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NCT Servo Amplifiers

Structure of NCT Drive Systems

NCT drive system contains a power supply and an optional number of servo amplifiers and servo motors, each servo amplifier is connected to a motor. The system does not need transformer in case of voltage levels customary in Europe, however line chokes constitute a separate unit in case of larger power supplies. The depths of the different modules are the same and all electric connectors are placed on the front panel, thus can be placed in one row and an aesthetic, clear, cable-friendly system can be generated. The order of the modules is optional, they can even be placed in more rows. The direct line supply and the modular construction characteristic to NCT drive systems make the electric planning, the implementation of line supply as well as the possible future enhancement or module replacement simple.

Servo Amplifiers DS.. and DA..

Servo amplifiers DS.. and DA.. developed and produced by NCT Kft. together with the appropriate servo motors create high-accuracy servo drives meeting the tough economic, environmental and technical requirements concerning precision drives of modern automatic machine tools and machining centers.
The servo amplifier supplied by direct-current (DC) bus generates by pulse width modulation voltage needed for the supply of motor. High-voltage switch elements are IGBT supplied with heat and over-current protection integrated in a mutual package, while all control and information tasks are accomplished by a microprocessor. The switching frequency of the output voltage is constant, yet it is formed as base harmonic of variable-width pulse sequence. The modulation is space-vector-controlled with superior current and speed as well as position control. Supply of rectangular-field synchronous machine, sine-field synchronous machine as well as asynchronous machine is possible by choosing the appropriate program.
Servo amplifiers DS.. and DA.. can also operate in speed control mode as well as position control mode. In speed control mode they can receive both analog and digital reference signals, while in position control mode they only receive digital reference signal. Analog reference signal means +/- 10V voltage range, digital reference signals can be received by the servo amplifiers using CAN bus.

Safety Instructions

Installation, control, repairment and maintainance of servo drive produced by NCT Kft. can only be done by person with adequate qualification and with the knowledge of the general safety instructions of electrotechnics. Besides the person must know all dangers of the given type of equipment and all rules to avoid accidents. The person working with electric equipment is not only responsible for his own health but must also ensure, that other people are not subject to danger.

protection against indirect contact

Installation, repairment and maintenance of servo drives produced by NCT Kft. must always be proceeded according to MSZ 172-1:1986/1 M:1989.
The metal casing of servo amplifiers DS.. and DA.. must always be connected to the protective conductor carefully, with a cable of standard size. Higher than extra-low voltage can only be connected to servo amplifiers

DS.. and DA.. when they are properly connected to the protective conductor. Only cables with non-damaged isolation, intact
connector counter parts without cracks and coated end sleeves may be applied. DC bus outlets of servo amplifiers DS.. and DA.. are out to touch, their unaccessibility must be ensured after mounting the servo amplifiers. Till the DC bus outlets are free to touch, it is forbidden to power the drive system. High-capacity condensators are connected to the DC bus, keeping the stored charge for a long time even after power-off. If for some reason the servo amplifiers DS.. and DA.. have to be touched, always check if the voltage of DC bus has decreased to zero.

Hot Surfaces

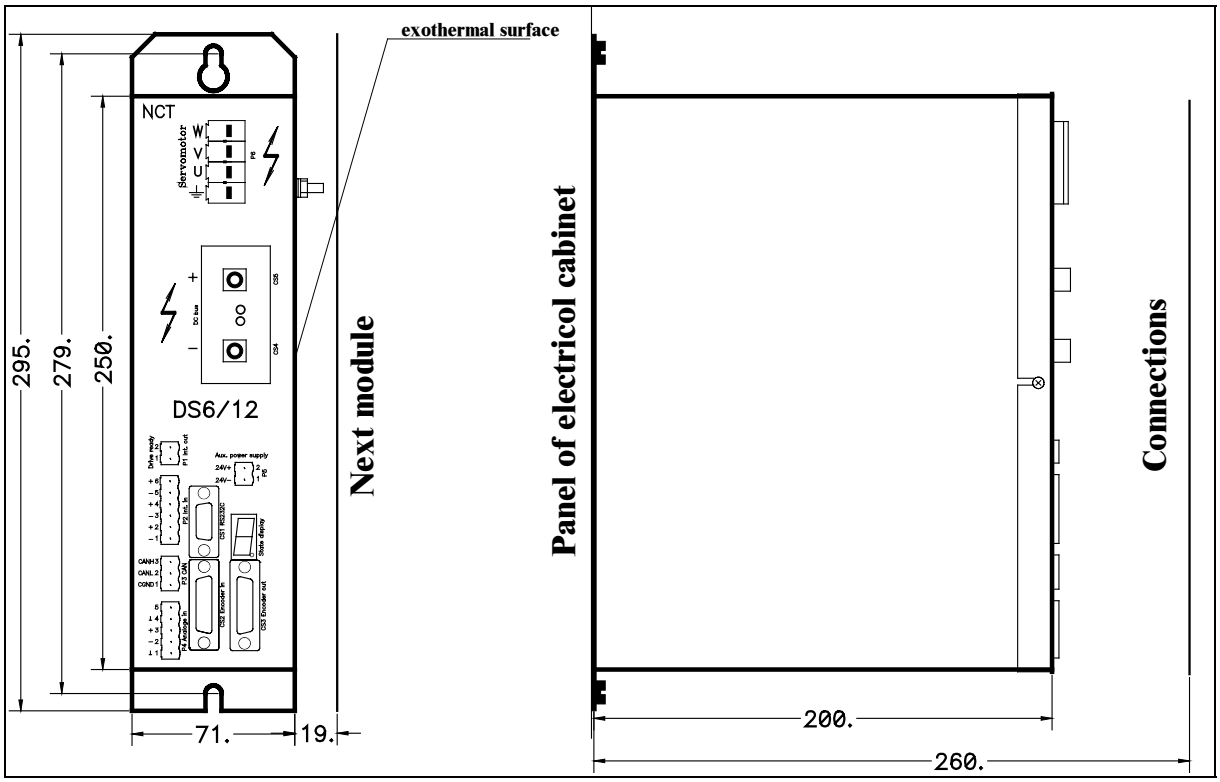
Servo amplifiers DS.. and DA.. generate heat during operation, warming the drive and also its environment. Servo amplifiers DS.. and DA.. may warm up so high temperature, that would cause burning injury upon touch. Especially the exothermal surfaces may become hot. Always check if the surface to be touched can cause burning injury.

Accidental Motor Movements

If motors are connected to powered servo amplifiers DS.. and DA.. these motors have a chance of starting to move and the accidental motor movements can cause personal injury or serious property damage. Motor movements may be caused by drive failure, external disturbance or accidental power-on. After switching the supplying voltage off, so much energy remains for a long time in the DC bus condensators that can rotate the motor. The industrial noise is a basic problem, encumbering the detection of non-predicted mechanical movements, and thus the possibility of quick reaction.

Servo Amplifiers DS2/4, DS6/12, DS8/16 and DA8/12

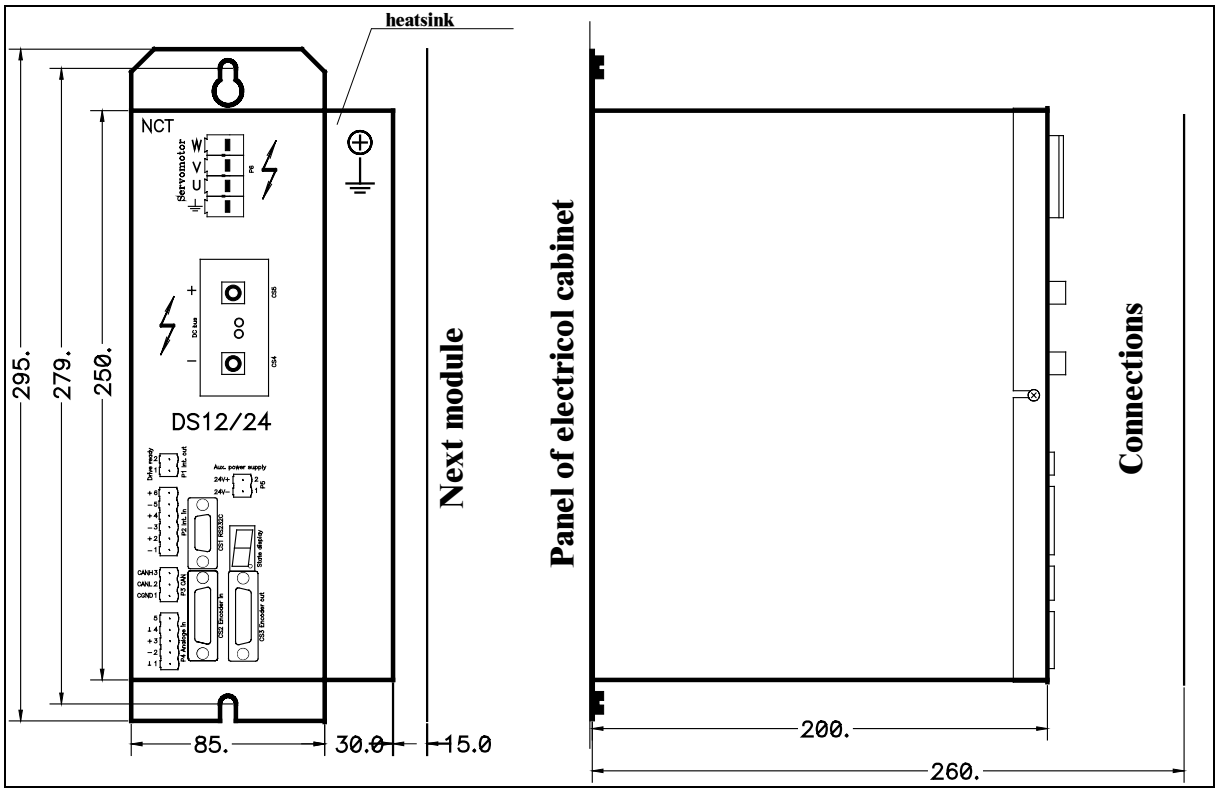
	DS2/4	DS6/12	DS8/16	DA8/12
Nominal DC voltage	540 V			
Output voltage	0…400 V			
Nominal output current	2 A	6 A	8 A	8 A
Maximum output current	4 A	12 A	16 A	12 A
Peak current	9 A	14.5 A	25 A	25 A
Nominal output power	2 KVA	4.1 KVA	5.5 KVA	5.5 KVA
Maximal motor power				3.5 KW
Temperature range	0…40 C°			
Protection	IP00			



Mechanical sizes of servo amplifiers DS2/4, DS6/12, DS8/16 and DA8/12

Servo Amplifiers DS12/24, DS18/36, DA16/24 and DA24/36

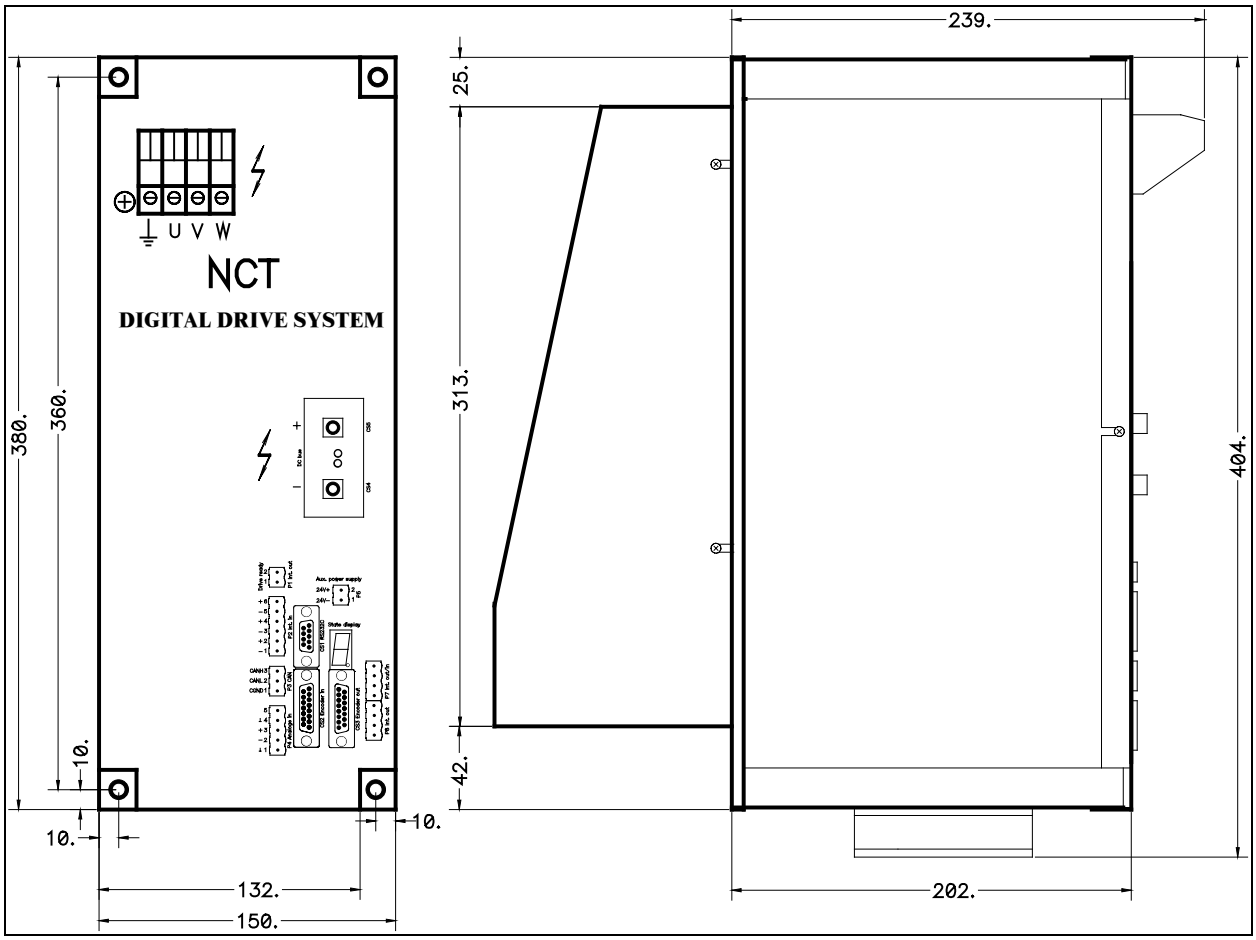
	DS12/24	DS18/36	DA16/24	DA24/36
Nominal DC voltage	540 V			
Output voltage	0…400 V			
Nominal output current	12 A	18 A	16 A	24 A
Maximum output current	24 A	36 A	24 A	36 A
Peak current	45 A	67 A	45 A	67 A
Nominal output power	8 KVA	12 KVA	11 KVA	17 KVA
Maximal motor power			7 KW	11 KW
Temperature range	0…40 C°			
Protection	IP00			



Mechanical sizes of servo amplifiers DS12/24, DS18/36, DA16/24 and DA24/36

Servo Amplifiers DS24/48, DS36/72, DA32/48 and DA48/72

	DS24/48	DS36/72	DA32/48	DA48/72
Nominal DC voltage	540 V			
Output voltage	0…400 V			
Nominal output current	24A	36 A	32 A	48 A
Highest output current	48 A	72 A	48 A	72 A
Peak current	100 A	150 A	100 A	150 A
Nominal output power	17 KVA	25 KVA	22 KVA	33 KVA
Maximal motor power			15 kW	22 KW
Temperature range	0…40 C°			
Protection	IP00			



Mechanical sizes of servo amplifiers DS24/48, DS36/72, DA32/48 and DA48/72

Installation of Servo Amplifiers DS.. and DA..

Setting-in Servo Amplifiers DS.. and DA..

Basically four standpoints must be taken into consideration when mounting servo amplifiers DS.. and DA..:

-Prevention of accidents
-Protection against harmful environment
-Avoidance of overheat
-Mechanical fixing

Privention of Accidents

There are points under voltage on servo amplifiers DS.. and DA.. that are out to touch. Therefore the place of mounting must be one where normally servo amplifiers DS.. and DA.. are unaccessible. The most commonly applied procedure is their placement in the electric switchboard.
Servo amplifiers DS.. and DA.. have IP00 protection and can only support IP20 protection when protective cover is placed above DC buses.

Protection against Harmful Environment

Similarly to other electronic equipments, servo amplifiers DS.. and DA.. are sensitive to different contaminations as well as to moisture. Naturally drives must be protected from water, as well as from different solid and liquid materials. Similarly contaminated (coolant, oil mist, powdered carbon, sawdust ect.) or moist air must be avoioded, keeping the inside of the equipment safe.
In case servo amplifiers DS.. and DA.. are operated in rooms, where air clarity is inadequate, the equipment must be protected. When ensuring the adequately clear environment, the resulting heat, carried away by the air surrounding the drive must be also taken into consideration. Nowadays the best solution seems to be the hermetically sealed electric switchboard supported with heat exchanger or climatizated.

Avoidance of Overheat

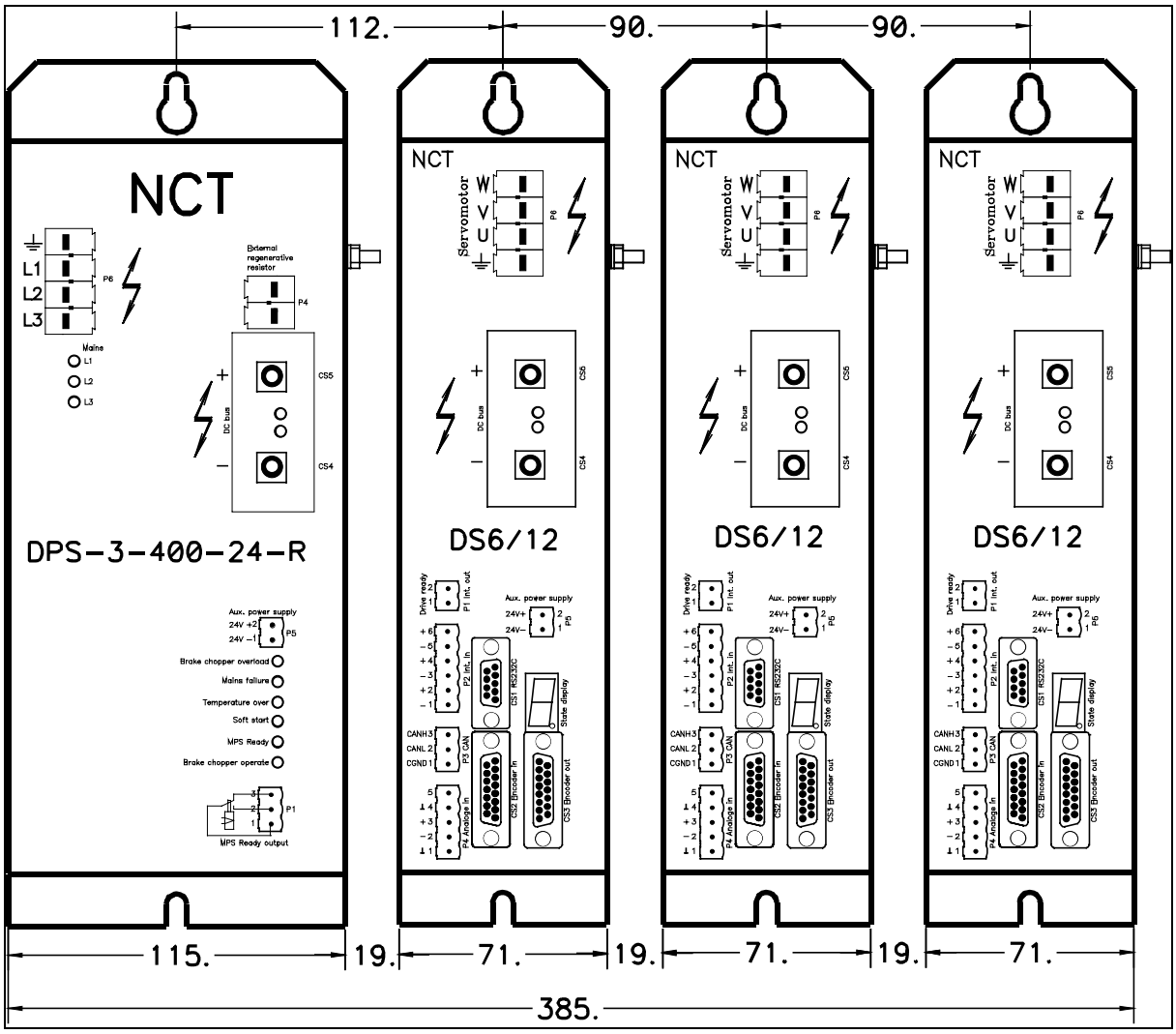
Servo amplifiers DS.. and DA.. generate heat under operation, warming themselves, as well as their environment. Should the generated heat not be able to leave the device with the adequate intensity, the equipment is overheated. One of the most important standpoints of installation is the avoidance of the previous case.

In Case of Servo Amplifiers DS2/4, DS6/12, DS8/16 and DA8/12

The cooling plate of the servo amplifier can be found on the right side of the equipment. The conditions of natural thermal flow must be ensured in the course of setting-in:

- The equipment can only be mounted vertically
- Adequate place must be ensured for thermal flow on the bottom and top
- At least 19 mm must be left between the right side of the device and the next equipment. (The grounding screw of the equipment is on the right side, so that no other equipment can be placed directly beside.)

Often three DS6/12 servo amplifiers are used together with one DPS-3-400-24-R main supply. Diagram of the recommended mounting of this configuration is shown below as an example.

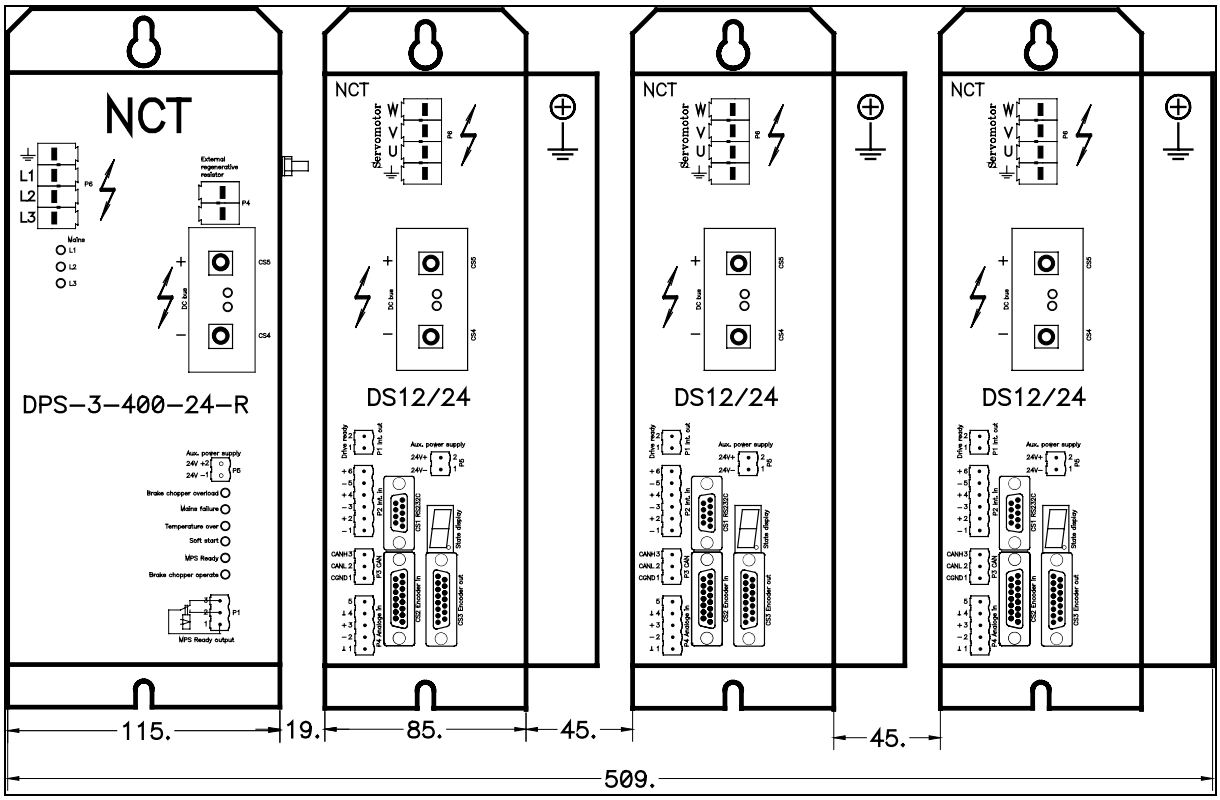


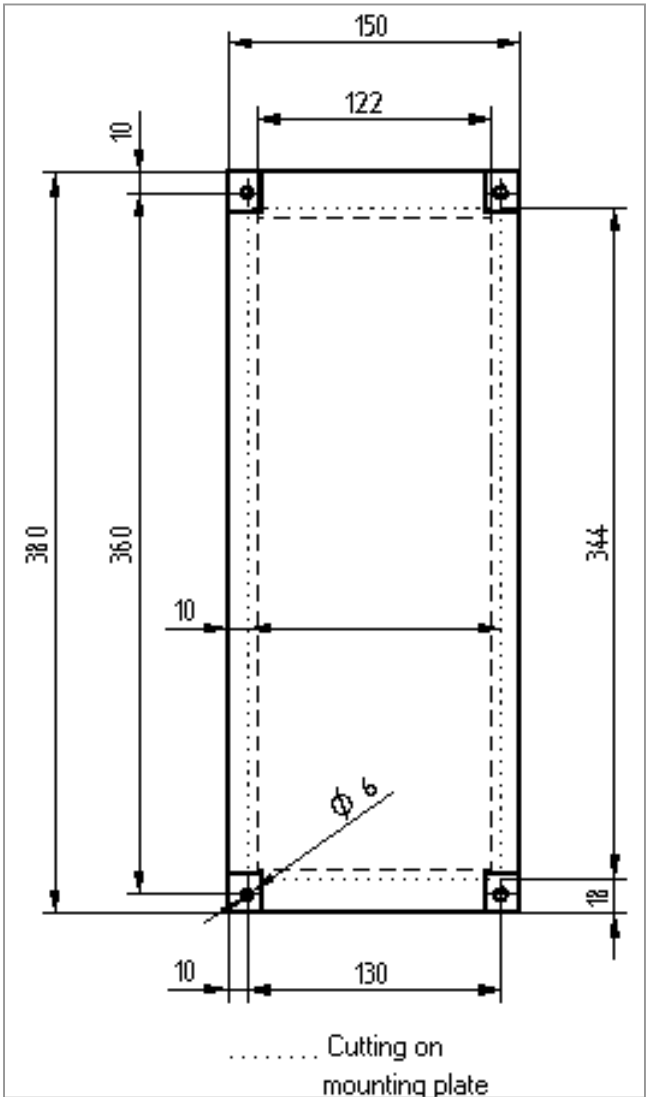
In Case of Servo Amplifiers DS12/24, DS18/36, DA16/24 and DA18/36

The cooling plate of the servo amplifier can be found on the right side of the equipment. The conditions of natural thermal flow must be ensured in the course of setting-in:

- The equipment can only be mounted vertically
- Adequate place must be ensured for thermal flow on the bottom and top
- At least 15 mm must be left between the right side of the device and the next equipment.

Often three DS12/24 servo amplifiers are used together with one DPS-3-400-24-R main supply. Diagram of the recommended mounting of this configuration is shown below as an example.





In Case of Servo Amplifiers DS24/48, DS36/72, DA32/48 and DA48/72

These servo amplifiers can be mounted in a closed electric switchboard, so that the part of the drive containing electronic parts contacts the clear air of the electric switchboard, while the cooling fin giving off most of the generated heat contacts the air outside the electric switchboard. Its advantage is that only a little part of the heat generated by the drives warms the inside of

the electric switchboard. For this mounting method the cutting shown on the diagram must be performed on the back panel of the electric switchboard and the cooling fin must be got through this offcut.
Should this mounting method be not implementable, the drives can be fixed to a mounting plate with the help of a mounting bracket.

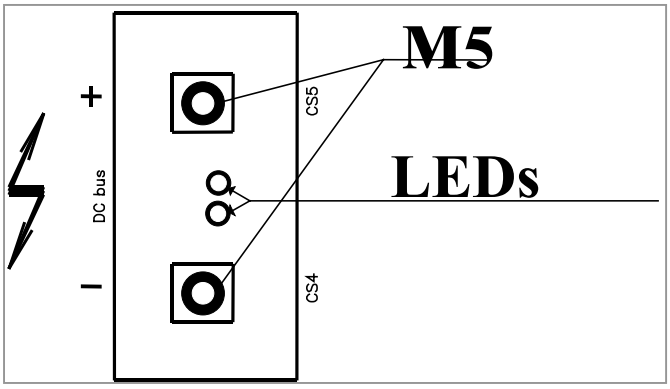
Other equipment must also be protected from the heat generated by servo amplifiers DS.. and DA.. It is not recommended to build electronic equipment sensitive to heat above the drives (e.g. NC control, other drive ect.).
It is very important to clean, as well as to replace the filters of ventilators found on the casing with the prescribed periodicity.
When applying heat exchanger the characteristics of the given type as well as its position in the casing must be taken into consideration, and the different exothermal units must be placed in the casing on the basis of these.

Mechanical Fixing

Servo amolifiers DS2/4, DS18/36, DA8/12, DA24/36, DS12/24, DS18/36, DA16/24 and DA18/36 can be fixed with 2 M5 screws (hexagon-socket head screw is recommended) to an at least 3mm-thick steel. Distance of fixing bores is 279 mm.
Servo amplifiers DS24/48, DS36/72, DA32/48 and DA48/72 can be fixed with 4 M5 screws (hexagon-socket head screw is recommended) to an at least 3mm-thick steel. For position of bores see previous diagram
.

Electric Connection of Servo Amplifiers DS.. and DA..

DC Bus Connection

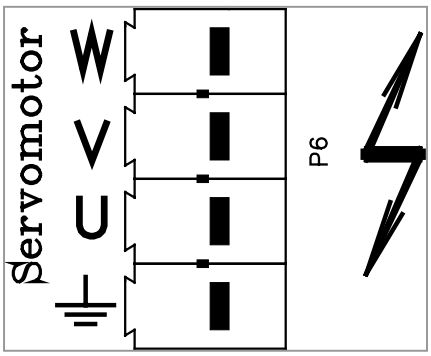


DC bus connection points of NCT servo amplifiers and supplies are equally far from the mounting plate (in the case of servo amplifiers DS24/48, DS36/72, DA32/48 and DA48/72 and supply modules DPB-3-40-80 it is only true if cutting is performed on the mounting plate for the cooling fin), thereby copper bus can be used for connecting modules. Each NCT servo amplifiers have two copper bus accessories. In case the modules cannot be connected with these buses, copper cable supported with cable-eye must be applied. The cross-section of the copper cable must coincide with the cross-section of line cables of the supply.
The voltage of DC bus is dangerous (for a few minutes even after switching the drive off the drive system line). Two red-lighted diodes between the DC voltage connection points warn to this. Because of the dangerous voltage the accidental touch of DC buses must be avoided, this is the task of the transparent protective cover.
Related accessories:

DC bus (red and bue)	2 pcs	90mm-division bus belongs to DS6/12, 130mm-division bus belongs to DS12/24 and DS18/36
M5 x 10 convex crosscut head screw	2 pcs	DC bus connection
M5 outer-claw galvanized block	2 pcs	DC bus connection
M3 x 30 plastic spacer	1 pc	DC bus protector
Transparent protecting cap	1 pc	DC bus protector

M3 x 10 convex crosscut head screw	1 pc	DC bus protector

Motor Connector



Produced by PHOENIX CONTACT

For Servo Amplifiers DS2/4, DS6/12, DS8/16 and DA8/12
Type: PC 4/4-G-7.62
Counter part type: PC 4/4-ST-7.62
Maximum 4 mm^2 cable can be connected to the counter part.

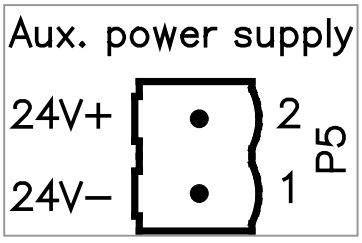
For Servo Amplifiers DS12/24, DS18/36, DA16/24 and DA18/36
Type: PC 6/4-G-10.16
Counter part type: PC 6/4-ST-10.16
Maximum 10 mm^2 cable can be connected to the counter part.

For Servo Amplifiers DS24/48, DS36/72, DA32/48 and DA48/72
Type: HDFKV 16
Maximum 16 mm^2 cable can be connected to the connector.
The cross-section of the phase conductor of the motor cable must be defined on the basis of the motor current in accordance with MSZ EN60204-1:2001, the cross-section of the protective conductor coincides with the cross-section of the phase conductors.
The cables must be shielded in order to decrease the EMC, shielding must be connected to the metal case on both sides electrogalvanically.
A motor connector counter part is the accessory of servo amplifiers DS.. and DA.., however the motor cable of specified length prepared in advance can be ordered to a specified motor type.

Ground connection

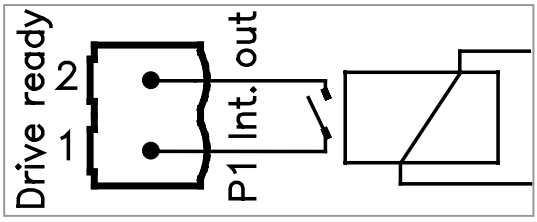
The case of servo amplifiers DS.. and DA.. must be connected to the protective conductor: for this purpose a connection point can be found on the metal case of all devices indicated with the generally accepted grounding symbol. The cross-section of the applied protective conductor must be equal to the cross-section of the line cable of the supply.

Auxiliary Supply Connection (Input)



In order to operate internal units, servo amplifiers DS.. and DA.. need external power supply.
Voltage of auxiliary supply: 24 Vdc (+20%, -10%)
Maximum current: 500 mA
Manufacturer of connector: Phoenix Mecano
Connector type: STLZ 950/2G-5.08-V
Counter part type: AKZ 950/2-5.08

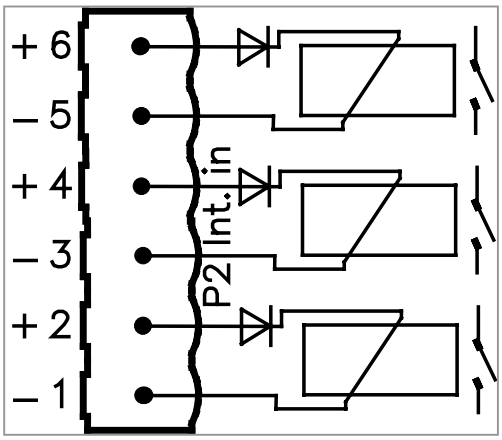
Drive Ready Sign Connection (Output)



Drive ready signal means an electrically controlled contact. If the servo ampllifier can operate properly, this contact is closed (0 Ohm). If for some reason the device is not able to operate properly, this contact is open (abruption), or becomes open.
Maximum contact current: 0.5A
Maximum voltage enabled on the contact poles: 100 Vac, 100 Vdc
Manufacturer of connector: Phoenix Mecano

Connector type: STLZ 950/2G-5.08-V
Counter part type: AKZ 950/2-5.08

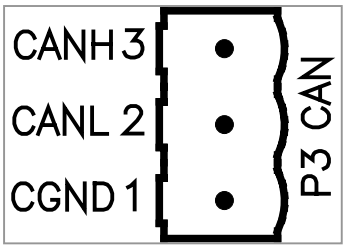
Connection of Motor Stop, Drive Enabled and Directional Change Signs (Inputs)



The external voltage is potentially seperated from internal voltages.
Operating voltage: 24 Vdc (+20%, -10%)
Manufacturer of connector: Phoenix Mecano
Connector type: STLZ 950/6G-5.08-V
Counter part type: AKZ 950/6-5.08

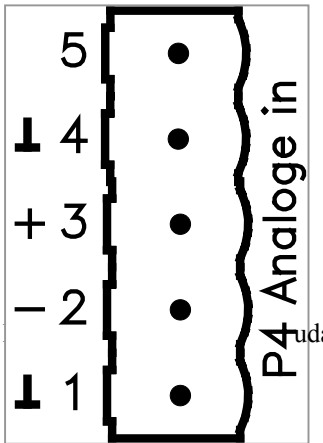
Motor Stop (Connection points 1 and 2, only in case of servo amplifiers DA..) Should this input be powered, the drive speed reference signal is zero, independent of external reference signals.
Drive Enabled (connection points 3 and 4) The servo amplifier operating properly sends voltage to the motor connected only if the Drive Enabled input is powered externally.
Direction Change-M3/M4 (connection points 5 and 6, only in case of servo amplifiers DA..) In case of unipolar analog reference signal (specified at parameter UNIPOLAR/BIPOLAR) the direction of servo motor rotation can be defined through this input.

CAN Bus Connection (Digital Reference Signal Input)



Servo amplifiers DS.. and DA.. may receive speed reference signal from two types of source, (analog) reference signal with a voltage range between +10V and –10V, or (digital) reference signal through CAN bus. Selection between the two sources can be made by setting the appropriate parameteter. The CAN bus system of servo amplifiers DS.. and DA.. can only interpret information coming from NCT 99 or NCT 2000 CNC controls because of the unique protocol. Servo amplifiers DS.. and DA.. can only be connected to other systems through the analog speed reference signal.
Manufacturer of connector: Phoenix Mecano
Connector type: STLZ 950/3G-5.08-V
Counter part type: AKZ 950/3-5.08
Shielded twisted pair must be used for the connection, shielding must always be connected to point CGND. All modules with CAN bus must be threaded to the same CAN bus structure, since CAN bus system uses digital addresses in order to select the appropriate module. The bus structure must be closed in both sides by a resistance in accordance with the wave impedance of the cable (genrerally accepted cable under 40 m: 120S). In case of servo amplifiers DS.. and DA.. CAN bus address can be set as a parameter.
Connection to control NCT 99 or NCT 2000:

	AKZ950/3-5.08	NCT control connector N1	9p. D-Sub female
CANH	3	CAN	8
CANL	2	-CAN	2
CGND	1	GND	3

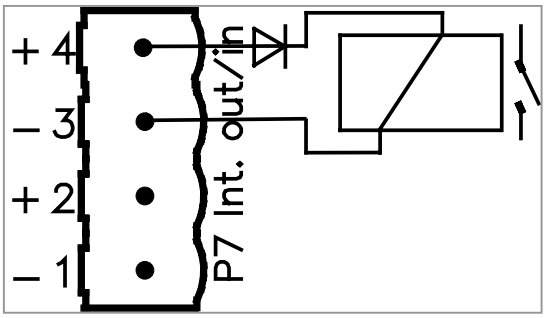


Servo amplifiers DS.. and DA.. do not only receive reference signals through CAN bus, but also send different information to the control.

Analog Reference Signal and Motor PTC Connection (Input)

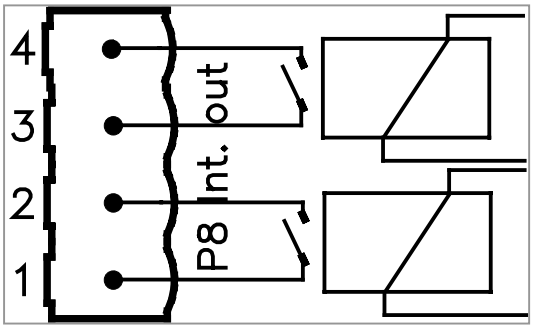
Analog Reference Signal Servo amplifiers DS.. and DA.. take the voltage difference between + and – inputs as a basis for defining the reference signal value (signals + and – are received by a differential amplifier). The voltage difference value may vary between +10V and –10V. (One parameter of servo amplifiers DS.. and DA.. has the task to assign the maximum speed value to the maximum analog reference signal value.) Shielded twisted pair must be used for the analog reference signal, shielding must be connected to the ground (point 1) at both ends.
Motor PTC Outputs of PTC resistance fixed to the end winding of the motor must be connected to connection points 5 and 4.
Manufacturer of connector: Phoenix Mecano
Connector type: STLZ 950/5G-5.08-V
Counter part type: AKZ 950/5-5.08

Parametric Change Connection (input)



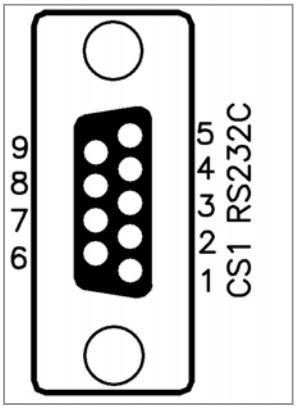
The external voltage is potentially separated from the internal voltages.
Operating voltage: 24 Vdc (+20%, -10%)
Producer of connector: Phoenix Mecano
Connector type: STLZ 950/4G-5.08-V
Counter part type: AKZ 950/4-5.08
Servo amplifiers DA.. and DS.. can handle two parameter tables. Of the parameter tables selection can be made through this input. When this input is not controlled, parameter table No. 1 is in effect, in case of 24V is switched, parameter table No. 2 is affected.

Connections n=0 and n=n_s (Output, Only in Case of Servo Amplifier DA..)



n=0 (connection points 1 and 2) This output provides information about the stop status of the motor. The absolute value of the motor speed should be less than the value specified at parameter n=0, the resistance betwen the two connection points is zero, otherwise it is infinite.
n=n_s (connection points 3 and 4) If the current motor speed is within the specified range of the reference signal (deifned by the value given at parameter n=ns), the contact between connection points 3 and 4 is closed, if it is out of the range, the contact is open.
Maximum contact curent: 0.5A
Maximum voltage enabled at the contact poles: 100 Vac, 100 Vdc
Manufacturer of connector: Phoenix Mecano
Connector type: STLZ 950/4G-5.08-V
Counter part type: AKZ 950/4-5.08

RS232C Connection



Parameter setting of servo amplifiers DS.. and DA.. is possible by means of IBM compatible personal computers (PC). In this case servo amplifiers DS.. and DA.. must be connected to the computer. Shielded cable must be used for the connection, shielding must be soldered to the connector casing on both sides.
Connector type: 9-polar D-Sub female
Counter part type: 9-polar D-Sub male

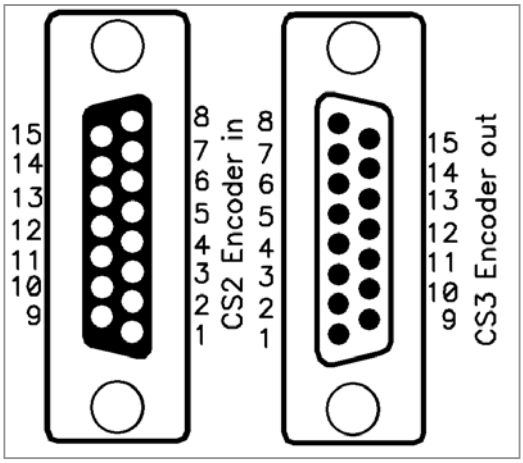
Servo amplifiers DS.. and DA.. CS1 RS232C (9P. D-Sub female) PC serial port (9P. D-Sub male)

2: Transmitter Output (TXD)		2: Receiver Input (RXD)

3: Receiver Input (RXD)		3: Transmitter Output (TXD)
5: Ground (GND)		5: Ground (GND)

Encoder Connection

1: signal **A**
2: supply ground (**GND**)
3: signal $\overline{B}$
4: signal **C**
5: Positive supply voltage (**5V**)
6: **I** commutative signal
7: **II** commutative signal
8: **III** commutative signal
9: signal $\overline{A}$
10: signal **B**
11: supply ground (**GND**)
12: signal $\overline{C}$
13: NC
14: Positive supply voltage (**5V**)
15: NC
shielding: connector casing



Control loops of servo amplifiers DS.. and DA.. need information on the position as well as speed of the servo motor. These data are provided by the encoder found on the servo motor. Encoders with the following characteristics can be connected to servo amplifiers DS.. and DA..:

- Their supply voltage request is 5V
- They send TTL signals
- They send three kinds of signals (incremental, reference and commutative)
- Beside the two incremental and the reference signals their negated signals are also available
- Maximum pulse number: 32000
- Maximum output frequency (speed multiplied by pulse number): 200 kHz.

The information sent by the encoder may be needed not only by servo amplifiers DS.. and DA.., but by the equipment superior to drives (e.g. CNC-control, process control computer ect.) as well. Therefore servo amplifiers DS.. and DA.. are not only mounted with a connector suitable for receiving the encoder signals (CS2 Encoder in), but the servo amplifiers transfer the same signals through another connector (CS3 Encoder out) as well. All points of the two connectors are connected inside servo amplifiers DS.. and DA.. (except for the points of the positive supply voltage).

CS2 Encoder in:
Connector type: D-Sub female 15 pin
Counter part type: D-Sub male 15 pin

CS3 Encoder out:
Connector type: D-Sub male 15 pin
Counter part type: D-Sub female 15 pin

The cable connecting the encoder with servo amplifiers DS.. and DA.., as well as the drives with the superior equipment must be prepared according to the instructions of the manufacturer of the encoder. If encoder signals are transmitted from the servo amplifier, the encoder cable length is resulted from the sum of the length of the two cables and this must be less than the value prescribed by the manufacturer. General rules are that shielded cables containing twisted pairs must be used, the negate and ponate of a signal must be connected to the same wire pairs and the shielding must be connected at both ends to the metal case electrogalvanically. When cabling, the encoder cable must be as far as possible from disturbing places, lines (e.g. high-voltage cables). Servo amplifiers DS.. and DA.. are designed, so that the high-voltage connectors can be found on top, while the information connectors are on the bottom. Thus it is recommended to cable high-voltage lines above the drives, and wires carrying signals below the drives.

Operation of Servo Amplifiers DS.. and DA..

Normal Operation

If 24V is switched to the auxiliary supply connector of a properly operating servo amplifier DS.. or DA.., blinking error code or blinking decimal point can be seen on the seven-segment display. Error codes refer to false parameter setting or to non-appropriate connection (e.g. encoder is not connected). The cause can be eliminated on the basis of the error code. The fault-free state is indicated by a blinking decimal point. If the servo amplifier is enabled in fault-free state, the number of the current parameter table appears on the seven-segment display (No. 1 or 2, however in case parameter selecting input is not applied, it is always No. 1). Operation of drive ready signal is also influenced by parameter SERVO READY TYPE. If this parameter is 0, the servo amplifier is ready, provided no error is detected. If this parameter is 1, the ready state is a result of fault-free state and drive enabling.
It is important to assign the reference signal source to the parameter table values appropriately. The effective reference signal source can be specified at parameter AXIS ADRESS. If it is set to 0, the drive awaits analog reference, while it is other than 0, the reference signal is awaited from the CAN bus, and at the same time this is the CAN address of the servo amplifier.
The motor connected to the servo amplifier must be adapted to the servo amplifier by parameter setting. Afterwards if the DC bus outlets of the servo amplifier are powered and reference signal is sent, the motor must rotate with a speed, which is according to the reference signal.

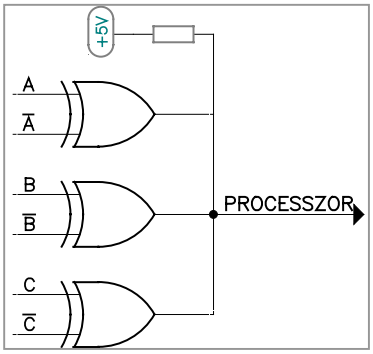
Error Messages

Servo amplifiers DS.. and DA.. continuously monitor themselves as well as their environment, if any error is detected, they do not send voltage to the motor connected, and interrupt the contact of the drive ready output. For the user to identify the unit causing the error, different blinking characters appear on the seven-segment display. If an error occurs, the servo amplifier changes the value of a flag depending on the cause of error, thereby storing the error even after the cease of the cause. The servo amplifier is not ready till the values of the different flags are not set back to their default state (error erasing). The flag belongs to the error can be erased in two ways depending on the cause of the error. There are errors that are regarded so hard, that their flag can only be erased by restarting the servo amplifier (these are the so-called nonerasable errors). In case of lighter error causes, the content of the flag can be erased without servo amplifier restart, by the off- and on-switch of servo amplifier enabled signal (the system is sensitive to the rising edge).
If nothing is seen on the seven-segment display, or the decimal point is not blinking, or an unidentified diagram can be seen, it is likely to be the fault of the processor. In this case the high-voltage supply must be switched off and the drive must be restarted by switching the auxiliary supply voltage off and on. If the processor seems to be unoperational after repeated restarts, it is the servo amplifier malfunctioning.
Should the processor operate properly, the following codes can be seen on the seven-segment display after an error is sent:

Blinking 1 PDPINT Error (Nonerasable)

The power electronic module (IGBT) applied in servo amplifiers DS.. and DA.. is provided with different monitoring functions (monitoring of overcurrent, sort-circuit, overheat, ect.). Provided the IGBT module detects abnormality, it sends signal to the processor (PDPINT – power device protection interrupt).
If this code is seen on the seven-segment display, both the high-voltage supply and the auxiliary supply voltage must be switched off. Remove the motor cable connector from the servo amplifier, switch both the high-voltage supply and the auxiliary supply voltage on, enable the drive and send a reference signal. If blinking 1 appears again, it is either the servo amplifier malfunctioning or a very strong external disturbance influences the operation of the servo amplifier. If blinking 1 is not seen, the motor cable or the motor is likely to be short-circuited (turn-to-turn fault, body fault, leakage, ect.).

Blinking 2 Encoder Error (Erasable)



In servo amplifiers DS.. and DA.. the two incremental and the reference signal pairs received from the encoder are monitored by the circuit seen on the diagram. If one signal pair is not different, the corresponding output will be low. This however does not cause error immediately, only if the processor detects more successive low levels without interruption. The number of negative results after which the processor generates an error signal can be set at parameter REP ENCODER.

Possible causes of encoder error:
- encoder is not connected
- damaged encoder cable
- damaged shading
- inadequate power supply of the encoder
- malfunctioning encoder
- strong external disturbance
- ect..

In case superior equipment is ordered above servo amplifiers DS.. and DA.. also receiving the encoder signal, the encoder monitoring of the superior equipment must be taken into consideration, whether it signals error or not. Generally for such systems the servo amplifiers perform speed control, while the superior equipment performs position control, therefore the later one provides stricter encoder monitoring than servo amplifiers. If in this case only the servo amplifier signals error, and the encoder monitoring of the superior equipment is on, it might be the servo amplifier malfunctioning.

Blinking 3 CAN Error (Erasable)

CAN bus monitoring is only active if the servo amplifier awaits reference signal from CAN bus input. The effective reference signal source can be specified at parameter AXIS ADRESS. In case 0 is set, the drive awaits analog reference signal, while if it is other than 0, the reference signal is awaited from the CAN bus, and at the same time this is the CAN address of the servo amplifier. CAN error may only occur after servo amplifier enabling.
Possible causes of CAN error:
- short circuit on CAN bus
- CAN bus is not properly closed
- CAN bus is too long
- demaged shielding
- broken CAN bus

Take care not to have two different modules on one CAN bus at the same address, since it would also lead to error.

Blinking 4 CAN Timing Error (Erasable)

CAN timing monitoring is only effective, if the servo amplifier awaits the reference signal from the CAN bus input. CAN timing error may only occur after servo amplifier enabling.

Servo amplifiers DS.. and DA.. calculate the average of time elapsed between the first 128 message on CAN bus after power-on ($T_{CAN\_AVERAGE}$), and then always check if the time elapsed between two CAN messages is within interval 0.5x $T_{CAN\_AVERAGE}$ –1.75x $T_{CAN\_AVERAGE}$, if not, CAN error is generated. If servo amplifier is enabled before the arrival of the 128th CAN message, also CAN error is generated.

Take care not to have two different modules on one CAN bus at the same address, since it would also lead to error.

Blinking 5 DC Bus Voltage Error (Erasable)

Units of servo amplifiers DS.. and DA.. may be damaged in case the DC voltage is over 800V. Therefore a voltage monitoring system is built in, generating error when the DC bus voltage exceeds 800V.
There is an operation mode (brake mode) in every drive system, when the power flows from the motor to the main supply. The power is either transformed into heat through resistance (resistance brake), or forced into the supplying system (reversible brake) by the main supply. Error occurs when the main supply is not able to transform the power coming from the motor into heat, or to force it into the line. In case of resistance brake the main supply must be checked, if there is also external brake resistance, the connecting wires and the external brake resistance must also be checked. If the error occurs repeatedly – and the main supply is intact – it is likely to be the inadequate size of the brake resistance. The main supply may also be suspicious in case of reversible brake error. However it can also happen, that the line is unable to receive the brake power.
Other cause of voltage increase may be the enormous rise of the high-current supply voltage.

Blinking 9 Commutative (HALL) Signal Error (Unerasable)

Commutative signals provide information about the servo motor position, should they not be correct the servo motor may go wrong. Servo amplifiers DS.. and DA.. check the TTL signal levels of commutative signals for every 1ms and register fault, if the level of all three commutative signals is low or high. However they only generate error if fault is detected successively as much times as the value specified at parameter REP HALL.
Possible causes of commutative error:

- encoder is not connected
- damaged encoder cable
- damaged shielding
- inadequate power supply of the encoder
- malfunctioning encoder
- strong external disturbance
- ect.

Blinking A Commutative Error (Erasable)

Servo amplifiers DS.. and DA.. determine the proportion of the commutative signal cycle and the incremental signal cycle by taking the number of motor poles and the number of incremental encoder signals into account. This proportion is continuously checked and should the measured proportion differ to the calculated proportion by a value specified earlier, the servo amplifier generates error.
In this case the parameters of the motor and encoder must be checked as well as the usual errors related to the encoder might have occured:

- encoder is not connected
- damaged encoder cable
- damaged shielding
- inadequate power supply of the encoder
- malfunctioning encoder
- strong external disturbance
- ect.

Blinking C Current Limit Error (Erasable)

Servo amplifiers DS.. and DA.. compare the momentary current value with the value of parameter I PEAK in accordance with the time measure of the processor and if the momentary value is higher than the parameter value, error message is generated. The error refers to false parameter value or to servo amplifier error.

Blinking E Parameter Table Checksum Error (Erasable)

The parameters of servo amplifiers DS.. and DA.. may be set using IBM compatible personal computers (PC). The program running on the PC calculates the checksum of the values set at the parameters (parameter table checksum), and loads it into the servo amplifier. The servo amplifier recalculates the checksum from time to time while operating and compares it with the loaded parameter table checksum. Should there be difference, the servo amplifier generates error message.
In this case the servo amplifier must be restarted. If the error occurs even after repeated restarts, presumably the content of the memory is damaged. In this case the parameter table must be re-flashed into the servo amplifier. If the error remains after repeated re-flashes, the servo amplifier is erroneous.

Blinking F Follow Error

The most important task of a servo amplifier is to force the connected servo motor to a state in accordance with the reference signal sent to its input. If the motor is not in the given environment of the demanded state after reference signal change, the servo amplifier generates error message. This error refers to problems that make the proper operation of the drive impossible:

- the motor cable is broken
- the motor is malfunctioning
- the encoder glass disk is bad
- DC bus voltage is to low
- the load moment is too high
- ect.

Blinking P I^2t as well as PTC Error (Erasable)

Servo amplifiers DS.. and DA.. can protect the servo motor from overheat in two ways. The method to be applied can be selected at parameter THERM PROTECTION CODE:
0 – no protection
1 – I^2t protection
2 – PTC protection
The power transforming into heat in the winding of electric motors is proportional to the square of the current flowing through and to the winding resistance. In view of heat power engineering an electric motor can be modelled as a single capacity element, where the inducing signal is the power transforming into heat, the responding signal is the temperature change, and the thermal time constant as well as the heat resistance creates contact between the two. Servo amplifiers DS.. and DA.. detect the current flowing through the motor windings. In addition, the thermal constant (MOTOR THERM CONST) and the motor nominal current (MOTOR NOMINAL CURRENT) must be specified for I^2t protection. With the help of these data the algorhythm of the servo amplifier can monitor the motor temperature, and if it exceeds the value set earlier, the servo amplifier generates an error. I^2t protection provides adequate protection in case of motors with natural cooling. However in the case of motors with forced cooling the values set at the parameters referring to properly operating forced cooling may cause trouble, the motor may deteriorate upon cease of forced cooling. Therefore it is recommended to apply PTC protection for motors with forced cooling. The point in PTC protetion is the positive heat-dependent resistance (PTC) fixed to the end winding of the motors. The servo amplifier measures the PTC resistance continuously, and should it be higher, than the value set at parameter PTC RESISTANCE, the servo amplifier generates error message.