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SERC 06 and SERC 12

Revision V

Stepping motor power amplifier board with
position control and SERCOS interface

Manual for installation and description of parameters

Edition July 98

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1. General notices

1.1 Safety rules

The stepping motor drivers SERC 06 and SERC 12 with SERCOS interface are for the installation into other devices or machines or for mounting together with other devices or machines.

The operator of the SERC 06/12 has to ensure that all installation-, maintenance-, montage- and inspection works at the SERC 06/12 are carried out **only from qualified and authorized professionals**, who informed themselves by a detailed study of this manual.

The operator is responsible, that all installation-, montage-, maintenance - and inspection works are carried out correctly.

The manufacturer rejects any liability for mistakes or damages because of not correct installation or not proper handling.

The SERC 06/12 may not be commissioned, as long as it is not built into a device, which corresponds to the specifications of the norm VDE 0100 part 410 – protection against dangerous currents through human bodies – and VDE 0100 part 420 – protection against thermal influences.

At any installation-, maintenance-, montage- and inspection works the SERC 06/12 first has to be separated **from all electric circuits**. There may not be any electricity at the device **(check it !!!) !**

Do not touch the SERC 06/12 during operation.

During operation the SERC 06/12 can heat up to over 85°C !

Before touching the unit after switching it off, check first the temperature, because it takes some time to cool down !

1.2 General notices SERC 06/12

The SERC 06 respective SERC 12 is a **stepping motor power amplifier board** with **integrated control of position** and **SERCOS-interface**.

The unit controls **2-phase stepping motors** with phase currents of 0 until 8,4 ampere / phase respective 0 until 14 ampere / phase.

SERC 06 res. SERC 12 is designed modular with three levels (realized with three PCB's connected via PCB-connectors).

The lower level is the power amplifier with a 32 pole male connector according to DIN 41612 (type D). Here the phase currents are created within two H-bridges.

The second level controls the phase currents (control of the microstepping and commutation of the phase currents).

The upper level consists of the position control and velocity control and a SERCOS-interface.

The **power amplifier** of the SERC 06/12 features :

- control of 2-phase stepping motors by using the bipolar chopper-principle.
- microstepping with a resolution of 12800 steps per revolution
- protection against short circuit (in the motor : phase to phase and phase to GND-earth)
- phase currents from 0 to 8,4 ampere and power supply until 85 VDC (SERC 06) res. 0 to 14 ampere and power supply until 120 VDC (SERC 12)

The **control of motor velocity and position** features :

- acceleration : 2 rad/s² to 15600 rad/s²
- velocity : 0,12 rev/min to 12000 rev/min (motor – depending on size – can be operated until 4000 rev/min)
- control of limit switches and homing

The **SERCOS interface** features:

- selectable cycle times of 0,5 ms , 1 ms and 2ms.
Position command values are accepted every 2 ms.
That means, that the slave (SERC 06/12) takes over a new position command value every 2 ms from the SERCOS-master and also returns its new position feedback value every 2 ms to the SERCOS-master.
The SERCOS-cycle time can be selected $\geq 0,5$ ms in the SERC 06/12.
Position command values, which are sent between the 2ms timing (e.g. at 0,5 ms , 1ms, 1,5ms), will be ignored by the SERC 06/12.
- Selectable baud rates at the fiber optical interface of 2MBaud or 4Mbaud via a DIP-switch
- Selectable transmitting power of the fiber optical interface via DIP-switches
- Selectable device numbers in the SERCOS ring via DIP-switches

1.3 SERCOS-interface

SERCOS = **S**ERial **R**ealtime **C**OMmunication **S**ystem

The SERCOS interface is specified in the standard IEC 61491.

The open SERCOS interface is a serial real time communication system between controls (master) and drives (slaves).

Because of the standardization of formats, weightings (position, speed and acceleration) and a standardized connection (fiber optical interface), drives of different type and different manufacturers can interact or be exchanged between each other (e.g. servo motor system manufacturer A and servo motor system manufacturer B or servo motor system and stepping motor system).

For a detailed information of the working principle of the SERCOS interface we refer to the literature especially of the

Interests Group SERCOS interface e.V.

(Address : Im Mühlenfeld 28, 53123 Bonn, Tel.: 0228/646670, Fax 0228/6420396)

SERCOS-interface in SERC 06/12 :

SERC 06/12 is realized as class B positioning drive. Additionally all preferred weightings, the gear ratio (S-0-0121 and S-0-0122) and the feed constant (S-0-0123) of class C are implemented.

The telegrams 4 and 5 are implemented. In telegram 5 only positioning data are used. All other telegrams are ignored.

Because SERC 06/12 is a stepping motor control unit, which controls the motor in an open loop (meaning without position feedback from an encoder), there are differences at some IDNs in comparison to servo motors, as for example the drive controlled homing procedure (see IDN 0147 page 27).

The **operation mode** in the SERC 06/12 is always **position control**.

Beside the primary operation mode there are implemented also the secondary operation modes because of compatibility reasons. But the contents of these secondary operation modes are ignored.

The maximum motor velocity will be limited to the defined value 'maximum motor velocity' – bipolar velocity value limit - (usually not planned for servo motors).

1.4 Installation

Before doing any installation-, maintenance-, mounting- or inspection work pay attention to the safety rules (this manual chapter 1.1) !!!

All relevant standards of the low voltage-, EMC- and machine directives must be fulfilled before commissioning the SERC 06/12 !!!

Leads to the stepping motor:

Shielding:

The leads of the SERC 06/12 to the stepping motor should be shielded, for preventing noise radiation.

A shield made of metal braiding achieves better results, than a shield made of metal foil.

The shield should be mounted on a large surface at both sides (motor and SERC 06/12).

The type WSERC with wall mounting case provides special clamps here fore (see drawing page 12 chapter 2.2.1.).

Leads cross section:

The following table shows reference values for choosing the right cross sections.

The values in the table refer to a standard leads type, e.g. flexible PVC control leads with copper-shield braiding.

By using different types of leads, we reference to the standard VDE 0298 part 4.

motor current [A]	cross section [mm ²]
until 4	0,75
until 6	0,75 to 1,0
until 10	1,0 to 1,5
until 16	1,5 to 2,5

Ground conductor system:

The ground conductor system must be installed correctly (VDE 0113).

Here fore it is important e.g.:

- The ground clamp inside the motor must be connected.
- The GND-connection of the power supply for the SERC 06/12 must be connected to ground direct at the power supply (in case of long leads between the power supply and the supplied device – SERC 06/12).

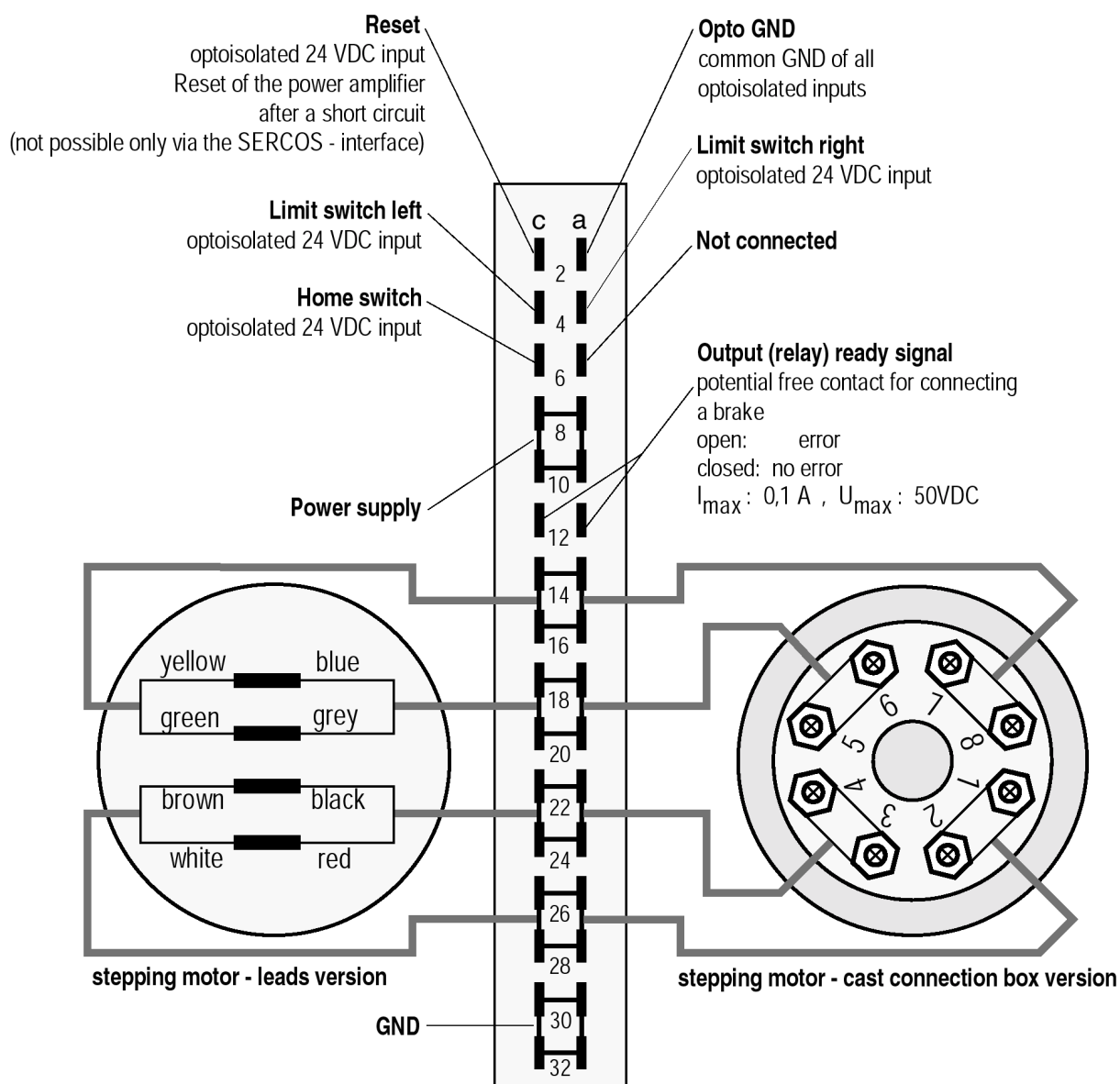
Protection against being touched:

The SERC 06/12 must be installed in a way, that it is protected against being touched (VDE 0113).

2. Power amplifier

2.1 with 32-pole male connector

2.1.1 Connections



2.1.2 Connection limit-, home- and reset switches

The two limit switch-inputs, the home switch-input and the reset-input are optoisolated 24 VDC inputs.

Both **limit switch-inputs** **must** be connected for the operation of the SERC 06/12 ! Meaning that for the operation there must be 24 VDC at both limit switch inputs, in case of the motor is not on a limit switch position. Otherwise the unit returns the error 'position overflow' and the 7-segment display indicates a 'C'.

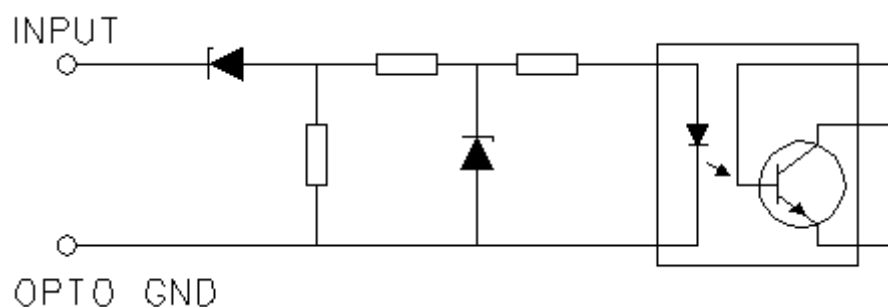
The **home switch-input** is used for the drive controlled homing procedure. A 24 VDC voltage level at the home switch-input means, that the home position is reached (the motor is on the home position).

The **reset-input** is for resetting an error short circuit (at the motor or at the power amplifier).

This error can not be reset only via the SERCOS interface !

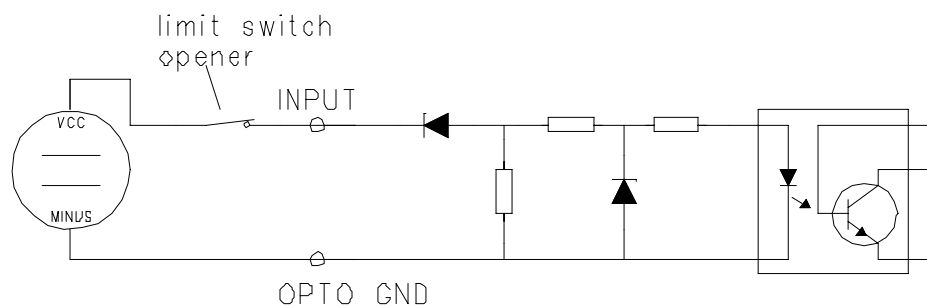
A 24 VDC voltage level at the input activates the reset. After resetting the power amplifier of SERC 06/12 with the reset input, the error indication in class 1 diagnostic (IDN S-0-0011) can be reset with IDN S-0-0099 via the SERCOS interface.

The following electrical schematics shows the input circuits at the SERC 06/12.



Voltage range inputs: 13 VDC – 30 VDC !

With a connected limit switch the electrical schematics is as follows (motor not on limit switch position) :



Both limit switches must be break contacts (opener) !!!

The home switch and the reset switch must be make contacts (closer) !!!

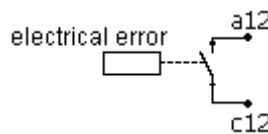
2.1.3 Output circuit - relay for the brake

The output 'ready signal' is for the connection of an emergency brake at the motor (especially for Z-axis).

Stepping motors with integrated brake usually have permanent magnet brakes, which will be activated in case of loss of power.

Between the pins 12a and 12c of the 32-pole male connector there is a relay, which is controlled by the internal signal 'electrical error'.

The signal 'electrical error' will be set in case of 'error undervoltage' (see 2.1.4 and 3.2), 'error overtemperature' (see 3.2) or in case of 'error shortcircuit' (see 3.2).



Maximum load of the relay : 50 VDC – 100mA

Inside the **type WSERC** with wall mounting case (see 2.2) the **contact a12** is connected to the potential **Opto-GND** (see page 8 – home- and limit switch inputs).

Attention : When connecting the outputs 12/ac with an external circuit the maximum load of the relay has to be followed (see above).

Especially when connecting a brake, because of the working inductance of the brake there must be installed a recovery diode !!!

In case of non disturbed operation the 'error electrical' = 0, the 'ready signal' = 1 and the **relay contact is closed.**

In the cases listed as follows, the signal 'electrical error' = 1, the 'ready signal' = 0 and the **relay is open :**

1. **undervoltage** (voltage supply is too low – see 2.1.4) at the SERC 06/12
2. **overtemperature** at the power amplifier of SERC 06/12
3. **shortcircuit** (motor phase to motor phase or motor phase to GND or short circuit in the power amplifier)

In the cases 1. (undervoltage) and 2. (overtemperature) the drive will be stopped controlled, meaning that the motor will be decelerated until motor stand still and then the signal 'electrical error' will be set and the relay will be opened to activate the brake. After activating the brake the phase currents will be switched off.

In case 3. (shortcircuit) the phase currents will be switched off immediately and at the same time the signal 'electrical error' will be set and the relay will be opened to activate the brake.

2.1.4 Power supply

The SERC 06/12 requires a DC-voltage supply.

The unit includes an electrolytical capacitor, which is calculated for buffering a **non controlled DC-voltage** with a **Ripple of maximum 5%**.

In case of **power supply leads > 0,5 m** (distance between power supply and SERC 06/12), at the input of SERC 06/12 (Pins 8-10 ac and Pins 30-32 ac - see connections 2.1.1) there has to be installed an **additional electrolytical-capacitor with at least 1000 μ F**.

Following voltage values are defined :

1. U_V = Maximum voltage supply = nominal voltage supply
2. U_W = Voltage level for the indication of 'pre-warning undervoltage'
3. U_B = Voltage level for the indication of 'error undervoltage'
4. U_L = Voltage level for switching off the power amplifier internally

	U_V [VDC]	U_W [VDC]	U_B [VDC]	U_L [VDC]
SERC 06	85	48	44	32
SERC 12	120	58	50	36

U_V :

The maximum voltage supply U_V is calculated for a maximum mains tolerance of + 15%. That means, that the non controlled DC-voltage output of the power supply, which is used for the **voltage-supply** for the SERC 06/12, **may have nominally maximum 85 VDC and not 85 VDC + 15% !**

U_W

If the supplied voltage becomes lower than U_W , then 'pre-warning undervoltage' will be indicated (diagnostic text S-0-0095), Bit 15 of IDN 0012 (class 2 diagnostic) will be set and a blinking '9' will be indicated at the 7-segment display.

U_B

If the supplied voltage becomes lower than U_B then the drive will be stopped, meaning that the stepping motor will be decelerated until stand still.

Then the brake signal will be activated (output-relay for the control of the brake will be opened) and 50ms afterwards the stepping motor phases will be switched off (switching off the motor torque).

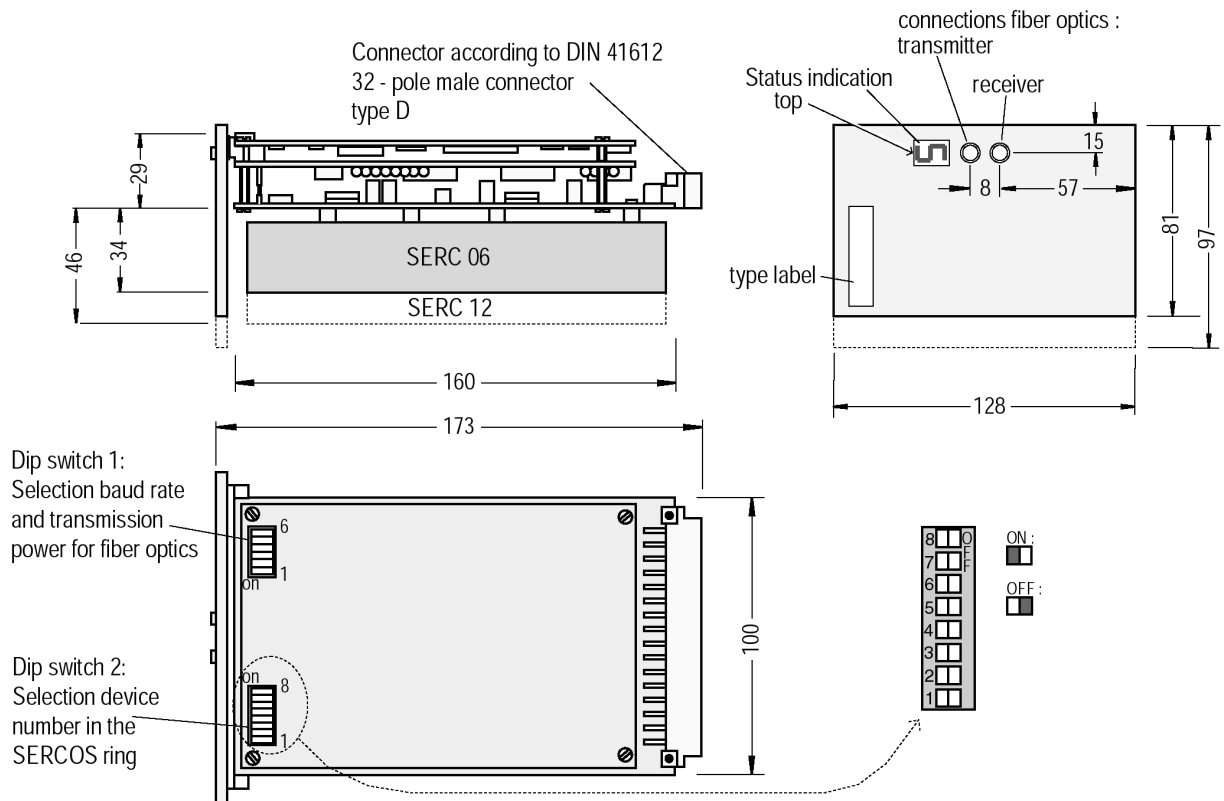
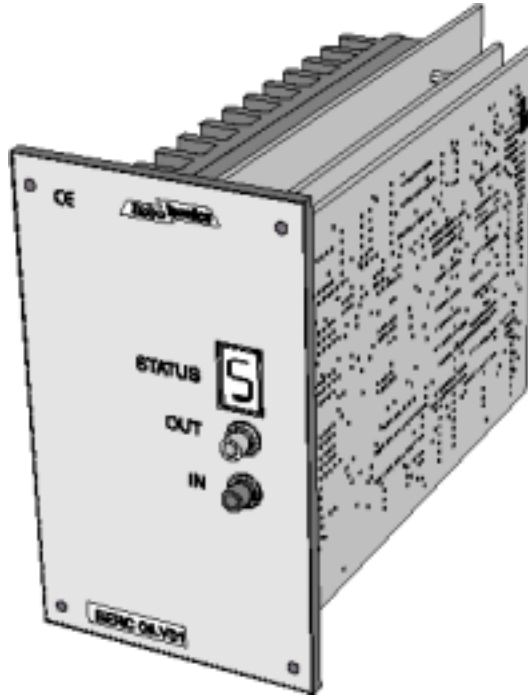
The 'error undervoltage' (in the diagnostic text S-0-0095) will be indicated, Bit 9 of IDN 0011 (class 1 diagnostic) will be set and the 7-Segment display will indicate '9'.

U_L

If the supplied voltage becomes lower than U_L then the motor torque will be switched off immediately without decelerating the motor for protecting the electronics of the power amplifier.

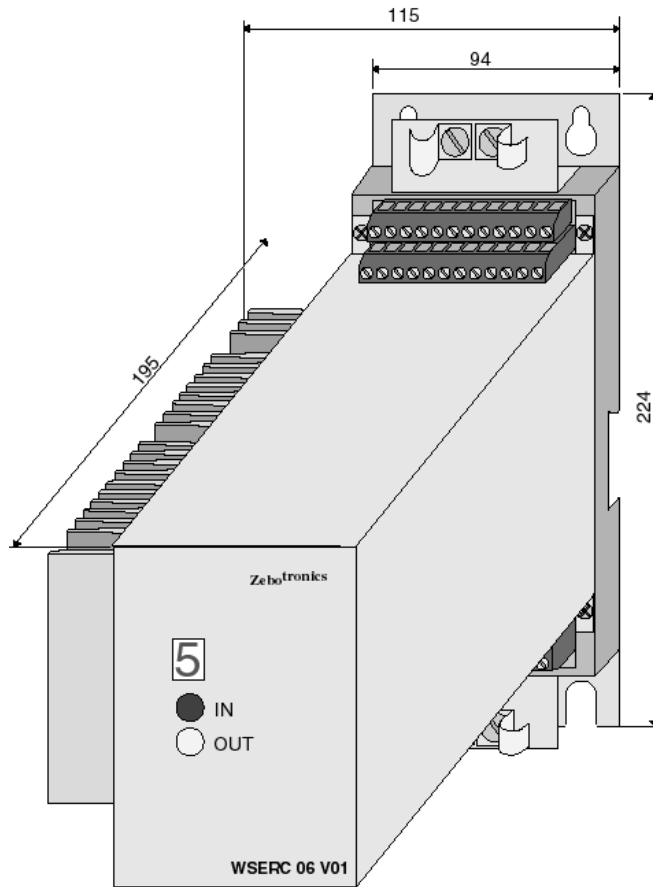
The 7-Segment display and the diagnostic text are as described in U_B .

2.1.5 Dimensions SERC 06/12



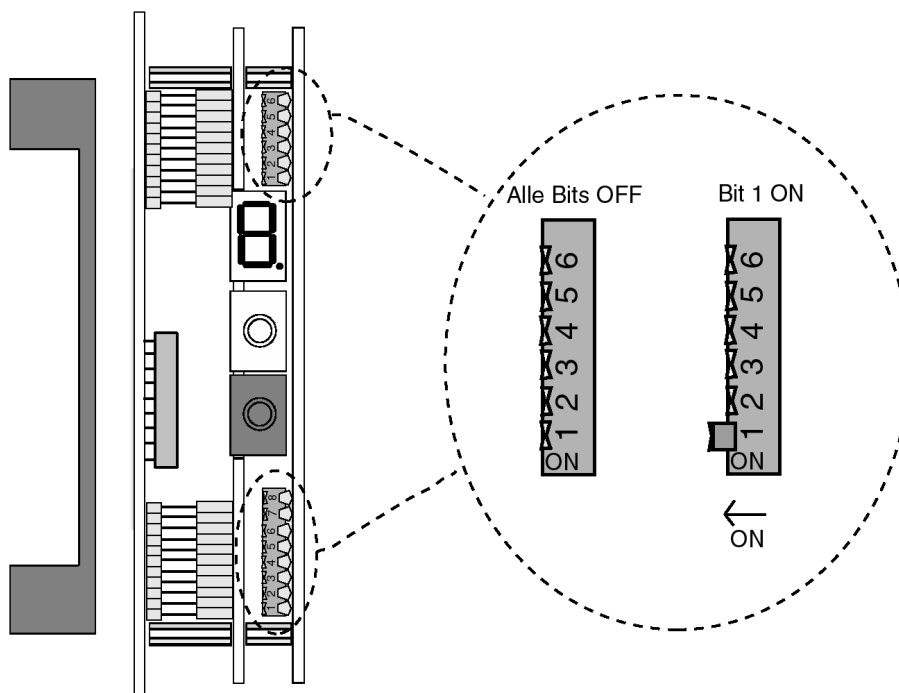
2.2 Optionally as wall mounting unit WSERC

2.2.1 Dimensions WSERC

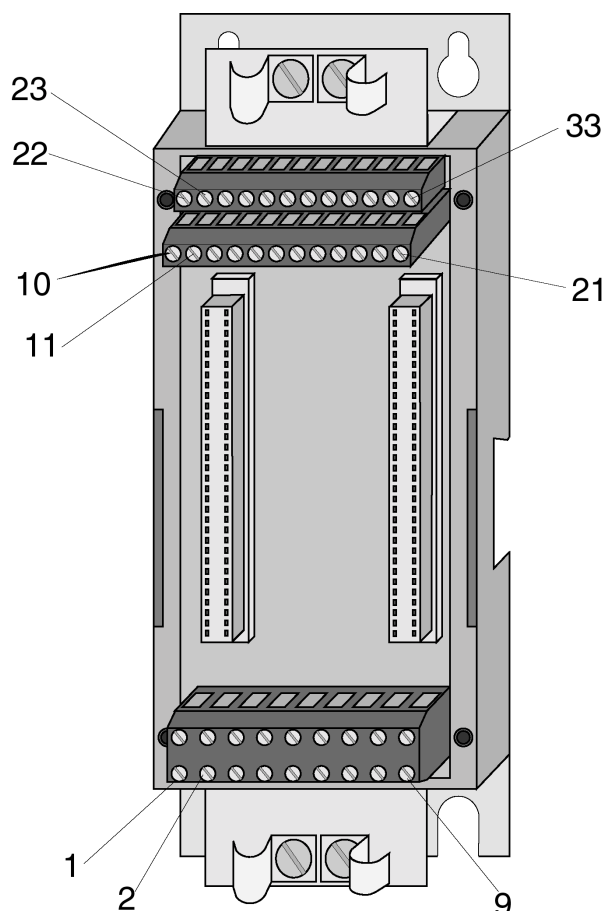


For adjustments at the DIP-switches (see 3.1) , the front panel must be screwed off.

DIP-switches at WSERC :



2.2.2 Connections screw terminal with DC-voltage supply



terminal	Signification
1	Motor phase 1 – in
2	Motor phase 1 – out
3	Motor phase 2 – in
4	Motor phase 2 – out
5,6,7	PE
8	+ VDC – power supply
9	GND – power supply
10	Input (not used)
11,13	Opto GND (common for all inputs)
12	Input home switch
14	Input reset (see page 8 – reset)
15	Opto GND (common for all inputs)
16,17,18	Not connected
19,20,21	Not connected
22	Input limit switch right
23,25	Opto GND (common for all inputs)
24	Input limit switch left
26	Not connected
27	Opto GND (common for all inputs)
28	Output brake – Opto GND
29	Output brake – error electrical
30,31	Not connected
32,33	Not connected

2.2.3 Option AC-voltage supply

With the model WSERC 06/12 there is an option AC-voltage supply.

With this option the wall mounting unit includes a bridge rectifier, electrolytical capacitors, a burn out fuse, a mains filter and a device for the limitation of the current at make.

With that components included, the WSERC 06/12 can be supplied directly from a transformer with AC-voltage.

type	Supply : AC-voltage [VAC] and 50/60 Hz
WSERC 06	37 – 60
WSERC 12	44 - 85

With the option AC-supply the configuration of terminals in 2.2.2 changes as follows:

terminal 8 : AC – voltage supply

terminal 9 : AC – voltage supply

3. SERCOS interface via fiber optics

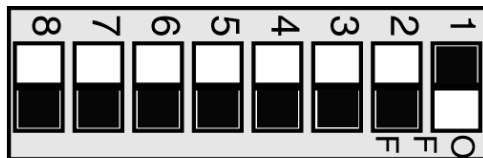
3.1 Adjustments via DIP-switches

3.1.1 Device number

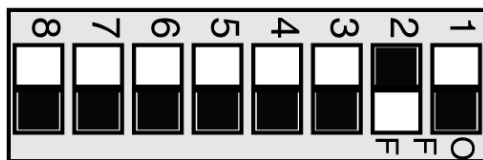
The device number (= number of the SERCOS-slave in the SERCOS-ring) can be selected with the 8-pole DIP-switch 2 (see 2.1.5 / 2.2.1 - dimensions).

The selected device number is binary coded with the 8 switch positions.

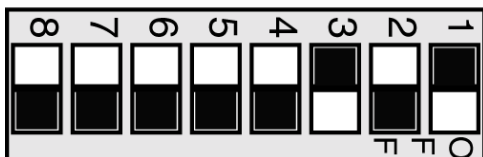
The ON-position of a switch signifies a set Bit.



Selected device number : 1



Selected device number : 2



Selected device number : 5

Allowed values are 1 to 254.

3.1.2 Baud rate / transmission power

The baud rate and the transmission power of the fiber optics transmitting device can be selected with the 6-pole DIP-switch 1 (see 2.1.5 / 2.2.1 - dimensions).

Switch position:

ON = 1 , OFF = 0

Transmitting power

With Bits 1 to 5 of DIP-switch 1 the transmission power of the transmitting-LED can be selected. Following table shows the necessary switch positions depending on the length of the transmission length and the selected baud rate (Bit 6 - see below) :

Transmission length	2 Mbit/s (Bit 6 = OFF)					4 Mbit/s (Bit 6 = ON)				
	Bit 1	Bit2	Bit3	Bit 4	Bit 5	Bit 1	Bit2	Bit3	Bit 4	Bit 5
0,1m ... 1,0m	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1,1m ... 20,0m	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
20,1m ... 40,0m	ON	ON	OFF	ON	OFF	ON	ON	OFF	ON	ON
40,1m ... 50,0m	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

The use of separators in the transmission line requires a higher transmission power of the transmitting LED.

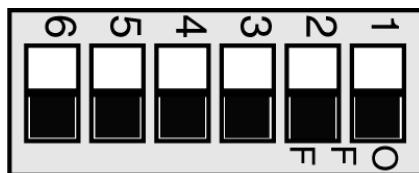
For each separator there has to be calculated a 10 m longer transmission line in the table.

Baud rate

With Bit 6 of the DIP-switch 1 there can be selected the baud rate of the transmission via the fiber optical interface.

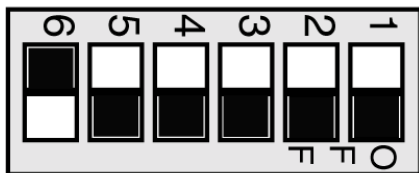
OFF = 2 Mbit/s

ON = 4 Mbit/s



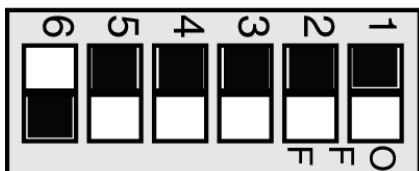
Selected baud rate : 2 Mbit/s

For transmission lines : 0,1...1,0m



Selected baud rate : 4 Mbit/s

For transmission lines : 0,1...1,0m



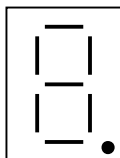
Selected baud rate : 2 Mbit/s

For transmission lines: 40,1...50,0m

3.2 Indication of status and error at 7-segment display

The 7-segment display located beside the fiber optical interface devices (see 2.1.5 dimensions) indicates the actual status of the SERC 06/12.

Elements for indication :
7 segments and 1 point



In case of an error, the 7 segment display indicates a corresponding error number.

An error pre-warning will be indicated by a blinking number.

The table below shows all possible indications :

indication	diagnose text (S-0-0095)	denotes
point		The light received is too weak or there is no light received
-		no communication, SERCOS-ring open, wrong device nr. , wrong baud rate
0	phase 0	SERCOS communication is in phase 0
1	phase 1	SERCOS communication is in phase 1
2	phase 2	SERCOS communication is in phase 2
3	phase 3	SERCOS communication is in phase 3
4	ready for power on	SERCOS communication is in phase 4
5	ready for operation	motor phases are excited, motor can be moved
6	EEPROM standard values are used	
7	EEPROM checksum error	visible only at open SERCOS ring
8	error overtemperature	from 85 °C (± 10%) at the power amplifier
9	error undervoltage	see 2.1.4
8 (blinking)	Pre-warning overtemperature	From 75 °C (± 10%) at the power amplifier
9 (blinking)	Pre-warning undervoltage	see 2.1.4
A	error control loop	excessive position deviation : the motor couldn't follow the position command value – acceleration was too high
b	error communication	In case of an error during communication SERC 06/12 will change back to phase 0
c	error position overflow	a limit switch is open – input 'limit switch' is not connected to 24 VDC
D	manufacturer specific error	not used
E	error short circuit	short circuit at the motor or at the power amplifier board – can be reset only with the input reset (see page 8 : reset input)

3.3 Parameters

3.3.1 SERCOS identification numbers - IDN (S-X-XXXX)

Terminology : S-0-XXXX = IDN XXXX (e.g. S-0-0051 = IDN 0051)

Following identification numbers are implemented :

IDN	page	IDN	page	IDN	page	IDN	page	IDN	page
S-0-0001	18	S-0-0002	18	S-0-0003	18	S-0-0004	18	S-0-0005	18
S-0-0006	18	S-0-0007	18	S-0-0008	18	S-0-0009	18	S-0-0010	19
S-0-0011	20	S-0-0012	20	S-0-0013	20	S-0-0014	21	S-0-0015	24
S-0-0017	22	S-0-0018	22	S-0-0019	22	S-0-0021	22	S-0-0022	22
S-0-0025	22	S-0-0028	21	S-0-0029	21	S-0-0032	24	S-0-0033	24
S-0-0034	24	S-0-0035	24	S-0-0041	26	S-0-0042	26	S-0-0044	28
S-0-0047	25	S-0-0051	25	S-0-0052	27	S-0-0055	25	S-0-0057	25
S-0-0076	28	S-0-0087	19	S-0-0088	19	S-0-0089	19	S-0-0090	19
S-0-0091	26	S-0-0095	21	S-0-0096	19	S-0-0097	21	S-0-0098	21
S-0-0099	21	S-0-0103	25	S-0-0108	29	S-0-0121	30	S-0-0122	30
S-0-0123	30	S-0-0127	19	S-0-0128	19	S-0-0134	23	S-0-0135	23
S-0-0138	26	S-0-0142	23	S-0-0143	23	S-0-0147	27	S-0-0148	27
S-0-0159	29	S-0-0160	29	S-0-0181	21	S-0-0189	25	S-0-0206	29
S-0-0207	29	S-0-0265	23	S-0-0266	23	S-0-0301	22	S-0-0303	22
S-0-0305	22	S-0-0307	22	S-0-0336	22	S-0-0400	23	S-0-0403	23

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3.3.1.1 General parameters

3.3.1.1.1 Communication

Control unit cycle time (TNcyc) IDN 0001

Will be transmitted from the master.
Integer multiple of TScyc (IDN 0002)
(see also chapter 1.2 general notices – SERC 06/12)

Communication cycle time (TScyc) IDN 0002

Will be transmitted from the master.
Possible values : 0,5 ms , 1ms , 2ms
(see also chapter 1.2 general notices – SERC 06/12)

Shortest transmission AT starting time (T1min) IDN 0003

Pre-selected value : 12 μ s

Transmit/receive transmission time (TATMT) IDN 0004

Pre-selected value : 50 μ s

Minimum feedback processing time (T5) IDN 0005

Pre-selected value : 30 μ s

AT transmission starting time (T1) IDN 0006

Will be transmitted from the master ($T1min \leq T1 \leq TScyc$)

Feedback acquisition capture point (T4) IDN 0007

Will be transmitted by the master ($T4 \leq Tscyc - T4min$)

Command value valid time (T3) IDN 0008

Will be transmitted by the master ($T3 \leq Tscyc$)

Position of data record in MDT IDN 0009

Will be transmitted by the master

Length of MDT Will be transmitted by the master	IDN 0010
Transmit to transmit recovery time (TATAT) Pre-selected value : 10 μ s	IDN 0087
Receive to receive recovery time (TMTSY) Pre-selected value : 11 μ s	IDN 0088
MDT transmission starting time (T2) Will be transmitted by the master	IDN 0089
Command value proceeding time (TMTSG) Pre-selected value : 10 μ s	IDN 0090
Slave arrangement (SLKN) Pre-selected value : 0101 - if selected device number is '1' (see 3.1.1)	IDN 0096
Communication phase 3 transition check Command from master to slave.	IDN 0127
Communication phase 4 transition check Command from master to slave.	IDN 0128

3.3.1.1.2 Diagnostics

Class 1 diagnostic

IDN 0011

An error in the class 1 diagnostic leads to the stopping the drive as fast as possible (decelerating with the value in IDN 0138) and after that releasing the torque (switching off the phase current of the stepping motor).

Following bits of the class 1 diagnostic are implemented :

- Bit 1 : amplifier over temperature shut down
(from 85 °C \pm 10% temperature of the power amplifier board)
- Bit 7 : overcurrent error
(in case of a short circuit at power amplifier or at the motor – phase to phase or phase to GND)
- Bit 9 : undervoltage error
(see 2.1.4)
- Bit 11: excessive position deviation
(difference between position feedback value and position command value is to large – out of monitoring window (IDN 0159))
- Bit 12: communication error
- Bit 13: overtravel is exceeded
(a limit switch is open res. the drive is on a limit switch)

Class 2 diagnostic

IDN 0012

In the class 2 diagnostic there are indicated shutdown warnings.

Following bits of the class 2 diagnostic are implemented :

- Bit 1 : amplifier over temperature warning
(from 75 °C \pm 10% temperature on the power amplifier board)
- Bit 15: manufacturer specific warning (see IDN 181)

Class 3 diagnostic

IDN 0013

In the class 3 diagnostic there is indicated the status of operation.

Following bits of the class 3 diagnostic are implemented :

- Bit 6 : In-position
The bit will be set, when the speed of the drive is 0 and the drive is within the positioning window (IDN 0057).

Interface status Here only the SERCOS-communication phase is implemented. In case of an interface error the slave will return to phase 0.	IDN 0014
Reset Class 1 diagnostic Setting the bit 0 and Bit 1 leads to erasing of the bits of class 1 diagnostics and locking of the drive in the drive status.	IDN 0099
Diagnostic message The diagnostic message contains the actual operation status, written in plain language (see also 3.2).	IDN 0095
Manufacturer class 2 diagnostic In the manufacturer class 2 diagnostic there are indicated manufacturer specific shut down warnings. Following bits of the manufacturer class 2 diagnostic are implemented : - Bit 0 : undervoltage shut down warning (see 2.1.4)	IDN 0181
Mask class 2 diagnostic With mask class 2 diagnostic it can be defined whether a warning in the class 2 diagnostic will set the corresponding change bit in the drive status or not.	IDN 0097
Mask class 3 diagnostic With mask class 3 diagnostic it can be defined whether a message in the class 3 diagnostic will set the corresponding change bit in the driver status or not.	IDN 0098
MST error counter Counter of all invalid master-synchronization-telegrams in the communication phases 3 and 4	IDN 0028
MDT error counter Counter of all invalid master-data-telegrams	IDN 0029

3.3.1.1.3 IDN lists

IDN list of all operation data**IDN 0017**

List of all implemented IDNs of the drive
(see 3.3.1.)

IDN list of all procedure commands**IDN 0025**

List of all implemented drive procedure commands of the drive :
S-0-0099 S-0-0127 S-0-0128 S-0-0148

IDN list of operation data for CP2**IDN 0018****IDN list of operation data for CP3****IDN 0019****IDN list of invalid operation data for CP2****IDN 0021****IDN list of invalid operation data for CP3****IDN 0022**

3.3.1.1.4 Internal and external signals

Allocation of real-time control bit 1**IDN 0301****Allocation of real-time control bit 2****IDN 0303****Allocation of real-time status bit 1****IDN 0305**

Following IDN can be assigned :

S-0-0336 S-0-0400 S-0-0403

Allocation of real-time status bit 2**IDN 0307**

Following IDN can be assigned :

S-0-0336 S-0-0400 S-0-0403

Status 'in position'**IDN 0336**

Bit 6 of class 3 diagnostic (in-position) is mapped on
bit 0 of IDN 0336.

So via the IDN 0336 the message 'in-position' can be assigned
to a real-time status bit (IDN 0305 or IDN 0307).

Home switch**IDN 0400**

The external home switch is mapped on bit 0 of the IDN 0400. So the home switch can be assigned to a real-time status bit (IDN 0305 or IDN 0307).

Position feedback value status**IDN 0403**

The position feedback value status is mapped on bit 0 of IDN 0403. So the position feedback value status can be assigned to a real-time status bit (IDN 0305 or IDN 0307).

3.3.1.1.5 Manufacturer specifications

Application type**IDN 0142**

Value : motor drive

System interface version**IDN 0143**

Value (state 98) : V 01.02

Language selection**IDN 0265**

Available languages :
00000000 – german
00000001 – englisch

List of available languages**IDN 0266****Master control word****IDN 0134****Drive status word****IDN 0135**

3.3.1.2 Definition of telegram contents

Telegram type parameters

IDN 0015

The standard telegrams 4 and 5 are implemented.
In telegram 5 there are used only the position data,
the velocity data are ignored.

3.3.1.3 Drive operation modes

Primary operation mode

IDN 0032

The primary operation mode 00000000 00001011 - position control - using position feedback value 1 and cyclic position command values, is implemented.

Secondary operation mode 1

IDN 0033

The content of this IDN is ignored.

Secondary operation mode 2

IDN 0034

The content of this IDN is ignored.

Secondary operation mode 3

IDN 0035

The content of this IDN is ignored.

3.3.1.4 Standard operation data

3.3.1.4.1 Position data

Position command value**IDN 0047**

Scaled value, which is transmitted from the master to the slave at a set interval (NC-cycle time).

Position feedback value (motor feedback)**IDN 0051**

Actual position of the drive, which is sent from the slave to the master.

Notice:

Because a stepping motor drive does not need an encoder for positioning, the actual position value 1 is equal to the internal step register of the SERC 06/12 amplifier.

Position polarity parameter**IDN 0055**

Following bits are relevant :

Bit 0 : Position command value

Bit 2 : Position feedback value 1

All other bits are ignored

Pre-selected value : 00000000

Position window**IDN 0057**

If

$\text{position-command-value} - \text{position-feedback-value 1} < \text{position window}$
then the message 'In-position' will be sent to the master.

Pre-selected value: 3.6°

Modulo value**IDN 0103**

Only relevant in case of rotational scaling of position data and modulo format

(see IDN 0076)

Pre-selected value : 360.0000°

Following distance**IDN 0189**

Following distance = position command value – position feedback value 1

Value stored by the slave

3.3.1.4.2 Velocity data

Bipolar velocity limit value**IDN 0091**

Maximum allowed velocity of the drive

Pre-selected value : 3000.0000 rev/min

Bipolar velocity limit value section 1**IDN P-0007**

See 3.3.2 (page 31) and appendix B (page 35)

Bipolar velocity limit value section 2**IDN P-0008**

See 3.3.2 (page 31) and appendix B (page 35)

Homing velocity**IDN 0041**

Velocity of the drive, during the procedure drive controlled homing.

Pre-selected value : 1000.0000 rev/min

3.3.1.4.3 Acceleration data

Bipolar acceleration limit value**IDN 0138**

The maximum possible acceleration of the drive will be reduced to this value.

In case of an error class 1 diagnostic the drive will be decelerated with the negative value 'bipolar acceleration limit value', and after motor stand still it will be switched off.

Pre-selected value : 4000.000 rad/s²**Bipolar acceleration limit value section 1****IDN P-0005**

See 3.3.2 (page 31) and appendix B (page 35)

Bipolar acceleration limit value section 2**IDN P-0006**

See 3.3.2 (page 31) and appendix B (page 35)

Homing acceleration**IDN 0042**

When the procedure drive controlled homing is activated, then this acceleration value will be used.

Pre-selected value : 500.000 rad/s²

3.3.1.4.4 Procedure commands and data for homing

Drive controlled homing procedure command

IDN 0148

Setting and enabling of the command 'driver controlled homing' leads to a homing to the home switch, completely controlled by the driver.

The driver accelerates with the 'homing acceleration' (IDN 0042) until reaching the velocity 'homing velocity' (IDN 0041).

In case of a positive edge of the homing switch the drive will decelerate with the negative 'homing acceleration' until motor stand still. After that the drive will run with the 'homing velocity slow' (manufacturer specific SERCOS-IDNr P-0-0003) in the contrary direction, until reaching a negative edge of the homing switch.

Reference distance 1

IDN 0052

Location point referred to the machine-zero-point.

The reference distance 1 will be transmitted from the master to the slave after a homing procedure.

Scaled value.

Homing parameter

IDN 0147

Following bits are evaluated :

Bit 0 : homing direction

The other bits are ignored.

The home switch is connected always to the drive (Bit 2).

The homing is always with using motor feedback (Bit 3).

The interpretation in the drive is always home switch and homing enable.

Pre-selected value : 00000100

3.3.1.5 Scaling of operation data

3.3.1.5.1 Position data

Position data scaling type

IDN 0076

Following scaling types are selectable :

Bit	76543210	unit	data reference	
	00000000	incr.	motor	
	01000000	incr.	load	
	01000001	10^{-7} m	load	
	01010001	10^{-6} in	load	
	00000010	10^{-4}°	motor	
	01000010	10^{-4}°	load	
	10000000			modulo (also linear scaling)

Pre-selected is 00000010 (10^{-4}° – motor)

3.3.1.5.2 Velocity data

Velocity data scaling type

IDN 0044

Following scaling types are selectable :

Bit	76543210	unit	reference	scaling
	01000001	10^{-6} m/min	load	linear
	01010001	10^{-5} in/min	load	linear
	00000000	10^{-4} rev/min	motor	no scaling
	00000010	10^{-4} rev/min	motor	rotational
	01000000	10^{-4} rev/min	load	no scaling
	01000010	10^{-4} rev/min	load	rotational
	00100010	10^{-6} rev/s	motor	rotational
	01100010	10^{-6} rev/s	load	rotational

Pre-selected is 00000010 (10^{-4} rev/min – motor)

3.3.1.5.3 Acceleration

Acceleration data scaling type

IDN 0160

Following scaling types are selectable :

Bit	76543210	unit	reference	scaling
	01000001	10^{-6} m/s ²	load	linear
	01010001	10^{-5} in/s ²	load	linear
	00000000	10^{-3} rad/ s ²	motor	no scaling
	00000010	10^{-3} rad/ s ²	motor	rotational
	01000000	10^{-3} rad/ s ²	load	no scaling
	01000010	10^{-3} rad/ s ²	load	rotational

Pre-selected is 00000010 (10^{-3} rad/ s² – motor)

3.3.1.6 Drive parameters

Monitoring window

IDN 0159

The monitoring window defines the maximum allowed difference between position feedback value and position command value. In case of exceeding this value the drive will set the error bit 'excessive position deviation' in class 1 diagnostic (IDN 11)

The value is not scaled - one motor-revolution corresponds to the value 12800.
Pre-selected value : 1280

Feedrate-Override

IDN 0108

When activating the procedure drive controlled homing the 'homing velocity' (IDN 41) will be multiplied by this value.
Pre-selected value : 100% (that means the multiplying factor is 1)

Drive on delay time

IDN 0206

After setting the bits 'drive enable' and 'drive on' of the master control word, the motor torque will be switched on. But only after this waiting time is elapsed, the drive will follow the position command values.
Minimum value : 50.0 ms
Notice : 50 ms are necessary, for releasing the motor brake.
Pre-selected value: 50.0 ms

Drive off delay time

IDN 0207

After clearing the bit 'drive on' in the master control word the motor will be powered, until this waiting time is elapsed.
Minimum value : 50.0 ms
Notice : 50 ms are necessary, for activating the motor brake.
Pre-selected value: 50.0 ms

3.3.1.7 Mechanics

Feed constant

IDN 0123

With the feed constant a rotational movement will be converted into a linear motion.

The feeding constant indicates the linear motion while doing one revolution of the feeding spindle (rotation after all gear levels at the motor).

Pre-selected value: 1.0000 °

Gear :

$$\text{Gear ratio} = \frac{\text{Input revolutions of load gear}}{\text{Output revolutions of load gear}}$$

Input revolutions of load gear

IDN 0121

Input revolutions at the first level of all gear levels at the drive.

- at the motor shaft

Pre-selected value : 1

Output revolutions of load gear

IDN 0122

Output revolutions at the last level of all gear levels

At the drive.

- at the load

Pre-selected value : 1

3.3.2 Manufacturer specific IDNs P-X-XXXX

Homing velocity slow

IDN P-0003

After running with 'homing velocity' (IDN 0041) and passing a positive edge of the input home switch during driver controlled homing the drive will run with '**homing velocity slow**' in the contrary direction until reaching the next negative edge at the input home switch.

Pre-selected value: 100.0000 rev/min

EEPROM init_default

IDN P-0004

When setting this operation data to 00000011, then all operation data will be reset to standard values.

When writing this IDN, some masters will send a busy-timeout message. But the operation data in the SERC 06/12 will be set to their right values anyway.

This standard values are the pre-selected values, described in this manual for the IDNs.

Bipolar acceleration limit value section 1

IDN P-0005

See appendix B: Interrelationship velocity limits and acceleration limits

Pre-selected values : 4000.000 rad/s²

Bipolar acceleration limit value section 2

IDN P-0006

See appendix B: Interrelationship velocity limits and acceleration limits

Pre-selected values : 4000.000 rad/s²

Bipolar velocity limit value section 1

IDN P-0007

See appendix B: Interrelationship velocity limits and acceleration limits

Pre-selected value: 3000.0000 rev/min

Bipolar velocity limit value section 2

IDN P-0008

See appendix B: Interrelationship velocity limits and acceleration limits

Pre-selected value : 3000.0000 rev/min

Commutation table**IDN P-0009**

Here the characteristics of the stepping motors phase currents can be selected. (See also appendix A)

The characteristics to be selected depends on the used stepping motor type.

A good consistency of the current characteristics and the motor-characteristics, leads to smooth running of the stepping motor at low motor velocity.

Following values are selectable:

0 : Sinus-characteristics (real sinus – curve)

1 : '87' characteristics (matching the Zebotronics stepping motor series SM 87)

2 : Characteristics 3 (corresponds to a sinus² – curve)

3 : Characteristics 4 (corresponds to a damped sinus² – curve)

see also appendix A: current characteristics

Pre-selected value: 1

Current**IDN P-0010**

Here the nominal current per phase (peak-value) at the power amplifier board can be selected.

Unit : mA

Range :

SERC 06 : 0 until 8400 mA

SERC 12 : 0 until 14500 mA

Pre-selected value : SERC06 : 8400 mA

SERC12 : 14500 mA

Current modifier**IDN P-0011**

Following current parameters can be selected:

1. Reducing of the phase current of the stepping motor at stand still by 50% of the selected nominal current (IDN P-0010).
2. Boost by 20% of the selected nominal current (IDN P-0010) when the acceleration exceeds the value 'current boost acceleration' (IDN P-0012).
3. Boost of the selected nominal current (IDN P-0010) at motor stand still.

Selections :

00000001 : Phase current reduction at stand still - see 1.

00000010 : Phase current boost 20% when acceleration > IDN P0012 - see 2.

00000100 : Phase current boost 20% at motor stand still – see 3.

Pre-selected value: 00000001

Current boost acceleration**IDN P-0012**

When the acceleration exceeds this value, and bit 1 in IDN P-0011 is set, the phase current will be increased by 20%.

Notice: Because at a constant velocity of the motor, due to the system there can be a very small jitter of the velocity (can not be recognized at the motor), the selected value should not be lower than 100 rad/s².

Otherwise the boost would be switched on and off with that small jitter-frequency at a constant running velocity.

Pre-selected value: 100 rad/s²

Driver status and switches**IDN P-0013**

This IDN contains all bits direct from the amplifier board.
The lower eight bits content the switches (home and limit switches),
and the higher eight bits content driver status (undervoltage, short-circuit...)

Test mode fiber optics**IDN P-0014**

By writing the first three bits of this IDN, the SERCOS-Controller chip on the SERC 06/12 will be set to a testing mode.
Standard the value is 111 (= 7 – decimal), what results in setting the SERCOS controller in the normal mode.
By deleting the first bit (writing 110 to P-0014) the SERCOS controller will be set to permanent light mode.
By deleting the second bit (writing 101 to P-0014) the SERCOS controller will be set to Zero-bit-current mode.
For returning to normal mode, the SERC 06/12 has to be powered off (separated from the power supply) and powered on again.
Pre-selected value : 7 (normal modus)

Step angle control diagnostic class assignment**IDN P-0015**

This IDN is only significant in case of the implementation of the option encoder.
The IDN P-0015 defines whether in case of an error step angle control the Bit 5 (feedback error) in class 1 diagnostics will be set – results in the shut down of the drive - , or Bit 1 (manufacturer specific error) in class 2 diagnostics will be set – only warning - , or there will be no reaction.

Selections:

00000000 : disabled – no reaction on error step angle control
00000001 : Bit 5 in class 1 diagnostics is set in case of error step angle control
00000010 : Bit 1 in class 2 diagnostics is set in case of error step angle control
Pre-selected value: 00000000

Phase current 1A version**IDN P-0016**

This IDN is set by factory and may not be changed !

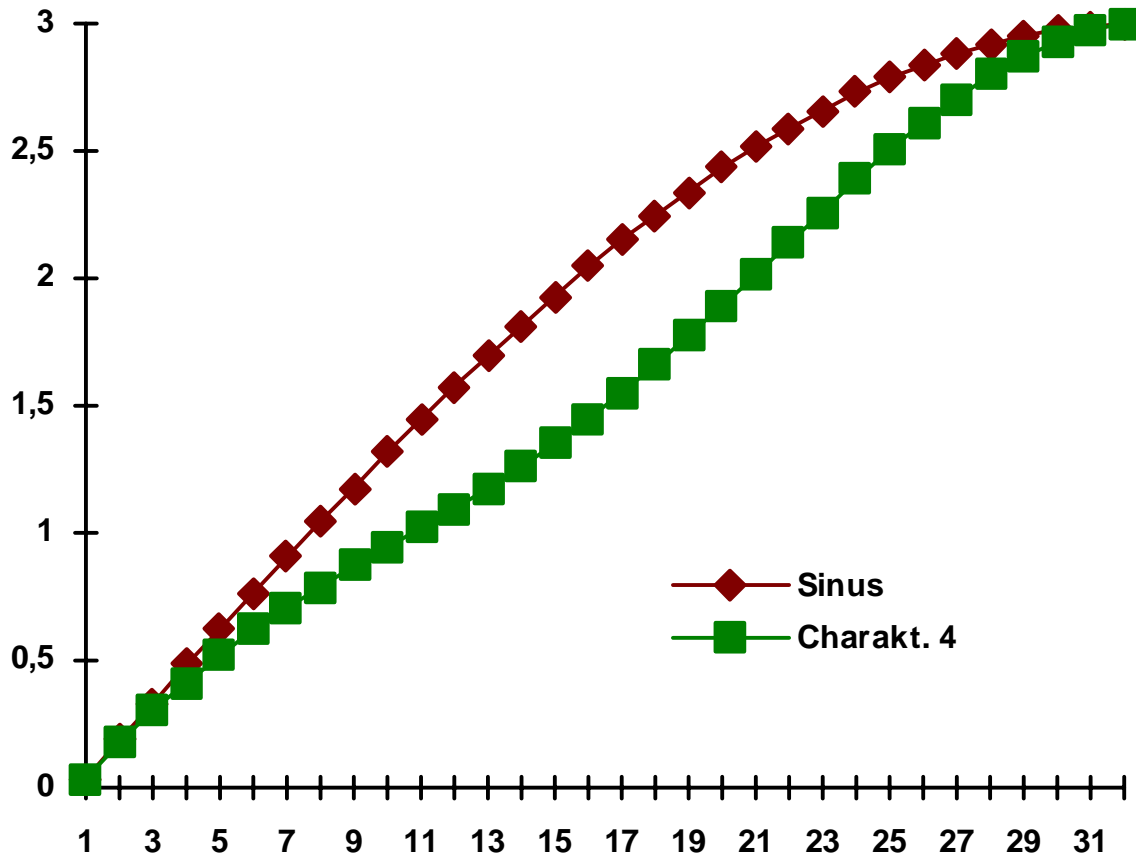
Settings:

00000000 : disabled – amplifier is 6A or 12A version
00000001 : amplifier is 1A version – selectable value range for phase current : 0 – 1450mA

Appendix A: Current characteristics

Appendix to IDN P-0009

The here illustrated phase current characteristics are referred to a maximum phase current of 3 Ampere.



A value of 32 at the X-axis corresponds to an angle of $1,8^\circ$ at the motor.

The values of the '87' characteristics and the characteristics 3 are between the sinus characteristics and the characteristics 4.

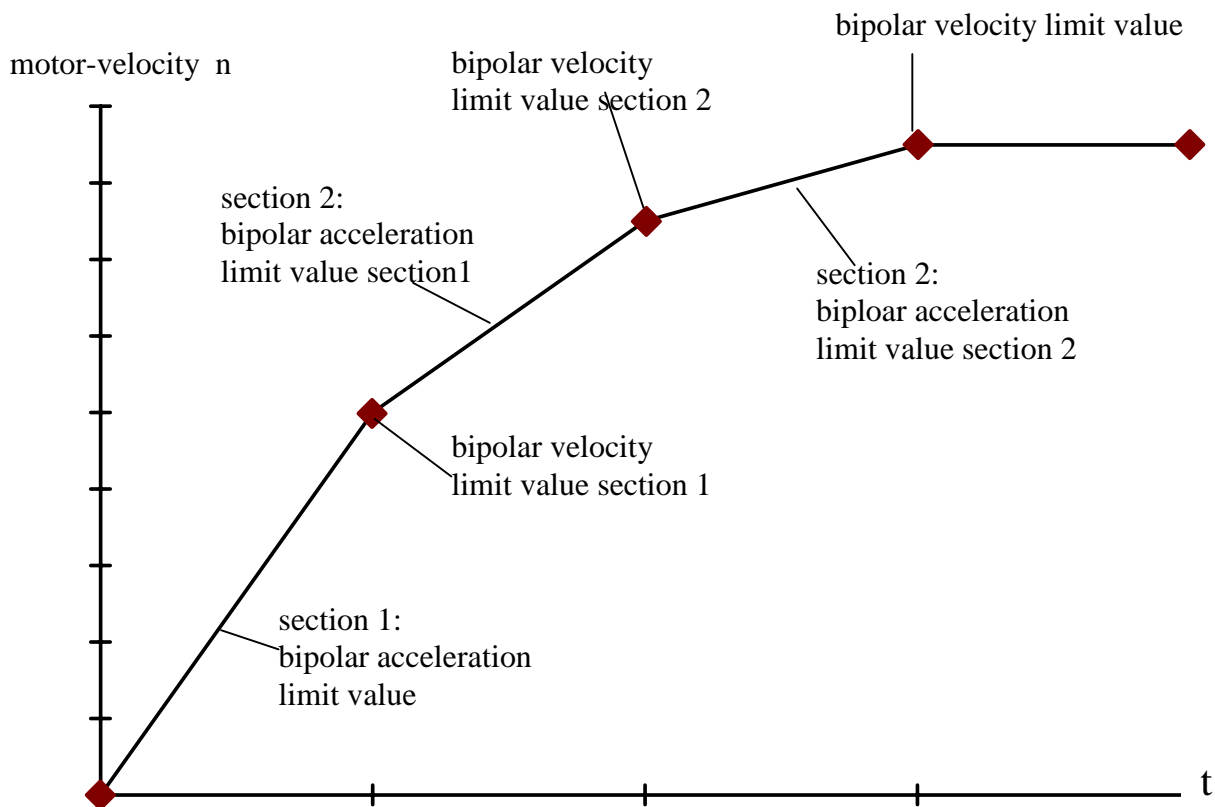
Recommended phase current characteristics to be selected for Zebotronics stepping motors:

- Series SM 56 : '87' characteristics
- Series SM 87 : '87' characteristics
- Series SM 107/108 : characteristics 4
- Series SM 168 : characteristics 4

Appendix B: Interrelationship velocity and acceleration limits

The diagram below shows the timing of the motor velocity during acceleration

$$n[\text{rev/min}] = f(t)$$



Appendix C: Technical specifications

Protection of the device

SERC 06 and SERC 12 : IP 00

WSERC 06 and WSERC 12 : IP 20

Protection against over temperature, under voltage and short circuit (phase to phase and phase to GND)

Weight

SERC 06 : 0,77 kg

SERC 12 : 1,1 kg

WSERC 06 : 1,87 kg (without option AC-supply)

WSERC 12 : 2,2 kg (without option AC-supply)

Ambient conditions

Ambient temperature : 0°C until 50°C

A forced draft is required when the selected phase current exceeds 6A.

Noise immunity

At correct installation : according to EN50082-2

Noise radiation

At correct installation and shielding of the leads : according to EN55011 class B

Voltage supply

SERC 06 and WSERC 06 : 50 – 85 VDC (max ripple 5%)

SERC 12 and WSERC 12 : 60 – 120 VDC (max ripple 5%)

Phase currents

SERC 06 and WSERC 06 : 0 – 8,4 A/phase

SERC 12 and WSERC 12 : 0 – 14 A /phase

Inputs

Opto-isolated inputs with common Opto-GND

Signal level : 13 VDC – 30 VDC

Output

SERC 06 and SERC 12 : - potential free

- max load : 100mA / 50VDC

WSERC 06 and WSERC 12 : - potential bound with Opto-GND (see page 8/9)

- max load : 100mA / 50VDC