clock [kHz]
Only accessible when the interface is set to SSI. Determines the SSI clock rate and the quiescent level of the clock line. Setting : 200, 1500, 200 inverted, 1500 inverted.

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II.4.2 Current controller

I_{rms} , root mean square current [A]
Sets the desired rms output current.

I_{peak}, peak current [A]
Sets the desired peak output current according to requirements.

I^2t threshold, signal threshold [%]
Monitors the actual rms current required.

Kp, P-gain [-]
Determines the proportional gain of the current controller.

Tn, integration time [ms]
Determines the integration time constant / integral-action time of the current controller.

II.4.3 Speed controller

K_p, P-gain [-]
Determines the proportional gain (also known as AC-gain).

T_n, integration time [ms]
Determines the integration time constant / integral-action time.

PID-T2, second time constant [ms]
Influences the P-gain at medium frequencies.

SW offset [mV]
For the offset compensation of CNC controls and the analog input.

SW ramp + [ms]
Delays the rate of rise of the setpoint value during **acceleration.**

SW ramp – [ms]
Delays the rate of fall of the setpoint value during **braking**.

Speed limit [min^{-1}]
Determines the normalization of the actual value for speed.

DC monitor [-]
Selects the output of IDC- or VTA-monitor at terminal X3/23.

Limit switch, Stop [-]
The limit switch inputs can be activated or deactivated together or individually.
The Stop function enables a controlled, drift-free standstill with the standstill torque.

Start Phi, phase shift [min^{-1}]
Compensates the inductive phase shift between motor current and motor voltage.

Limit Phi, phase shift [°electr.]
The phase shift is increased linearly between the start speed and the final speed up to the final value of Phi.

T tacho, tachometer time constant [ms]
Influences the speed feedback by a low-pass response.

Speed steadiness [-]
Improves the smooth running qualities for drive applications with a constant speed.

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II.4.4 Service functions

The service functions are auxiliary functions for optimizing the controller parameters.

Constant speed
Drive runs with constant speed. The analog setpoint input is inoperable.

Constant current
Drive runs with constant current, under current control.The analog setpoint input is inoperable.

Reversing mode
Drive runs in reversing mode. The analog setpoint input is inoperable.

II.4.5 Display actual value

Internal temperature
The internal temperature is displayed in °C.

Heat sink temperature
The temperature of the heat sink is displayed in °C.

Intermediate circuit voltage
The intermediate circuit voltage which is produced in the servo amplifier is displayed in V.

I^2t
The momentary effective load is displayed in % of the preset rms current value.

Ballast power
The actual ballast power is displayed in W.

Speed
The actual speed of the motor is displayed in min^{-1}

Current: actual value
The momentary value of the rms output current (active component) in A

Rotational angle
Displays the actual rotational angle of the rotor (only for n < 20 min^{-1}) in °mech and counts, referred to the mechanical zero point of the measuring system.

Operating time
Counts the hours of operation of the servo amplifier.

II.5 Fault signals, BTB signal

All fault messages are signalled by the red collective display LED on the front panel and displayed on the PC screen.
All faults result in opening of the BTB contact and a switch-off of the output stage.

- undervoltage in intermediate circuit : limit set to 65V by the manufacturer
- overvoltage in intermediate circuit : limit set to 750V by the manufacturer
- output stage fault : fault in the output stage
- aux. voltage fault : internal aux. voltage not correct
- heat sink temperature too high : limit set to 80°C by the manufacturer
- Internal temperature too high : limit set to 70°C by the manufacturer
- motor temperature too high : limit set to 145°C by the manufacturer
- brake fault : short-circuit
- resolver error : cable break or similar
- line to earth fault : line to earth fault in the motor or motor cable

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III Control inputs and outputs

III.1 Input functions

III.1.1 Analog inputs

Setpoint input SW

The servo amplifier is equipped with a decoupled differential input for an analog setpoint.
It is set for a differential input voltage of max. ± 10 V, resolution 1mV.
Ground reference: AGND, terminal X3/17.

A positive voltage on terminal X3/1 with regard to terminal X3/2 produces a clockwise rotation of the motor shaft (looking at the shaft). The common-mode voltage range (important to avoid earth loops) amounts to an additional ± 10 V, input resistance: 20 kΩ.

III.1.2 Digital control inputs

All inputs are **isolated** and coupled via optocouplers. The ground reference is **Digital-GND** (DGND, terminal X3/12). The logic is designed for +24V/7mA (**PLC compatible**), logic-high level is +12 ... 30V / 7mA.

Enable input E

The output stage of the amplifier is enabled by the Enable signal (terminal X3/16, input 24V, **active high**). The attached motor is torque-free in the disabled state.

PSTOP / NSTOP (limit switch) inputs

Limit switch positive/negative (**PSTOP / NSTOP**, terminals X3/10 and 11)**, high level in normal operation** (fail-safe for cable break). A low signal (open) disables the corresponding direction of rotation, **the ramp function remains active**. If the inputs are blocked the I-component of the speed controller will also become ineffective, so that a mechanical demarcation (dead stop) is permissible. This function must be explicitly enabled (parameter LIMIT SWITCH to ON).

If the parameter LIMIT SWITCH is set to STOP, the result is a controlled drift-free standstill of the motor, with the standstill torque M_0, when the limit switch inputs are disabled (I-component is active).

Programmable input I/0

Terminal X3/15 (I/O) can be programmed by means of the I/O parameter for the following input functions (see Chapter II.2.2 for a wiring example) :

— **RESET** : hardware reset of the servo amplifier (active high)
— **1:1 CONTROL** : servo amplifier operates purely as a current controller (active high)
— **INT. OFF** : switches offf the I-component of the speed controller (active high)
Ground reference : DGND (terminal X3/12)



Warning !

Do not program terminal X3/15 as an output if it is wired up as an input !

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III.2 Output functions

III.2.1 Analog outputs

DC-monitor: armature current setpoint IDC and tachometer monitor output VTA

Depending on the setting of the DC-MONITOR parameter, the IDC/VTA output (terminal X3/23) provides either the current setpoint (IDC) or a tachometer voltage (VTA).

IDC preselection

The IDC monitor provides ± 10V at ± **peak equipment current** (sinusoidal rms value) referred to AGND.
The output is the equivalent to the **active** current value, which is approximately **proportional** to the **motor output torque**. Output resistance: 2.2kΩ, resolution: 8bit.

VTA preselection

The output provides ±10V referred to AGND at the preset final speed limit.
Output resistance: 2.2kΩ, resolution: 10 bit.

III.2.2 Digital outputs

Ready-to-operate contact BTB

Ready-to-operate (**BTB**, terminal X3/21 and 22, **max. 60V/0,5A DC**) is signalled via a **floating** relay contact. The contact it **closed** when the amplifier is ready for operation. The signal is **not** affected by the enable signal or the I²t limit.

Programmable output I/0

Terminal X3/15 (I/O) can be programmed by the I/O parameter for the following output functions (see Chapter II.2.2 for a wiring example):

— **I2T** : signals that the preset I²t threshold (high level) has been reached
— **BALLAST** : signals that the preset ballast limit (high level) has been exceeded

Ground reference: DGND (terminal X3/12)



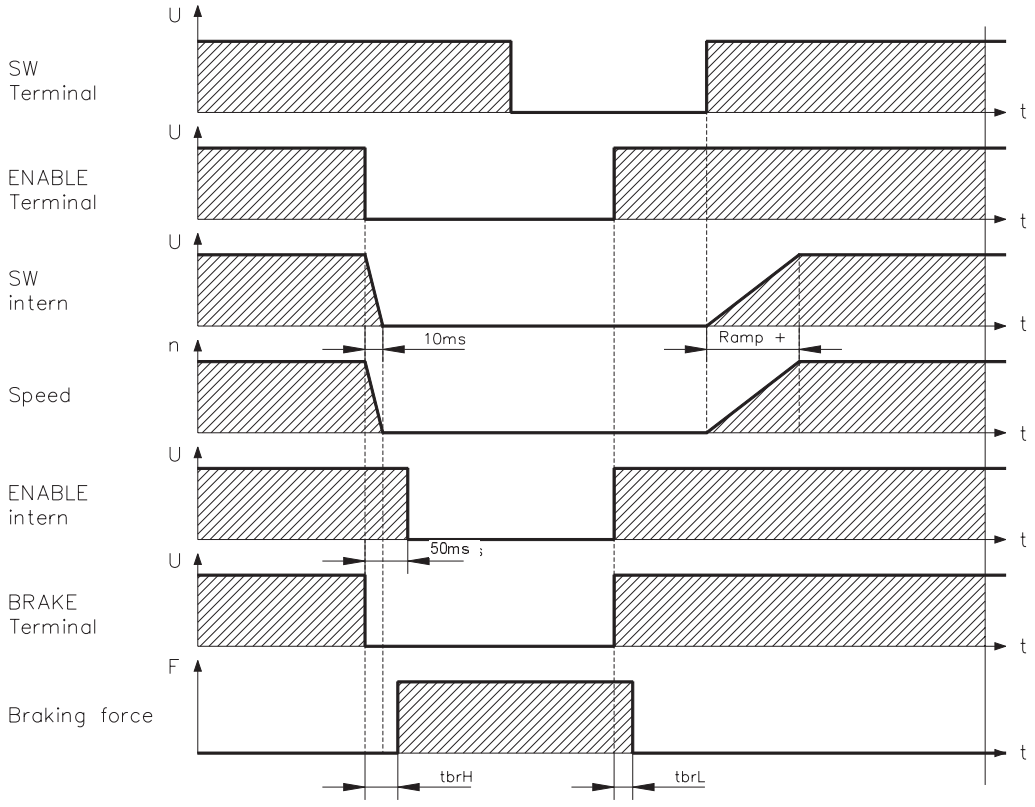
Warning !

Do not program terminal X3/15 as an input if it is wired up as an output !

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III.2.3 Brake

A 24V holding-brake in the motor can be operated directly from the servo amplifier.
The braking function must be explicitly enabled by using the BRAKE parameter: setting WITH.
The diagram below shows the timing and functional relationship between the ENABLE signal, speed setpoint, speed and braking force.



During the internal ENABLE delay time of 50ms the speed setpoint of the servo amplifier is run down to 0V along a 10ms ramp.

The rise and fall times of the holding brake which is built into the motor are different for the individual motor versions of the 6SM series of motors (see the manual for 6SM motors).

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IV Interfaces and options

IV.1 Incremental encoder interface (only for units without a CONNECT module)

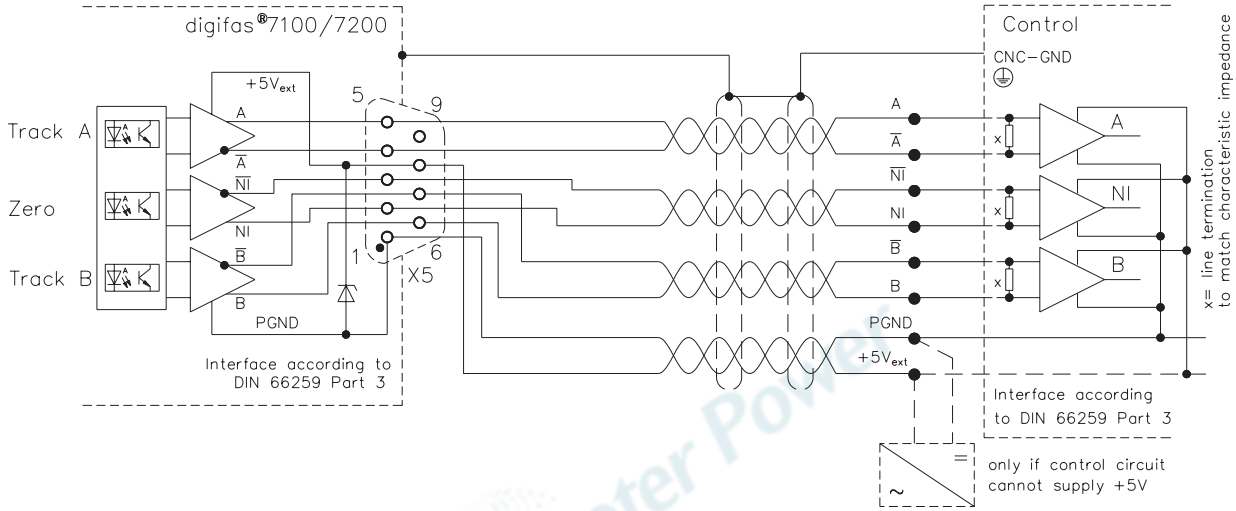
The incremental encoder interface is included as part of the delivery package for servo-drives which do not have a CONNECT module (standard version). Set the parameter ROD/SSI to ROD with the operator software BS7200.

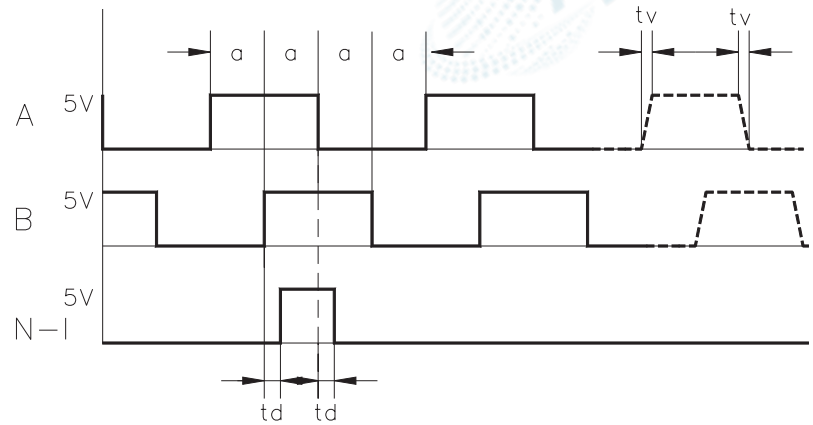
The position of the motor shaft is calculated in the servo-amplifier from the cyclically-absolute 14-bit information of the resolver digital converter. Pulses are derived from this information which are compatible to the incremental encoder. Two pulse trains (signals A and B) which are electrically set off by 90° and a zero pulse are available at the SubD connector. You can choose between 500, 512, 1000 and 1024 pulses per turn (parameter: RESOLUTION).

The position of the zero pulse can be adjusted over one mechanical turn and stored (parameter: NI-OFFSET). The zero pulse can only be set with A=B=1, so as to maintain compatibility with normal commercial encoders.

The power for the drivers is provided by an external supply voltage (GND: X5.1 and +5V: X5.8). **PGND must be connected to the control.**

Incremental encoder interface : connections and signal definitions





Edge spacing a ≥ 8 µs

U_H ≥ 3.7V/−20mA

U_L ≤ 0.8V/+20mA

Edge steepness tv ≤ 0.1 µs

Delay N–I–td ≤ 0.1 µs

Scanning frequency > 160kHz

Limit speed 6000 rpm

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IV.2 SSI-Interface, (only for units without a CONNECT module)

The SSI position interface is included as part of the delivery package for servodrives which do not have a CONNECT module (standard version) . Set the ROD/SSI parameter to SSI with the operator software BS7200.

The signal sequence can be output in **Gray** code (standard) or in **Binary** code. Set the SSI-CODE parameter by using the operator software or the operating keys.

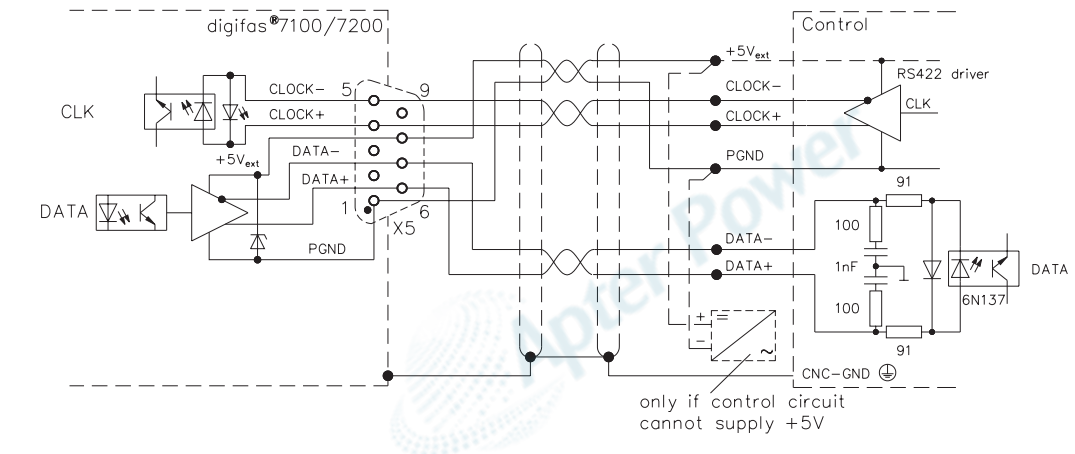
Operate the interface off an external supply voltage (GND : X5.1 and +5V : X5.8).
PGND must be connected to the control.
A serial signal is read out synchronously by the interface at a clock rate of max. 1.5 MHz. You can adapt the servo-amplifier to the clock frequency of the SSI evaluation by using the SSI-CLOCK parameter (200 kHz or 1.5MHz and reversed).

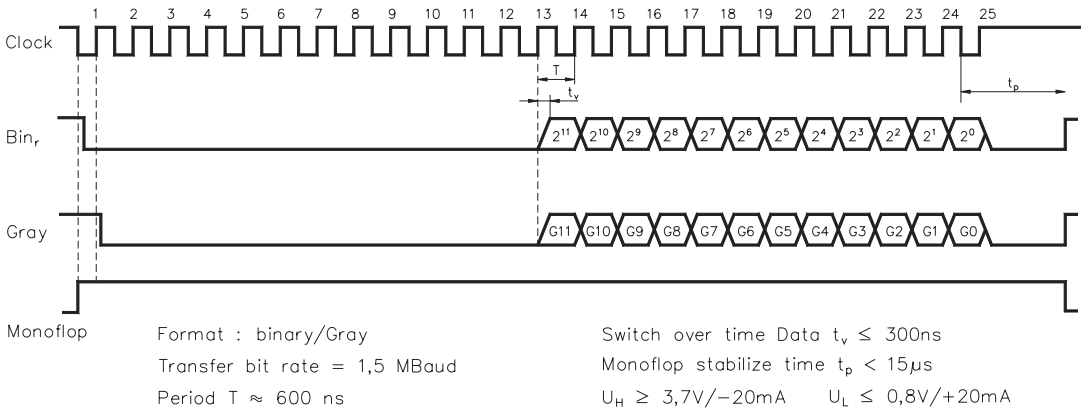
The position of the motor shaft is now calculated from the cyclically-absolute 14-bit information of the resolver digital converter. A position output which is compatible to the usual data format for normal commercial SSI absolute encoders is generated from this information. This synchronous, serial, cyclically-absolute 12-bit information is output on the SubD connector X5.

24 bits are transmitted. The most significant 12 bits are permanently set to ZERO, the least significant 12 bits contain the position output. The interface has to be read like a multi-turn encoder, but supplies valid single-turn data.

SSI-Interface: connections and signal definitions:

The count direction for the SSI interface is set to be upwards for clockwise rotation, looking along the motor axis.





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IV.3 PC interface

With the operating software BS7200 you can carry out the setting of the operating, positional, and motion parameters, using a normal commercial personal computer (PC).
The PC interface (X6) of the amplifier is connected with the parallel or serial port of the PC by a 9-core special cable.

Connect / disconnect only while all supply voltages are switched off.

The interface in the servo amplifier is electrically isolated by optocouplers.

Connection to a parallel port :
Use our special 9-core interface cable

Connection to a serial port :
Use our special serial cable with power pack.

Minimum requirements for the PC :

Processor	:	80386 or higher
Clock	:	16 MHz or higher
Operating system	:	MS-DOS (3.3 or higher)
Graphics adaptor	:	VGA
Monitor	:	s/w or colour
Disk drive	:	floppy 3.5”, hard disk (C:)
Main memory	:	at least 1MB, there must be at least 400K of contigous memory in the conventional (640K) memory area
Interface	:	one free port (LPT1:, LPT2:, COM1: or COM2:) ***LPT1: adress 378_H*** ***COM1: adress $3F8_H$*** ***LPT2: adress 278_H*** ***COM2: adress $2F8_H$***
System configuration (config.sys)	:	Buffers : min. 30 Files : min. 30 Stacks : 0,0 or not defined Environment : Size of environment (/E:xxxx) must be defined, min. 1024 byte. Correct syntax runs: **shell=command.com /E:1024** if nessesary, specify path of *command.com*.

Further advice and an illustration of the special cables can be found in the manual for the BS7200 operating software.

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VI Appendix

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

D elivery package :
— 1 digifas™ 7200 series servo amplifier
— 3.5" diskette with the operator software BS7200
— 2 ring cores
— installation/commissioning manual for digifas™ 7200
— BS7200 operating manual
— installation/commissioning manual for the CONNECT module, if one is built in

Transport :
— only by qualified personnel
— only in the original recyclable manufacturer's packaging
— avoid shocks
— temperature –25 ... +70°C, max. 20 K/hr variation
— humidity relative humidity max. 95% no condensation
— the servo amplifiers contain electrostatically-sensitive components which can be damaged by incorrect handling. Discharge yourself before you touch the servo-amplifier. Avoid touching highly insulating materials (artificial fabrics, plastic wrappings etc.). Place the servo amplifier on a conductive base.
— if the packaging is damaged, check the unit for visible damage. In such a case inform the shipper and the manufacturer.

Storage :
— only in the original recyclable manufacturer's packaging
— the servo amplifiers contain electrostatically-sensitive components, which can be damaged by incorrect handling. Discharge yourself before you touch the servo-amplifier. Avoid touching highly insulating materials (artificial fabrics, plastic wrappings etc.). Place the servo amplifier on a conductive base.
— max. stacking height 10 cartons
— storage temperature –25 ... +55°C, max. 20 K/hr variation
— humidity relative humidity max. 95% no condensation
— storage duration < 1 year without restriction
> 1 year : the capacitors must be re-formed before commissioning the servo amplifier.
To do this: remove all electrical connections, feed the servo amplifer for about 30 min from single-phase 230V AC on terminals L1 / L2.

Maintenance :
— no maintenance required
— opening the equipment housing invalidates the guarantee

Cleaning :
— if the housing is dirty : clean with isopropanol or similar
do not immerse or spray
— if there is dirt inside the unit : to be cleaned by the manufacturer

Disposal :
— the servo amplfier may be reduced to its principal components (aluminium heat sink and front panel, steel housing sections, electronics boards) by undoing all screw connections
— the disposal should be performed by a certified disposal company. We can give you suitable addresses.

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Only under the condition that the system components listed below are used and that the commissioning instructions in this documentation (Chapter II.1 ff) are followed, can we guarantee the conformance of the servo amplifier with the following standards for industrial areas:

- **EC EMC Directive 89/336/EEC**
- **EC Low Voltage Directive 73/23/EEC**

If there is any deviation from these requirements you must provide your own measurements to demonstrate conformance to the standards.

The item nos. below refer to the system diagram on the opposite page.

Item no.	Designation	Description
1	analog cable	shielded, twisted pairs, 3x2x0.25mm²
2	shield terminal clamps	various sizes, manuf. Weidmüller, type KLBÜ
3	mains adapter 24VDC/xA	auxiliary voltage supply
4	1EF06	mains filter, manuf. Seidel, single-phase
5	mains cable	shielded, 4x1.5 mm²
6	3EFxx	mains filter, manuf. Seidel, for various currents
7	digifas™ 72xx	servo amplifier, manuf. Seidel, various versions
8	ROD/SSI cable	shielded, twisted pairs, 4x2x0.25mm²
9	resolver cable	manuf. Seidel, ready-made, can be trailed
10	EMC-RES-connector	component of resolver cable manuf. by Seidel
11	woven tape	manuf. Seidel, ready-made
12	motor-/brake cable	manuf. Seidel, shielded, can be trailed, with or without integral brake cable, in case of shielded
	motor cable	length ≤ 25m : 1.5mm² length 25m to 100m: 1mm² with motor choke box
13	EMC-PGxx	PG screwed gland, built into the terminal box of motor series 6SM45,56
	EMC-Power connector	EMC power conn. for motors 6SM27/37/47/57/77
14	6SMxx	synchronous servo-motor, various frame sizes
15	ring core	ferrite ring

x = various value

Make a selection from our price list. Configure your own tailor-made CE servo system from our individual components.

Our applications department is always available to deal with your queries.

The components listed below do not have any decisive effect on the conformance of single-axis systems to the standards. However, for multi-axis systems item F may need to be shielded, depending on the length.

A	—	7 x 0.5mm^2, single cores
B	—	PC cable, manuf. Seidel
C	—	line driver (booster)
D	—	earth lead, 1.5 ... 16mm^2
F	—	length more than 20cm : shielded cable, 7x1.5mm^2 length up to 20cm : 5 single cores, 1.5mm^2

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VI.3 Fault-finding

The table below should be seen as a “First-Aid” box. There may be a wide variety of possible reasons for the occurrence of a fault, depending on the circumstances in your system.

Multi-axis systems may conceal further causes of a fault.

Our applications department can give you further assistance with problems.

Fault	possible causes	ways to remove the cause of the fault
fault signal: comms. fault	— wrong cable used — cable inserted into wrong position in the PC or the servo amplifier — wrong PC interface selected — PC amplifier power insufficient — booster defect — booster power pack defect — mains voltage for booster power pack not correct — PC is not grounded	— use the Seidel PC cable — insert the connector into the correct position in the PC or the servo amplifier — correct call in the op. software — use a booster — replace booster — replace power pack — check mains supply — ground the PC
fault signal: undervoltage	— mains voltage not present or too low when the servo amplifier is enabled	— enable the servo amplifier only when the mains supply has been switched on
fault signal: overvoltage	— ballast power inadequate, ballast power limit was reached, the ballast resistor was switched off. This caused the excessive intermediate circuit voltage. — mains voltage too high	— shorten the RAMP- braking time set the parameter ballast power to 75W / 140W (7206) connect the intermediate circuits of several amlifiers — use a mains transformer
fault signal: brake	— short-circuit in the supply leads to the motor-holding brake — defective motor-holding brake	— remove short-circuit — replace motor
fault signal: output stage fault	— motor cable has short-circuit / earth short — motor has short-circuit / earth short — output stage overheated — defect in output stage	— replace cable — replace motor — improve ventilation — return servo amplifier to manufacturer for repair
Fault signal: V-fault (aux. voltage)	— the aux. voltage produced in the servo amplifier is defective	— return servo amplifier to manufacturer for repair

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Fault	possible causes	ways to remove the cause of the fault
fault signal: resolver	— resolver plug not properly connected — break in resolver cable, cable crushed etc. — wrong type of resolver	— check connector — check cable — use two-pole resolver
fault signal: heat sink temperature	— permissible heat sink temperature exceeded	— improve ventilation
fault signal: internal temperature	— permissible internal temperature exceeded	— improve ventilation
fault signal: motor temperature	— thermal cut-out in motor has been activated — resolver connector loose or break in resolver cable	— wait until the motor has cooled down, then investigate the cause of the overheating — use new resolver cable
no motor rotation	— servo amplifier not enabled — break in setpoint lead — motor phases swapped — brake not released — amplifier mechanically jammed — no. of motor poles set incorrectly — wrong type of resolver	— apply ENABLE signal — check setpoint lead — correct motor phasing — check braking control — check mechanism — set parameter: motor pole no. — use two-pole resolver
motor runaway	— motor phases swapped — with -IL- option: ROD cable defect or not properly connected	— correct motor phasing — check ROD/SSI cable
motor oscillates	— gain too high — shielding in resolver cable broken — AGND not wired up	— reduce Kp parameter — replace resolver cable — join AGND to CNC-GND

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