



SYSDA02.2
Commissioning Aid for Digital, Intelligent
AC Drives with SERCOS interface
Application Manual

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Commissioning Aid for Digital, Intelligent AC Drives with SERCOS interface

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1 General Informations

1.1 Introduction

The commissioning aid for certified drives with SERCOS interface is used in particular with initial startups and when servicing.

The comfortable user interface, DriveTop, offers parameter administration, diagnoses and a simple test operation mode independent of a control unit.

The equipment is suited for such tasks as single drives or complete drive packages, whereby the number of drives in the SERCOS ring is limited to 8 participants. The drives in the ring are individually set into operation; only one axis can be run.

Operating with SYSDA requires no special settings in the drive. For example, the same address settings are acceptable as used when operating with one control.

In addition to the general functions for parameter administration and service, the user interface also offers extensive commissioning. The user is guided step by step through parametrization up to a simple test run of the drives.

Parameter administration offers several possibilities for filling and the documentation of drive parameters. Thus, for example, all the parameters of all the drives in one ring can be compiled into one backup copy. The data secured in this fashion can now easily be transferred to a different drive package.

Back-up copies are stored as ASCII files. This data format permits processing any time thereafter with any editors and a simple output (monitor, printer) without having to call up the menu program.

Parameter files put together by the user (e.g., correction tables) can be imported without any additional work.

1.2 Components

Included in the delivery of the commissioning aid for certified drives with SERCOS interface are:

- 1 SercBox (SERCOS interface master) 200x110x45mm
- 1 plug-in power supply unit 100 - 240 V / 47 - 63 Hz
- 1 serial cable (l = 5m) to connect the SercBox to a PC
- 2 fibre-optics cable (l = 5m)
- 1 DriveTop software
- this document

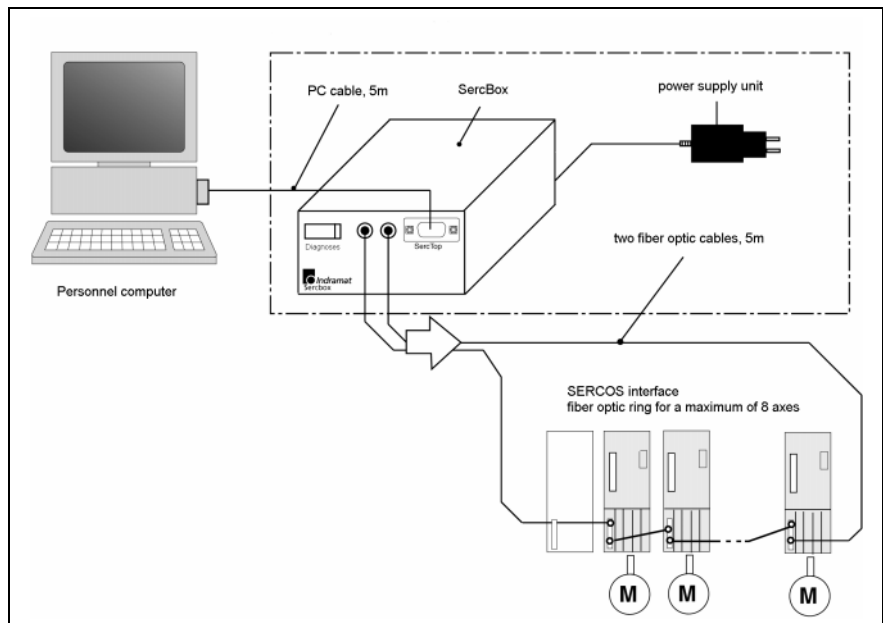


Fig. 1-1: Overview: commissioning aid for digital intelligent drives

The components are connected as illustrated.

The user of SYSDA02.2 does not need extensive knowledge of SERCOS interface specifications.

The SERCOS interface conform connection means that the modules works in all SERCOS interface applications.

2 Commissioning

2.1 Backing up parameters

To enable operations with all certified drives, the SercBox automatically initiates specific settings in the units. It is recommended, that the following parameters of all drives are secured or backed up, so that they can be loaded back into the drives once operation with the SercBox has been successfully completed.

S-0-0001	NC cycle time (Tncyc)
S-0-0002	SERCOS cycle time (Tscyc)
S-0-0006	AT transmission starting time (T1)
S-0-0089	MDT transmission starting time (T2)
S-0-0008	Command valid time (T3)
S-0-0007	Feedback acquisition starting time (T4)
S-0-0009	Beginning address in master data telegram
S-0-0010	Length of master data telegram
S-0-0015	Telegram type
S-0-0032	Main operating mode
S-0-0024	Configuration list of master data telegram
S-0-0016	Configuration list of drive telegram

2.2 First Steps

The goal of this commissioning is to bring the SercBox with a SERCOS drive into SERCOS phase 4.

The following steps must be completed to startup:

- Install DriveTop as described in section 3.3, "Installation DriveTop".
- Establish connection with serial cable between the SercBox (connector code: DriveTop) and your PC (connector COM1/2).
- The two fibre-optics cables must be connected from the SercBox connection RxD/TxD to the drive connection RxD/TxD.
- Prepare the drive for the operation with a data rate of 2MBit. Switch the SERCOS participant address of the drive to one.
- Switch drive on.
- Switch the SercBox on (the supplied plug-in power supply unit has a voltage range of 100 - 240 V).
- Start DriveTop.

Call up "system overview" under "Parameter -> System basic configuration" and make the following settings:

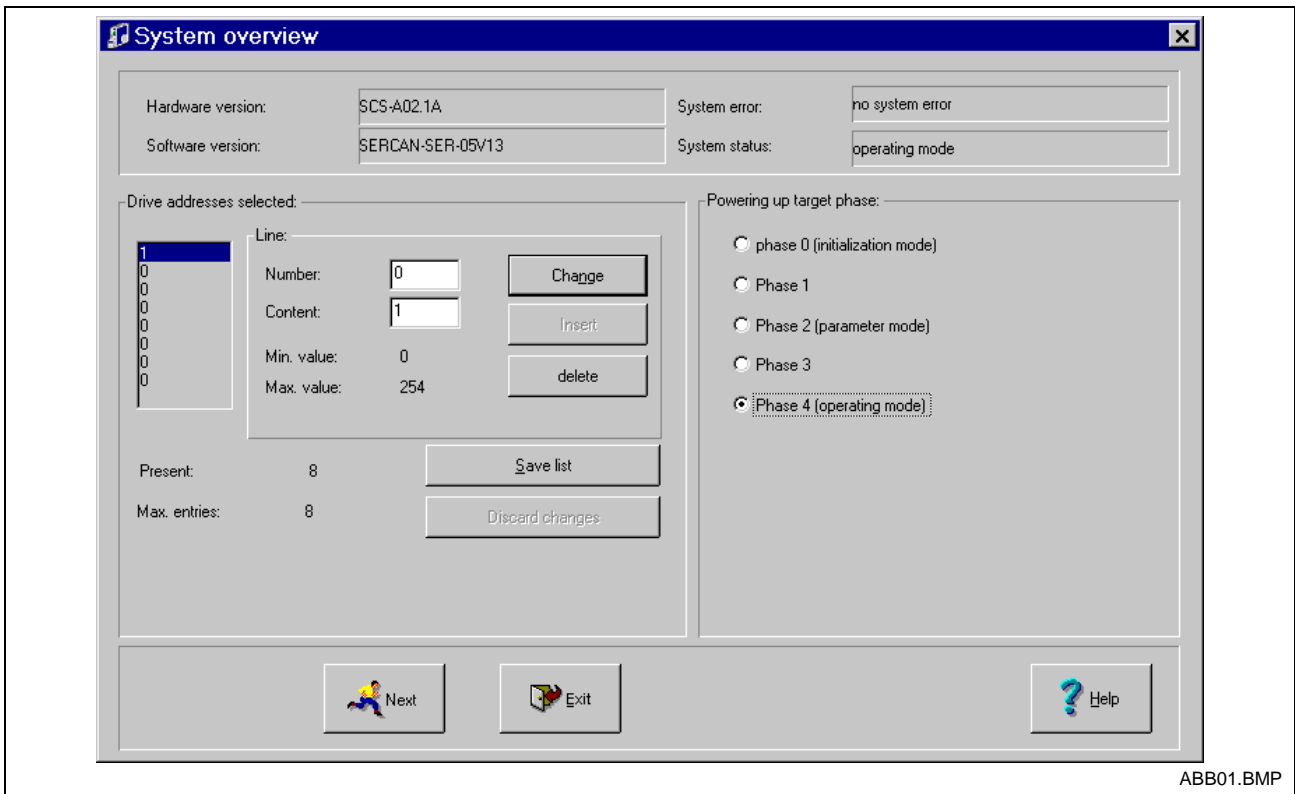


ABB01.BMP

Fig. 2-1: System overview

With "next" move into the next window.

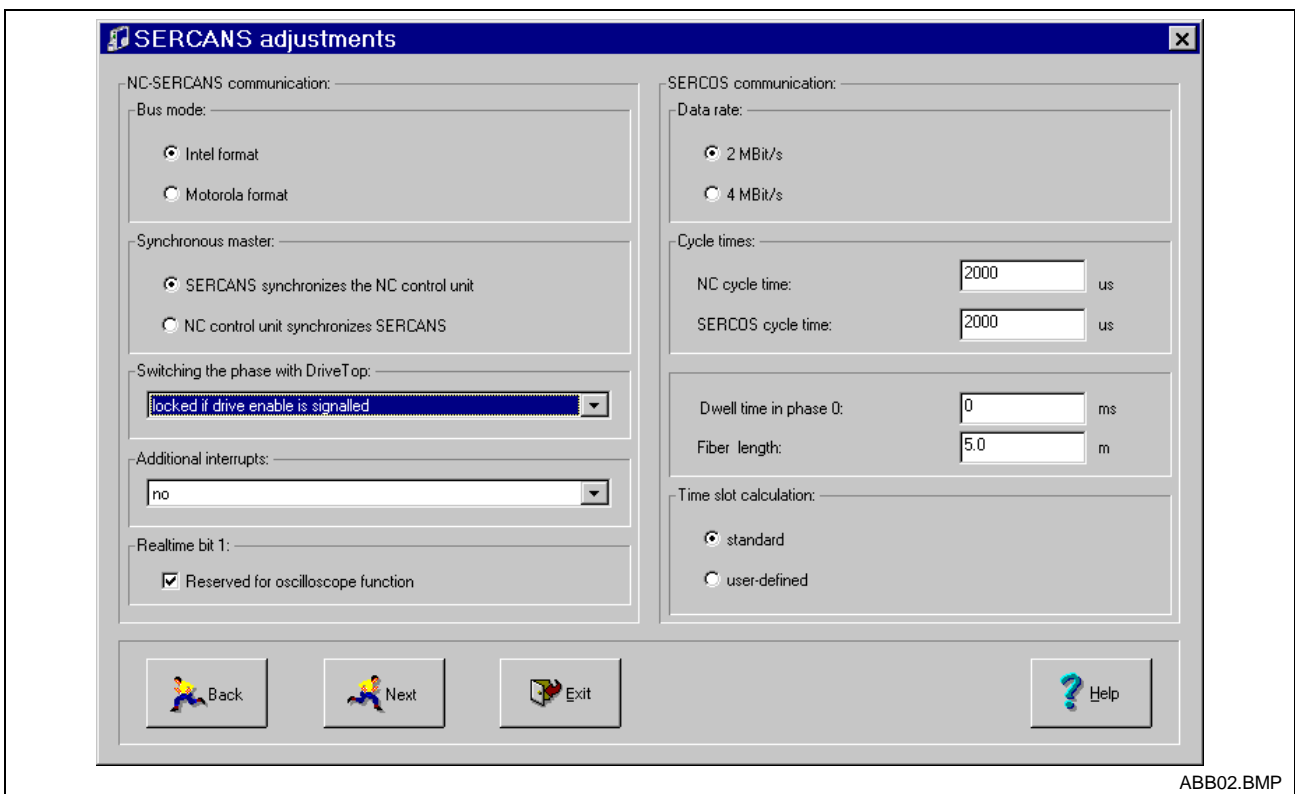


ABB02.BMP

Fig. 2-2: SERCANS adjustments

With "next" move into the next window.

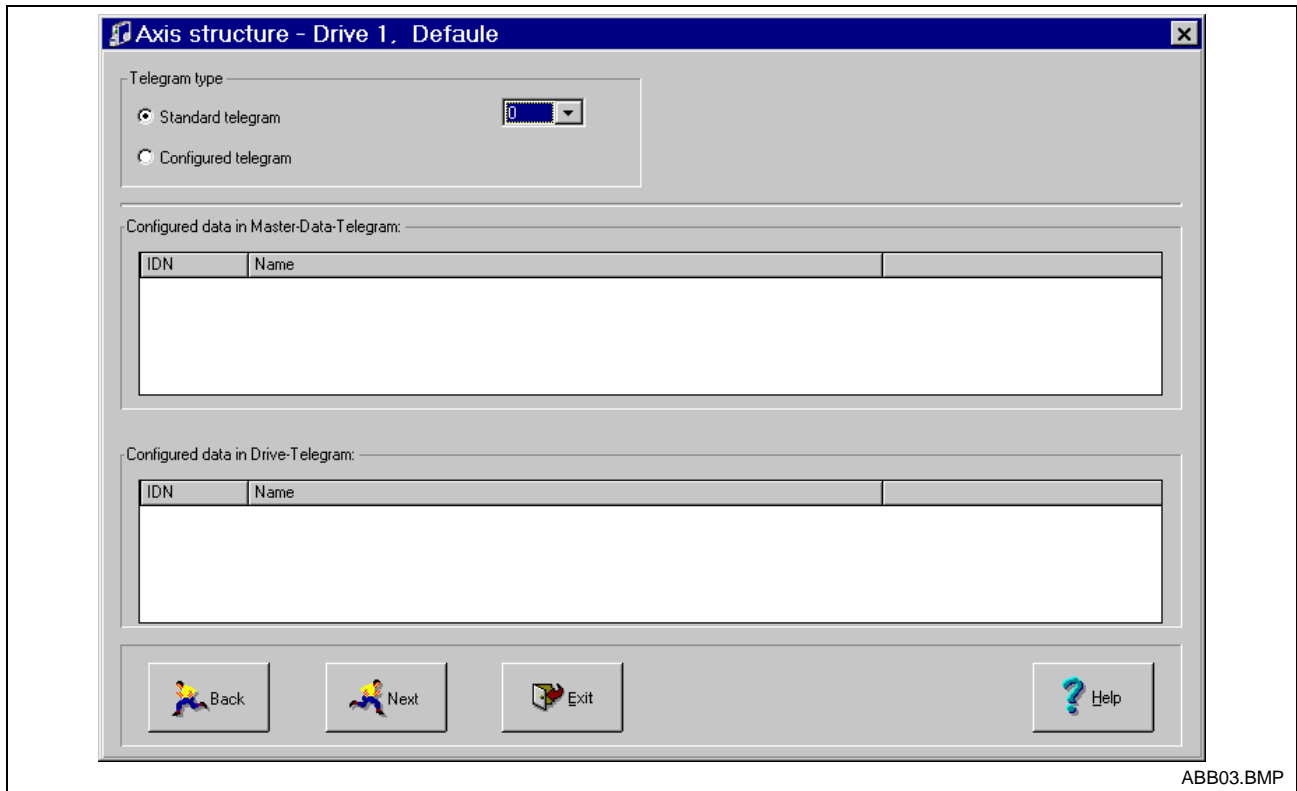


ABB03.BMP

Fig. 2-3: Axis structure 1 - drive address 1, axis 1

Under "Parameter" select "individual parameter".

The following parameters must be set to zero:

"Lifecounter difference", Y-0-0018

"Command value generator enable", Y-0-0044

Select "Extras" under "operating mode".

The SercBox commissioning is now completed.

3 DriveTop: User Interface for SYSDA02.2

3.1 General Information about DriveTop

DriveTop is the comfortable commissioning interface on SYSDA and SERCOS interface drives which can be run with MS-Windows.

DriveTop offers the following functions:

- Parametrization and commissioning of any machine that meets the international standard IEC 61491 of SERCOS interface.
- A highly directed commissioning of the settings on the SoftSERCANS software.
- The SERCOS interface functions are easy to hand, e.g., phase changeovers, cyclic configurations and initial program loading.
- Function specific commissioning of drives belonging to drive firmware
 FWA-DIAX03-AHS-03VRS-MS,
 FWA-DIAX04-AHS-03VRS-MS,
 FWA-DIAX03-ASE-02VRS-MS,
 FWA-DIAX04-ASE-02VRS-MS,
 FWA-DIAX03-ATE-01VRS-MS,
 FWA-DIAX04-ATE-01VRS-MS,
 FWA-DIAX03-ELS-04VRS-MS,
 FWA-DIAX03-ELS-05VRS-MS,
 FWA-DIAX04-ELS-05VRS-MS,
 FWA-DIAX03-SSE-01VRS-MS,
 FWA-DIAX03-SSE-02VRS-MS,
 FWA-DIAX03-SSE-03VRS-MS,
 FWA-DIAX04-SSE-01VRS-MS,
 FWA-DIAX04-SSE-02VRS-MS,
 FWA-DIAX04-SSE-03VRS-MS,
 FWA-DIAX03-SHS-02VRS-MS,
 FWA-DIAX03-SHS-03VRS-MS,
 FWA-DIAX04-SHS-02VRS-MS,
 FWA-DIAX04-SHS-03VRS-MS,
 FWA-DIAX03-STE-01VRS-MS,
 FWA-DIAX04-STE-01VRS-MS,
 FWA-ECODRV-SSE-02VRS-MS,
 FWA-ECODRV-SSE-03VRS-MS,
 FWA-ECODR3-FGP-01VRS-MS,
 FWA-ECODR3-FGP-02VRS-MS,
 FWA-ECODR3-SGP-01VRS-MS,
 FWA-ECODR3-SMT-01VRS-MS,

 FWA-SERCAN-SER-02VRS-MS,
 FWA-SERCAN-SER-03VRS-MS,
 FWA-SERCAN-SER-04VRS-MS,
 FWA-SERCAN-SER-05VRS-MS,

 FWA-SoftSercans-01VRS-MS.
- Selected parameter sets can be loaded and stored.
- There are various diagnostics possibilities on the most varying of levels for the assembly or for a specifically selected drive.
- A context sensitive help system (Ctrl-F1) in connection with the help system drive firmware of Indramat and the help system of the SercBox.
- Dialogues for oscilloscope functions with time and frequency diagram.

3.2 System Prerequisites

DriveTop can be run with Windows 95, 98 and NT but requires the following hardware:

- 80486 processor or faster
- a main memory of at least 8MB
- at least 7MB of available hard drive memory
- one available RS232 interface

3.3 Installation DriveTop

DriveTop is supplied on CDROM.

Please follow the steps below to install DriveTop:

- Read this documentaion in ist entirety.
- Switch PC on and start Windows.
- Insert DriveTop CDROM in CD drive.
- In menue "file" select command "execute..."

Note: If DriveTop is to be installed on a PC which already has an older version of it, then this version will be retained. The directory suggested by the installation program will list the version number as well as the icon of the program group. If an older version of DriveTop is to be removed from the hard drive, then "DriveTop" must be erased in settings\system control\software.

- In input field "command line:" enter D:\SETUP (if DriveTop-CD-ROM is in drive D:).
- Now follow the instruction of the installation program.

Once installation is complete, the new Indramat program group should be on your PC. The DriveTop program symbol should be in this group.

Connecting the PC to the SercBox

A connecting cable, SYSDA02.2, is needed for the data exchange between the SercBox and the PC.

This connection cable is included in delivery.

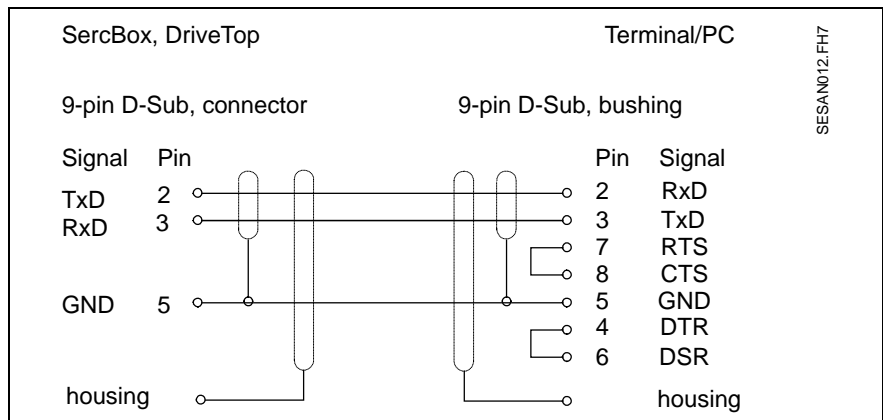


Fig. 3-1: Allocation of the connectors

Start DriveTop

Prerequisites:

DriveTop has been installed successfully, the SercBox is on and connected to the PC via a serial cable.

Start DriveTop in the Indramat group in the program manager.

DriveTop is started and attempts to establish a connecting structure with the SercBox.

DriveTop can be run parallel to all other applications.

Select "Online using SERCANS" from dialog below.

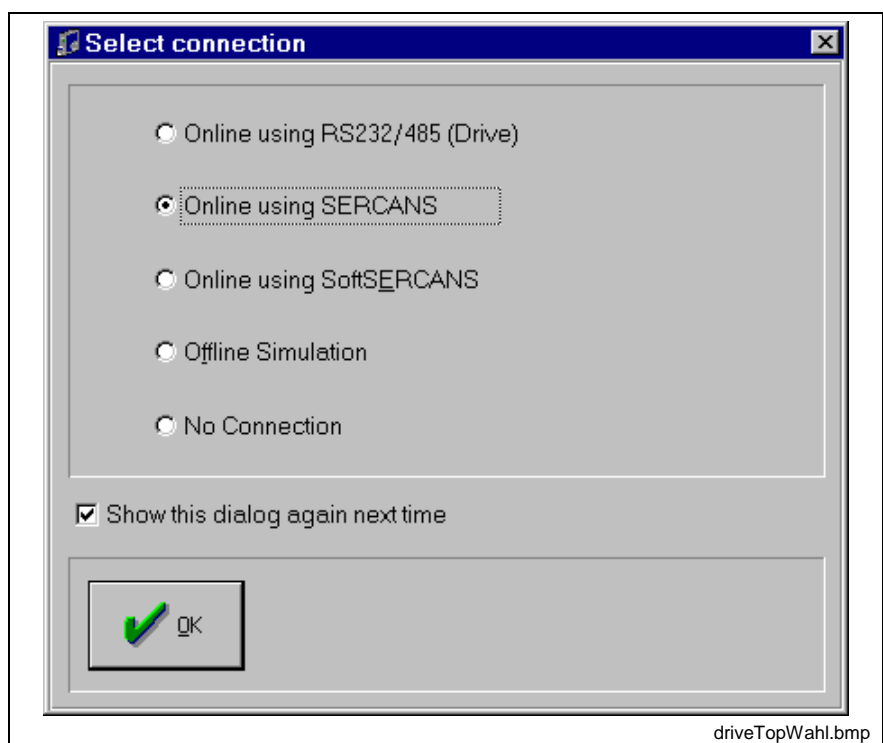


Fig. 3-2: Select Connection

3.4 Functions

Menu File

The submenus load and store are listed in the menu file.

Submenu load

Parameters can be loaded out of a file into the drives of the SercBox software.

Submenu storage

The S/P parameters in the drives and the Y parameters of the SercBox are stored in a file.

Menu Parameter

The dialog windows, run through during commissioning, are in the menu parameters as well as the dialog windows for individual parameters and the lists of all S, P and Y parameters.

List of all S, P and Y Parameters

The S/P parameters of the selected drive and Y parameters are listed by name, operating data and unit. The user can sort per ident number or alphabetically, can search per ident number or text and change parameters.

List of all invalid parameters

The invalid parameters of the SercBox or the selected drive are listed by name, operating data and unit. The user can sort alphabetically or numerically or search for texts and change parameters.

Individual Parameters

A parameter of a selected drive address is listed by name, operating data, minimum and maximum value and unit. The user can sort per ident number or alphabetically, search per ident number or text and change ident number.

Menu Commissioning

The menu items SercBox basic configuration or parameter fixing are located in the menu commissioning. If these are called up, then the user must run through a series of dialog windows for the parametrization of axis independent Y parameters or axis parameters (Y/S/P parameters).

Menu View

In menu view the diagnostic screen displayed in the background is switched from installation status, drive status of a drive within a selected installation status and a parameter group that the user can configure.

Menu Extras

This entails menu items on phase changeovers (parametrization mode, operating mode, phase change), and menu item diagnosis with the submenus of the internal inputs and outputs as well as dialog windows for additional diagnosis and startup tools, for e.g., "analog outputs", "oscilloscope" .

Menu Options

Such menu items as connections, for switching online to offline, language, for switching between German, English and Japanese and for switching to japanese codes are located here.

Menu Help

When bringing down the submenus, all drive firmware helps and the SercBox installed are displayed. The user can reconfigure, using submenu "settings", the allocation of the helps to the drive firmwares as needed.

Menu Right Mouse Key

The right mouse key (Shift-F10) can open a local menu at any point in DriveTop making some help functions available (phase change, drive help, dialog "single parameter". If the current cursor position is on a display element of a parameter (e.g., input field), then additional info on the parameter can be accessed and it can be accepted into a list in menu "parameter group accepted".

4 SercBox

4.1 SERCOS interface

The SercBox is a SERCOS interface master that can support up to a **maximum of eight drives**. Both the communication cycle times and the data rates can be set via the system parameter "SERCOS cycle time" and "data rate".

The SERCON410B assembly assumes the processing of SERCOS interface communications.

As the assembly can only support the standard functions of SERCOS interface functions it is possible to connect SERCOS compatible slaves (I/O stations and drives).

4.2 Cycle Times

The SercBox makes SERCOS cycle times of 0,5 ms, 0,75 ms, 1 ms, through 32 ms in increments of 0,25 ms. The following table supplies data about SERCOS cycle times, data rates and the number of drives in a ring.

Data rate in ring	4 drives in ring	8 drives in ring
2 Mbit/s	1 ms	2 ms
4 Mbit/s	0,5 ms	1 ms

Fig. 4-1: Cycle times

4.3 Diagnoses and Error Display

A display module (M1) is on the SercBox. It is made up of a 7-segment display and a red LED.

The definition of the errors displayed is defined in section 6.

4.4 Communication Phases SercBox

Communication Phase 0

Close fiber optic ring: "system status" = 0x0000

The SercBox attempts to close the fiber optic ring.

- "system status" = 0xE008: fiber optic ring not closed.
- "system status" = 0xE001: fiber optic ring closed.

If the fiber optic ring is closed, then the SercBox switches into communication phase 1.

Communication Phase 1

Drive identification: "system status" = 0xE002

All drives with addresses in the system parameter "list of drive addresses" (Y-0-0012) are queried.

If all programmed drive addresses in the ring are present, then "system status" is set to 0xE003 and the SercBox switches into communications phase 2.

If the SercBox detects a difference between the programmed drive addresses and those addresses on the ring, then the relevant axis structure of the diagnostic status is set to 0x8005 (see display "A", "Definition of Error Messages", section 6.3).

Communication Phase 2

Parameterization mode: "system status" = 0xE003

In phase 2 the SercBox permits the transmission of parameters via DriveTop. If DriveTop generates the transition of phases 2 and 3, then the SercBox conducts the following operations:

- In addition, during phase 2, the operating mode and the scaling parameters must be set in the drives for the relevant application by the user interface.

This involves the following ident numbers:

operating modes:	S-0-0032, S-0-0033, S-0-0034, S-0-0035
position scaling:	S-0-0076, S-0-0077, S-0-0078, S-0-0079
velocity scaling:	S-0-0044, S-0-0045, S-0-0046
torque scaling:	S-0-0086, S-0-0093, S-0-0094
accel scaling:	S-0-0160, S-0-0161, S-0-0162
polarity parameters:	S-0-0055, S-0-0043, S-0-0085

Note: See drive handbook for instructions on programming these parameters!

- All necessary data (identification numbers) are copied from all drives to calculate the time slot:

S-0-0003	t1min
S-0-0004	tATMT
S-0-0005	t5
S-0-0087	tATAT
S-0-0088	tMTSY
S-0-0090	tMTSG
S-0-0096	SLKN

- Both command value and actual value configuration lists are checked.
- The SercBox calculates the time slot.

- The calculated communication parameters are transmitted to the drive.
 S-0-0006 t1
 S-0-0089 t2
 S-0-0008 t3
 S-0-0007 t4
 S-0-0001 tNcyc
 S-0-0002 tScyc
- The SercBox transmits the parameters for the telegram structure to the drives (S-0-0009, S-0-0010, S-0-0015, S-0-0016, S-0-0024).
- The command "reset class 1 diagnostics" (S-0-0099) is transmitted to the drives.
- The changeover command (S-0-0127) is transmitted to the drives.

If the SercBox was able to switch into communication phase 3, then system status is set to 0xE004.

If changeover phase 2 -> 3 was not possible, then the diagnostics status is set to 0xD002 (see display "E", "Definition of Error Messages", section 6.3).

Communication Phase 3

Parameterization mode: "system status" = 0xE004

In phase 3 the SercBox permits the transmission of parameters via DriveTop. If DriveTop generates the transition of phase 3 to phase 4, then the SercBox conducts the following operations:

- Changeover command (S-0-0128) is transmitted to the drives.

If the SercBox was able to switch into communication phase 4, then the system status is set to 0xE005.

If the changeover phase 3 -> 4 was not possible, then the diagnostics status is set to 0xD003 (see display "F", "Definition of Error Messages", section 6.3).

Communication Phase 4

Operating mode: "system status" = 0xE005

In communication phase 4 command and actual values are valid.

5 Command Value Generator Functions

5.1 Introduction

General

The command value generator is a general tool to initiate operation of the drive without the control unit but using the SERCOS interface.

The drive receives defined command values during the drive check with command value generator with the help of which the electrical and mechanical features of the system can be checked.

In addition, an optimum matching of the drive to a specific application is possible. With the help of the available command value it is, for example, possible to optimize the behavior of the drive by changing the loop parameters.

The command value generator is a test and optimization tool and should, therefore, only be used by trained personnel.



WARNING

Error in the drive control

can injury personnel and destroy mechanical parts.

⇒ It is forbidden to remain within the motional range of the machine.

Overview

In operating modes "velocity control" and "position control" the command value generator makes functions

- jogging
- reversing
- step mode available.

In modes "torque control" in drives with external measuring systems it is additionally possible to check

- the setting of encoder polarity

The next section outlines the automatic encoder polarity check in mode "torque control".

The subsequent section describes the functions in mode "velocity control". This is followed by an explanation of the functionalities of the command value generator in mode "position control".

The movement of the drives are not only effected by the command value generator functions but also the drive limits and drive-internal functions.

Limit values The limit values set in the drive for the operating variables

- current
- torque
- velocity

are always monitored (see application description of the drives).

Monitoring position limit values The monitoring of the position limit values which have been set in drives with an absolute position measurement must be separately activated (see S-0-0055, bit 4, position polarity). If these limit values are exceeded, then the drive is stopped.

Drive firmware If special drive firmware is used, then additional variables can play a role. These are explained, however, at the relevant point in the text.

The command value generator is set by the SercBox using parameters relevant to the its function. It is activated in the SercBox user interface "DriveTop" in the window of the command generator box.

Note: The command value generator only works if preferred scaling has been parametrized in the drive. If parameter scaling has been set, then an error message will be generated.

Note: Drive parameters (time slot parameters or parameters for telegram configuration) S-0-0009, S-0-0010, S-0-0015, S-0-0016, S-0-0024, S-0-0032 are changed when the command value generator function is activated. With the next runup, all parameters except for S-0-0032 are corrected with the values determined by the SercBox (if the time slot calculations have not been deactivated in parameter Y-0-0001). The user must reset parameter S-0-0032 upon completion of the command value generator function (e.g., by means of the commissioning interface).

5.2 Command Value Generator Torque Control

Checking Encoder Polarity

General The first startup of drives with external measuring systems (e.g., linear drives) necessitates a checking of the polarity of the measuring system and eventually inverting it. The polarity can be inverted for the following reasons:

- encoder system is mounted on the wrong side
- stator is mounted inverted
- bit 3 of parameter "position feedback 1 type parameter" (S-0-0277) has been incorrectly programmed.

Function Encoder polarity can only be checked in mode "torque control".
To do so, the drive force is increased ramp-like to the value set in parameter "bipolar torque/force limit value" (S-0-0092). The sign of the drive's force is set via bit 4 in parameter "command value generator control word" (Y-0-0053).

The command value generator determines the polarity of the external measuring system if the actual velocity value leaves the velocity window. Drive force is simultaneously set to zero. The velocity window is automatically determined by the command value generator.

If the velocity of positive (negative) force command exceeds positive (negative) limit of the velocity window, then the polarity has been correctly set. In the opposite case the polarity has been incorrectly set.

If maximum drive force is reached and the actual velocity value is still in the window, then the error message "max. torque reached" is generated in parameter Y-0-0059. The drive is then brought to standstill.

Activation To start the function, it is necessary to execute the following:

- Call up menu item "virtual battery box selection" under "Extras → virtual battery box" and make the following settings.

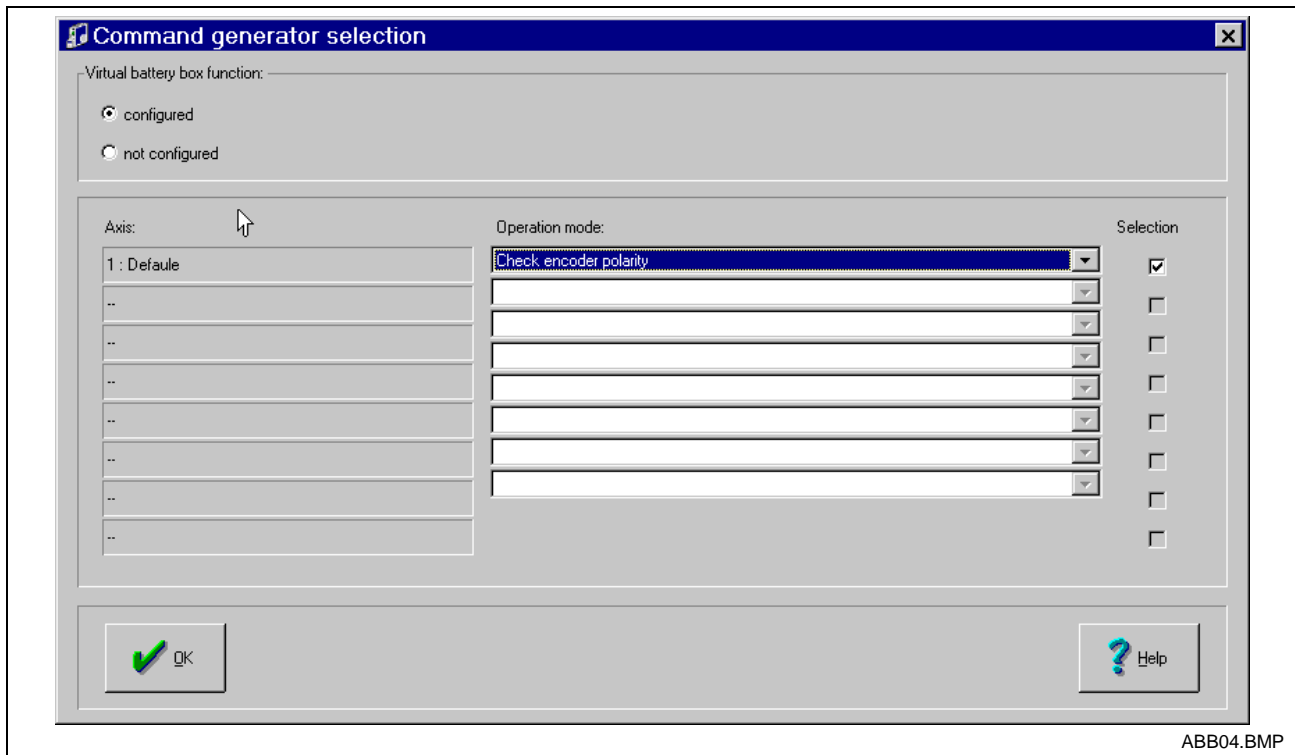


Fig. 5-1: Command generator selection

- Then select menu item "virtual battery box adjustments" under "Extras → virtual battery box". To start the check it is necessary to set the drive enable and the command value generator must also be started.

Parameter The following parameters can be set:

- "Bipolar torque/force limit value" (S-0-0092)
- Drive force sign (Y-0-0053, bit 4)

5.3 Command Value Generator Velocity Control

Jogging

Function Jogging an axis is only possible in "velocity control" mode.

The drive, in this case, is given the jog velocity in steps ("command value generator jogging speed translatory", Y-0-0058 or "command value generator jogging speed rotary", Y-0-0063) as a command value. The motional direction is set in parameter "command value generator control word" (Y-0-0053).

Note: Drives which shall only be moved in one direction, can be moved with the help of the jogging function (e.g., modulo rotary axis).

The following illustrates the resulting velocity command in terms of the activation of the jogging key.

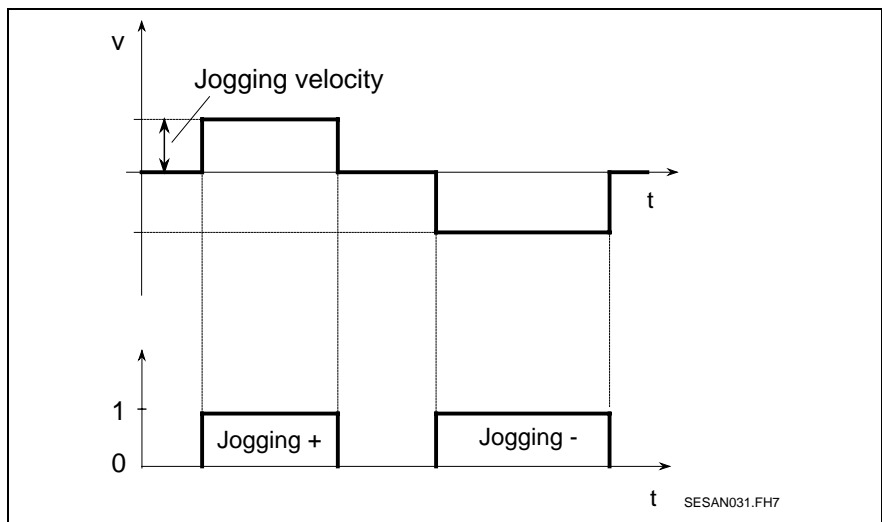


Fig. 5-2: Jogging in velocity control

- Activation**
- Call up menu item "virtual battery box selection" under "Extras → virtual battery box" and make the following settings.

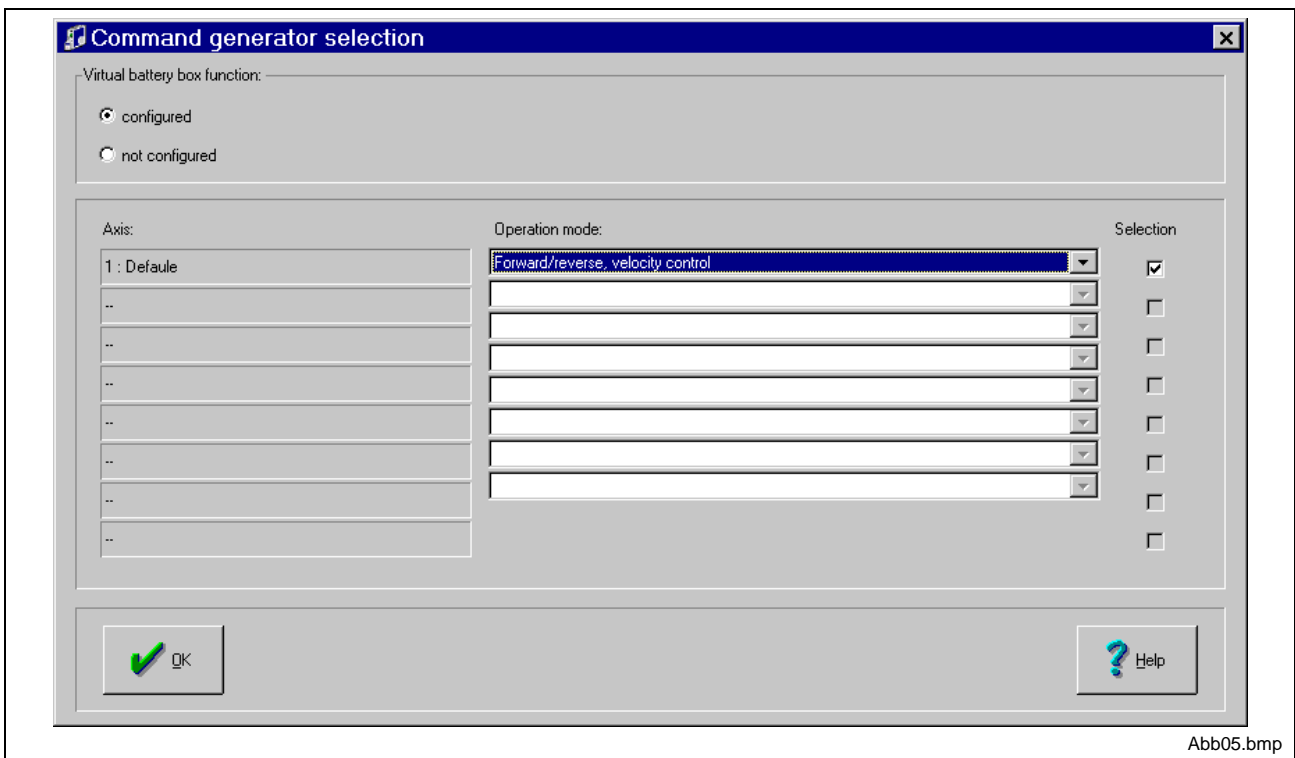


Fig. 5-3: Command generator selection

- Then select menu item "virtual battery box adjustments" under "Extras → virtual battery box". To start the check it is necessary to set the drive enable and the command value generator must also be started.

Jogging the axis is only possible as long as the drive enable is activated. If it is cleared, then the drive is shut down.

Parameter The following parameters can be set

- "Command value generator jogging speed translatory" (Y-0-0058)
- "Command value generator jogging speed rotary" (Y-0-0063)
- Motional direction (Y-0-0053, bits 0 and 1)

Reversing

Function When reversing in mode "velocity control" the drive moves, for example, with the velocity profile depicted below. The velocity command value is entered in steps. The command value generator brakes the drive once the actual position value has reached positions x_1 or x_2 . After dwell time (Y-0-0057) the motional direction is reversed.

The resulting position deviation depends on the velocity set.

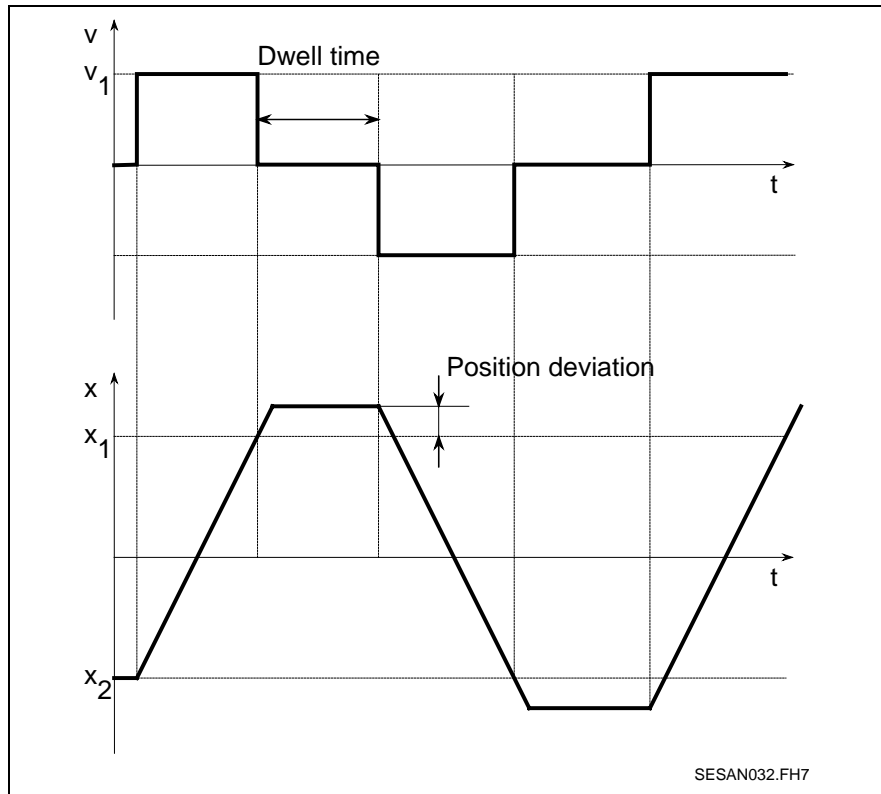


Fig. 5-4: Reversing with velocity control

Activation Run activation as described in "jogging".

Reversing the axis is only possible as long the drive enable is activated. If it is removed, then the drive brakes.

Parameter The following parameters can be set with translatory axes:

- x_1 : "Command value generator pos. 1 translatory" (Y-0-0054)
- x_2 : "Command value generator pos. 2 translatory" (Y-0-0055)
- v_1 : "Command value generator velocity translatory" (Y-0-0056)
- "Command value generator dwell time" (Y-0-0057)

The following parameters can be set with rotary axes:

- x_1 : "Command value generator pos. 1 rotary" (Y-0-0060)
- x_2 : "Command value generator pos. 2 rotary" (Y-0-0061)
- v_1 : "Command value generator velocity rotary" (Y-0-0062)
- "Command value generator dwell time" (Y-0-0057)

Step Mode

Note: This function is only possible with axes with modulo format. The axes move approximately around the specified travel path Δx !

Relative motion The present position conducts a relative motion with the travel path Δx . The direction is set by the sign of Δx .

Function During step mode, "velocity control" moves the drive, for example, as illustrated below. The velocity command value is set in steps. The command value generator stops the drive after reaching the relative position Δx . After dwell time (Y-0-0057), the motion is continued in the same direction.

A constant motion can be reached with Y-0-0057 = 0.

The resulting position deviation depends on the velocity set.

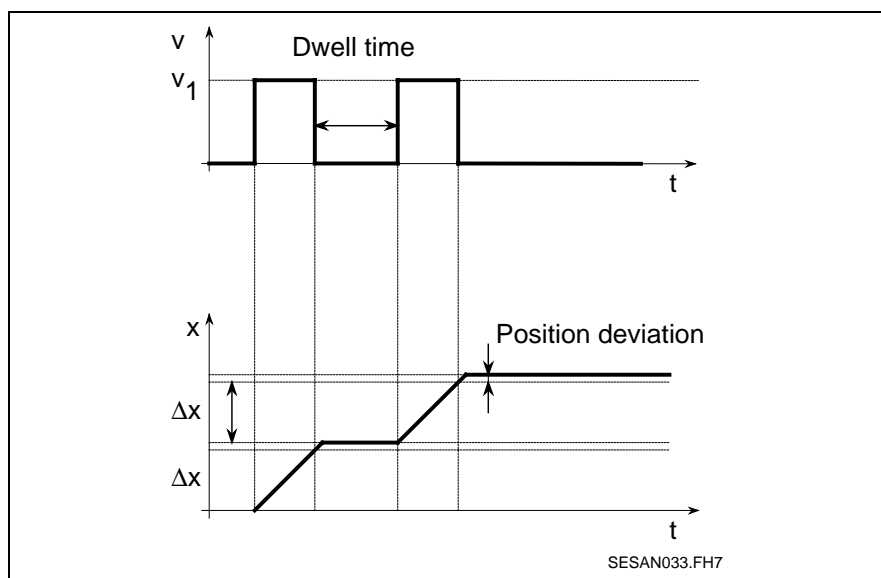


Fig. 5-5: Step mode with velocity control

Activation Execute activation with relevant operating mode as described in "jogging".

Step mode is only possible if the drive enable is activated. If it is removed, then the drive is braked.

Parameter The following parameters can be set with translatory axes:

- Δx : "Command value generator travel distance translatory" (Y-0-0064)
- v_1 : "Command value generator velocity translatory" (Y-0-0056)
- "Command value generator dwell time" (Y-0-0057)

The following parameters can be set with rotary axes:

- Δx : "Command value generator travel distance rotary" (Y-0-0065)
- v_1 : "Command value generator velocity rotary" (Y-0-0062)
- "Command value generator dwell time" (Y-0-0057)

5.4 Command Value Generator Position Control

Reversing

Function When reversing in "position control" mode the drive moves as illustrated below.

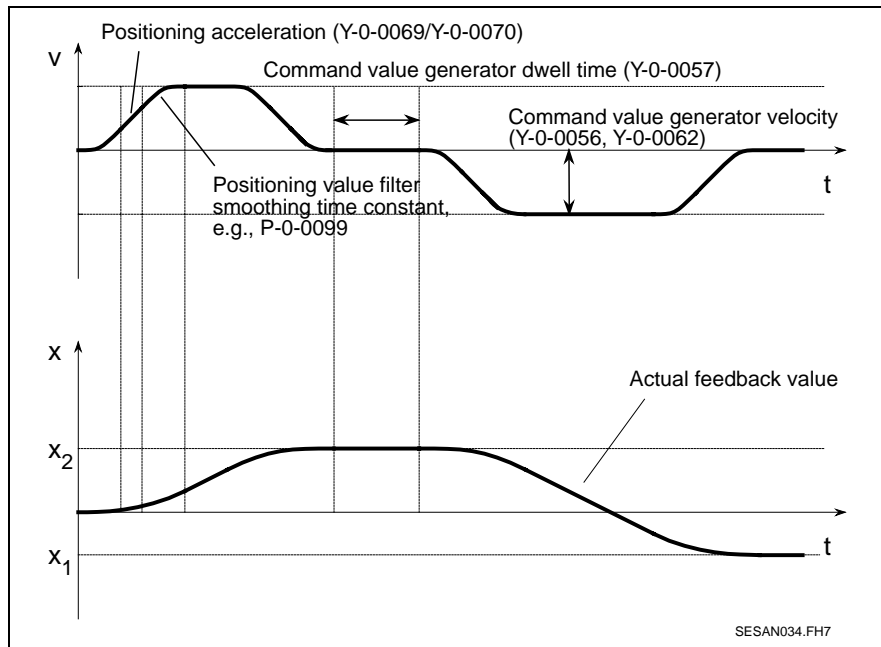


Fig. 5-6: Reversing with position control

The drive reverses between positions x_1 and x_2 .

Starting with the present position, the drive accelerates to "command value generator velocity translatory" (Y-0-0056) or "command value generator velocity rotary" (Y-0-0062). The rise of velocity depends on "positioning acceleration translatory" (Y-0-0069) or "positioning acceleration rotary" (Y-0-0070) and "position command value smoothing filter time constant" (P-0-0099).

After "command value generator dwell time" (Y-0-0057) the rotational direction is reversed.

Activation Execute activation with relevant operating mode as described in "jogging".

Reversing is only possible as long as drive enable is activated. If removed, the drive is braked.

Parameter The following parameters can be set with translatory axes:

- "Command value generator position 1 translatory" (Y-0-0054)
- "Command value generator position 2 translatory" (Y-0-0055)
- "Command value generator velocity translatory" (Y-0-0056)
- "Positioning acceleration translatory" (Y-0-0069)
- "Position command value smoothing filter time constant" (P-0-0099)
- "Command value generator dwell time" (Y-0-0057)

The following parameters can be set with rotary axes:

- "Command value generator position 1 rotary" (Y-0-0060)
- "Command value generator position 2 rotary" (Y-0-0061)
- "Command value generator velocity rotary" (Y-0-0062)
- "Positioning acceleration rotary" (Y-0-0070)
- "Position command value smoothing filter time constant" (P-0-0099)
- "Command value generator dwell time" (Y-0-0057)

Step Mode

Relative motion Starting with the present position, a relative motion is being conducted with travel path Δx . The direction is specified by the sign of Y-0-0064 or Y-0-0065.

Function Step mode in "position control" mode results, for example, in the following motion:

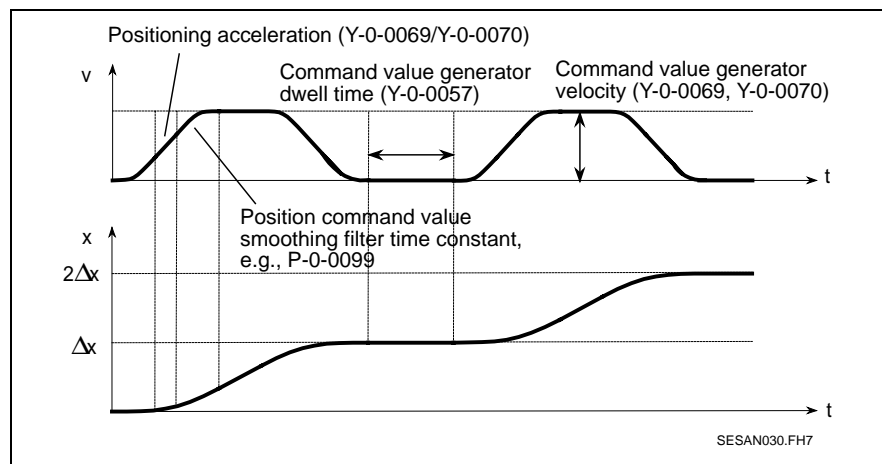


Fig. 5-7: Step mode with position control

First there is acceleration, starting from present position, whilst taking into account "positioning acceleration translatory" (Y-0-0069) or "positioning acceleration rotary" (Y-0-0070) and "position command value smoothing filter time constant" (P-0-0099) to "command value generator velocity translatory" (Y-0-0056) or "command value generator velocity rotary" (Y-0-0062).

The drive precisely runs to position Y-0-0064/Y-0-0065.

After "command value generator dwell time" (Y-0-0057), the procedure is repeated.

Activation Execute activation with relevant operating mode as described in "jogging".

Step mode is only possible if the drive enable is activated. If it is removed, then the drive is braked.

- Parameter** The following parameters can be set with translatory axes:
- "Command value generator travel distance translatory" (Y-0-0064)
 - "Command value generator velocity translatory" (Y-0-0056)
 - "Positioning acceleration translatory" (Y-0-0069)
 - "Position command value smoothing filter time constant" (P-0-0099)
 - "Command value generator dwell time" (Y-0-0057)

The following parameters can be set with rotary axes:

- "Command value generator travel distance rotary" (Y-0-0065)
- "Command value generator velocity rotary" (Y-0-0062)
- "Positioning acceleration rotary" (Y-0-0070)
- "Position command value smoothing filter time constant" (P-0-0099)
- "Command value generator dwell time" (Y-0-0057)

5.5 Noise Generator

- General** When starting up a machine axes it is not always possible to use the step response of the velocity or position control loop to determine the system's frequency. In such cases, a noise generator can be used. It makes a test signal without average available.
- Function** The noise generator makes a pseudo-static binary signal available. Its amplitude accepts positive and negative values. The drive receives a new command value during each SERCOS cycle.
- The amplitude of the output signal can be scaled for the axis in use via parameter "amplitude noise source" (Y-0-0067).
- The output signal is generated repeatedly about every 8 seconds given a SERCOS cycle time of 2 ms. The repetition time t_W of the noise generator depends on the "SERCOS cycle time" (Y-0-0004) and is computed as follows:
- $$t_W = 2^{12} \cdot t_{Syc}$$
- The noise signal can be switched on in any command value generator mode and is added to the relevant command value. This takes place by setting bit 5 in parameter "command value generator control word" (Y-0-0053).
- Activation** The noise generator can be activated as long as the command value generator has been started and drive enable is set. If the drive enable is removed, then the noise generator stops.
- Parameter** The following parameters can be set with rotary and translatory axes:
- "Amplitude noise source" (Y-0-0067)
 - "Command value generator control word" (Y-0-0053)
 - "Command value generator enable" (Y-0-0044)
 - "SERCOS cycle time" (Y-0-0004)
 - all parameters of the command value generator operating mode.

6 Diagnostics and Error Messages

6.1 List of Diagnostics and Error Messages

Distortion Display (LED of M1)

The distortion LED must be off at normal operation.

Possible error causes at lighting LED:

- Drive switched off.
- Fiber optic cable defective.
- Optical transmission power of last drive before SERCANS wrongly adjusted.
- Hardware defect of SERCANS or drive.
- Test mode activated (see drive documentation).

Diagnoses on the 7 Segment Display

The following lists the diagnostics and fault messages of the 7 segment display:

Error Free Case

M1 7-Seg.	Systemstatus	status message in system parameter "system status" (Y-0-0015)
0	0xE001	phase 0
0	0xE011	phase 0, phase changeover active
1	0xE002	phase 1
1	0xE012	phase 1, phase changeover active
2	0xE003	phase 2
2	0xE013	phase 2, phase changeover active
3	0xE004	phase 3
3	0xE014	phase 3, phase changeover active
b	0xE005	phase 4: "ready"
5.	0xE006	test mode: zero bit stream
6.	0xE007	test mode: continuous light
7	0xE008	fiber optic ring not closed
8.	0x0000	reset

Fig. 6-1: Error free case

System Error

M1 7 seg.	Error in phase	Reaction	System error	error messages in system parameter "system error" (Y-0-0011)
A	1	phase 0	0x8005	drive address not correct
C	3-4	phase 0	0x8007	double AT failure
C	3-4	phase 0	0xF008	double MST failure
L	1-4	phase 0	0x8009	fiber optics cable disconnected
n	2	phase 0	0xF001	configuration error (command/actual value channel)
o	2	phase 0	0xF002	error in time slot calculation
r	0-4	phase 0	0xF004	SERCANS: internal error
U	4	phase 0	0xF005	lifecounter error
u	2	phase 0	0xF006	copy times too long
y	0	phase 0	0xF007	checksum error (Y parameter)
c	2-4	phase 0	0xF008	input signal SYNCIN failed

Fig. 6-2: System error

Axis Specific Error

M1 7 seg.	Error in phase	Reaction	Diagnostics status	Error messages in diagnostics text of the eight axis specific diagnostics channels
d	2-4	phase 0	0x8006	HS timeout
E	2	phase 2	0xD002	changeover phase 2 -> 3 not possible
F	3	phase 3	0xD003	changeover phase 3 -> 4 not possible
h	2-4	phase 2-4	0xD001	drive error (class 1 diagnostics, S-0-0011)

Fig. 6-3: Axis specific error

6.2 Status Message Definitions

Display "0" : Phase 0 or phase 0, phase transition active

The SercBox sets communication phase 0.

Display "1" : Phase 1 or phase 1, phase transition active

The SercBox sets communication phase 1.

Display "2" : Phase 2 or phase 2, phase transition active

The SercBox sets communication phase 2.

Display "3" : Phase 3 or phase 3, phase transition active

The SercBox sets communication phase 3.

Display "b" : Phase 4 "ready to operate"

The SercBox sets communication phase 4. Power can be switched on and the drives can be moved.

Display "5." : Test mode: Zero bit stream

Test mode "zero bit stream" was selected.

Reaction from the SercBox

The SercBox sends a zero bit stream and prevents phase runup.

Cause

Test mode activated via DIP switch SD1 switch 1.

Remedy

Set DIP switch SD1 switch 1 to off position.

Display "6." : Test mode: Continuous light

Test mode "Continuous light" was selected.

Reaction from the SercBox

The SercBox sends continuous light and prevents phase runup.

Cause

Test mode activated via DIP switch SD1 switch 2.

Remedy

Set DIP switch SD1 switch 2 to off position.

Display "7" : Fiber optic ring not closed

After a hardware reset from the SercBox the SERCOS ring was not closed. The SercBox cannot receive ten sequential MST telegrams of phase 0.

Reaction from the SercBox

The SercBox remains in state "fiber optic ring not closed" until the fiber optic ring is closed. It then conducts a runup itself into target phase (see parameter "phase initiation" Y-0-0014).

Cause

- Fiber optic cable transposed or not correctly screwed on.
- Fiber optic cable ring defective.
- Data rate of drives and the SercBox have different settings.
- The optical transmission power (for the SercBox see parameter Y-0-0016) of a user on the SERCOS ring is set inadequate.
- Drive defective.

Remedy

- Check all fiber optic cables.
- Check data rates,
SercBox: see parameter Y-0-0003,
Drive: see manual of drive manufacturer
- Optical transmission power of all users on SERCOS ring must be adjusted to the actual fiber optic cable length.

Display "8." : Reset

The SercBox is in reset. Communication with DriveTop not possible.

Reaction from the SercBox

-

Cause

- SercBox assembly defective.

Remedy

- Contact customer service.

6.3 Definition of Error Messages

Display "C" : Double AT failure or double MST failure

The SercBox did not receive two consecutive drive telegrams (AT) or did not receive two consecutive master synchronization telegrams (MST) from a drive.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- Fiber optic cable not correctly screwed on.
- Fiber optic cable defective.
- Drive defective.
- The optical transmission power (for the SercBox see parameter Y-0-0016) of a user on the SERCOS ring is set inadequate.

Remedy

- Check all fiber optic cables.
- Optical transmission power of all users on SERCOS ring must be adjusted to the actual fiber optic cable length.

Display "d" : NC/MMI service channel HS timeout

A drive has not toggled bit 0 in the drive status word (service transport handshake) within ten SERCOS cycles as a result of a query via the service channel.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- Drive defective.

Remedy

- Replace drive.
- Contact Customer Service of the drive manufacturer.

Display "E" : Transition: Phase2 ⇒ 3 not possible

The SercBox cannot switch from phase 2 to 3.

Reaction from the SercBox

The SercBox retains the transition command set and ends phase runup. The diagnosis of the relevant drive is written into the diagnostics channel.

Cause

At least one drive refuses to move into phase 3 with command "communication phase 3 transition check" (S-0-0127).

Remedy

Clear error in drive affected (see help guidelines from drive manufacturer).

Display "F" : Transition: Phase 3 ⇒ 4 not possible

The SercBox cannot conduct phase transition from phase 3 to 4.

Reaction from the SercBox

The SercBox retains the transition command set and ends phase runup. The diagnosis of the relevant drive is written into the diagnostics channel.

Cause

At least one drive refuses to move into phase 4 with command "communication phase 4 transition check" (S-0-0128).

Remedy

Clear error in drive affected (see help guidelines from drive manufacturer).

Display "h" : Drive error

A drive signals a drive error by setting the static status bit in drive status for class 1 diagnostics.

Reaction from the SercBox

The diagnosis of the relevant drive is written into the diagnostics channel.

Cause

An error has occurred in the drive.

Remedy

Evaluate parameter "class 1 diagnostics" (S-0-0011), "diagnostic message" (S-0-0095) and "diagnostic message number" (S-0-0390) and then eliminate the cause of the problem.

Display "A" : Drive addresses not correct

The phase changeover from phase 0 to phase 1 cannot be executed because the drive addresses entered in "list of drive addresses" (Y-0-0012) could not be found in the ring.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- At least one drive address has been entered in Y-0-0012 which could not be found in the ring.
- After the SercBox detected that the fiber optic ring was closed, it was broken in phase 1 again.
- The wrong data rate is entered in Y-0-0003.

Remedy

- Check drive addresses. It is allowed to have drive addresses in the ring that are not entered in the "list of drive addresses" (Y-0-0012).
- Check the fiber optic ring.
- Check data rates,
SercBox: see parameter Y-0-0003,
Drive: see application description of the drive manufacturer.

Display "L" : Fiber optics cable disconnected

The fiber optic ring was broken after it was recognized that it was closed.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- Fiber optic cable ring defective.
- The optical transmission power (for the SercBox see parameter Y-0-0016) of a user on the SERCOS ring is set inadequate.
- Drive defective.

Remedy

- Check all fiber optic cables.
- Check data rates,
SercBox: see parameter Y-0-0003,
Drive: see application description of the drive manufacturer.
- Optical transmission power of all users on SERCOS ring must be adjusted to the actual fiber optic cable length.

Display "n" : Configuration error (command/actual value channel)

An error has occurred while configuring the cyclic telegram data with the entries from command/actual value channel.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- Too many command or actual values have been configured.
- Bit 15 has been set in Y-0-0039 or Y-0-0040 and the length entered in low byte is too large.

Remedy

- Reduce the amount of cyclic data (see parameters S-0-0016, S-0-0024 in the drives).
- Clear Y-0-0039 or Y-0-0040 or change the length of command or actual value channel.

Display "o" : Error in time slot calculation

While calculation times for SERCOS transmission in phase 4, an error occurred.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- The configured command or actual values are not supported by at least one drive (see parameter Y-0-0021 - Y-0-0036) because the parameter number is not present or cannot be cyclically configured (see parameter S-0-0187, S-0-0188).
- The command value generator has been activated in the SercBox and a mode set for which the SercBox wants to automatically cyclically configure parameters for cyclic transmission that are not present in the drive or cannot be configured cyclically (see parameter S-0-0187, S-0-0188).

Remedy

- Check whether the parameters entered in relevant command and actual value channels are allowed by the drive for cyclic transmission. (see parameters Y-0-0021 - Y-0-0036 and parameters S-0-0187, S-0-0188)

Display "r" : SercBox: Internal error

An internal error has occurred on the SercBox.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

Internal hardware test routines have not been properly completed.

Remedy

- Contact Customer Service.

Display "U" : Error in lifecounter

NC and the SercBox monitor the transmission of new command and actual values in each NC cycle. The SercBox increments the "Lifecounter SERCANS" (Y-0-0019) for this purpose and the NC does the same for "lifecounter NC" (Y-0-0020). The difference between the two is greater than the maximum lifecounter difference (Y-0-0018).

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

The NC is not using the "lifecounter NC" (Y-0-0020) properly.

Remedy

- Check NC program.
- If NC not connected: switch lifecounter monitoring off, to do so write 0 into Y-0-0018.

Display "u" : Copy times too long

The copying of the actual values of the drive into the DPR is not yet completed at the time when the copying of the command values out of the DPR into the MDT is to start. ($S-0-0006 + \text{transmission time of last AT} + Y-0-0037 > S-0-0089 - Y-0-0010$).

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

- Too many command values configured.
- Too many actual values configured.
- SERCOS cycle time too small for the number of real-time data to be transmitted.
- "Data rate" (Y-0-0003) too small to transmit the amount of data in the cycle time.

Remedy

- Configure fewer command values.
- Configure fewer actual values.
- Increase "SERCOS cycle time" (Y-0-0004).
- Increase "data rate" (Y-0-0003).

Display "y" : Checksum error (Y parameter)

The SercBox checks all Y parameters for validity by means of a checksum. Each parameter that passes this check, is entered in the "list of invalid Y-parameters" (Y-0-0042).

Reaction from the SercBox

Communication phase 0 is set.

Cause

- New SercBox firmware has been downloaded.
- E²PROM defective.

Remedy

- Write valid values into the parameters in "list of invalid Y-parameter" (Y-0-0042).
- Contact Customer Service.

Display "c" : Input signal SYNCIN failed

The exchange of real time data via the DPR between the SercBox and the NC is synchronized by the synchronous master. If the NC is the "synchronous master" (Y-0-0002), then the SercBox monitors the SYNCIN signal.

Reaction from the SercBox

Phase changeover back to communication phase 0.

Cause

Parameter Y-0-0002 is not zero.

Remedy

- Parameter Y-0-0002 must be set to zero.

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