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SERCANS
SERCOS interface Assembly

Application Description: Version 04

DOK-SERCAN-SER-04VRS**-AW02-EN-P

Rexroth
Indramat

Title SERCANS SERCOS interface assembly

Type of documentation Application description

Documentation code DOK-SERCAN-SER-04VRS**-AW02-EN-P

Internal file reference
- SCS04E_Y.DOC
- Document no. 120-2000-B301-02/EN

What is the purpose of this document?

This documentation helps
- in the familiarization with SERCANS - assemblies
- in the evaluation of SERCANS - functions
- as development documentation respective the control

Course of modifications

Document identification of previous and present output	Release Date	Comments
DOK-SERCAN-SER-04VRS**-ANW1-EN-P	06/98	
DOK-SERCAN-SER-04VRS**-AW02-EN-P	11.99	

Reference firmware see section 1.2

Reference hardware see section 1.2

Commissioning software see section 1.2

Hardware license see section 1.2

Firmware license see section 1.2

Published by REXROTH INDRAMAT GmbH
Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main

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Note This document has been printed on chlorine-free bleached paper.

Contents

1 General Informations

1.1 Basic Information on the SERCANS Assemblies

The SERCANS module supports the simple implementation of a SERCOS interface in an existing control or when developing a control which implements a SERCOS interface.

There are three hardware versions of the SERCANS assemblies:

a) The SCS-A assembly has a universal µP interface. This interface makes it possible to connect to all conventional microprocessors.

b) The SCS-V assembly is a VMEbus card in single europe format.

c) The SCS-P assembly is a slot card for the PC (ISA-BUS).

The only difference between the SERCANS assemblies is the interface to the NC control. The firmware is identical for all assemblies.

SERCANS has an expanded dual port RAM interface on the NC control unit.

The expansion consists of

- power supply connections,
- the reset,
- an interrupt output and
- one synchronization input and output each.

SERCANS and the NC control unit communicate via the expanded DPR interface. The following communication channels exist to each of up to eight drives:

- command value channel,
- actual value channel
- command channel
- NC service channel
- diagnostics channel

There is a communication channel with low priority for all axes for the user interface:

- MMI service channel

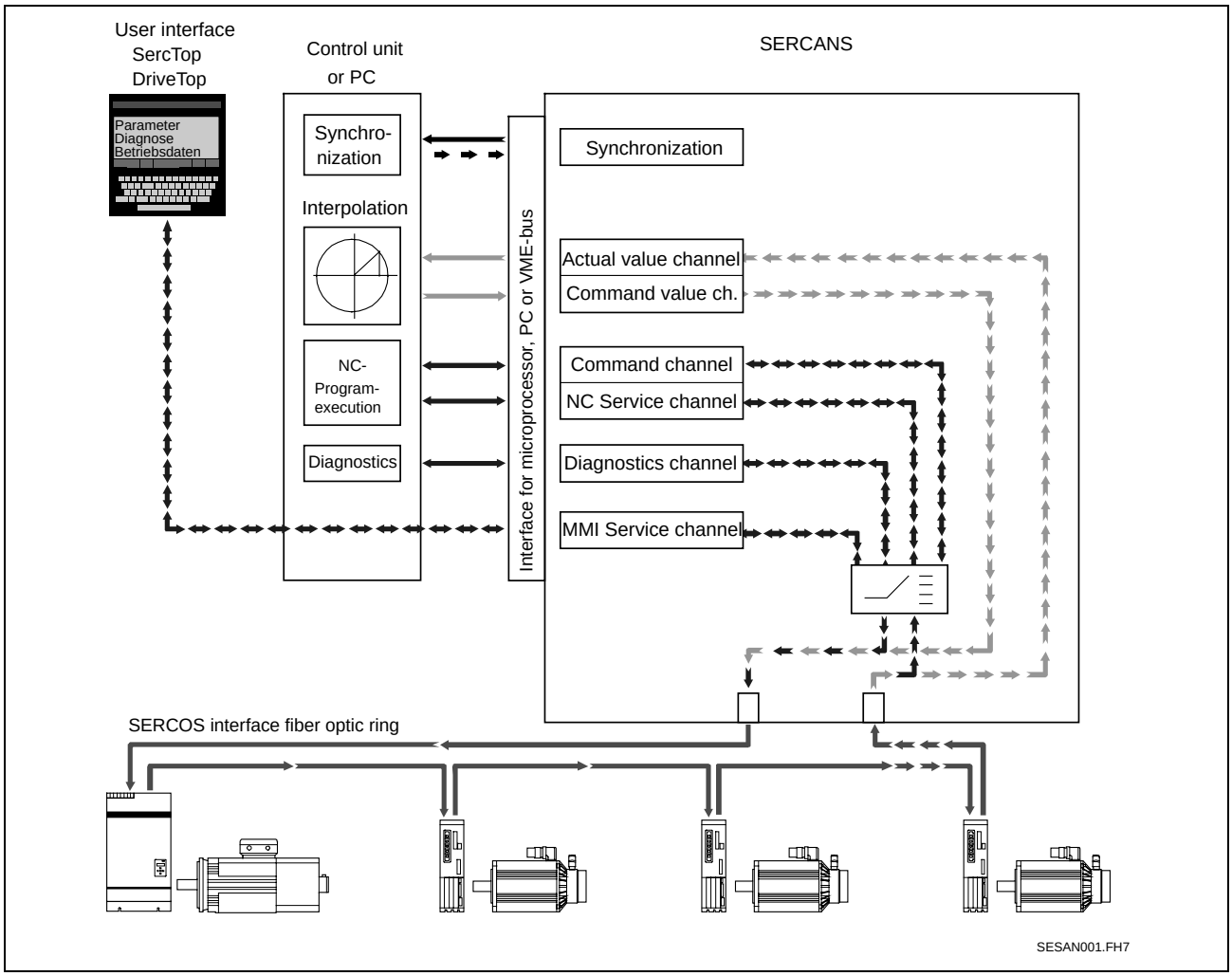


Fig. 1-1: System Overview

The SERCANS user needs no detailled knowledge of SERCOS interface specifications.

The SERCOS interface conformity means that the assemblies will function in all SERCOS interface applications.

Note: Hexadecimals in this documentation are given in the form of "0xNNNN".

1.2 SERCANS-Reference List

Referenced Firmware

Product	Product firmware (order designation)	Printed board firmware (EPROM/flash labelling)
SCS-A, SCS-P, SCS-V	FWA-SERCAN-SER-04VRS-MS FWA-SERCAN-SER-04VRS-MS-FLASH	FWC-SERCAN-SER-04VRS-MS FWC-SERCAN-SER-04VRS-MS-FLASH

Fig. 1-2: Referenced firmware

Referenced Hardware

Product	Hardware-labelling
SCS-A	SCS-A01.1A-FW SCS-A01.1B-FW SCS-A01.2A-FW SCS-A01.2B-FW SCS-A02.1A-FW SCS-A02.1B-FW
SCS-P	SCS-P01.1A-FW SCS-P01.2A-FW SCS-P02.1A-FW
SCS-V	SCS-V01.1A-FW SCS-V01.2A-FW SCS-V02.1A-FW SCS-V02.1D-FW

Fig1-3: Referenced hardware

Note: The hardware types SCS-A01.x, SCS-P01.x, SCS-V01.x should no longer be used for new applications.

Commissioning Software

Product	Product software (order designation)	Product software (disks/CDROM labelling)
SercTop Version 04	SWA-S*TOP*-INB-04VRS-MS-C1,44-COPY	SWD-S*TOP*-INB-04VRS-MS-C1,44
DriveTop Version 12	SWA-DTOP**-INB-12VRS-MS-CD600-COPY	SWD-DTOP**-INB-12VRS-MS-CD600

Fig. 1-4: Commissioning software

Note: The software with suffix -COPY may be copied.

Hardware License

A hardware license for the SCS-A assembly can be purchased. It is made up of

- circuitry diagrams,
- items list,
- standard layout,
- documentation and
- a copy license depending on the number of items (hardware).

The purchaser can thus produce and copy his own hardware format.

Order designation: SWA-SCS*A1-HW1-02VRS-MS-C1,44

1.3 The Hardware

SCS-A, SCS-P, SCS-V

- µP 80C165
- EPROM or FLASH-EPROM 2x128kB
- RAM 2x128 kB
- EEPROM 512 bytes (serial)
- Dual Port Ram (2k x 16) for data exchange
- two serial interfaces (RS 232)
- diagnostics display
- a reset logic (with external reset)
- interrupt register
- hardware synchronization
- SERCOS interface
- config register
- current consumption maximum 400mA at 5V
- voltage supply 5V ± 5%
- operating temperature: 0-50°C

Additionally with the SCS-V

- a slave for the VMEbus (standard VMEbus D16, A23)
- interrupt logic with two programmable vectors
- settable base addresses (64 kB range)
- synchronization input (from SCS-V02.1 up)

Additionally with the SCS-P

- 2 settable interrupts
- settable base addresses (4 kB range)

1.4 Functional Structure of the Software

- real-time processing,
- the monitor program,
- drive diagnostics
- initialization (phase runup),
- the command interpreter,
- service channel processing,
- command value generator
- troubleshooting and
- the serial protocol of the user interface SercTop or DriveTop.

2 Commissioning Parameter

2.1 General Information

For a proper commissioning of the entire system it is necessary that the settings on the SERCANS assembly correspond to the conditions of the machine. To make this so, the following system parameters must be programmed in terms of the application.

Note: After these system parameters have been parametrized, it is necessary to run up through phase 4. The SERCANS stores these system parameters in the EEPROM and therefore need only be entered once via the user interface.

In the following example, a drive with an address of "1" is programmed in speed control.

2.2 Parameter Settings of SERCANS

Y-0-0001 Bus mode

Set Intel or Motorola format depending on how the NC control accesses the DPR with 4 byte values.

Set an intel format for the test (input = 0).

Y-0-0002 Synchronous master

Set as per the hardware synchronization.

It is synchronized either as per SYNCIN or SYNCOUT signal.

Activate SYNCOUT for the test (input = 0).

Y-0-0003 Data rate

Set all drives and SERCANS to 2 Mbit/s (input = 0).

Y-0-0004 SERCOS cycle time

Set both "NC cycle time" (Y-0-0005) and "SERCOS cycle time" (Y-0-0004) to the same time (input, e.g., 2000µs)

Y-0-0005 NC cycle time

Set both "SERCOS cycle time" (Y-0-0004) and "NC cycle time" (Y-0-0005) to the same time (input, e.g., 2000µs)

Y-0-0012 List of drive addresses

Enter drive address "1" in the first element of the address, in drive set address "1" also.

Y-0-0016 Optical transmission power

Set optical transmission output at 5.0 m.

Y-0-0017 Phase switching lock

It must be possible to change phases with the user interface (input = 1).

Y-0-0018 Lifecounter difference

Switch off lifecounter function (input = 0)

Y-0-0021 Command value configuration list axis 1

Enter speed command value in first element (S-0-0036).

This configures the velocity command value (4 bytes) in the DPR to address 0x00A8 (see "Axis Structure, NC and MMI Service Channel", section 7).

Y-0-0022 Actual value configuration list axis 1

Enter actual speed value in first element (S-0-0040).

This configures the actual velocity value (4 bytes) in the DPR to address 0x00C4 (see "Axis Structure, NC and MMI Service Channel", section 7).

Y-0-0038 NC access time

Program this parameter to 150 - 500µs (see "Synchronization", section 3.11)

Y-0-0039 List of command value header

The value 0 must be entered into the first element.

Y-0-0040 List of actual value header

The value 0 must be entered into the first element.

Y-0-0041 Language selection

Set English (input = 1)

Y-0-0044 Command value generator enable

Switch command value generator off (input = 0)

Y-0-0066 List of telegram type parameter

The value 7 (application telegram) must be entered into the first element.

Y-0-0071 Powering up target phase

Enter phase 4 (input = 4)

2.3 Parameter Settings in the Drive

S-0-0032 Main operating mode

The main operating mode in the drive must be set to speed control. (Input: 0000 0000 0000 0010).

S-0-0044 Speed data scaling type

Preferred scaling set to rotary.

S-0-0091 Bipolar speed limit value

Limit value set in terms of mechanical system.

S-0-0092 Bipolar torque/force limit value

Limit value set in terms of the mechanical system.

For additional parameter settings, see the manual of the drive.

3 Hardware Functions

3.1 Block Diagram

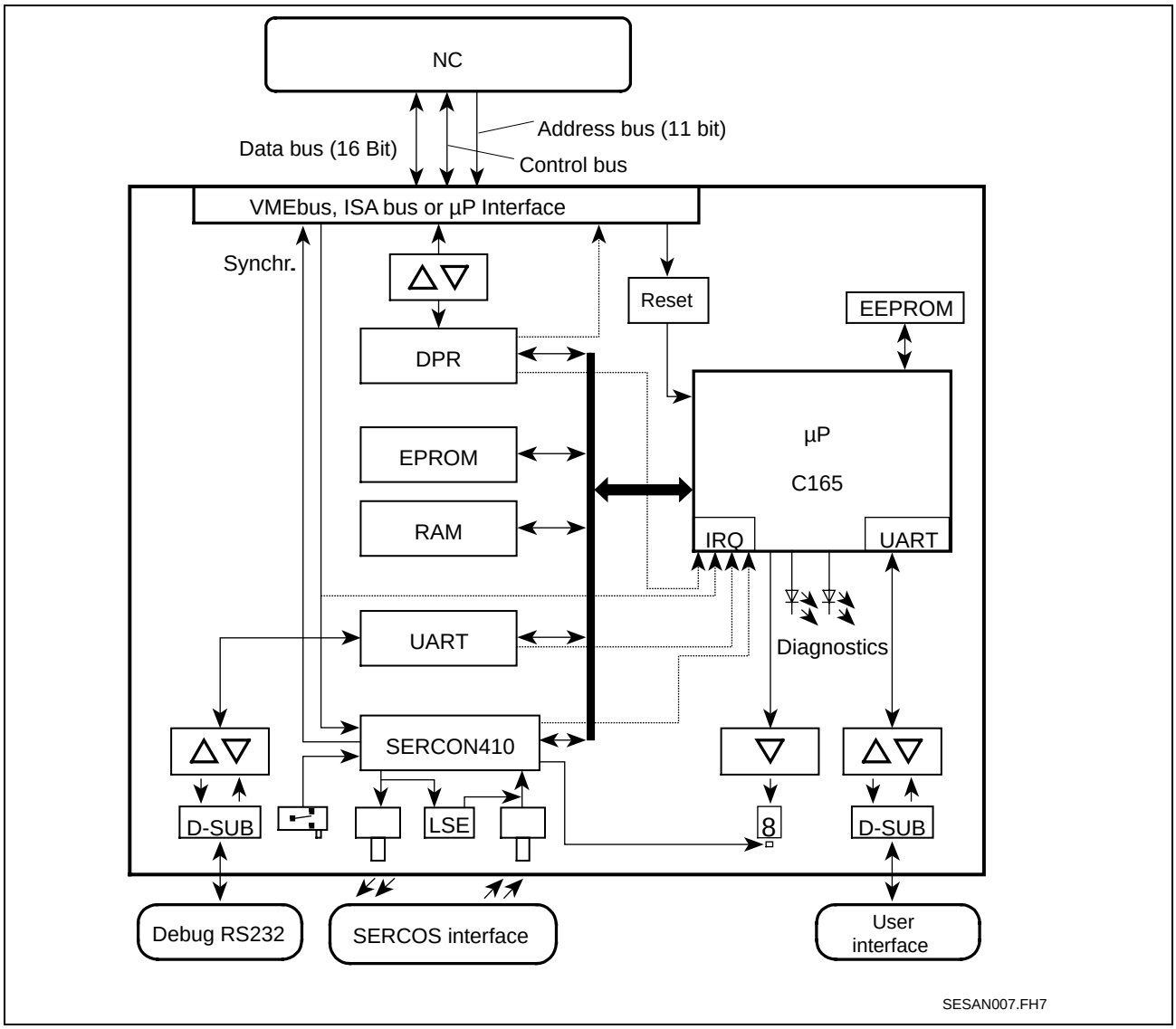


Fig. 3-1: Block diagram

3.2 SCS-A01 Assembly

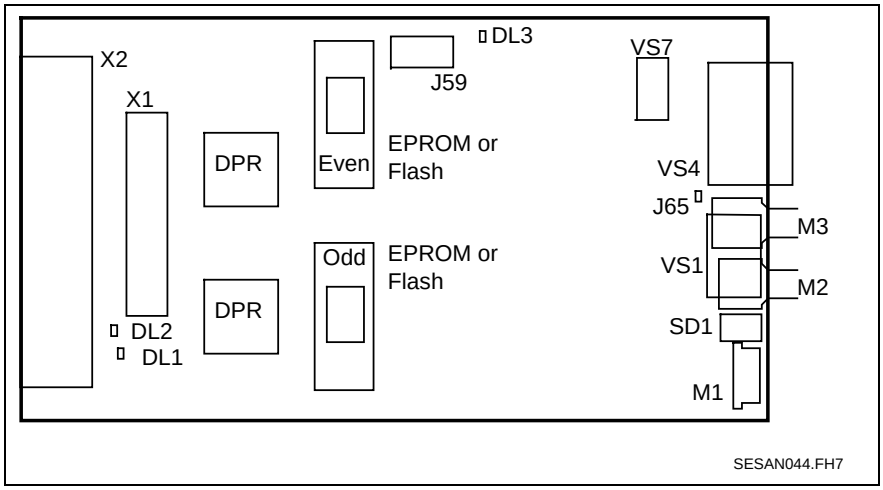


Fig. 3-2: SCS-A01 overview

Connector:

J1: For test purposes only

J59: External reset (see "Reset Logic", section 3.10)
Firmware download (see "Downloading Firmware", page 4-8)

M2: Fiber optic receiver (only SCS-A01.xA-FW)
see "Fiber Optic Connections" (see page 3-27)

M3: Fiber optic transmitter (only SCS-A01.xA-FW)
see "Fiber Optic Connections" (see page 3-27)

VS1: Connector for external fiber optic module (only SCS-A01.xB-FW)
see "Fiber Optic Connections" (see page 3-27)

VS4: Interface for user interface (RS 232)
(see "Interface for User Interface SercTop or DriveTop", page 3-37)

VS7: Monitor program interface (RS232)
(see "Monitor Program Interface", page 3-38)

X1: Connector to the control unit
For connector assignment see "Plug-in Connector X1 (SCS-A)" (section 12.1).
Connector X2 can be used as an alternative.

X2: Connector to the control unit
For connector assignment see "Plug-In Connector X2 (SCS-A)" (section 12.2).
Connector X1 can be used as an alternative.

LEDs and Displays

DL1: LED red

see "List of Diagnostics and Error Messages" (section 5.2)

DL2: LED green

see "List of Diagnostics and Error Messages" (section 5.2)

DL3: LED yellow

see "List of Diagnostics and Error Messages" (section 5.2)

M1: 7 segment display (see "List of Diagnostics and Error Messages", section 5.2)

Settings:

J65 (only SCS-A01.2A-FW): The metal threads of the fiber optic transmitters and receivers can be connected to GND of the PC via bridge J65.

Bridge J65 may not be closed if the metal thread is connected to ground (protective earth).

SD1: Test mode

Test operation (see "Test Mode", section 3.15)

Base address: The address decoding (*CE) in the control unit sets the base address of the SCS-A. No further settings are needed.

Fiber Optic Module LSE3

See SCS-A02.

3.3 SCS-A02 Assembly

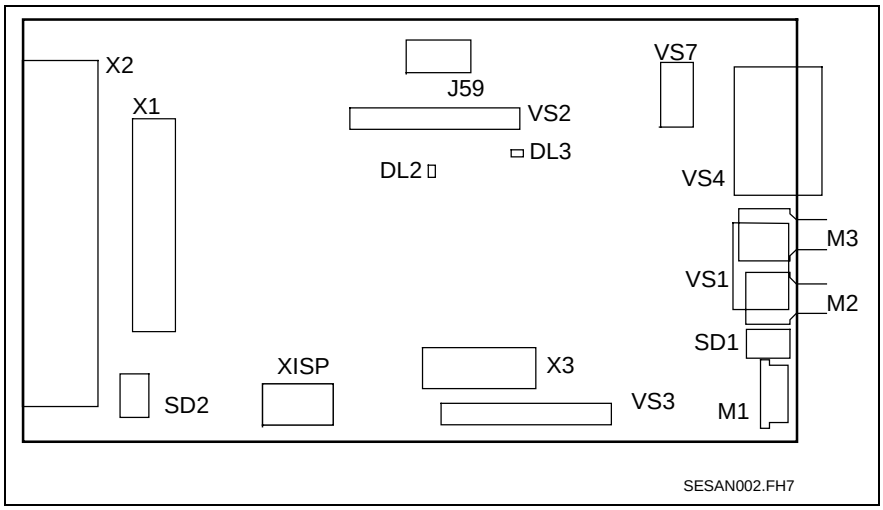


Fig. 3-3: SCS-A02 overview

Connector:

J59: External reset (see section "Reset Behavior", page 3-28)
Firmware download (see "Downloading Firmware", section 4.8)

M2: Fiber optic receiver (only SCS-A02.1A-FW)
see "Fiber Optic Connections" (see page 3-27)

M3: Fiber optic transmitter (only SCS-A02.1A-FW)
see "Fiber Optic Connections" (see page 3-27)

VS1: Connector for external LWL module (only SCS-A02.1B-FW)
see "Fiber Optic Connections" (see page 3-27)

VS2: For test purposes only

VS3: For test purposes only

VS4: Interface for user interface (RS 232)
(see "Interface for User Interface SercTop or DriveTop", page 3-37)

VS7: Monitor program interface (RS232)
(see "Monitor Program Interface", page 3-38)

X1: Connector to the control unit
For connector assignment see "Plug-in Connector X1 (SCS-A)" (section 12.1)
Connector X2 can be used as an alternative.

X2: Connector to the control unit

For connector assignment see "Plug-In Connector X2 (SCS-A)" (section 12.2)

Connector X1 can be used as an alternative.

X3: For test purposes only

XISP: Programming connector for hardware (ispLSI)

LEDs and Displays

DL2: LED green

see "List of Diagnostics and Error Messages" (section 5.2)

DL3: LED yellow

see "List of Diagnostics and Error Messages" (section 5.2)

M1: 7 segment display (see "List of Diagnostics and Error Messages", section 5.2)

Settings:

R104: By means of the R104 bridge, the metal threads signal the fiber optic cable transmitters and receivers can be connected to ground of the printed circuit board.

The R104 may not be closed if the metal thread is connected to ground (protective earth).

SD1: Test mode

Test operation (see "Test Mode", section 3.15)

SD2.1: Reset behavior (see "Reset Behavior", page 3-28)

SD2.2: Firmware download (see "Downloading Firmware", section 4.8)

Base address: The address decoding (*CE) in the control unit sets the base address of the SCS-A. No further settings are needed.

Fiber Optic Module LSE3

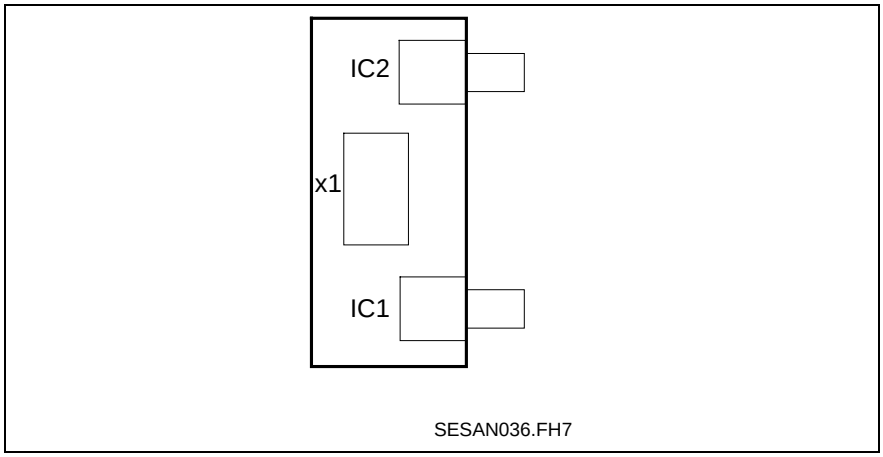


Fig. 3-4: Overview LSE3

X1: Plug-in connector for SERCANS assembly SCS-A

IC1: Fiber optic transmitter

see "Fiber Optic Connections" (see page 3-27)

IC2: Fiber optic receiver

see "Fiber Optic Connections" (see page 3-27)

Config Register 2

The SCS-A02 assembly only has the config register 2.

Config Register 2 (DPR-Adresse 0x0FFA)

This register supports firmware loading and module resetting.

Only bits 0 through 4 are set in the config register 2. Bits 5 through 15 are not relevant for writing and cannot be evaluated when reading.

Bit 0: *RESET

This bit controls the reset of the assemblies. This bit is cleared once the unit is switched on. This means that the reset status is retained until the control sets this bit.

This function can be switched off on module SCS-A02 via switch SD2.1.

This means that if this switch is in OFF position, then execution of program begins directly after control voltage is switched on.

Also see "Reset Logic", section 3.10.

Bit 2-1: Memory selection for program start

Address decoding on the SERCANS module for downloading firmware can be changed with these bits. After reset, start the SERCANS program in the selected memory.

These bits are set to normal mode (0 1) if an automatic runup is set.

Bit 3: DPR interrupt for the control

The logical state of the non-cyclic interrupt (DPR -> NC) is depicted in this bit.

This bit is set if SERCANS writes the interrupt status register (see "Memory Map in the Dual Port RAM", section 9).

This bit is cleared if the interrupt status register is read by the control.

If a control polls the bit cyclical, then a separate interrupt in the control is not needed.

Bit 4: DPR-Interrupt for SERCANS

The logical state of the non-cyclic interrupts (DPR -> SERCANS) is depicted in this bit.

This bit is set if the control writes the interrupt control register (see "Memory Map in the Dual Port RAM", section 9).

This bit is cleared if the interrupt control register is read by SERCANS.

The control can use this bit to sample the non-cyclic interrupt SERCANS side. If this bit=0, than the control can specify a new non-cyclic interrupt in the interrupt register. If the bit=1, then SERCANS has not processed the previous interrupt. In this case, the control cannot set a new interrupt.

Bit 15-5: reserved

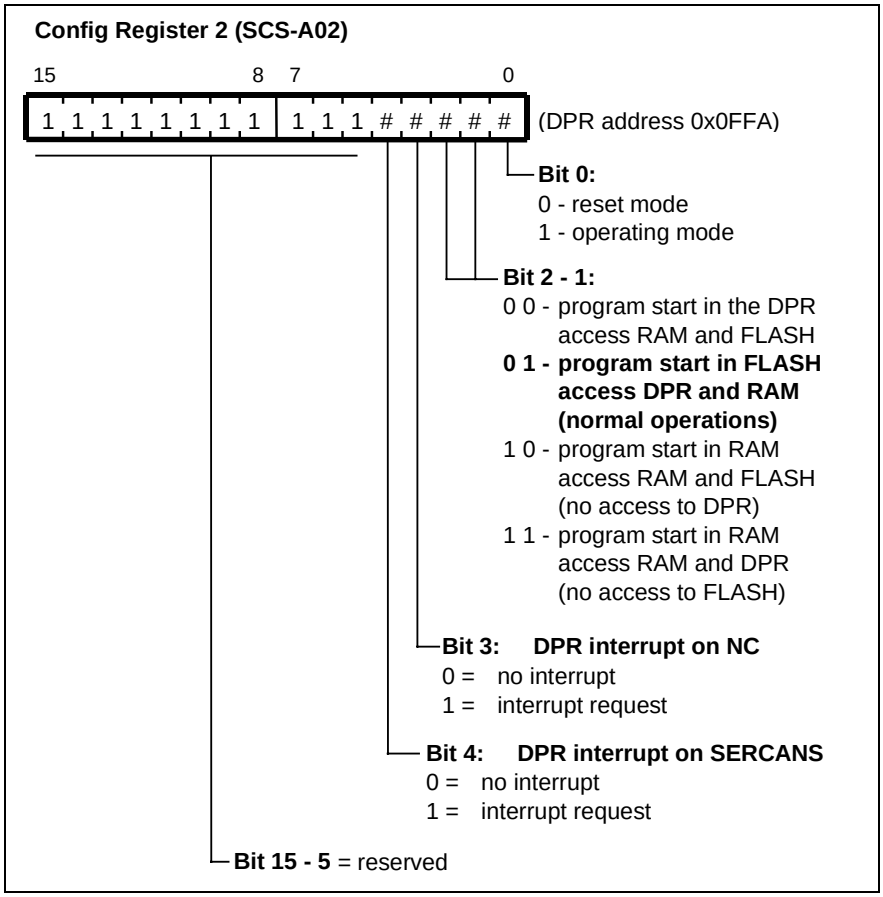


Fig. 3-5: Config register 2

To start the program in FLASH EPROM it is necessary to write the value 0x0003 into the config register 2. If the value 0x0000 is written into the config register 2, then the assembly is in reset mode.

The config register 2 must be accessed wordwise (16 bit access).

3.4 SCS-V01 Assembly

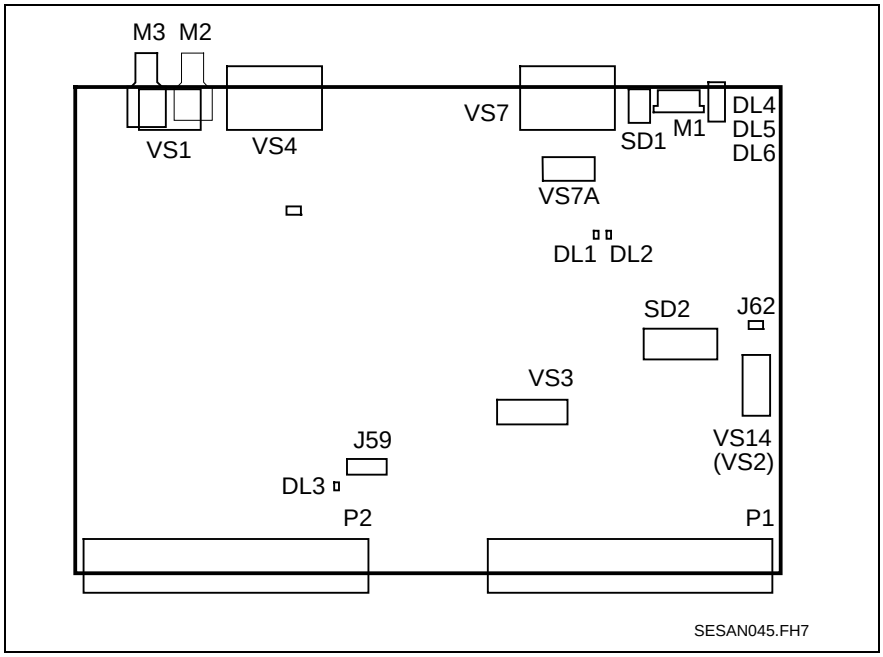


Fig. 3-6: Overview SCS-V01

Connector

J1: For test purposes only

J59: External reset (see section "Reset Behavior", page 3-28)

M2: Fiber optic receiver

M3: Fiber optic transmitter

VS3: For test purposes only

VS4: Interface for user interface (RS 232)
(see "Interface for User Interface SercTop or DriveTop", page 3-37)

VS7 (or VS7A): Monitor program interface (RS232)
(see "Monitor Program Interface", page 3-38)

VS14 (or VS2): Programming connector for hardware (FPLD from Altera)

P1: Connector J1/P1 of the VMEbus
For connector assignment see "Plug-In Connector X1 (SCS-V02) or J1/P1 (SCS-V01)" (section 12.5)

P2: Connector J2/P2 of the VMEbus
For connector assignment see "Plug-In Connector X1 (SCS-V02) or J1/P1 (SCS-V01)" (section 12.5)

LEDs and Displays:

DL1: LED red

see "List of Diagnostics and Error Messages" (section 5.2)

DL2: LED green

see "List of Diagnostics and Error Messages" (section 5.2)

DL3: LED yellow

see "List of Diagnostics and Error Messages" (section 5.2)

DL4/5/6: LED red, yellow, green

For VME bus diagnoses.

see "List of Diagnostics and Error Messages" (section 5.2)

M1: 7 segment display (see "List of Diagnostics and Error Messages", section 5.2)

Settings:

To operate module SCS-V the test mode must be set to normal operations, the base address and access mode must be set in the hardware. Additionally, config register 1 and 2 must be programmed by the VMEbus system.

J62: Access mode: Supervisor mode access / user mode access

a) The SCS-V assembly can only be operated with supervisor access if the VMEbus system is in supervisor mode.

Note: If supervisor access is selected, then the SCS-V generates a bus error (*BERR), when accessed in user mode.

b) If the jumper is open, then the SCS-V can be operated via supervisor and user access.

Access mode	J62
a) supervisor mode only	closed
b) supervisor or user mode	open

Fig. 3-7: Supervisor access table

SD1: Test mode

Test operation (see "Test Mode", section 3.15)

SD2: VMEbus address

The eightfold DIL switch SD2 determines the base address of the SCS-V. SCS-V occupies a memory range of 64 kB in the VMEbus system. Within the memory range, the DPR starts at adress offset 0x1000, eight control registers start at address offset 0x0.

The address decoding of the SCS-V uses addresses A16 through A23 of the VMEbus systems.

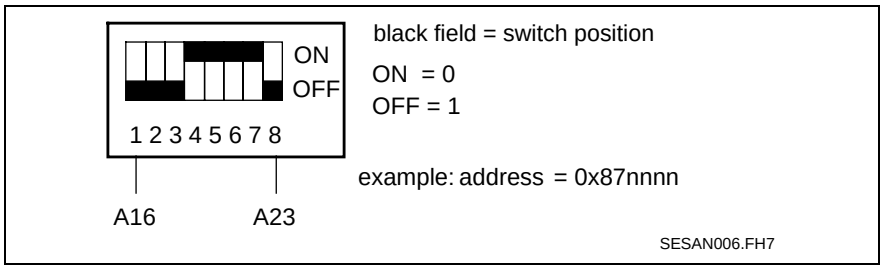


Fig. 3-8: SCS-V02 address settings

VMEbus Control Register

The SCS-V assembly has eight control registers which are eight bits wide. Only the VMEbus system can access the control registers SERCANS **cannot** access the control registers.

The VMEbus control register are stored in a selected storage area starting with address 0x0.

Control Register 0 through 5

The SCS-V assembly can be identified via the VMEbus using control registers 0 through 5. These control registers supply constant values when reading:

- control register 0: 0x44 (address 0x0001)
- control register 1: 0x4D (address 0x0003)
- control register 2: 0x53 (address 0x0005)
- control register 3: 0x0A (address 0x0007)
- control register 4: 0x11 (address 0x0009)
- control register 5: 0x00 (address 0x000B)

Control Register 6

The VMEbus system enters the vector number into control register 6. This is the vector number that the SCS-V should produce during an interrupt. Bit 0 must be cleared when programming the vector numbers.

SCS-V makes two vector numbers available in the control register via bit 0. In the event of an interrupt request from SCS-V, bit 0 displays whether the interrupt was triggered by the DPR via the interrupt control register or the SYNCOUT signal.

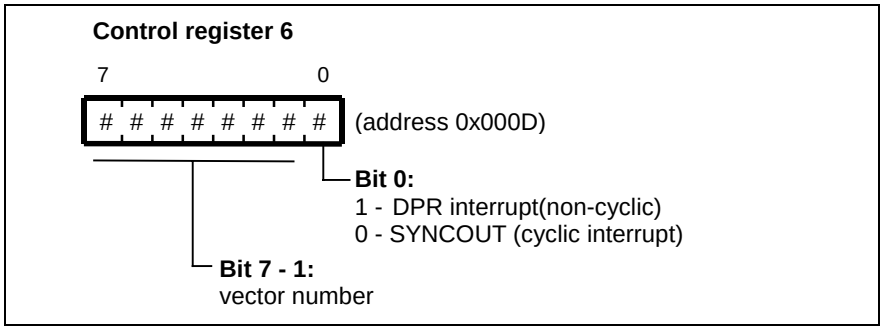


Fig. 3-9: Structure of control registers 6

Control Register 7

The following settings are programmed in control register 7:

- **Bit 2-0** determine the interrupt level (IRQ1 through IRQ6) of SCS-V.
- **Bit 3 = 0:** SCS-V is in reset. In addition, the signal SYSFAIL is activated on the VMEbus. The red VME LED (DL6) is on.
- **Bit 3 = 1:** Reset over, signal SYSFAIL deactivated, the red VME LED (DL6) is switched off and SCS-V starts initialization.
- **Bit 5** releases the DPR interrupt (non-cyclic). If this bit is cleared, then the DPR generates no interrupt. The NC must now cyclically query the relevant registers in the channels.
- **Bit 6:** The level of the internal IRQ (SYNCOUT) is depicted in this bit.
- **Bit 7:** The level of the selected IRQ signal on the VMEbus is depicted in this bit. Additionally, the yellow VME LED (DL4) is switched on.

Note: All bits in control register 7 are cleared with a reset (0x00).

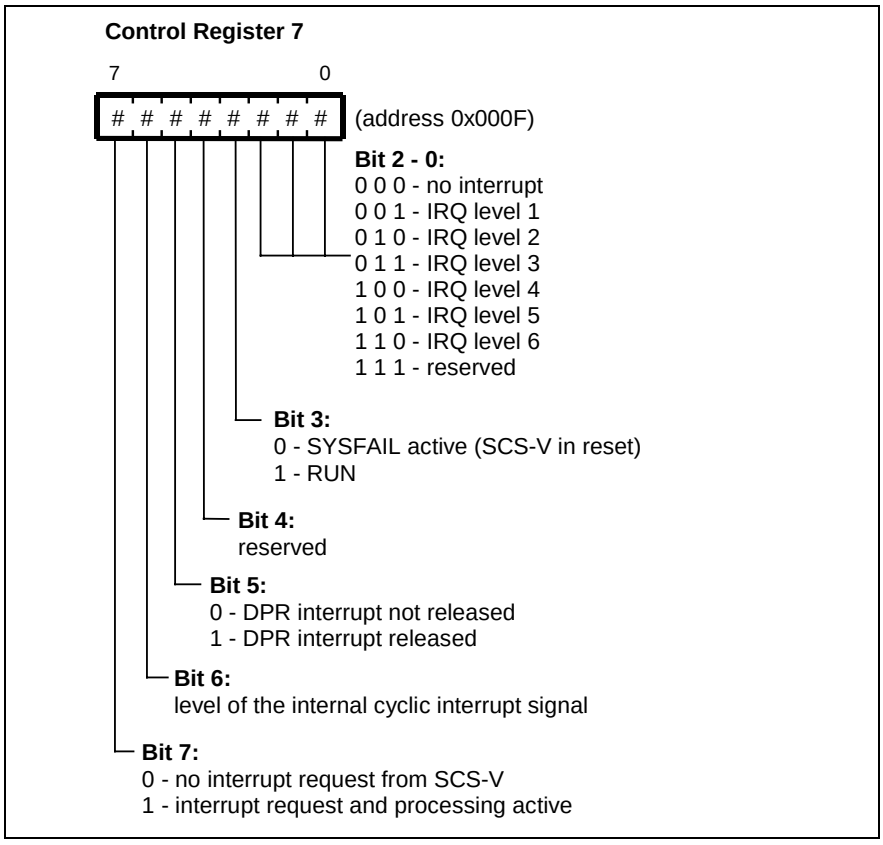


Fig. 3-10: Structure of control register 7

3.5 SCS-V02 Assembly

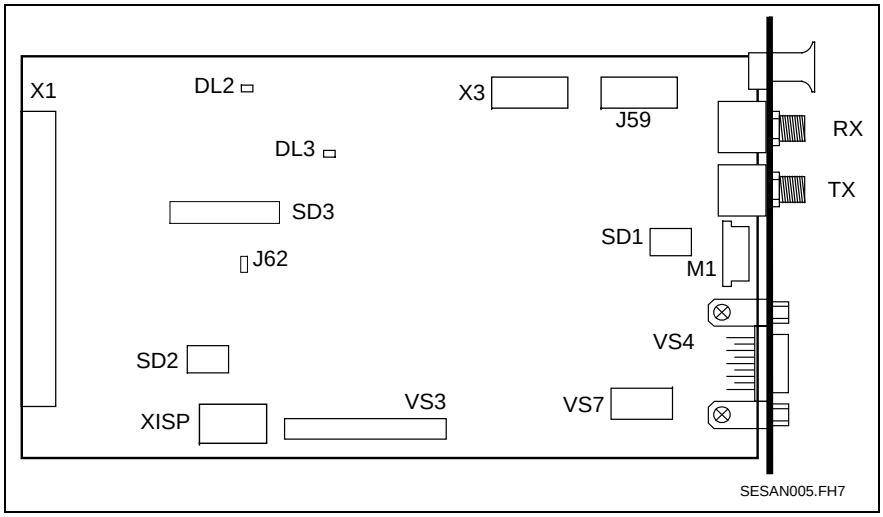


Fig. 3-11: SCS-V02 overview

Connector

J59: External Reset (see section "Reset Behavior", page 3-28)
Firmware download (see "Downloading Firmware", section 4.8)
Synchronous master/slave (see "settings")

RX: Fiber optic receiver

TX: Fiber optic transmitter

VS3: For test purposes only

VS4: Interface for user interface (RS 232) and external SYNCIN input (see "Interface for User Interface SercTop or DriveTop", page 3-37)

VS7: Monitor program interface (RS232)
(see "Monitor Program Interface", page 3-38)

X1: Connector J1/P1 of the VMEbus
For connector assignment see "Plug-In Connector X1 (SCS-V02) or J1/P1 (SCS-V01)" (section 12.5)

X3: For test purposes only

XISP: Programming connector for hardware (ispLSI)

LEDs and Displays:

DL2: LED green

see "List of Diagnostics and Error Messages" (section 5.2)

DL3: LED yellow

see "List of Diagnostics and Error Messages" (section 5.2)

M1: 7 segment display (see "List of Diagnostics and Error Messages", section 5.2)

SCS-V02.1 Versions

Hardware SCS-V02.1 is available in two versions. The only difference is the front panel.

Assembly	Front panel
SCS-V02.1A-FW	single europe format
SCS-V02.1D-FW	double europe format

Fig. 3-12: Versions of the SCS-V02.1 assembly

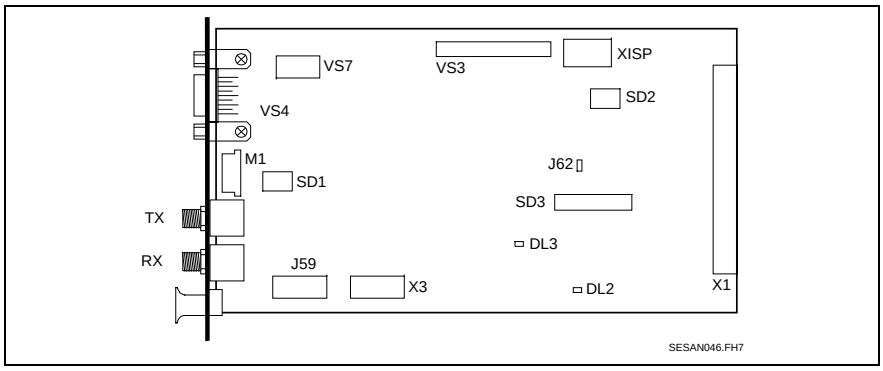


Fig. 3-13: SCS-V02.1A-FW, front panel with single height

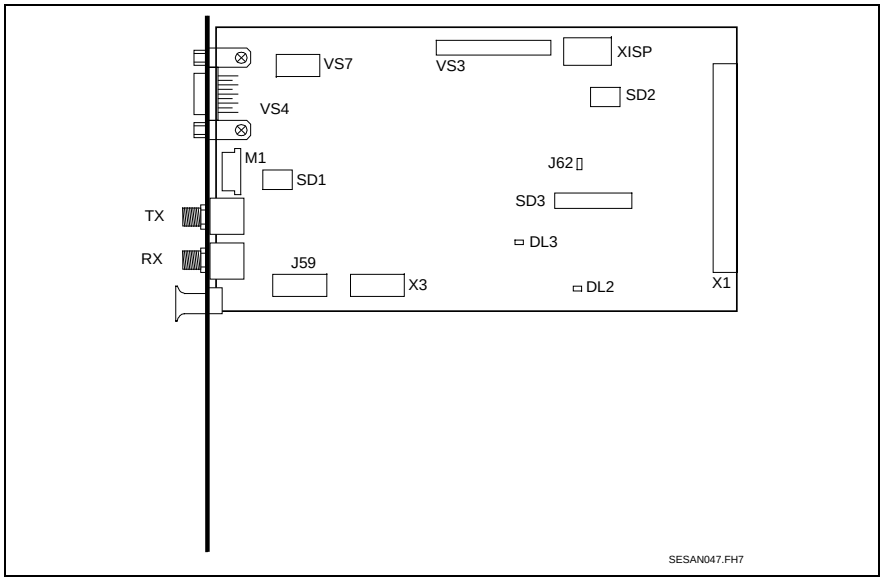


Fig. 3-14: SCS-V02.1D-FW, front panel with double height

Settings:

To operate module SCS-V the test mode must be set to normal operations, the base address and access mode must be set in the hardware. Additionally, config register 1 and 2 must be programmed by the VMEbus system.

J62: Access mode: Supervisor mode access / user mode access

a) The SCS-V assembly can only be operated with supervisor access if the VMEbus system is in supervisor mode.

Note: If supervisor access is selected, then SCS-V generates a bus error (*BERR), when accessed in user mode.

b) If the jumper is open, then the SCS-V can be operated via supervisor and user access.

Access mode	J62
a) supervisor mode only	closed
b) supervisor or user mode	open

Fig. 3-15: Supervisor access table

J59: Hardware synchronization

J59 Pin 3/4	Synchronization
closed	Synchronous master
open	Synchronous slave

Fig. 3-16: Hardware synchronization choice

SD1: Test mode

Test operation (see "Test Mode", section 3.15)

SD2.1: Reset behavior (see "Reset Behavior", page 3-28)

SD2.2: Firmware download (see "Downloading Firmware", section 4.8)

SD3: VMEbus address

The eightfold DIL switch SD3 determines the base address of the SCS-V. SCS-V occupies a memory range of 64 kB in the VMEbus system. Within the memory range, the DPR address starts at address offset 0x0, the two config registers start at address offset 0x8000.

The address decoding of the SCS-V uses addresses A16 through A23 of the VMEbus systems.

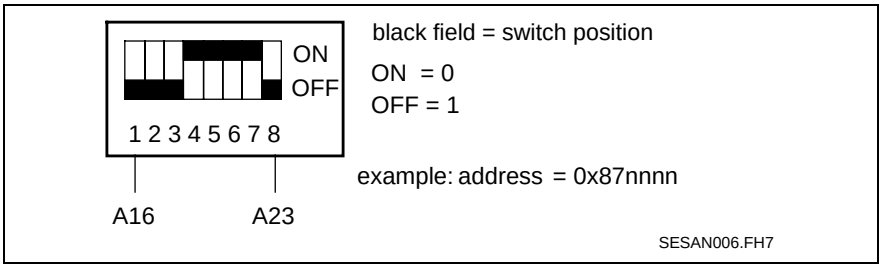


Fig. 3-17: SCS-V02 address settings

Config Register

The SCS-V02 assembly has two config register.

Config Register 1 (DPR address 0x8000)

The VME bus system has to program the vector number into config register 1. The SCS-V02 generates this vector number during an interrupt. Bit 0 must be cleared when programming the vector number.

SVS-V02 makes two vector numbers available in the config register 1 via bit 0. In the event of an interrupt request from SCS-V02, bit 0 displays wether the interrupt was triggered by the DPR via the interrupt status register or the SYNCOUT signal.

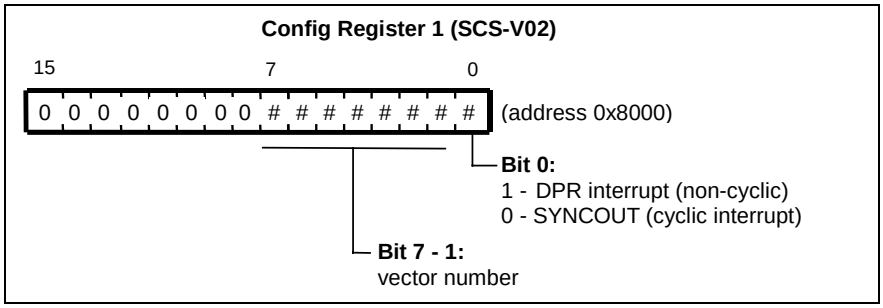


Fig. 3-18: Structure of config register 1

The config register 1 may only be accessed wordwise (16 bit access).

Config Register 2 (DPR address 0x8002)

This register supports firmware loading and module resetting.

Only bits 0 through 9 are defined in the config register 2. Bits 10 through 15 are not relevant for writing and cannot be evaluated when reading.

Bit 0: *RESET

This bit controls the reset input of the assemblies. This bit is cleared once the unit is switched on. This means that the reset status is retained until the control sets this bit.

On module SCS-V02 it is possible to switch this function off with switch SD2.1.

This means that if the switch is in OFF position, then the program is executed directly after control voltage is switched on.

See also "Reset Logic", section 3.10.

Bit 2-1: Selecting memory for program start

Address decoding on the SERCANS module for downloading firmware can be changed with these bits. After reset, SERCANS starts in the selected memory.

These bits are set to normal mode (0 1) with an automatic runup.

Bit 3: DPR interrupt for control

The logical state of the non-cyclic interrupt (DPR -> NC) is depicted in this bit.

This bit is set if SERCANS writes the interrupt status register (see "Memory Map in the Dual Port RAM", section 9).

This bit is cleared if the interrupt status register is read by the control.

If a control polls the bit cyclical, then a separate interrupt in the control is not needed.

Bit 4: DPR interrupt for SERCANS

The logical state of the non-cyclic interrupt (DPR -> SERCANS) is depicted in this bit.

This bit is set if the control writes the interrupt control register (see "Memory Map in the Dual Port RAM", section 9).

This bit is cleared if the interrupt control register is read by SERCANS.

The control can use this bit to query a non-cyclic interrupt SERCANS side. If this bit=0, then the control can set a new non-cyclic interrupt in the interrupt control register. If the bit=1, then SERCANS has not processed the previous interrupt. In this case, the control cannot set a new interrupt.

Bit 5: Non-cyclic interrupt enable

If the non-cyclic interrupt is locked, then SERCANS may not generate an interrupt via interrupt signals IRQ1 to IRQ6.

If this bit is set to "0" then the non-cyclic interrupt is disabled.

If this bit is set to "1" then the non-cyclic interrupt is enabled.

Bit 6: Cyclic interrupt enable

If the cyclic interrupt is locked, then SERCANS may not generate an interrupt via interrupt signals IRQ1 to IRQ6.

If this bit is set to "0" then the non-cyclic interrupt is disabled.

If this bit is set to "1" then the non-cyclic interrupt is enabled.

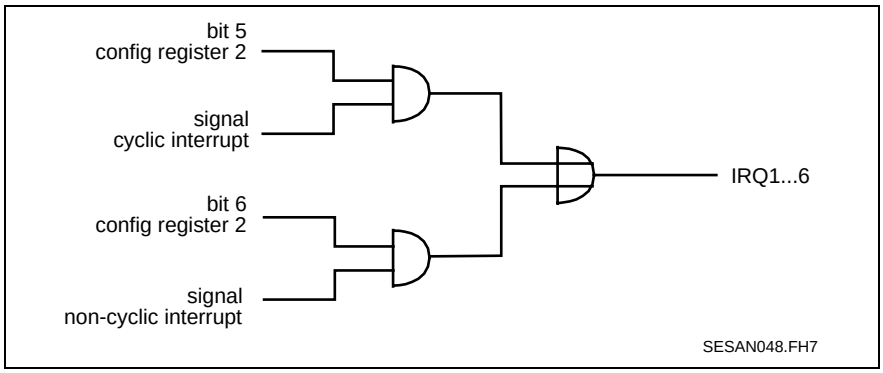


Fig. 3-19: Generating the Interrupt IRQ 1...6

Bit 9-7: Interrupt level

This bit is used to set the interrupt level.

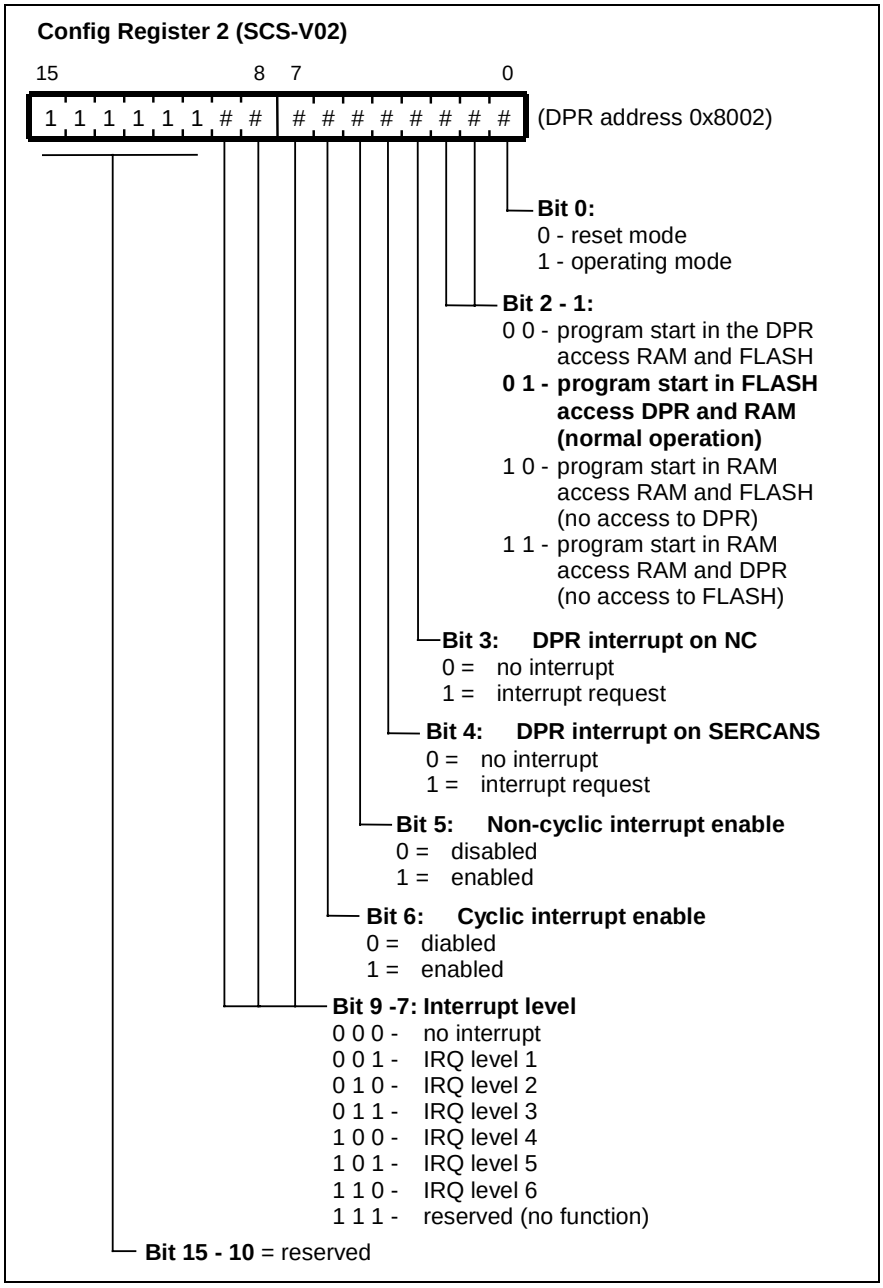


Fig. 3-20: Config register 2

To start the program in FLASH EPROM, it is necessary to write the value 0x0003 into the bits 0..2 of the config register 2. If the value 0x0000 is written into the config register 2, then the assembly is in reset mode.

The config register 2 may only be accessed wordwise (16 bit access).

3.6 SCS-P01 Assembly

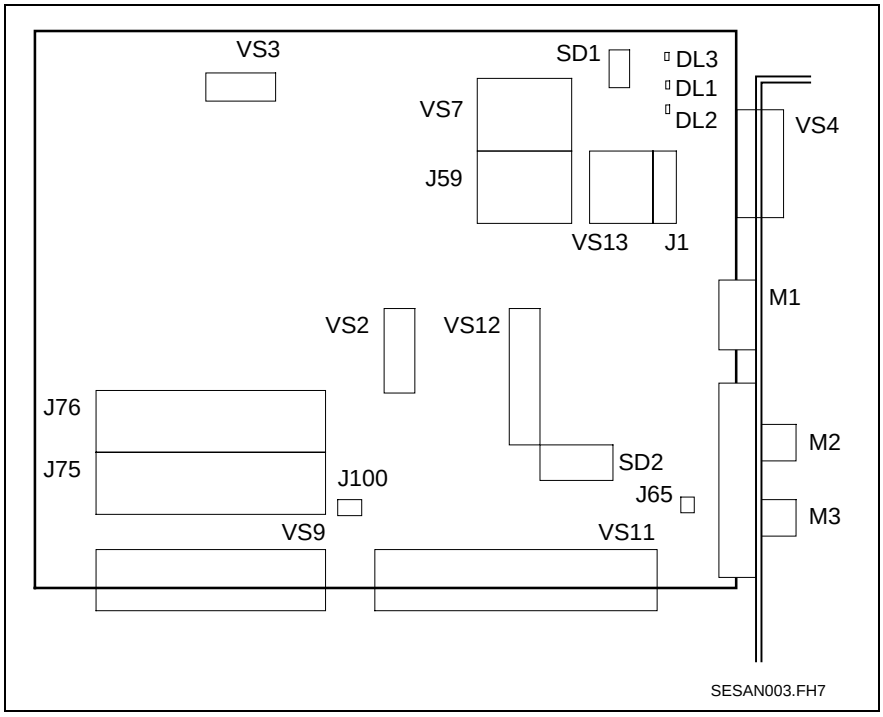


Fig. 3-21: SCS-P01 overview

Connector

J1: For test purposes only

J59: External Reset (see section "Reset Behavior", page 3-28)
Firmware download (see "Downloading Firmware", section 4.8)

M2: Fiber optic receiver

M3: Fiber optic transmitter

VS2: For test purposes only

VS3: For test purposes only

VS4: Interface for user interface (RS 232)
(see "Interface for User Interface SercTop or DriveTop", page 3-37)

VS7: Monitor program interface (RS232)
(see "Monitor Program Interface", page 3-38)

VS9: ISA-Bus connector
connector allocations (see "Plug-In Connectors VS11 and VS9 (SCS-P01)", section 12.3)

VS11: ISA-Bus connector
connector allocations (see "Plug-In Connectors VS11 and VS9 (SCS-P01)", section 12.3)

VS12: Hardware programming connector

VS13: For test purposes only

LEDs and Displays:

DL1: LED red

see "List of Diagnostics and Error Messages" (section 5.2)

DL2: LED green

see "List of Diagnostics and Error Messages" (see section 5.2)

DL3: LED yellow

see "List of Diagnostics and Error Messages" (see section 5.2)

M1: 7 segment display (see "List of Diagnostics and Error Messages", section 5.2)

Settings:

J65: The metal threads of the fiber optic cable transmitters and receivers can be connected to GND of the PC via bridge J65.

Bridge J65 may not be closed if the metal thread is connected to ground (protective earth).

J75: Selecting cyclic interrupt

Depending on the synchronization mode (see J100) the SYNCIN- or the SYNCOUT signal are assigned to one of the following interrupts:

IRQ 2, 3, 4, 5, 7, 10, 11, 12 or 15

The assigned interrupt cannot be used by any other interrupt source, e.g. other slot cards or J76 of this assembly.

J76: Selecting the non-cyclic interrupt (DPR interrupt).

The interrupt signal of the DPR can be assigned to one of the following interrupts via a jumper:

IRQ 2, 3, 4, 5, 7, 10, 11, 12 or 15

The assigned interrupt cannot be used by any other interrupt source, e.g. other slot card or J75 of this assembly.

J100: Synchronous master/slave

Jumper J100 is on the solder side of the printed circuit board.

J100	synchronization
closed	master
opened	slave

Fig. 3-22: Selection hardware synchronization

SD1: Test mode

Test operation (see "Test Mode", section 3.15)

SD2: Base address (segment address)

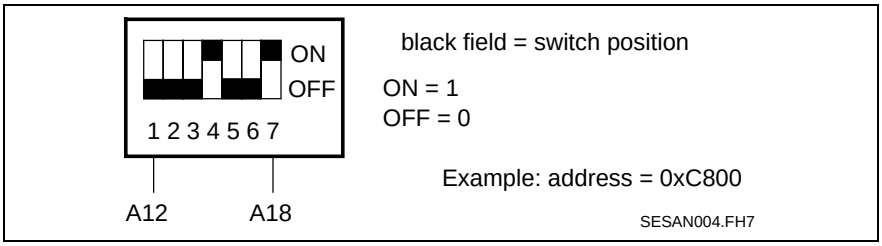


Fig. 3-23: SCS-P01 address settings

The sevenfold DIL switch SD2 sets the base address in the PC address range. Within the PC, the SCS-P occupies a memory of 4 Kbytes beyond the DOS storage range of 640 K in the first megabyte.

The segment address can be set in the range of 0xA000 to 0xEF00.

The basis address can be set with the following steps: 0xA000, 0xA100, 0xA200, ...

Switch 7 (A18) is always opened via the circuit-board conductor (J68). This means that the address range from 0xA000 through 0xBF00 can only be set if this circuit-board conductor (J68) is bridged.

The set address range can be cut off if expanded memory is used in the CONFIG.SYS as follows:

Example: DEVICE = EMM386.EXE X = C800 - C8FF

PC Control Register

The SCS-P01 assembly has two control register:

- the PC ident register and
- the PC control register

Both control registers are in the DPR.

PC Ident Register (DPR address 0xFF8)

This register identifies the module within the address range of the PC.

Once the PC reads the register, the assembly switches into ident mode. The value 0xFFF4 is in the PC ident register.

While in ident mode, the PC reads the same value, i.e., 0xFFF4, over the entire dual port ram.

The PC uses this to find assemblies and to determine the size of the dual port ram.

Ident mode is switched off by access of the PC control register.

The PC ident register may only be accessed wordwise (16 bit access).

PC Control Register (DPR address 0x0FFA)

This register supports firmware loading and module reset.

Only bits 0 through 3 are defined in the PC control register. Bits 4 through 15 are not relevant for writing. They supply the value of "1" when reading.

Bit 0: *RESET

This bit controls the reset of the assemblies. This bit is cleared once the unit is switched on. This means that the reset status is retained until the PC sets this bit.

Bit 2-1: Select memory for program start

Address decoding on the SERCANS module for downloading firmware can be changed with these bits. After reset, SERCANS starts in the selected memory.

Bit 3: DPR interrupt for control

The logical state of the non-cyclic interrupt (DPR -> NC) is depicted in this bit.

This bit is set if SERCANS writes the interrupt status register (see "Memory Map in the Dual Port RAM", section 9).

This bit is cleared if the interrupt status register is read by the control.

If a control polls the bit cyclical, then a separate interrupt in the control is not needed.

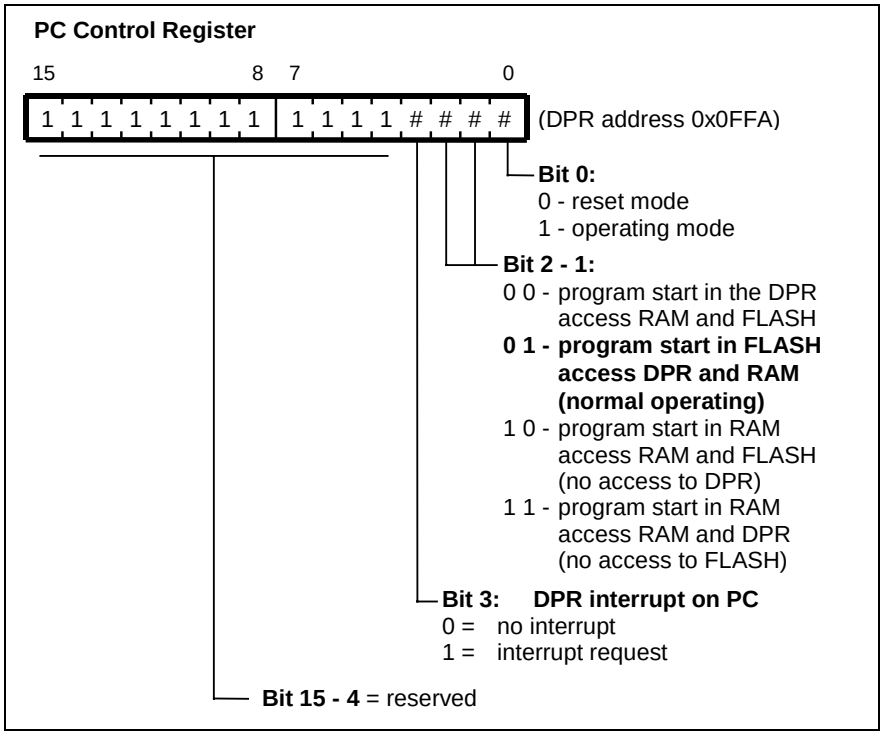


Fig. 3-24: PC control register

To start the program in FLASH EPROM, it is necessary to write the value 0x0003 into the PC control register. If the value 0x0000 is written into the PC control register, then the assemblies are in reset mode.

The PC control register may only be accessed wordwise (16 bit access).

3.7 SCS-P02 Assembly

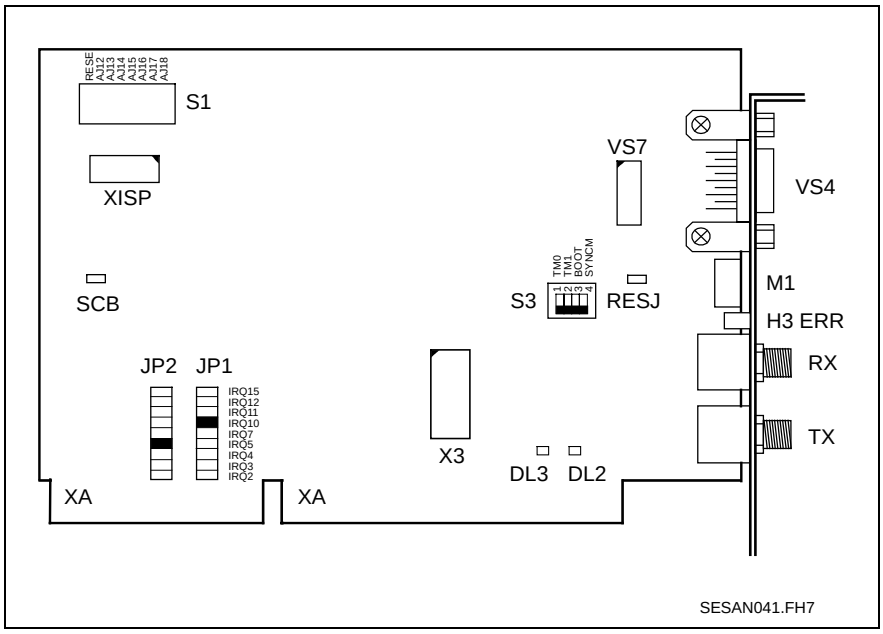


Fig. 3-25: SCS-P02 overview

Connector:

RESJ: External reset (see section "Reset Behavior", page 3-28)

RX: Fiber optic receiver

TX: Fiber optic transmitter

X3: For test purposes only

XISP: Programming connector for hardware (ispLSI)

VS4: Interface for user interface (RS 232)
(see "Interface for User Interface SercTop or DriveTop", page 3-37)

VS7: Monitor program interface (RS232)
(see "Monitor Program Interface", page 3-38)

LEDs and Displays:

DL2: LED green
see "List of Diagnostics and Error Messages" (section 5.2)

DL3: LED yellow
see "List of Diagnostics and Error Messages" (section 5.2)

M1: 7 segment display (see "List of Diagnostics and Error Messages", section 5.2)

H3 ERR: Distortion display (see "List of Diagnostics and Error Messages", section 5.2)

The LED diode is a display for a distorted optical signal at receiver input (RX) which can, for example, be caused by under or over control.

Settings:

JP1: Selecting cyclic interrupt

Depending on the synchronization mode (see S3.4) the SYNCIN or the SYNCOUT signal are assigned to one of the following interrupts:

IRQ 2, 3, 4, 5, 7, 10, 11, 12 or 15

The assigned interrupt cannot be used by any other interrupt source (e.g., other slot cards or JP2 of this assembly).

JP2: Selecting the non-cyclic interrupt (DPR interrupt).

The interrupt signal of the DPR can be assigned of the following interrupts via a jumper:

IRQ 2, 3, 4, 5, 7, 10, 11, 12 or 15

The assigned interrupt cannot be used by any other interrupt source (e.g., other slot cards or JP1 of this assembly).

SCB: Selecting cyclic interrupt (*SCB)

Can be connected to ISA bus, contact D15 (DRQ7 of ISA bus). This means that, in addition to JP1, another signal can be used as clock input or output of the PLC P card. In this case, JP1 should be left open.

S1.1-S1.7: Base address (segment address)

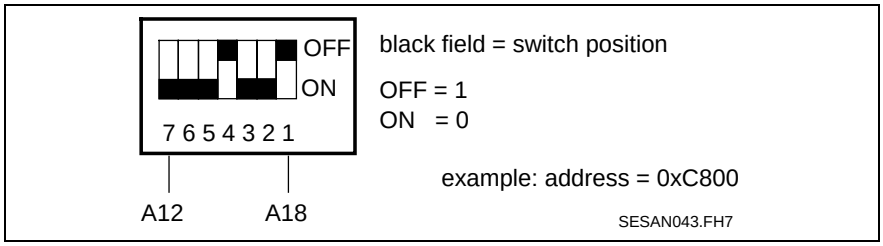


Fig. 3-26: SCS-P02 address settings

The eightfold DIL switch S1 sets the base address in the PC address range. Within the PC the SCS-P02 occupies a memory range of 4 Kbytes beyond the DOS storage range of 640 K in the first megabyte.

The segment address can be set in the range of 0xA000 to 0xEF00.

The base address can be set with the following steps (0xA000, 0xA100, 0xA200, ...).

Switch 1 (A18) is always opened via the circuit-board conductor (J68). This means that the address range from 0xA000 through 0xBF00 can only be set if this circuit-board conductor (J68) is bridged.

The set address range can be cut off if expanded memory is used in the CONFIG.SYS as follows:

Example: DEVICE = EMM386.EXE X = C800 - C8FF

S1.8: Reset behavior (see "Reset Behavior", page 3-28)

This means that if the switch is in OFF position, then the program is started up immediately after the control voltage is switched on.

S1.8	Reset behavior
open	program starts immediately after control voltage is switched on
closed	program started after bit 0 was set in PC control register

Fig. 3-27: Reset behavior

S3.1/2: Test mode

Test mode (see "Test Mode", section 3.15)

Test mode	S3.1 (TM0)	S3.2 (TM1)	optical signal output
normal mode	off	off	telegram
zero bit stream	on	off	1 MHz or 2 MHz
steady light	off	on	steady light

Fig. 3-28: Test mode

S3.3: Firmware download (see "Downloading Firmware", section 4.8)

S3.3 (BOOT)	Firmware download
open	normal mode
closed	firmware download via VS4

Fig. 3-29: Firmware download

S3.4: Hardware synchronization of the assembly

S3.4 (SYNCM)	synchronization behavior
open	Synchronous slave
closed	Synchronous master

Fig. 3-30: Hardware synchronization

PC Control Register

The SCS-P02 has two control register:

- the PC ident register and
- the PC control register.

Both control registers are in the DPR.

PC Ident Register (DPR address 0xFF8)

This register identifies the module within the address range of the PC.

Once the PC reads the register, the assembly switches into ident mode. The value 0xFFF4 is in the PC register. While in ident mode, the PC reads the same value (0xFFF4) over the entire dual port ram. The PC uses this to find assempblies and to determine the size of the dual port ram.

Ident mode is switched off by accessing the PC control register (see below).

The PC ident register may only be accessed wordwise (16 bit access).

PC Control Register (DPR address 0xFFA)

This register supports firmware loading and module reset.

Only bits 0 through 4 are defined in the PC control register. Bits 5 through 15 are not relevant for writing and may not be evaluated when reading.

Bit 0: *RESET

This bit controls the reset of the assemblies. This bit is cleared once the unit is switched on. This means that the reset status is retained until the PC sets this bit.

On module SCS-P02 it is possible to switch this function off with switch S1.8.

This means that if the switch is in OFF position, then the program is executed directly after control voltage is switched on.

Also see "Reset Logic", section 3.10.

Bit 2-1: Select memory for program start

Address decoding on the SERCANS module for downloading firmware can be changed with this both bits. After reset, SERCANS starts in the selected memory.

These bits are set to normal mode (0 1) with an automatic runup.

Bit 3: DPR interrupt for control

The logical state of the non-cyclic interrupt (DPR -> NC) is epicted in this bit.

This bit is set if SERCANS writes the interrupt status register.

This bit is cleared if the interrupt status register is read by the control.

If a control polls the bit cyclical, then a separate interrupt in the control is not needed.

Bit 4: DPR interrupt for SERCANS

The logical state of the non-cyclic interrupt (DPR -> SERCANS) is depicted in this bit.

This bit is set if the control writes the interrupt control register (see "Memory Map in the Dual Port RAM", section 9).

This bit is cleared if the interrupt control register is read by SERCANS.

The control can use this bit to query a non-cyclic interrupt SERCANS side. If this bit=0, then the control can set a new non-cyclic interrupt in the interrupt control register. If the bit =1, then SERCANS has not processed the previous interrupt. In this case, the control cannot set a new interrupt.

Bit 15-5: reserved

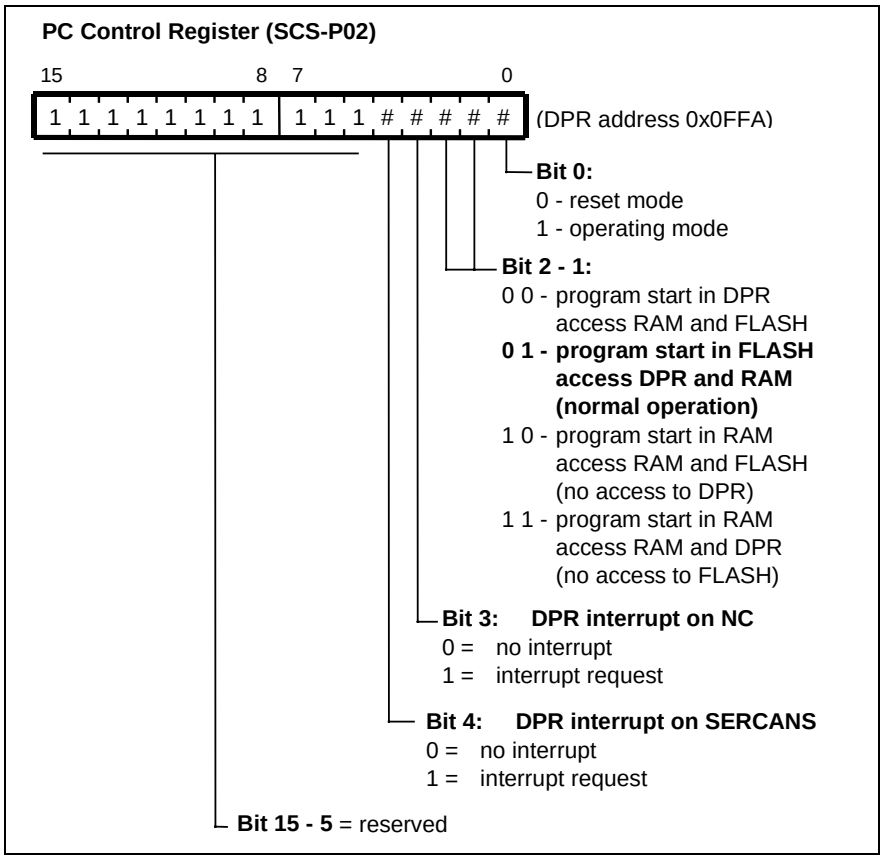


Fig. 3-31: PC control register

To start program in FLASH EPROM, it is necessary to write the value 0x0003 into PC control register. If the value 0x0000 is written into the PC control register, then the assembly is in reset mode.

The PC control register may only be accessed wordwise (16 bit access).

3.8 PCI Assembly

A SERCANS compatible PCI module can be obtained from SICAN GmbH.

For detailed information about this module, contact SICAN GmbH, Richard-Wagner-Straße 1, 38106 Braunschweig.

3.9 SERCOS interface

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

The SERCON410B IC processes the SERCOS interface communication.

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

Fiber Optic Connections

The SCS-A assembly supports two mounting variations:

a) The fiber optic components with standardized F-SMA connections are mounted to the assembly (e.g., SCS-A02.1A-FW).

b) A connector (VS1) is mounted to the assembly instead of the fiber optic components. This option uses an additional flat-ribbon cable and an LWL module (LSE3) to connect the fiber optic cable (e.g., SCS-A02.1B-FW).

Cycle Times

SERCANS is capable of 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. 3-32: Cycle times

- **command value channel:** position command and torque limit values
- **actual value channel:** actual position and torque values.

Note: The present conventional slaves generally only support cycle times of 0.5 ms, 1ms, 2ms, 3ms, and so on.

3.10 Reset Logic

Reset Behavior

Runup behavior (see Fig. 3-34: Reset behavior) after powering up can be set with switch "reset behavior" (see Fig. 3-33: Selection of reset behavior).

Assembly	Reset behavior switch
SCS-A01.1 SCS-P01.1 SCS-V01.1 SCS-A01.2 SCS-P01.2 SCS-V01.2	not available
SCS-A02.1	SD2.1
SCS-P02.1	S1.8
SCS-V02.1	SD2.1

Fig. 3-33: Selection of reset behavior

Reset behavior	Switch position
Automatic runup to set target phase	open
SERCANS remains in reset until start via config register 2 or PC control register is completed	closed

Fig. 3-34: Reset behavior

An external reset can be connected to **J59, pin 5 or RESJ** during the developmental stage. A low level at this input resets this assembly.

Reset Timing

The reset input must remain at low level for at least 5µs for it to be detected by the reset logic and for it to be properly processed. Given a proper reset, SERCANS generates an internal reset for approximately 35 resp. 500 ms. SERCANS then starts initialization, which takes about 150 ms. Upon completion of the initialization time, there are valid values in the DPR and the control can read data and system parameters out of the DPR.

Assembly (hardware-version, Y-0-0008)			Reset timing
SCS-A01.1	SCS-P01.1	SCS-V01.1	500 ms
SCS-A01.2 SCS-A02.1	SCS-P01.2 SCS-P02.1	SCS-V01.2 SCS-V02.1	35 ms

Fig. 3-35: Reset Timing of the different assemblies

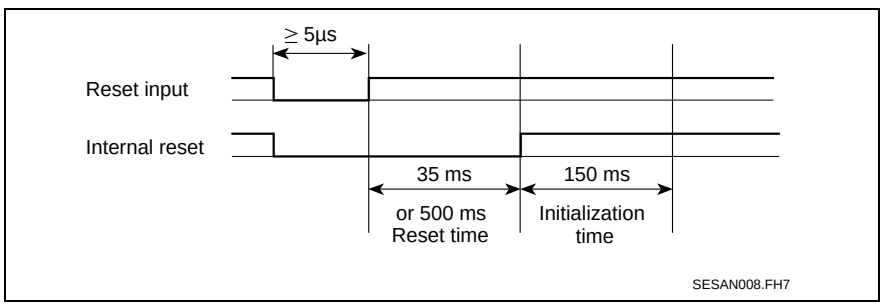


Fig. 3-36: Reset Timing

3.11 Synchronization

There are two hardware signals to make synchronization between the NC control and SERCANS possible. For SERCANS to run properly it is necessary to activate one of the two signals via a system parameter.

A synchronization monitoring with error counter is integrated to detect an access conflict in the DPR.

Using the lifecounter function, the NC control and SERCANS can cyclically monitor each other.

Hardware Synchronization

Hardware synchronization differentiates between synchronous master mode and slave mode.

case a) **"SYNCIN":** The control synchronizes SERCANS

case b) **"SYNCOUT":** SERCANS synchronizes the control

With synchronous master (case b) the signal "SYNCOUT" must be used and with synchronous slave (case a) signal "SYNCIN" must be used.

The possible synchronization modes and relevant settings for the SERCANS assemblies are listed in Fig. 3-37.

	SYNC Master Standard setting	**SYNC Slave**
SCS-A01.1 SCS-A01.2 SCSA02.1	Y-0-0002 = 0 Signal output: SYNCOUT via X1/X2	Y-0-0002 = 1 Signal input: SYNCIN via X1/X2
SCS-P01.1	Select IRQ via jumper on J75 Y-0-0002 = 0 Signal output: SYNCOUT via VS9/VS11	not possible
SCS-P01.2	Select IRQ via jumper on J75 Y-0-0002 = 0 J100 closed Signal output: SYNCOUT connected with the selected IRQ on connector VS9/VS11	Select IRQ via jumper on J75 Y-0-0002 = 1 J100 open Signal input: selected IRQ on connector VS9/VS11 connected to SYNCIN
SCS-P02.1	select IRQ via bridge JP1 Y-0-0002 = 0 SD3.4 closed Signal output: SYNCOUT connected with the selected IRQ on ISA bus	Select IRQ via bridge JP1 Y-0-0002 = 1 SD3.4 open Signal input: selected IRQ on ISA bus2 connected with SYNCIN
SCS-V01.1 SCS-V01.2	IRQ level via VME-selected control register 7 vector number in VME control register 6	not possible

	Y-0-0002 = 0 Signal output: SYNCOUT connected with the selected IRQ on connector P2	
SCS-V02.1	select IRQ level via config register 2 and vector number in config register 1 must be programmed Y-0-0002 = 0 J59 Pin 3/4 closed Signal output: SYNCOUT connected with the selected IRQ on connector X1	Select IRQ level via config register 2 and vector number in config register 1 must be programmed lock cyclic IRQ in config register 1 Y-0-0002 = 1 J59 Pin 3/4 open Signal input: SYNCIN via VS4

Fig. 3-37: Synchronization modes

SERCANS calculates the system parameters based on the communication parameters and the command/actual value configuration

- "DPR access time command value" (Y-0-0010) and
- "DPR access time actual value" (Y-0-0037).

If SERCANS detects an overlapping of these two parameters (Y-0-0010 and Y-0-0037), then the diagnosis "copy times too long" with the fault code 0xF006 is generated.

Taking the "NC access time" (Y-0-0038) SERCANS calculates the "displacement" (Y-0-0006) between the signal "SYNCIN" or "SYNCOUT" and the master synchronization telegram (MST).

Since NC access time is determined by the control or via user interface, there is the possibility of shifting the point in time of command/actual value transmission in the DPR an thus optimumly set it. The "NC-cycle time" (Y-0-0038) may not be programmed greater than the "SERCOS cycle time" (Y-0-0004).

The actual values are transmitted by the drives into the drive telegram (ATn) to SERCANS.

The command values in all drives are transmitted in the master data telegram (MDT).

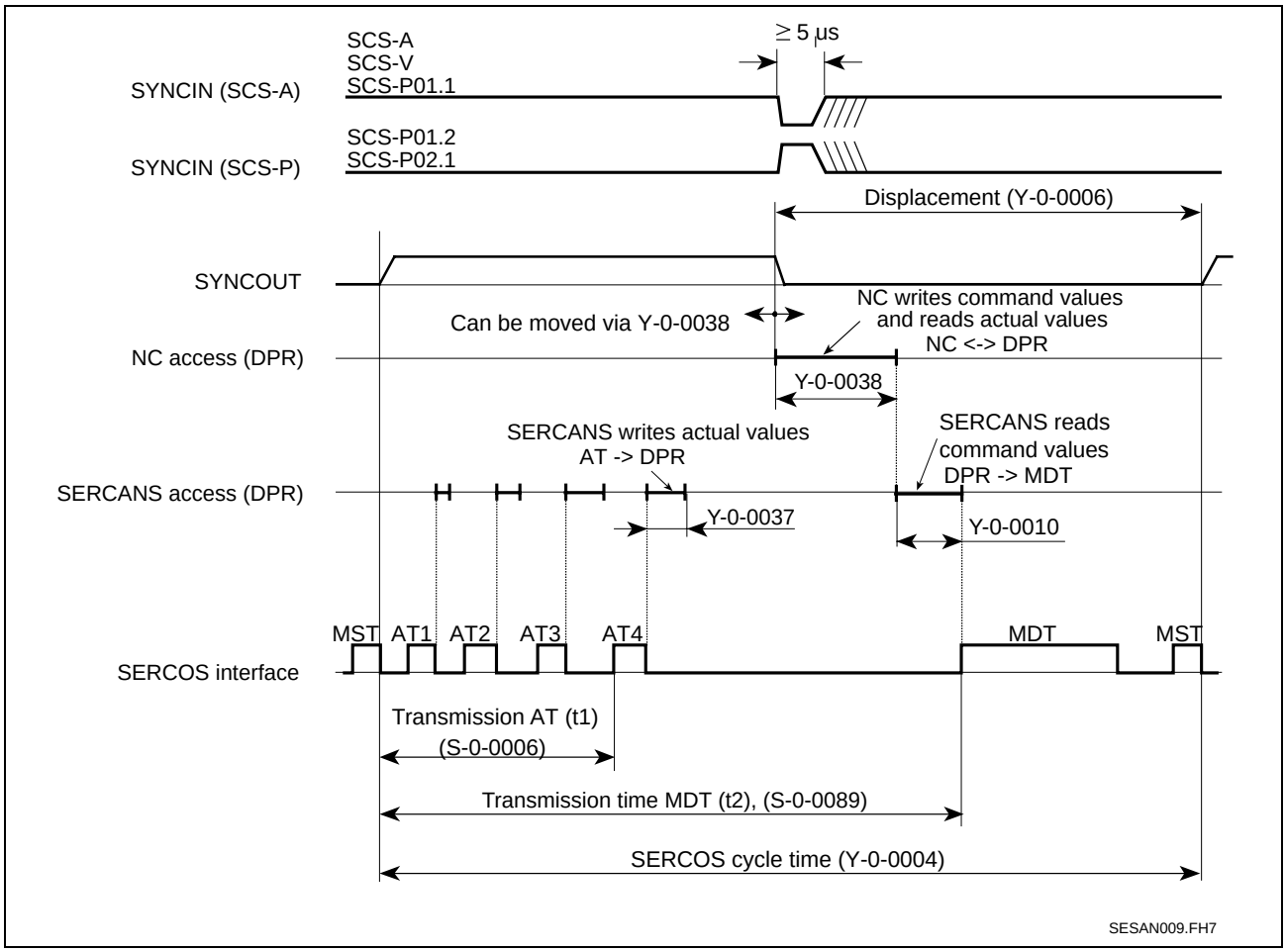


Fig. 3-38: Synchronization (case a and b)

The synchronization output SYNCOUT is at low level with reset.

Timing of the SYNCIN Signal

1. The time of the SYNCIN signal must agree with the programmed SERCOS cycle time (tSCYC).
   The maximum deviation of SERCOS cycle time may not exceed ± 100ppm.
   tSYNCIN = tSCYC x (1 ± 0,0001)
2. The jitter of the active edge of the SYNCIN signal may not exceed 5µs.
3. The pulse width (low or high) must exceed 5µs.

Hardware Synchronization of several SERCANS Assemblies

As SERCANS only has a limited number (8) of drives it can support, it may be that a control requires several SERCANS assemblies.

How hardware synchronization with SERCANS actually functions, is outlined in Fig. 3-39 to Fig. 3-44. The illustration is exemplary.

The control generates a cyclic interrupt and processes several SERCANS modules in this interrupt.

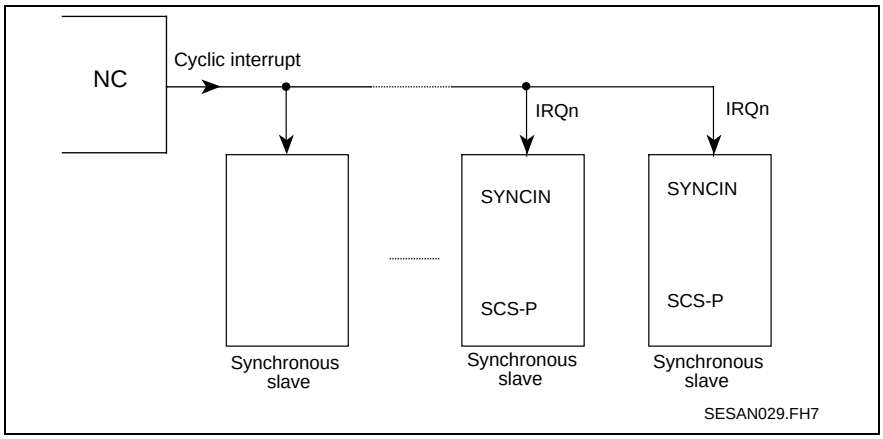


Fig. 3-39: Synchronous slave mode (SCS-A, SCS-P)

The control reacts to a cyclic interrupt and processes several SERCANS modules in this interrupt.

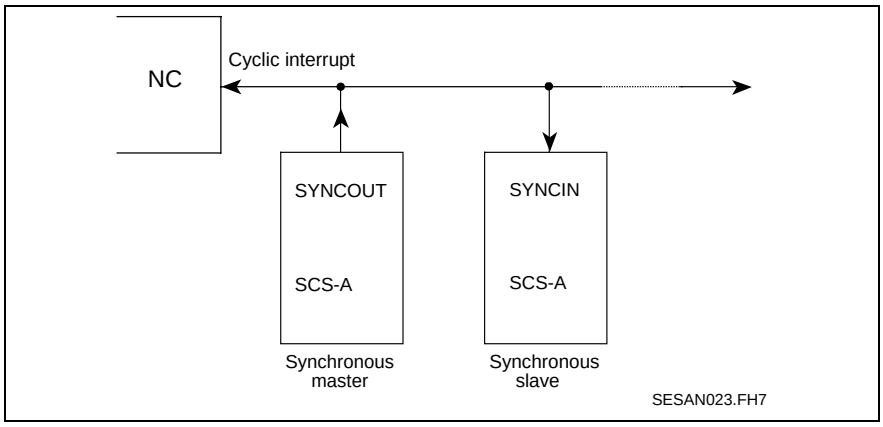


Fig. 3-40: Synchronous master/slave (SCS-A).

The PC reacts to two cyclic interrupts and processes a SERCANS module in each interrupt.

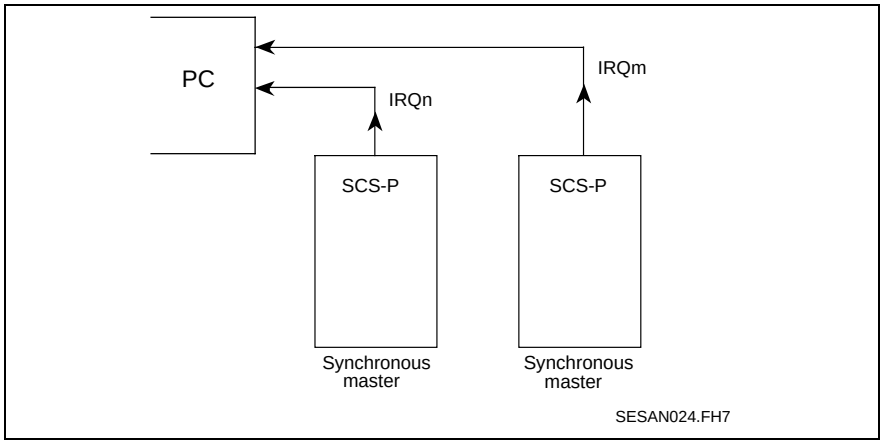


Fig. 3-41: Synchronous master (SCS-P).

The PC reacts to a cyclic interrupt and processes several SERCANS module in this interrupt.

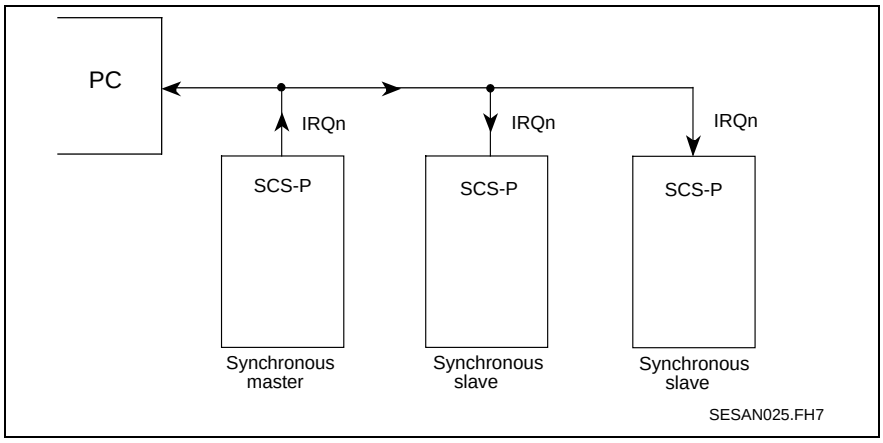


Fig. 3-42: Synchronous master/slave (SCS-P).

The VMEbus control reacts two cyclic interrupts and processes a SERCANS module in each interrupt.

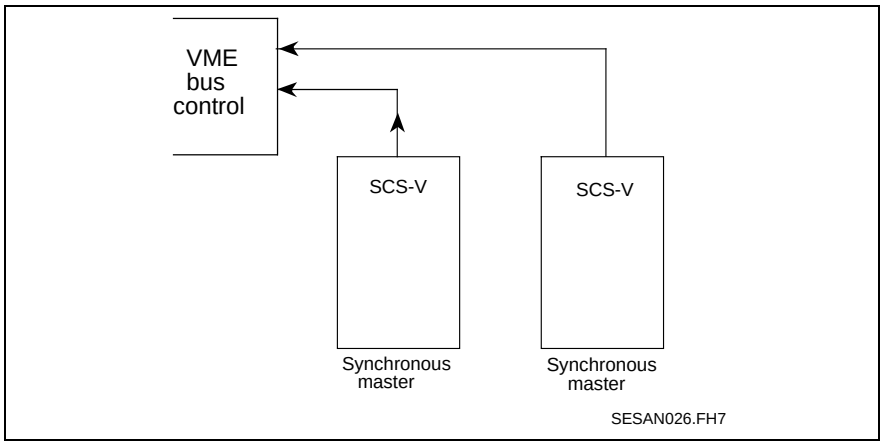


Fig. 3-43: Synchronous master (SCS-V).

The VMEbus control reacts one cyclic interrupts and processes a SERCANS module in several interrupts.

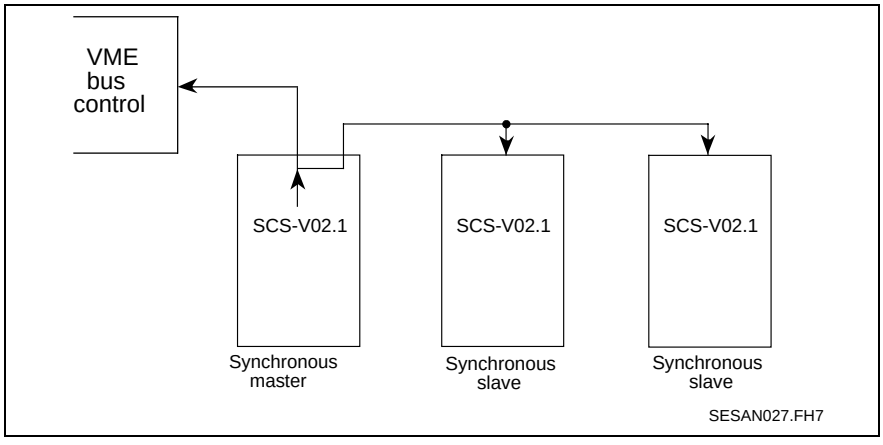


Fig. 3-44: Synchronous master/slave (SCS-V).

If the synchronization in all drives must take place at precisely the same time in an application, then the "displacement" (Y-0-0006) must have the same value in all SERCANS modules. The displacement can be set in terms of NC access time.

1. First, each SERCANS module determines NC access time.
2. Then the entire NC access time of the control must be determined from the sum of the individual NC acces times and programmed into all modules.
3. Switch SERCANS into communication phase 3 and reading the displacement of all assemblies.
   After this, the NC access times must be set so that the displacement is identical in all SERCANS modules. This requires that the greatest displacement is determined and the difference of the other displacements added onto the relevant NC access time.
4. Switch SERCANS into communication phase 2 and adjust NC acces times.

Example

NC access time	Module 1/2/3	= 300µs

this equals the following displacements based on the various command and actual values:

Displacement	Module 1	= 630µs
Displacement	Module 2	= 720µs
Displacement	Module 3	= 580µs
Greatest Displacement		= 720µs
Difference displacement	Module 3	= 720-580 = 140µs
Difference displacement	Module 1	= 720-630 = 90µs

For the synchronization to take place in all drives at the same time, the NC access time of module 3 must be set to 440µs (300 + 140); module 1 must be programmed to 390µs (300 + 90). The NC access time of module 2 is not changed.

After changing the NC access time in modules 1 and 3, the displacement in all modules must equal 720 µs.

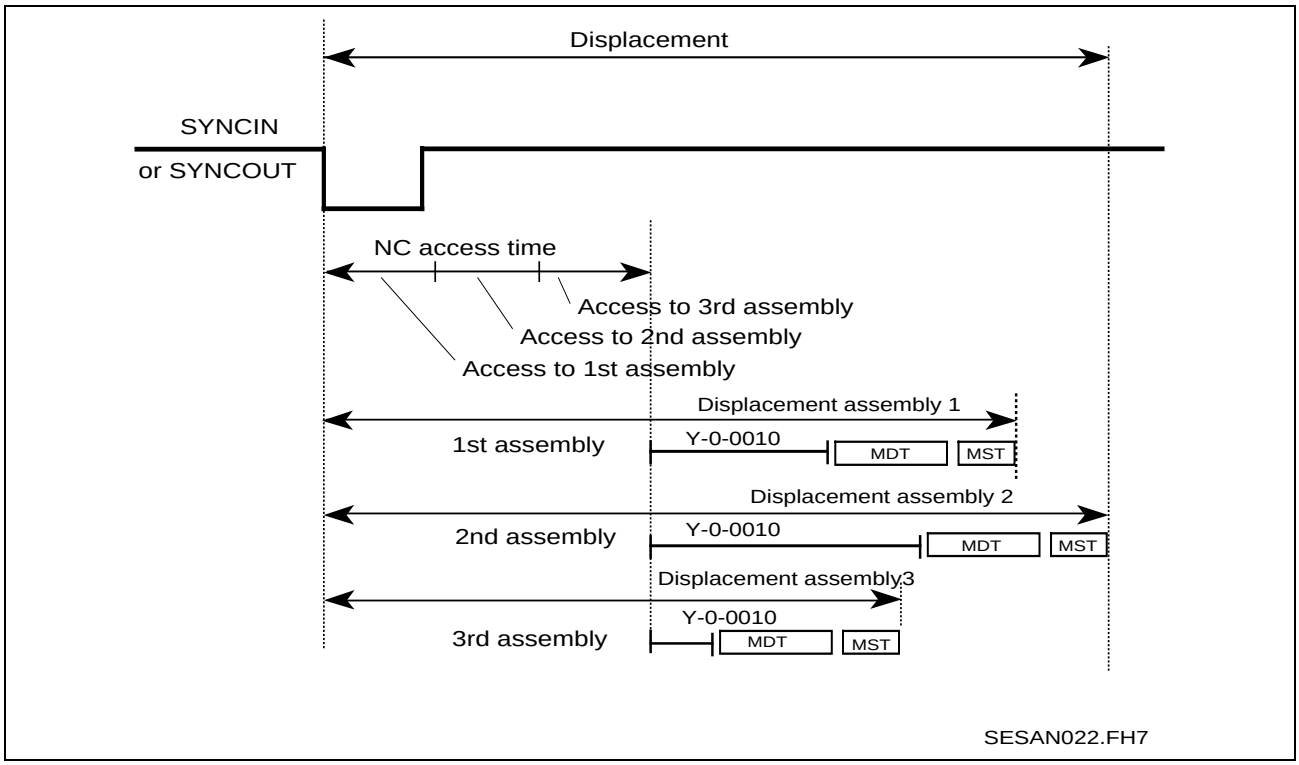


Fig. 3-45: Synchronization with several assemblies

Synchronization Monitoring

Using synchronization monitoring, SERCANS determines wether the control has written the command and actual values into the DPR on time.

The following is needed for this function

- SYNC register (DPR address 0x0FF6) and the
- "SYNC error counters" (Y-0-0043).

The synchronization monitoring is conducted on SERCANS once during each NC cycle in phase 4.

SERCANS:

Prior to copying the command values (Y-0-0010), SERCANS checks the SYNC register for value of 0xAA55. SERCANS then writes the value of 0x0 into the SYNC register. If the check is negative, then the SERCANS increases the "SYNC error counter" (Y-0-0043) by 1. No further diagnosis is generated.

NC:

After all command values (Y-0-0038) have been written into the DPR, the control must enter the value 0xAA55 into the SYNC register. If the control does not support this function, then the error counter SYNC runs through to 65535 and remains at this value.

Note: If the control supports this function and the error counter SYNC counts upwards, then the "NC access mode" (Y-0-0038) has not been correctly set. The timely access of the control and the duration of the access in the DPR must be checked. The NC access time must be increased until the SYNC error counter no longer counts upwards.

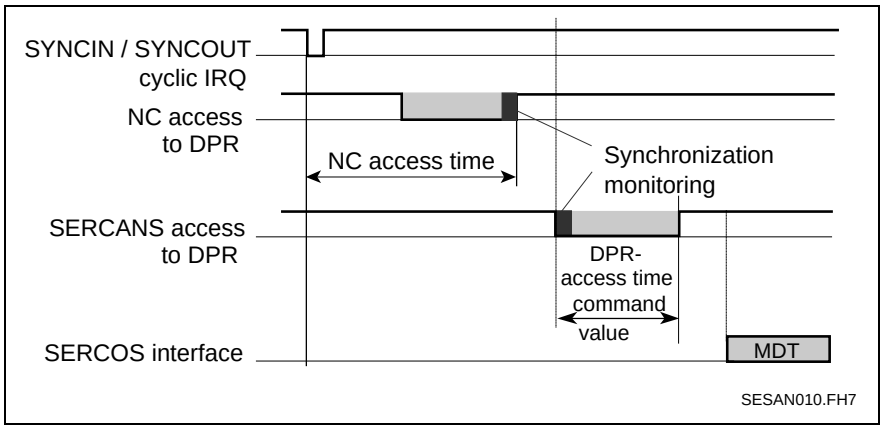


Fig. 3-46: Synchronization monitoring

Lifecounter

With the lifecounter function both the NC control and SERCANS are able monitor each other. There are three parameters available for this:

- Y-0-0018 Lifecounter difference
- Y-0-0019 Lifecounter SERCANS
- Y-0-0020 Lifecounter NC

Both the NC control and the SERCANS each have a lifecounter.

With the lifecounter difference, the monitor on SERCANS is either switched off (input = 0) or the permissible difference between both lifecounters is determined.

If a difference has been programmed, e.g. input = 5, then the monitor on SERCANS runs once in each NC cycle in phase 4.

Lifecounter must be executed by the NC every SERCOS cycle independent of Y-0-0004 and Y-0-0005.

Note: For parameters Y-0-0018**,** Y-0-0019 and Y-0-0020 the interrupt "system parameter changed" need not be set in the interrupt control register. The entered values are immediately valid (see "Control Commands in Interrupt Register", section 6.2).

SERCANS:

After the command values have been copied (Y-0-0010), SERCANS increases the lifecounter SERCANS by 1 and then compares it with the lifecounter NC. If the difference is greater than the lifecounter difference, then SERCANS switches to phase 0 and generates the system error 0xF005 (see "Definition of Error Messages", section 5.4).

NC:

The NC control must compare lifecounter NC and SERCANS after the transmission of the command and actual values (Y-0-0038) into the DPR and then increase the lifecounter NC by 1.

If the difference is greater than the lifecounter difference, then the NC control can activate its own error routine.

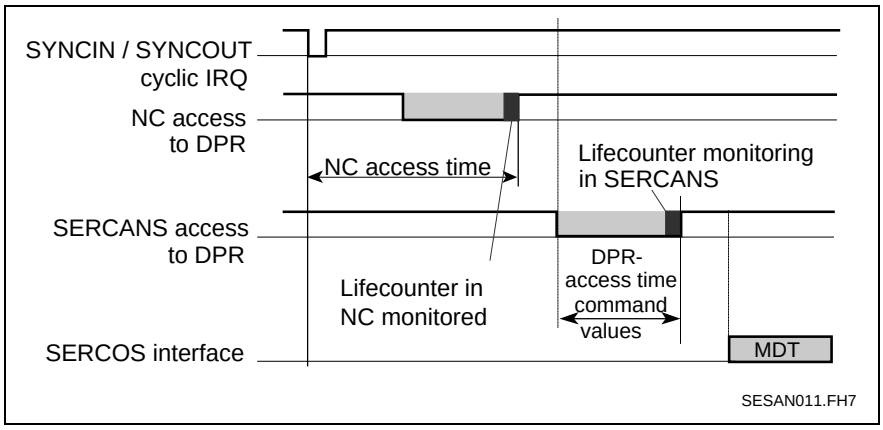


Fig. 3-47: Lifecounter

3.12 Asynchronous Serial Interfaces

The assembly supports two asynchronous serial interfaces (RS232) on the plug-in connectors VS4 and VS7.

Interface for User Interface SercTop or DriveTop

This interface communicates via the plug-in connector VS4 with the user interface.

Plug-in connector type (VS4): 9-pin D-SUB bushing

Plug-in connector assignment (VS4):

Pin	Name	Direction	Function
1	n.c.	—	no connections
2	TXD	output	TXD output
3	RXD	input	RXD input
4	n.c.	—	no connections
5	GND	—	ground refe-rence
6	n.c.	—	no connections
7	n.c.	—	no connections
8	n.c.	—	no connections
9	n.c.	—	no connections

Fig. 3-48: Interface for user interface

Note: The direction of the pins is depicted from the SERCANS perspective!

Note: With the SCS-V01.2 module, the SYNCIN signal is connected at VS4/pin 8 and the SYNCIN-OV signal at VS4/pin 9.

A connecting cable to operate SERCANS with SercTop must be used as illustrated in Fig. 3-49.

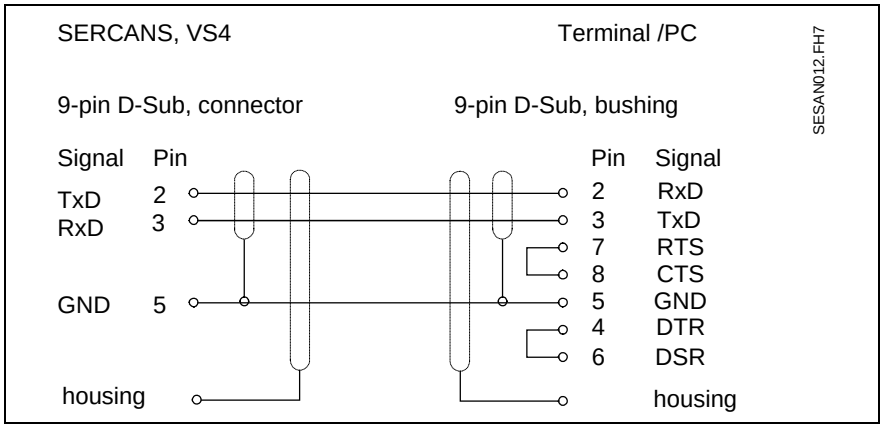


Fig. 3-49: Plug-in connector assignment (connecting cable SYSDA02.1)

Monitor Program Interface

A monitor program uses this interface via plug-in connector VS7 and permits not only read but also write access to each storage cell of the DPR. In addition, with its help, the systems parameters from the DPR can be saved to the parameter EEPROM.

Note: After downloading a new firmware version (e.g. before FWA-SERCAN-SER-02VRS-MS, after FWA-SERCAN-SER-04VRS-MS) it is necessary to reprogram the hardware type with the monitor program (see "Downloading Firmware", section 4.8).

An ASCII terminal can be connected to these asynchronous serial interfaces for the initial start up of this assembly.

The monitor program uses only ASCII symbols. CR, LF, BS, XON and XOFF are used as control symbols.

The interface has the following settings which cannot be changed:

Data rate	9600
Data bits	8
Stop bits	1
Parity	no
Protocol	XON/XOFF

Fig. 3-50: Setting monitor program interfaces

Plug-in connector assignment (VS7):

Pin	Name	Direction	Function
1	n.c.	—	no connections
2	n.c.	—	no connections
3	TXD	output	TXD output
4	n.c.	—	no connections
5	RXD	input	RXD input
6	n.c.	—	no connections
7	n.c.	—	no connections
8	n.c.	—	no connections
9	GND	—	ground reference
10	n.c.	—	no connections

Fig. 3-51: Pin assignment

Note: The direction of the pins is depicted from the SERCANS perspective!

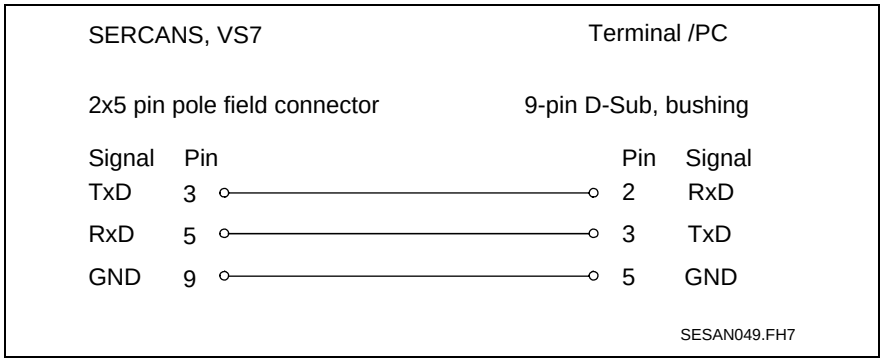


Fig. 3-52: Monitor program interface cable

3.13 Diagnoses and Error Displays

There is a display module (M1) and two LEDs (DL2 and DL3) for diagnostics purposes on the assembly. The M1 is made up of a 7 segment display and a rectangular red LED.

The definition of the shown errors are detailed in section 5.2 "List of Diagnostics and Error Messages".

3.14 Dual Port RAM

The exchange of data between SERCANS and the control is conducted via a dual port RAM (DPR). Types 71321, 71421 and 7024 with an access time of 55ns from IDT are used. With SCS-A there is a 16 bit data bus driver (74HCT245) between the DPR and plug-in connector X1 resp. X2. The technical data for read or write cycles are listed in the data sheets of the used DPRAMs. All signals have TTL level.

The DPR has a storage capacity of 2 Kx16 and has an internal interrupt logic.

By writing the address (0xFFE) (interrupt register), an interupt is triggered on the SERCANS side. By reading the address (0xFFC) by SERCANS the interrupt request is cleared.

Accessing the DPR can only be wordwise (2 bytes) or long wordwise (4 bytes). All memory accesses must be on even addresses. Byte accesses are not allowed.

Note: Odd addresses in the DPR may not be accessed!

A busy signal is generated with a simultaneous accessing of the same address (DTACK).

3.15 Test Mode

Test mode is set when either the optical power or the signal distortion are to be measured.

In normal mode, the state of the test mode switch (SD1 or S3) is cyclically queried. If the test modes for "continuous light" or "zero bit stream" are selected by this switch, then the software sets the selected mode. If normal mode is switched into from test mode, then a phase runup is performed.

Test mode	SD1/S3 switch 1	SD1/S3 switch 2	Optical signal output
normal mode	off	off	telegram
zero bit stream	on	off	1 MHz or 2 MHz
continuous light	off	on	continuous light

Fig. 3-53: Test mode

Note: Test mode is assumed independent of the respective operating state without further queries or checks.

4 Firmware Functions

4.1 Firmware Structure

Normal operating mode is determined by the firmware and the NC control unit. Depending upon the control commands and the data in the DPR, the firmware conducts initialization, phase runup, the cyclic exchange of real-time data, parameter transmissions, diagnostics messages and/or commands.

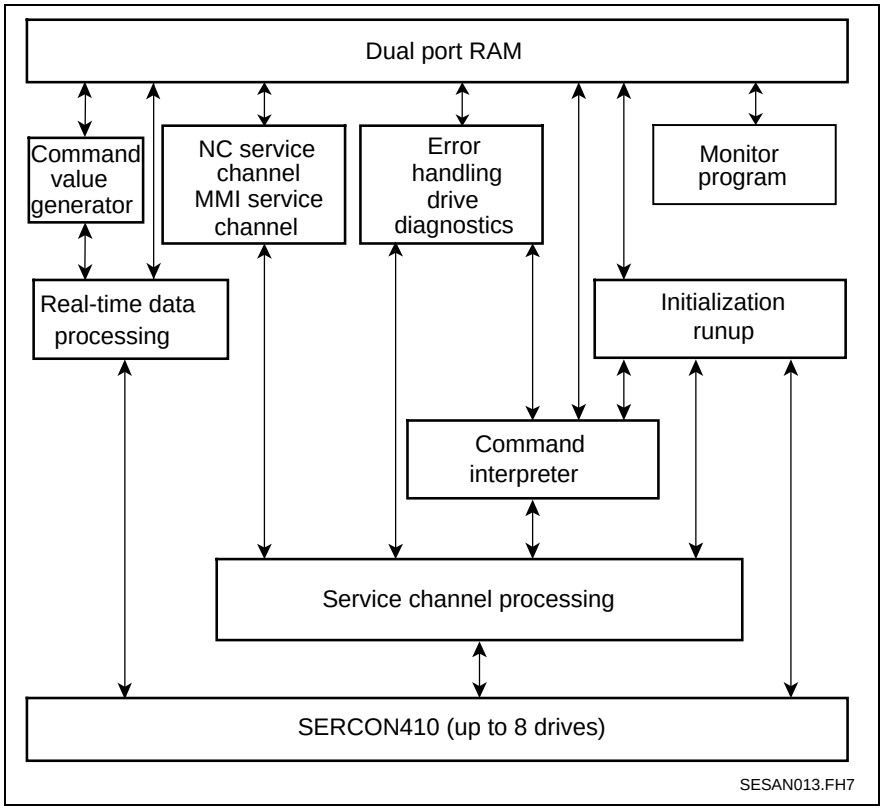


Fig. 4-1: SERCANS firmware structure

4.2 Real-Time Data Processing

Real-time data processing works independently of all other function blocks. It assists in the exchange of cyclic operating data between the SERCOS interface (SERCON410) and the DPR. It is cyclically activated by the SERCON410. The synchronized access to the DPR is set by the system parameter "NC access time" (Y-0-0038).

4.3 Monitor Program

The monitor program can access every storage location of the DPR and save the system parameters into the EEPROM. An ASCII terminal must be connected to the asynchronous serial interface of the assembly to be able to use the monitor program.

4.4 Drive Diagnostics

The drive diagnostic block uses the command interpreter and service channel processing to execute its functions. All drive-specific diagnostic display procedures are executed by the drive diagnostic function block.

4.5 Initialization

This function block performs initialization dependent upon the system parameters found in the DPR. Initialization uses the command interpreter and service channel processing for phase runup. SERCANS automatically switches up into the communication phase set in phase initiation.

Self Test

The following tests are executed after a reset (time **B** in the init diagram):

- program storage (EPROM): Checksum test
- serial EEPROM: Checksum test
- main memory (RAM): RAM test
- dual port RAM: RAM test
- SERCON 410B: RAM test
- The system parameters are copied from EEPROM to the DPR. At time **C** there are valid data in the DPR (see init diagram).
- SERCANS waits the programmed length of time (Y-0-0007) (time **D**).

SERCANS then switches into communication phase 0.

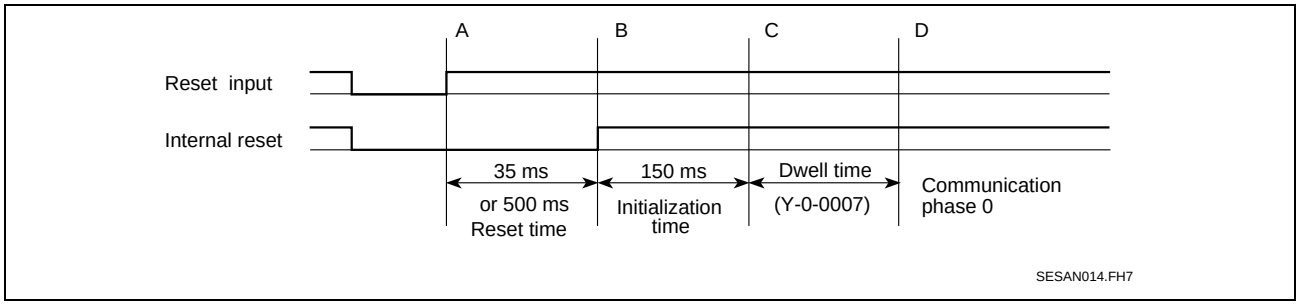


Fig. 4-2: Init diagram

Note: It is urgently necessary to write values into the system parameters via the NC control unit or the serial interface (user interface) and that these are then stored in the EEPROM!

After initialization, the NC can access the DPR.

Communication Phase 0

System status, Y-0-0015 Close fiber optic ring: "system status" = 0x0000

SERCANS 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 SERCANS can switch into communication phase 1.

Communication Phase 1

System status, Y-0-0015 Drive identification: "System status" = 0xE002

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

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

System error, Y-0-0011 If SERCANS detects a difference between the programmed drive addresses and those addresses on the ring, then the system error is set to 0x8005.

Communication Phase 2

System error, Y-0-0015 Parameter mode: "System status" = 0xE003

In phase 2 SERCANS permits the transmission of parameters via the NC-/MMI service channel or the user interface. If the control or the user interface generates the transition from phase 2 to 3, then SERCANS 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 either the NC control unit or via 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 read 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.
- SERCANS calculates the time slot.
- The calculated communication parameters are transmitted to the drives.
  S-0-0001 tNcyc
  S-0-0002 tScyc
  S-0-0006 t1
  S-0-0089 t2
  S-0-0008 t3
  S-0-0007 t4
- SERCANS transmits the parameters for the telegram structure to the drives (S-0-0009, S-0-0010, S-0-0015, S-0-0016 and S-0-0024).
- The command "reset class 1 diagnostics" (S-0-0099) is executed.
- The changeover command (S-0-0127) is executed.

System status, Y-0-0015 If SERCANS was able to switch into communication phase 3, then system status is set to 0xE004.

Diagnostics status If changeover phase 2 -> 3 was not possible, then in those axes structures which signalled an error, the diagnostics status is set to 0xD002.

The display M1 shows "E".

Communication Phase 3

System status, Y-0-0015 Parameter mode: "System status" = 0xE004

In phase 3 SERCANS permits the transmission of parameters via the NC-/MMI service channel or user interface. If the control or user interface generates the transition of phase 3 to phase 4, then SERCANS conducts the following operations:

- Changeover command (S-0-0128) is executed.

System status, Y-0-0015 If SERCANS was not able to switch into communication phase 4, then the system status is set to 0xE005.

Diagnostics status If the changeover phase 3 -> 4 was not possible, then in those axes structures which signalled an error, the diagnostics status is set to 0xD003.

The display M1 shows "F".

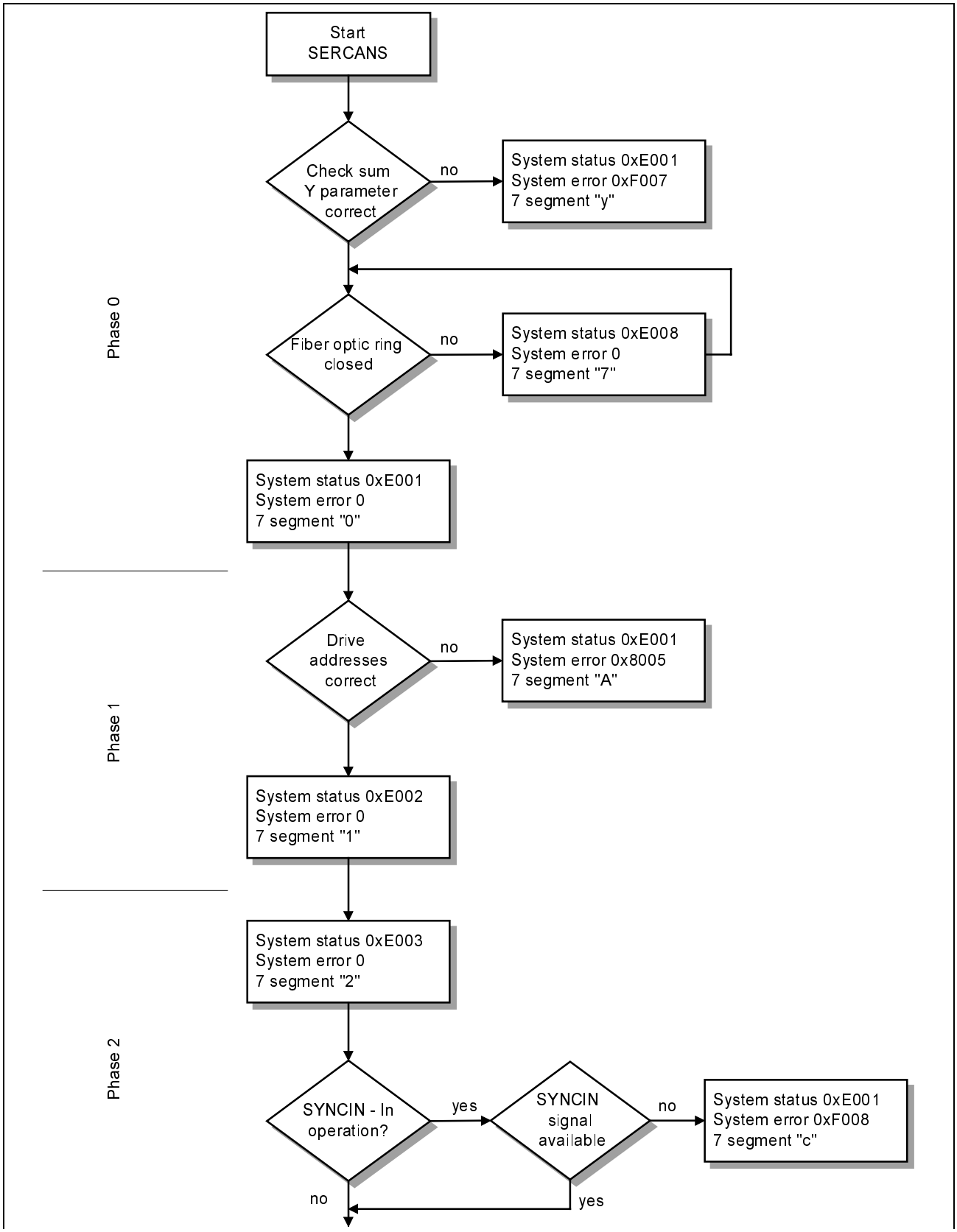
Communication Phase 4

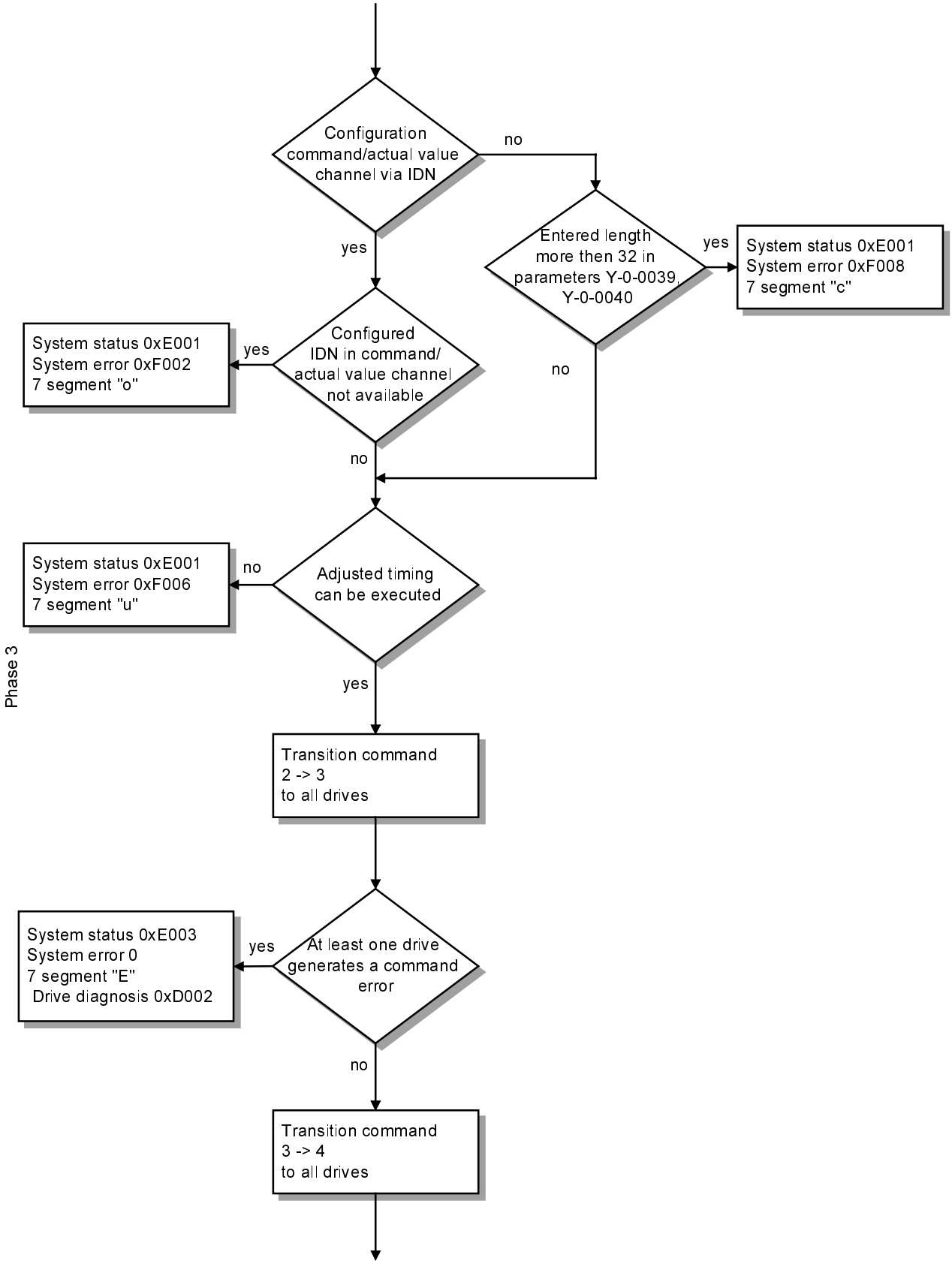
System status, Y-0-0015 Operating mode: "System status" = 0xE005

In communication phase 4 command and actual values are valid.

It is possible to transmit parameters via the NC/MMI service channel or user interface.

Runup with Occuring Errors




Phase 3
Configuration command/actual value channel via IDN
no
yes
Entered length more then 32 in parameters Y-0-0039, Y-0-0040
yes
System status 0xE001
System error 0xF008
7 segment "c"
no
Configured IDN in command/ actual value channel not available
yes
System status 0xE001
System error 0xF002
7 segment "o"
no
Adjusted timing can be executed
no
System status 0xE001
System error 0xF006
7 segment "u"
yes
Transition command
2 -> 3
to all drives
At least one drive generates a command error
yes
System status 0xE003
System error 0
7 segment "E"
Drive diagnosis 0xD002
no
Transition command
3 -> 4
to all drives

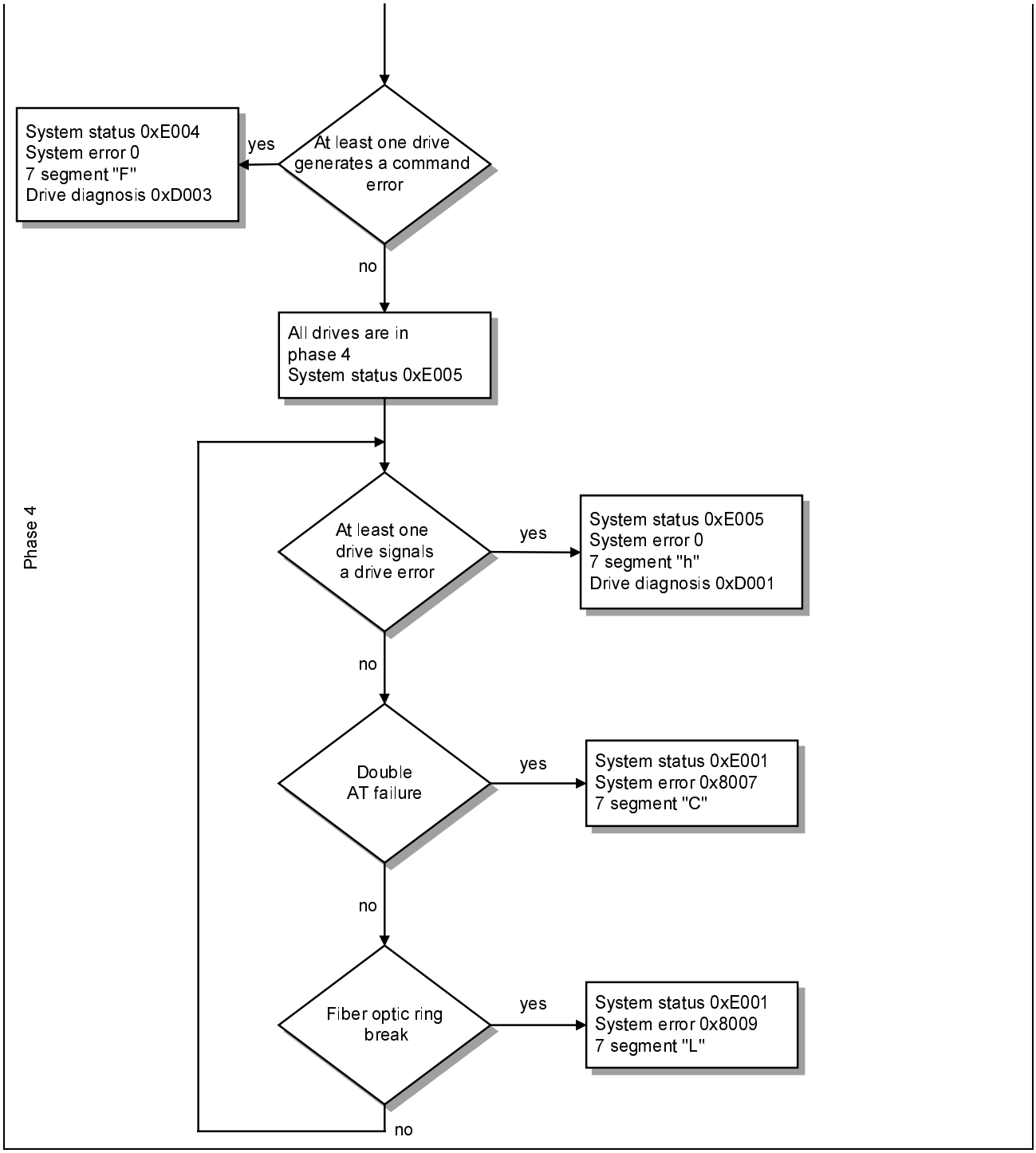


Fig. 4-3: Runup with occuring errors

4.6 Command Interpreter

The command interpreter executes all commands for the drive diagnostics, the initialization (phase runup) and the drive-specific command channels. It uses the functions made available by service channel processing.

4.7 Service Channel Processing

Service channel processing is used for the exchange of parameter data between the drives and the assembly and to execute commands. It supports up to eight drive-specific service channels.

These are

- eight NC service channels
- eight command channels
- eight diagnostics channels and
- the MMI service channel.

4.8 Downloading Firmware

Firmware can be downloaded into SERCANS either over the serial interface (VS4) or the dual port RAM.

The table below outlines the download options of each hardware version.

Hardware version	Downloading over VS4	Downloading over DPR
SCS-A01.1	not possible (EPROM version)	not possible (EPROM version)
SCS-A01.2	see "Downloading via Serial Interface (VS4)"	not possible
SCS-A02.1	see "Downloading via Serial Interface (VS4)"	possible with user program
SCS-P01.1 SCS-P01.2 SCS-P02.1	see "Downloading via Serial Interface (VS4)"	see "Downloading via DPR"
SCS-V01.1	not possible (EPROM version)	not possible (EPROM version)
SCS-V01.2	see "Downloading via Serial Interface (VS4)"	not possible
SCS-V02.1	see "Downloading via Serial Interface (VS4)"	possible with user program

Fig. 4-4: Downloading options

Downloading via Serial Interface (VS4)

Downloading

Downloading with the use of a serial interface implements a load program (Pshell). This load program is included in the firmware updates (e.g., SWA-SERCAN-SER-02VRS-MS-C1,44-FLASH) and comes on a disk.

- The following must be set before the first "Down-Load":
- Start the load program Pshell and select the menu point "Options":

Fig. 4-5: Settings before the first download

In setting point "load 2nd level" the file "PI.hex" must be set in the respective installation directory.

Running the Download

The following steps must be complied with when loading a new firmware via the serial interface into the SERCANS module:

- Save all Y parameters.
- SERCANS is brought into boot mode for the firmware download. To do so, the module is switched off and BOOT mode is set (see Fig. 4-7). Also set reset behavior (see "Reset Logic", section 3.10) to "automatic runup".
- The module is in boot mode once powered up.
- Activate load program Pshell. In menu item "file", execute "connect" to establish connection to the SERCANS module.

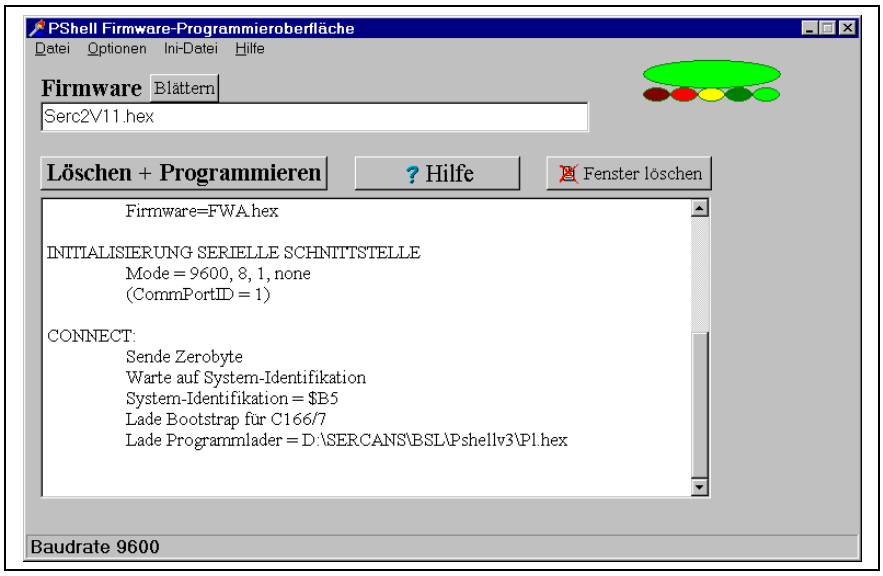


Fig. 4-6: Connection with SERCANS assembly

Assembly	Jumper/switch
SCS-A01.1 SCS-P01.1 SCS-V01.1 SCS-A01.2 SCS-P01.2 SCS-V01.2	J59, pin7/pin8
SCS-A02.1 SCS-V02.1	SD2.2
SCS-P02.1	SD3.3

Fig. 4-7: Settings of the BOOT mode

Note: The value $B5 or $D5 must be signalled back as a form of system identification.

- With "clear flash", clear the flash memory.

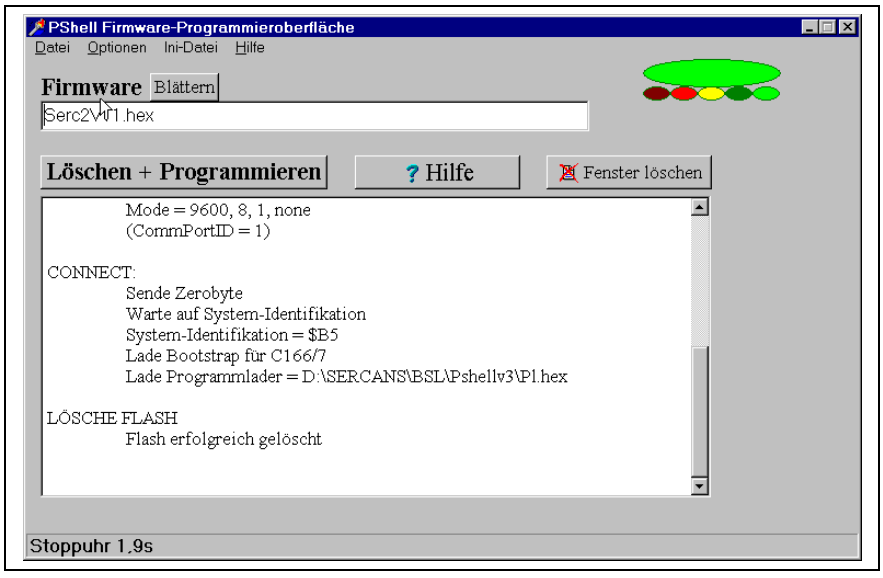


Fig. 4-8: Clear flash memory

- Using firmware "sheet" select the correct firmware file (ex.: SERC401.HEX).

- Using "programming" load the selected firmware file.

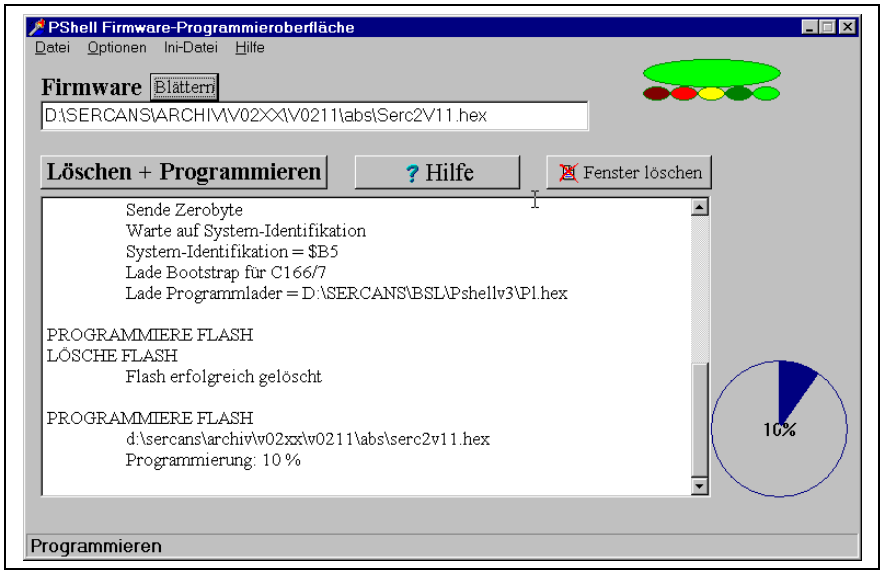


Fig. 4-9: Load firmware file

- It takes about five minutes to load via the serial interface. The loading process is displayed in terms of a % value.

Important!

- **Once downloading is completed, the jumper at J59 has to be removed or switch SD2.2 or SD3.3 opened.**

Note: It may be necessary to reload the Y parameters after the firmware has been downloaded.
The hardware type may have to be reset via a monitor program.

Downloading via DPR

With some SERCANS modules, the firmware can be loaded over the DPR (see Fig. 4-4: Downloading options).

The program needed in this case, or partial program with order, are supplied and come on disks.

Downloading with SCS-P

The PC modules SCS-P are outfitted with a loading program (SERCPC2) that is DOS capable.

Entering "SERCPC2" brings up a help menu.

The set base address of the module can be determined by entering SERCPC2 *.

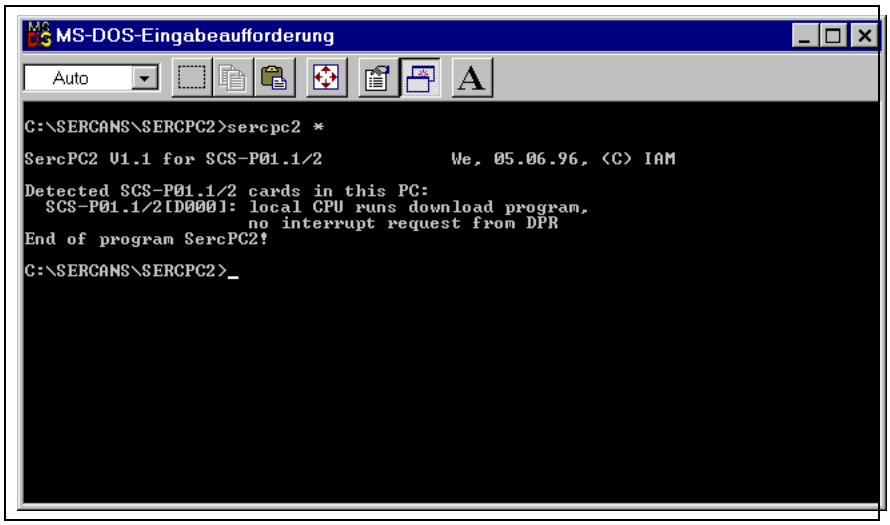


Fig. 4-10: Determing base address

Loading is initiated with

SERCPC2 <base address> FLASH: firmware file.

Once loading is finished, the program is automatically started. No further settings have to be made.

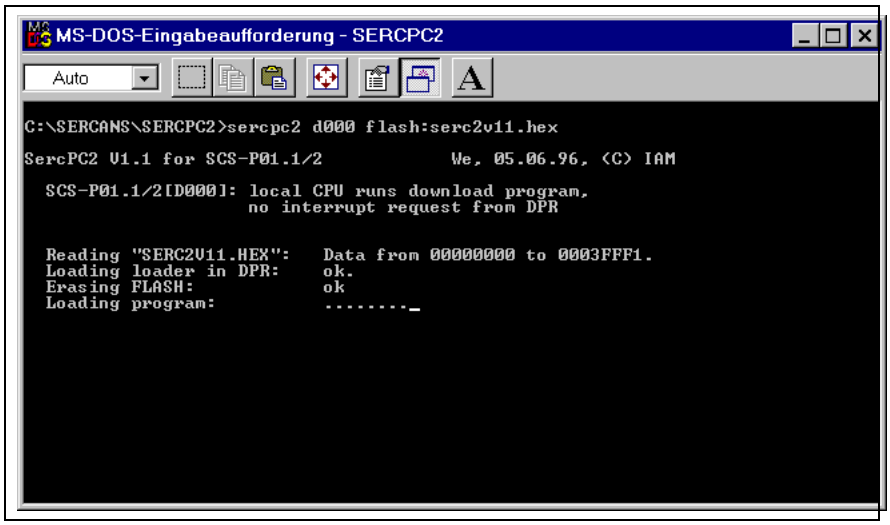


Fig. 4-11: Initiate loading

Downloading with SCS-A and SCS-V

The order and the partial programs are made available for modules SCS-A and SCS-V. The user has to program the order and the different ways of loading into the DPR.

5 Diagnostics and Error Messages

5.1 Overview:

In the event of certain faults or exceptional situations, the program branches into specific error routines with defined responses:

Internal error

The internal hardware components are checked after switching on the SCS assembly.

Possible errors are displayed via the 7 segment display "r".

System error

For system errors, the system parameter, "system error" is set and transmitted to the NC control unit via the value 0x4000 in the interrupt status register.

The error code is entered in parameter Y-0-0011.

SERCANS always switches to phase 0 in the event of a system fault, making error recovery possible. Once the fault is cleared, SERCANS starts a new phase runup.

Axis-specific error

For axis-specific errors, the diagnostics status is set and transmitted to the NC control unit with the value 0x01nn via the interrupt status register (nn: axis structure bit). Some axis-specific errors also cause a system error.

SERCANS remains in its current phase with system errors making error recovery possible. Once the fault has been cleared, then either the control unit or the user interface must activate a phase switch.

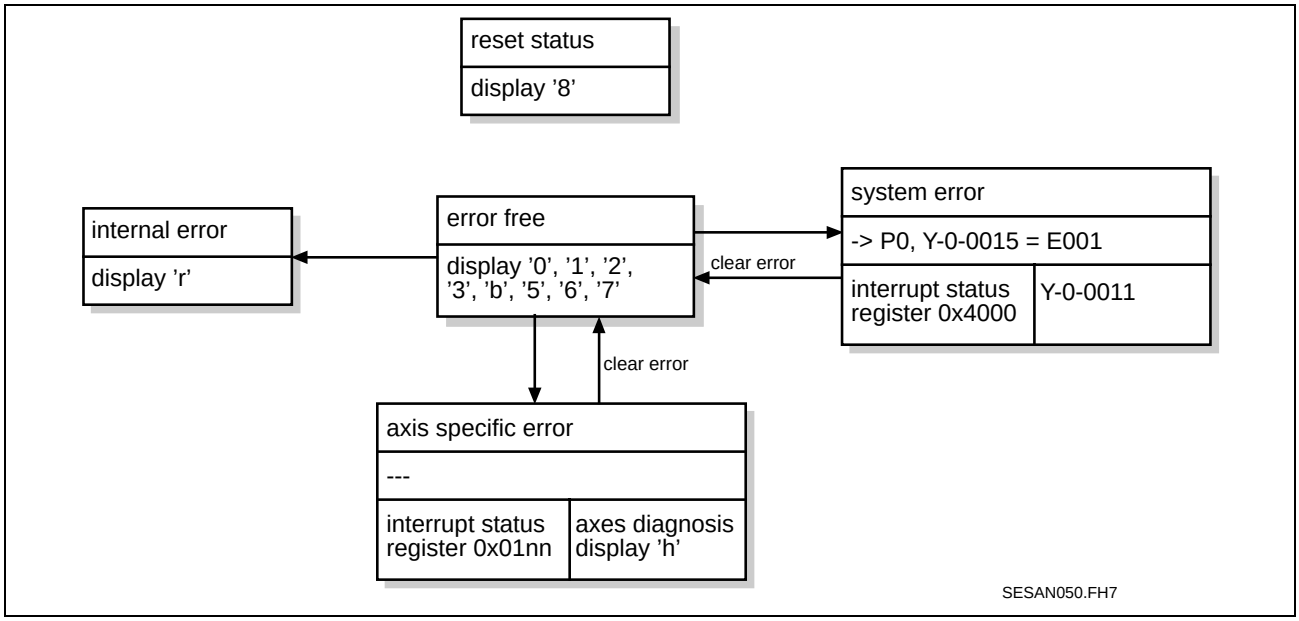


Fig. 5-1: System states

5.2 List of Diagnostics and Error Messages

Diagnoses and error messages are displayed via the LED and the 7-segment display.

LED Diagnostics

The table below lists the diagnostics and error messages signalled to the LEDs:

M1 or H3ERR		DL4	DL5	DL6	Function
7-Seg.	LED red	LED yell.	LED green	LED red	
8.	off				**Reset applied**
	off				**End of reset**
r					**Internal error:** reset assemblies
	on				**Distortion display:** the brightness of the red LED is a measure of the distortion of the optical input signal (see below).
					Transmitter active: If assembly is transmitting telegrams into SERCOS ring, then yellow LED (DL3) lights up.
		on			**Interrupt:** Interrupt request from the SCS-V to the control unit.
			on		**Data access:** The control unit is accessing the SCS-V assembly.
				on	**SYSFAIL:**The SCS-V assembly is reset via bit 3 in control reg. 7. It activates SYSFAIL signal on VME bus.
		only with SCS-V01.x			

Fig. 5-2: LED diagnoses

Distortion Display (LED of M1 or H3ERR Display)

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 "Test Mode", section 3.15).

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 (see Fig. 9-3)	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. 5-3: Error free case

System Error

When having system errors an interrupt is initiated with 0x4000 in the interrupt status register (see Fig. 6-3 Interrupt status register).

M1 7 seg.	Error in phase	Reaction	System error (see Fig. 9-3)	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
P	0-4	phase 0	0xF003	incorrect phase from NC
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
J	0-4	none	0xF009	error when storing system parameters or system parameter changed, the check of the minimum / maximum values failed
J	0-4	none	0xF00A	one or several parameters are write protected (see "Control Commands in Interrupt Register", section 6.2)

Fig. 5-4: System error

Axis Specific Error

When having specific errors an interrupt is initiated with 0x01nn (nn: axis structure bit) in the interrupt status register.

M1 7 seg.	Error in phase	Reaction	Diagnostics status (see Fig. 9-8)	Error messages in diagnostics text of the eight axis specific diagnostics channels (see Fig. 9-8)
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	0xD004	command in drive cannot be executed
H	0-1	phase 0-1	0xC003	command channel presently not active
h	2-4	phase 2-4	0xD001	drive error (class 1 diagnostics, S-0-0011)

Fig. 5-5: Axis specific error

5.3 Status Message Definitions

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

SERCANS sets communication phase 0.

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

SERCANS sets communication phase 1.

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

SERCANS sets communication phase 2.

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

SERCANS sets communication phase 3.

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

SERCANS 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 SERCANS

SERCANS 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 SERCANS

SERCANS 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 SERCANS the SERCOS ring was not closed. SERCANS cannot receive ten sequential MST telegrams of phase 0.

Reaction from SERCANS

SERCANS 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 SERCANS have different settings.
- The optical transmission power (for SERCANS 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,
  SERCANS: 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

SERCANS is in reset. Communication with SercTop not possible.

Reaction from SERCANS

-

Cause

- The control has not set bit 0 in config-register 2 or PC control register.

Remedy

- Set bit 0 in config register 2 or PC control register or set reset behavior to automatic runup (see "Reset Logic", section 3.10).

5.4 Definition of Error Messages

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

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

Reaction from SERCANS

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 SERCANS 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 SERCANS

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

SERCANS cannot switch from phase 2 to 3.

Reaction from SERCANS

SERCANS 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

SERCANS cannot conduct phase transition from phase 3 to 4.

Reaction from SERCANS

SERCANS 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" : Command in drive cannot be executed or command channel presently not activated

The NC has activated a SERCOS command via the command channel of SERCANS. This cannot be executed in the relevant drive.

Reaction from SERCANS

SERCANS retains the command set and writes the diagnosis of the relevant drive into the diagnostics channel.

Cause

- Diagnosis status D004: An error occurred in the drive during command execution.
- Diagnosis status C003: The NC has tried to start a command in phases 0 or 1.

Remedy

- Diagnosis status D004: Check whether the limit conditions are correct so that the drive can conduct the command.
- Diagnosis status C003: Switch into communication phase 2 or 4 and restart the command.

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 SERCANS

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 SERCANS

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 SERCANS detected that the fiber optic ring was closed, it was broken in phase 1 again.

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,
  SERCANS: 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 SERCANS

Phase changeover back to communication phase 0.

Cause

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

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 "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 SERCANS

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 SERCANS

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 SERCANS and a mode set for which SERCANS 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). For example, some drives do not support "drive-internal interpolation".

Remedy

- Check whether the parmeters 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)
- Command value generator must be switched off or a different mode selected.

Display "P" : Incorrect phase from the NC

The NC has set a target phase as SERCOS phase that is unequal to 0, 1, 2, 3 or 4.

Reaction from SERCANS

Phase changeover back to communication phase 0.

Cause

A target phase was set in parameter "phase initiation" (Y-0-0014) unequal to 0, 1, 2, 3 or 4 and the command "change phase" (value 0x2000) triggered in the interrupt control register.

Remedy

Write a valid phase into parameter "phase initiation" (Y-0-0014).

Display "r" : SERCANS: Internal error

An internal error has occurred on SERCANS.

Reaction from SERCANS

Phase changeover back to communication phase 0.

Cause

Internal hardware test routines have not been properly completed.

Remedy

- Chip enable signal of DPR for NC has to go to high when SERCANS is switched on. If NC is not connected, then apply +5 volts to chip enable signal with pull up resistor (10kOhm).
- Contact Customer Service.

Display "U" : Error in lifecounter

NC and SERCANS monitor the transmission of new command and actual values in each NC cycle. SERCANS 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 differcence (Y-0-0018).

Reaction from SERCANS

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 + transmission time of last AT + Y-0-0037 > S-0-0089 - Y-0-0010, see "Synchronization", section 3.11).

Reaction from SERCANS

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)

SERCANS 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 SERCANS

Communication phase 0 is set.

Cause

- New SERCANS 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 SERCANS and the NC is synchronized by the synchronous master. If the NC is the "synchronous master" (Y-0-0002), then the SERCANS monitors the SYNCIN signal.

Reaction from SERCANS

Phase changeover back to communication phase 0.

Cause

The SYNCIN signal from the NC failed or is incorrect (see "Synchronization", section 3.11).

Remedy

- Check the SYNCIN signal of the NC.
- Check whether SYNCOUT mode is possible (SERCANS is synchronous master).

Display "J" : Error with system parameter storage

In interrupt control register the command "system parameter changed" (value 0x0800) or command "store system parameters" (value 0x1000) has been activated. An error occurred during this procedure.

Reaction from SERCANS

The activated command was not executed.

Cause

At least one parameter was detected as invalid during the plausibility check. The invalid parameter is entered in the "list of invalid Y-parameters" (Y-0-0042).

Remedy

All parameters in "list of invalid Y-parameters" (Y-0-0042) must be chekked and valid values entered.

6 System Structure

6.1 System Parameter

System parameters set values for normal SERCANS operating modes and for the ring configuration. They can be changed by the NC control unit via the DPR or via the asynchronous serial interface (user interface).

The structure of these parameters is similar to that of the SERCOS interface operating data, i.e., they have a data block with ident number, name, attribute and so on.

The system parameters are loaded from the EEPROM onto the DPR after a reset. The SERCANS uses the system parameters in the DPR for the intialization of the SERCOS interface and its own firmware.

The system parameters are documented in the parameter description (see section " System Parameter Descriptions" 10.3).

The software works with parameters in the operating range. The transmission of parameters between DPR, EEPROM and operating range is described in Fig. 6-1.

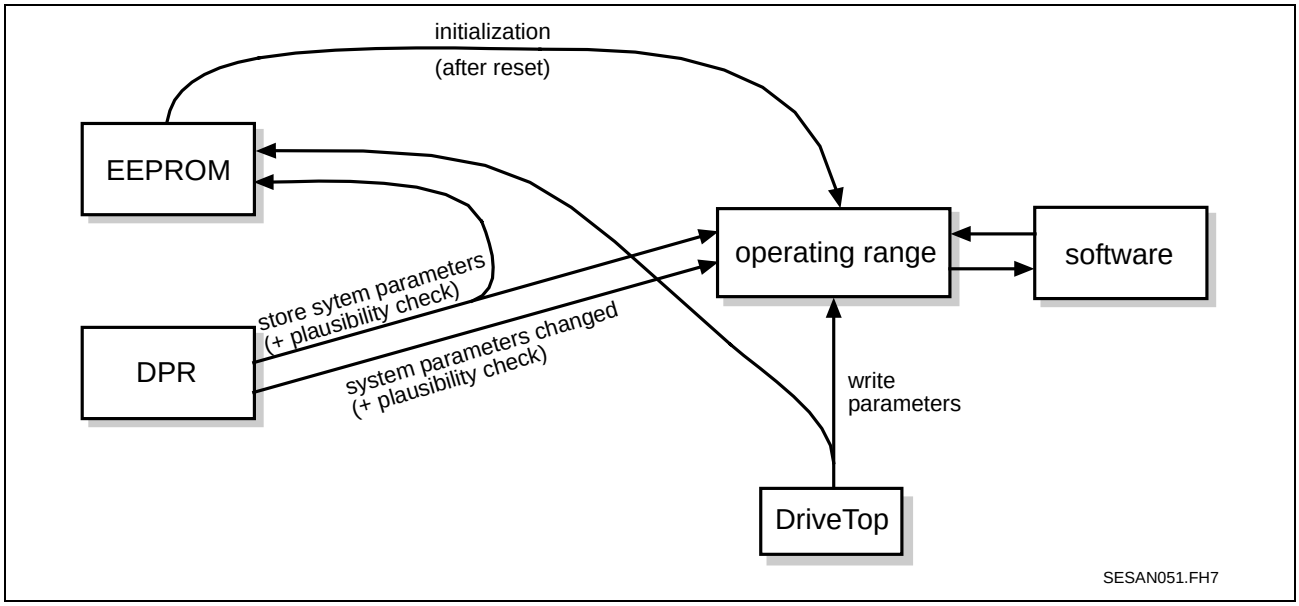


Fig. 6-1: Transmission of system parameters between EEPROM; DPR, operating range

6.2 Control Commands in Interrupt Register

With the use of control commands, the NC control unit prompts the assembly to execute drive-independent operations. Given drive-related control commands, the relevant axis structure must be marked in the interrupt control register (see "Overview of Axis Structure", section 7.1). The control commands are partially acknowledged in the interrupt status register.

The structure of the interrupt register (interrupt control register and interrupt status register) is illustrated in the figures below.

Interrupt Control Register

The NC control unit can trigger an interrupt of the SERCANS via the interrupt control register. SERCANS responds to this interrupt once per cycle. The NC control unit uses this for drive-independant activation of the control commands

- change phase
- clear error
- to activate changed system parameters
- to activate store system parameters and
- to start MMI service channel transmission.

With respect to the drive, it starts

- one NC service channel transmission
- signals any change in the command control word.

Attention: The control may only write and may not read the interrupt control register. A read access would clear the interrupt SERCANS side.

Note: Only one request should be started via the interrupt control register. In other words, a new request should be held back until the previous one has been completed.
The status of the interrupt process can be read in Config Register 2 or PC control register (only SCS-A02, SCS-V02, SCS-P02).

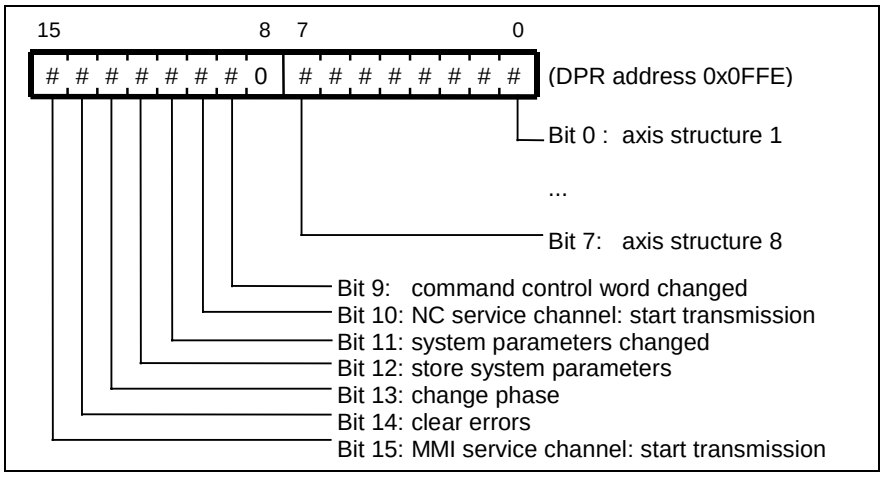


Fig. 6-2: Interrupt control register

MMI Service Channel: Start Transmission

With this control command, a parameter transmission is started in the MMI service channel (see "MMI Service Channel", section 7.7).

The command "MMI service channel start transmission" is activated in the interrupt control register with value 0x8000.

Acknowledgement in interrupt status register bit 15.

Clear Errors

The following errors are cleared with command "Clear errors":

- the errors in the drive
- the diagnostic status in the diagnostics channel of the drive and
- system errors.

The command "clear error" is activated in the interrupt control register with value 0x4000. All errors are cleared if

- **no system errors** (system error = 0) and
- **no axis-specific error** (diagnoses status = 0 of axes 1 to 8) are no longer pending.

Change Phase

Phase runup is affected by the target phase set in system parameter "phase initiation" (Y-0-0014). Its value sets the target communication phase in the SERCOS interface ring. The phase set is read after a reset out of the parameter EEPROM and copied into the DPR. In other words, the module itself conducts a runup using parameters in the DPR. If the control sets an invalid phase, then a relevant message is generated in the system error. The current communication phase displays SERCANS in the system state.

The command "change phase" is activated in the interrupt control register with value 0x2000.

Phase changes are displayed in "system status" (Y-0-0015) and are therefore available to the control.

Store System Parameters

With command "store system parameters" those system parameters in DPR are firstly **checked** and, if there is no error, **activated** and stored in the **EEPROM**.

If the check is negative, then the invalid parameters are entered in the "list of invalid Y-parameters" (Y-0-0042) and the system error corresponding the cause generates a diagnosis.

Diagnosis	Cause
0xF009	The check of minimum / maximum values of one or several parameters failed
0xF00A	One or several parameters are write protected.

With this command, the system parameters in the EEPROM can be set by the control to match the application.

The command "store system parameters" is activated in the interrupt control register with value 0x1000.

Note: The EEPROM has a maximum rewrite cycle of 100 000 write cycles.
Due to this a control should not automatically activate this during initialization. Only a service or a user should be able to do so!

System Parameters Changed

With command "system parameters changed" the system parameters in DPR are firstly checked and then activated if no error is present.

The following parameters are assumed:

- system parameters: see Fig. 9-3 System parameters
- axis parameters: Y-0-0012, Y-0-0021...Y-0-0036, Y-0-0039, Y-0-0040 (see Fig. 9-6 Overview of axis structures)
- command value generator parameter: see Fig. 9-4 Addresses of the command value generator

The control can thus change related system parameters sequentially in the DPR and inform SERCANS about the changes using this command.

If the check is negative, then the invalid parameters are entered in the "list of invalid Y-parameters" (Y-0-0042) and in the system error corresponding the cause generates a diagnosis.

Diagnosis	Cause
0xF009	The check of minimum / maximum values of one or several parameters failed
0xF00A	One or several parameters are write protected.

Note: System parameters which the control writes into the DPR must be activated with this command. If this command is not activated, then SERCANS ignores a change in system parameters.

The command "system parameters changed" is activated in the interrupt control register with value 0x0800.

NC Service Channel: Start Transmission

With this control command, a parameter transmission is started in the NC service channel (see "Service Channel", section 7.6).

The command "NC service channel: start transmission" is activated in the interrupt control register with value 0x0400.

Acknowledgement in interrupt status register bit 10.

Command Control Word Changed

With this control command, the command processing in the command channel (see "Command Channel", section 7.5) of the SERCANS module is controlled

The command "command control word changed" is activated via interrupt register with value 0x0200.

Acknowledgement in interrupt status register bit 9.

Interrupt Status Register

SERCANS can use the interrupt status register to trigger interrupts to the NC control unit. It can also

- signal a system error and
- acknowledge an MMI service channel transmission

as part of the drive independant operations.

In drive-related terms

- NC service channel transmission are acknowledged,
- a change in drive warnings (see parameter Y-0-0001),
- a change in drive messages (see parameter Y-0-0001),
- changes in command acknowledge are displayed and
- drive diagnostics are signalled.

SERCANS generates this interrupt only once during each cycle.

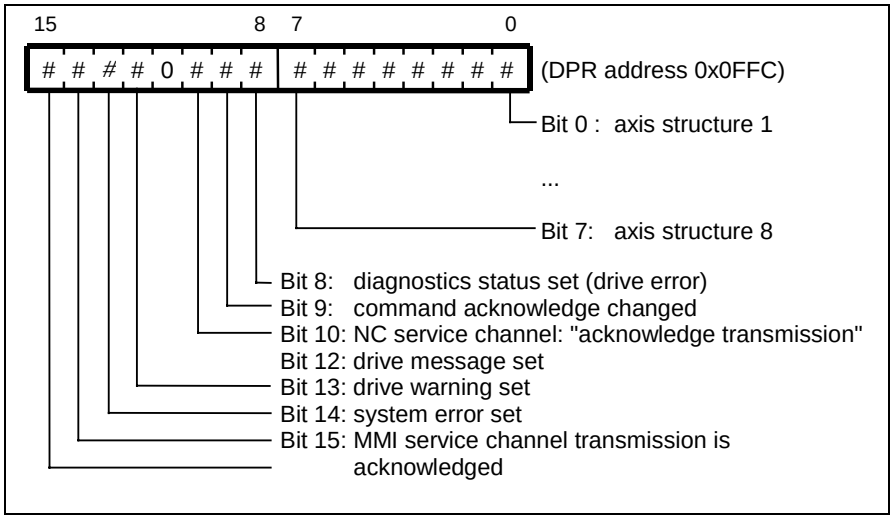


Fig. 6-3: Interrupt status register

Note: If an interrupt is not triggered in the NC control via the interrupt status register, then the following conditions must be met to avoid access problems in the DPR.

- With the SCS-A01 assembly the signal *DPRINT **must** be applied to the input register.
  The software can then asynchronously query this bit.
- With the SCS-A02, SCS-P and SCS-V02 assemblies the control **must** poll bit 3 in the config register 2.
- With the SCS-V01 assembly, the non-cyclic interrupt **must** be used. There is no way to query a bit with the software!

7 Axis Structure, NC and MMI Service Channel

7.1 Overview of Axis Structure

There are eight identically constructed and axis structures sequential in the DPR. These contain all drive-specific data which the NC control unit requires during initalization and cyclic operations.

The drive data is constructed as follows:

Overview axis structure		
DPR address	**Name**	**Data length**
start addr.+0x00	drive addresses (Y-0-0012)	2 bytes
start addr.+0x02	command value configur. Y-0-0039, 21, 23, 25, 27, 29, 31, 33, 35	18 bytes
start addr.+0x14	actual value configur. Y-0-0040, 22, 24, 26, 28, 30, 32, 34, 36	18 bytes
start addr.+0x26	command value channel	34 bytes
start addr.+0x48	actual value channel	34 bytes
start addr.+0x6A	diagnostics channel	68 bytes
start addr.+0xAE	command channel	30 bytes
start addr.+0xCC	NC service channel	10 bytes

Fig. 7-1: Overview axis structure

7.2 Addresses

The drive address is set by the NC control as a two byte value in the range of 0x000 through 0x00FE. The value 0x000 means that SERCANS is not evaluating the relevant axis structure.

7.3 Exchange of Real-Time Data

Real-time data is made up of the cyclically transmitted command and actual values. A command value and an actual value channel are available to each of the maximum of eight drives. The real-time data in these channels are determined via the configuration lists. Up to eight different operating data can be configured in the real-time data.

With parameter "list of telegram type parameter" (Y-0-0066) there is a choice between predefined real-time data configurations (standard telegrams).

The following standard telegrams are available:

Telegram type	Input in Y-0-0066	Contents of command channel	Contents of actual value channel
standard telegram 0	0	no cyclic data	no cyclic data
standard telegram 1	1	S-0-0080	no cyclic data
standard telegram 2	2	S-0-0036	S-0-0040
standard telegram 3	3/11	S-0-0036	S-0-0051/53
standard telegram 4	4/12	S-0-0047	S-0-0051/53
standard telegram 5	5/13	S-0-0047 S-0-0036	S-0-0051/53 S-0-0040
standard telegram 6	6	S-0-0036	no cyclic data
application telegram 7	7	configurable	configurable

Fig. 7-2: Selecting standard telegrams

By selecting standard telegrams 0 to 6, all real-time data are automatically configured. Application telegram 7 (default value in parameter Y-0-0066) requires additional settings, explained below.

The NC control unit or the user interface enters the identification number into the configuration list for the real time data to be cyclically exchanged. SERCANS determines the length of the operating data in the configuration list with the attribute and enters these in the header.

The configuration lists can include up to eight entries. If fewer are used, then the end marker (0x0000) must be entered after the last identification number in the configuration list.

If bit 15 is set in the header of the configuration list, then the length of the command value or actual value channels **without** control word resp. drive status word is indicated by the NC in bits 0 through 7. The length is indicated in bytes. Only even values are permitted.

The NC must write the operating modes used in the drive into parameter “primary mode of operation” (S-0-0032), "secondary operation mode 1" (S-0-0033).

In communication phase 4, the drives and SERCANS cyclically exchange the configured real-time data via the SERCOS interface. During each SERCOS synchronization cycle, SERCANS copies the real-time data from the receive buffer of the SERCON410 onto the actual value channel of the DPR and out of the DPR command value channels onto the transmit buffer of the SERCON410 (see "Synchronization", section 3.11).

Configuration of the Command Value Channel

The order of the command value identification numbers in the command value configuration list determines the order of the command values in the command value channel. Only those command values can be configured which the drive actually supports. These command value ident numbers are listed either in the drive in ident number S-0-0188, or they can be found in the manual of the drive.

In addition to the command values, the drive specific control word is also listed in the command value channel.

SERCANS also enters the length of the configured command value (Y-0-0039) into the command value header.

Command value configuration	IDN length (bytes)		Command value channel	Data length (bytes)
comm. value header	2		control word	2
IDN comm. value 1	2	=>=>	comm. value 1	2 or 4
IDN comm. value 2	2	=>=>	comm. value 2	2 or 4
IDN comm. value 3	2	=>=>	comm. value 3	2 or 4
IDN comm. value 4	2	=>=>	comm. value 4	2 or 4
IDN comm. value 5	2	=>=>	comm. value 5	2 or 4
IDN comm. value 6	2	=>=>	comm. value 6	2 or 4
IDN comm. value 7	2	=>=>	comm. value 7	2 or 4
IDN comm. value 8	2	=>=>	comm. value 8	2 or 4

Fig. 7-3: Command value channel configuration

Configuration of the Actual Value Channel

The order of the actual value ident numbers in the actual value configuration list determines the order of the actual values in the actual value channel. Only those actual values can be configured which the drive actually supports. These actual value ident numbers are listed either in the drive in ident number S-0-0187, or they can be found in the manual of the relevant drive.

In addition to the actual values, the drive status is also in the actual value channel.

SERCANS additionally enters the length of the configured actual value in the list header (Y-0-0040).

Actual value configuration	IDN length (bytes)		Actual value channel	Data length (bytes)
actual value header	2		drive status	2
IDN act. value 1	2	=>=>	actual value 1	2 or 4
IDN act. value 2	2	=>=>	actual value 2	2 or 4
IDN act. value 3	2	=>=>	actual value 3	2 or 4
IDN act. value 4	2	=>=>	actual value 4	2 or 4
IDN act. value 5	2	=>=>	actual value 5	2 or 4
IDN act. value 6	2	=>=>	actual value 6	2 or 4
IDN act. value 7	2	=>=>	actual value 7	2 or 4
IDN act. value 8	2	=>=>	actual value 8	2 or 4

Fig. 7-4: Actual value channel configuration

The following figure depicts the relationship between the command value configuration list and the command value channel.

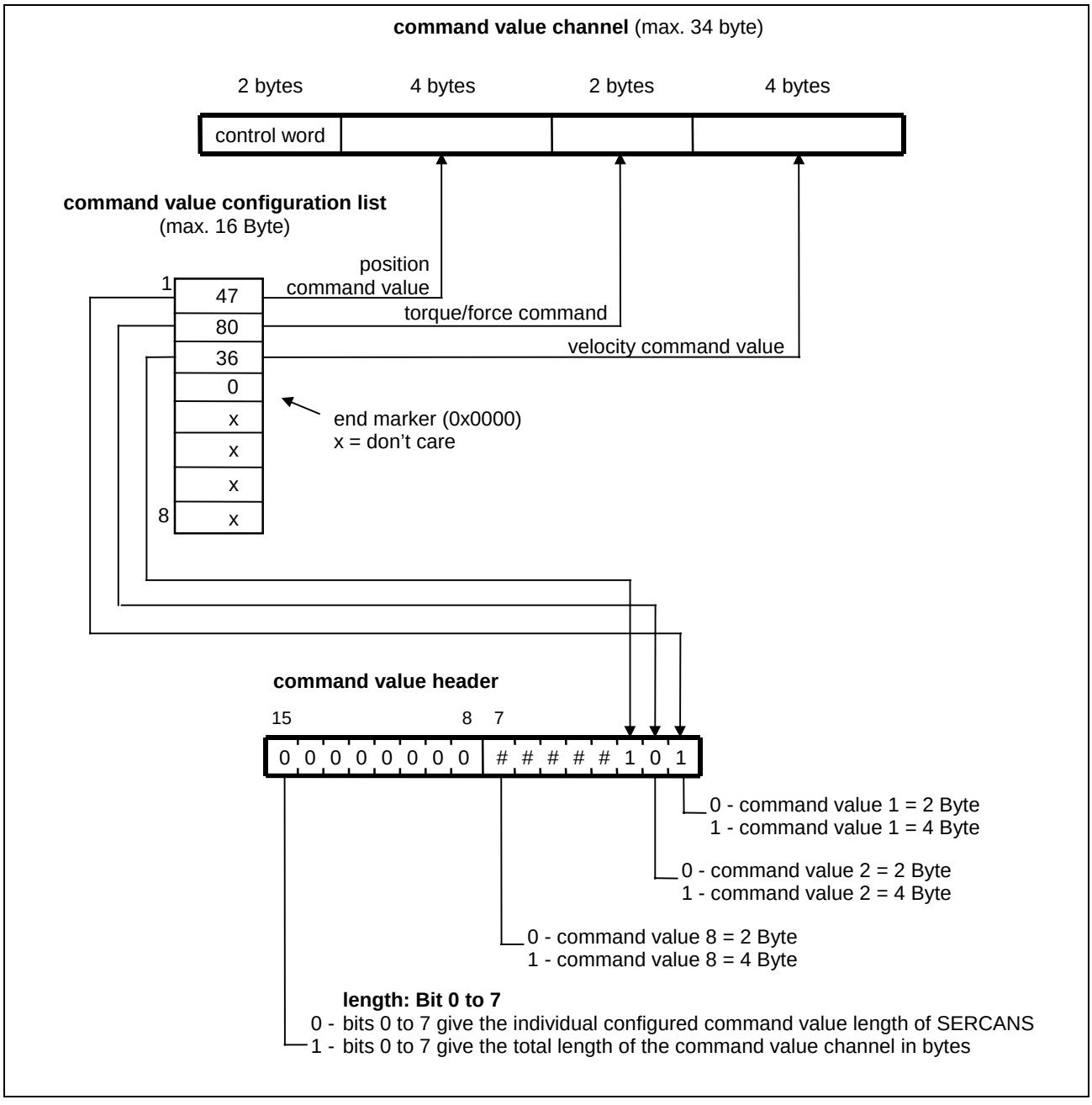


Fig. 7-5: Real-time data configuration (command values as example)

The following figures depict command/actual value configuration examples.

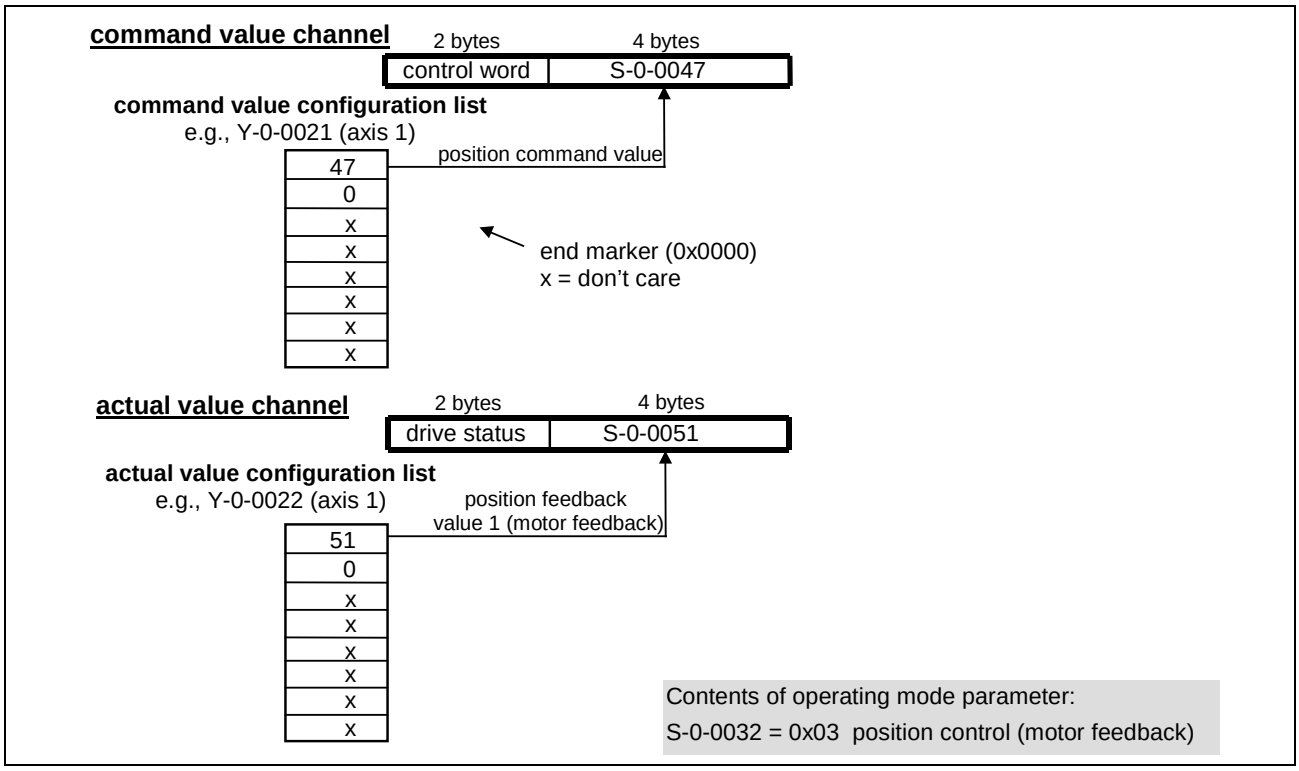


Fig. 7-6: Command/actual value configuration example 1

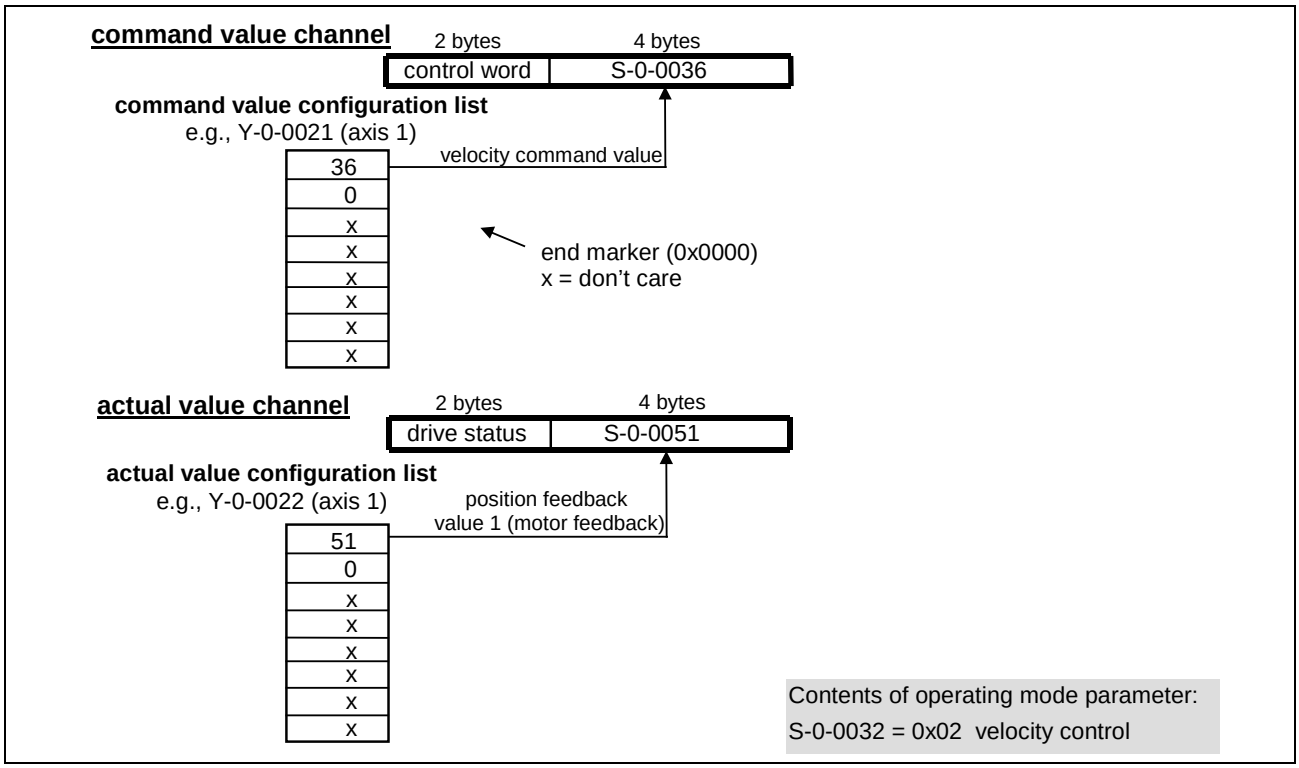


Fig. 7-7: Command/actual value configuration example 2

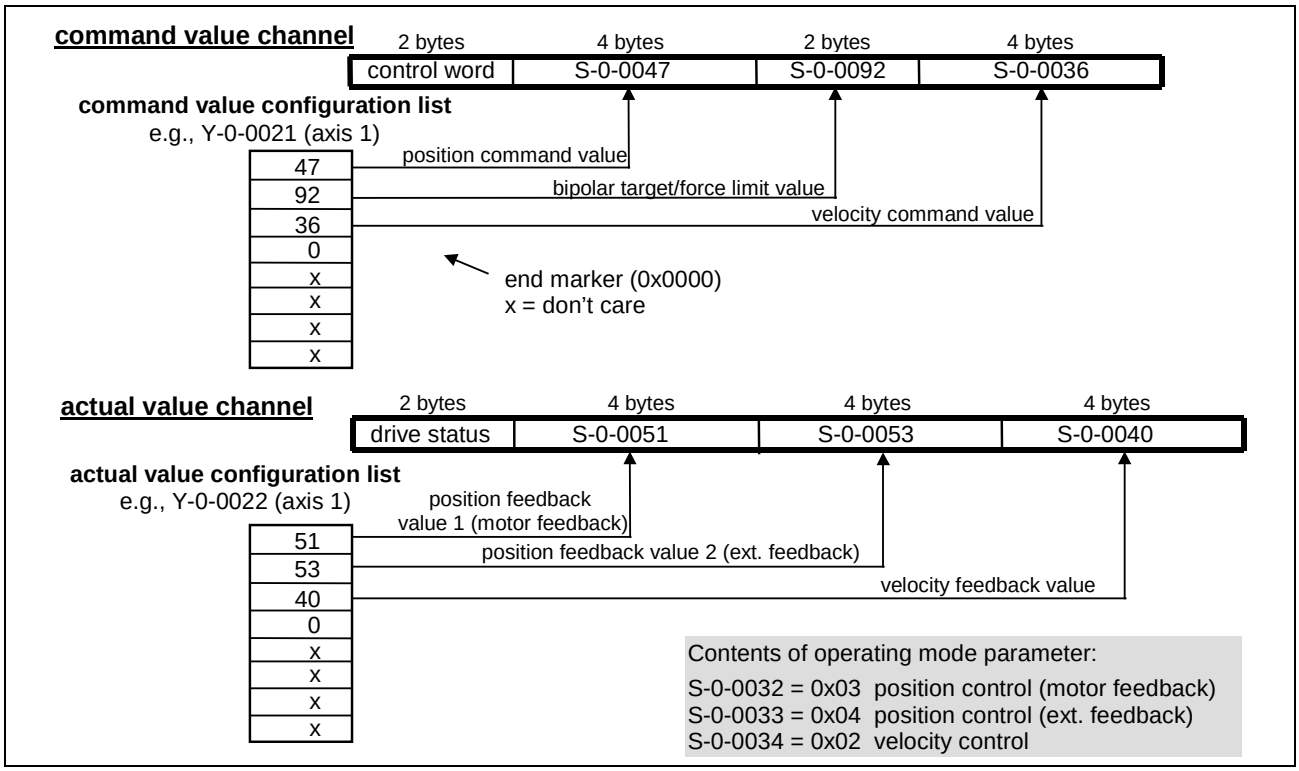


Fig. 7-8: Command/actual value configuration example 3

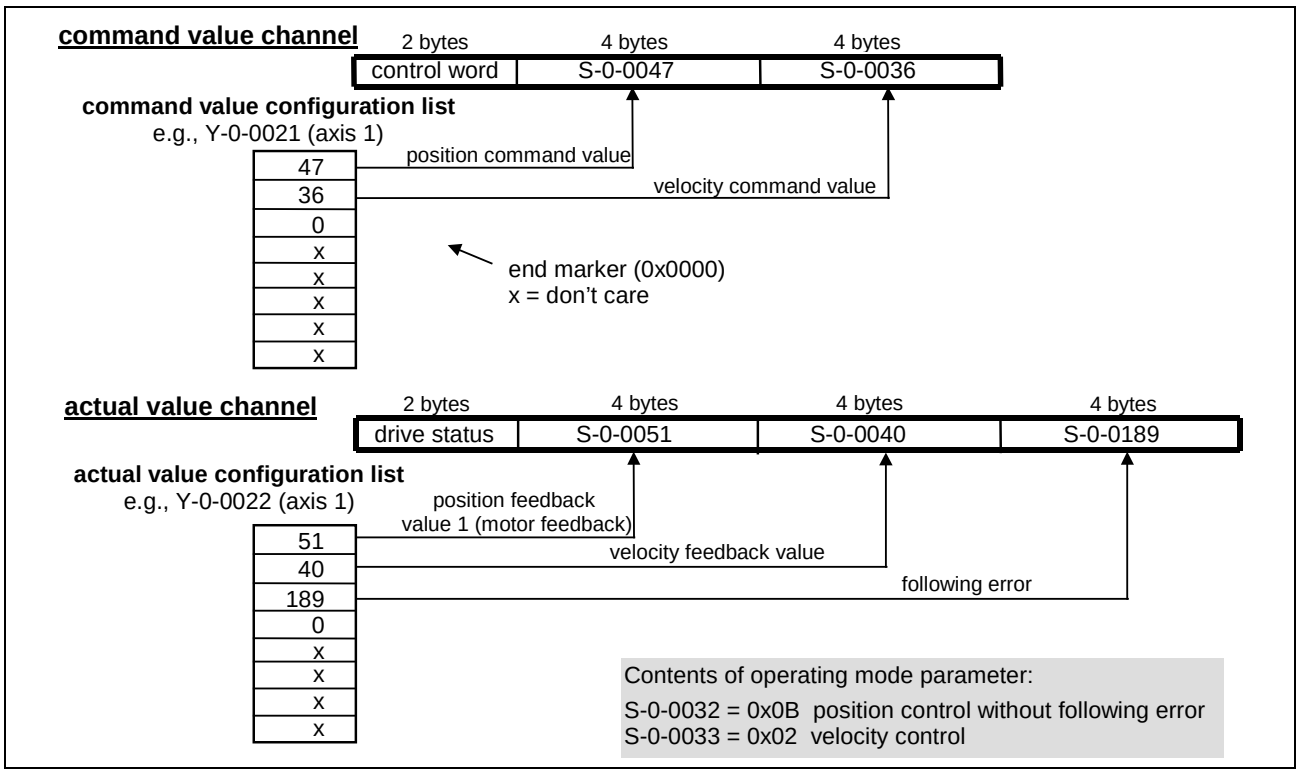


Fig. 7-9: Command/actual value configuration example 4

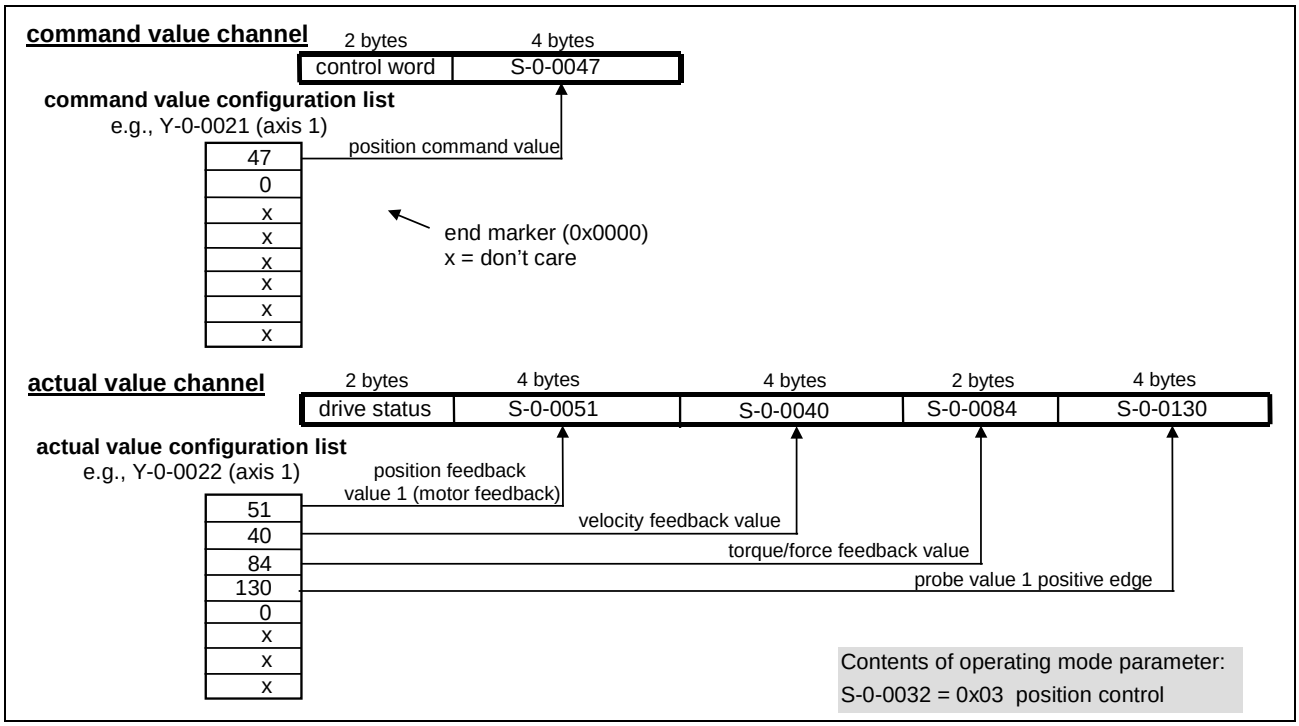


Fig. 7-10: Command/actual value configuration example 5

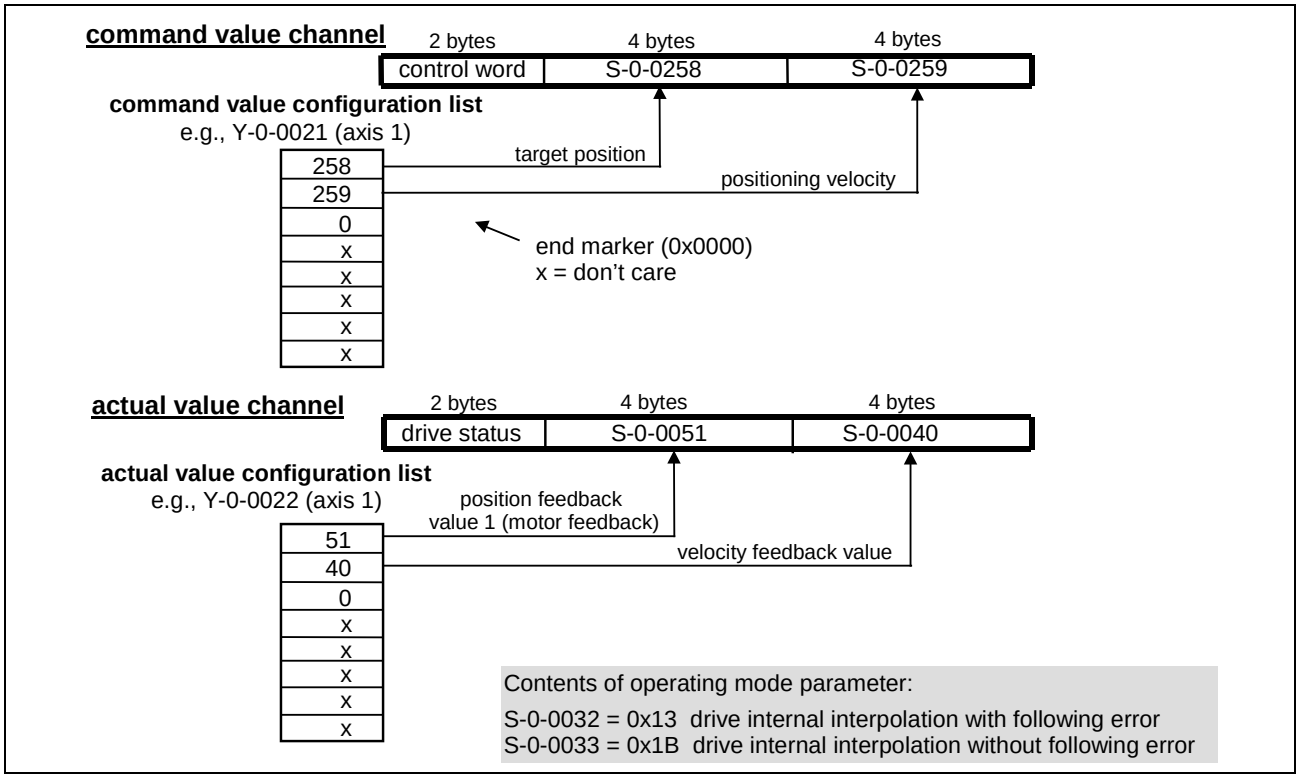


Fig. 7-11: Command/actual value configuration example 6

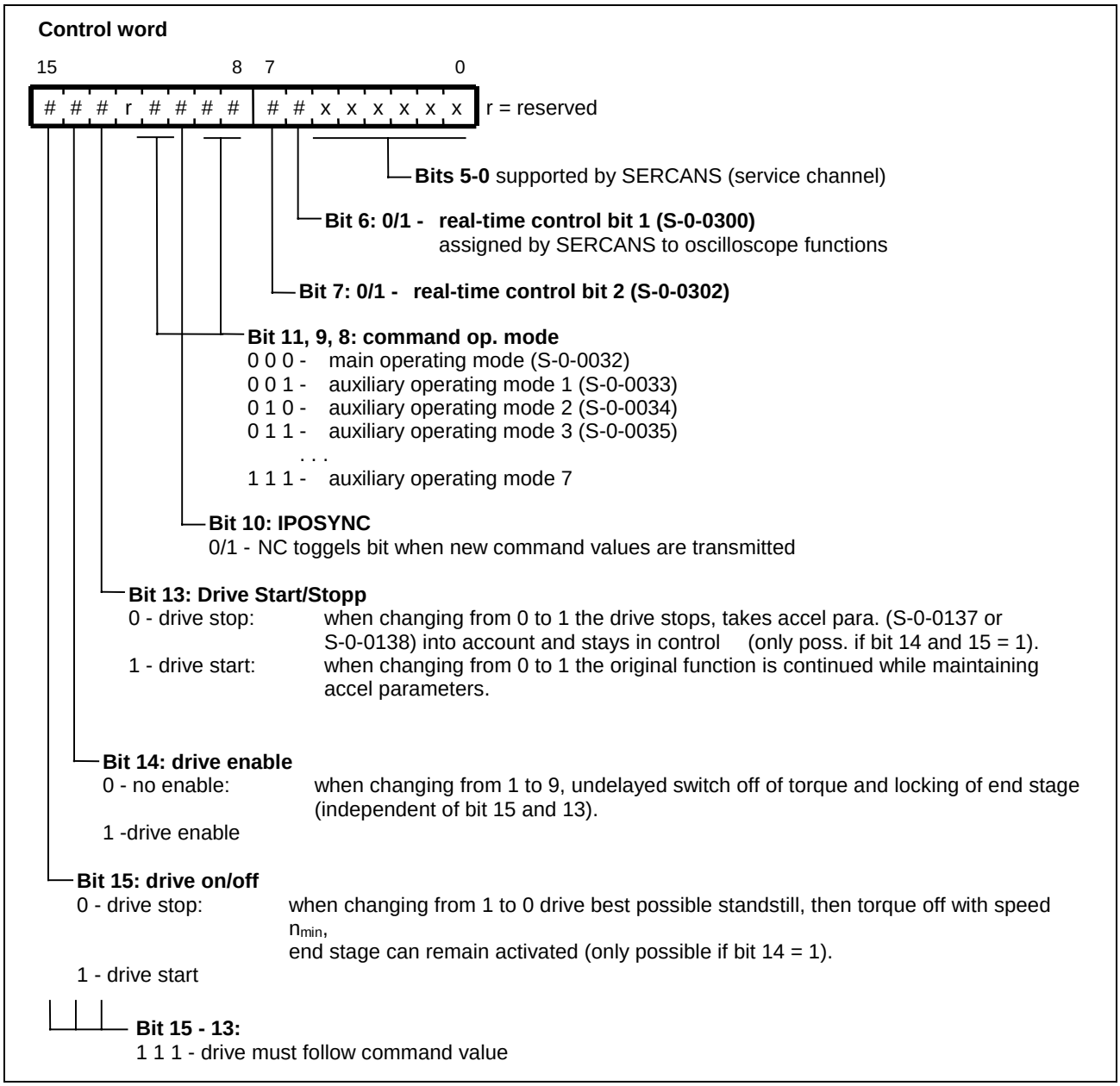


Fig. 7-12: Control word structure

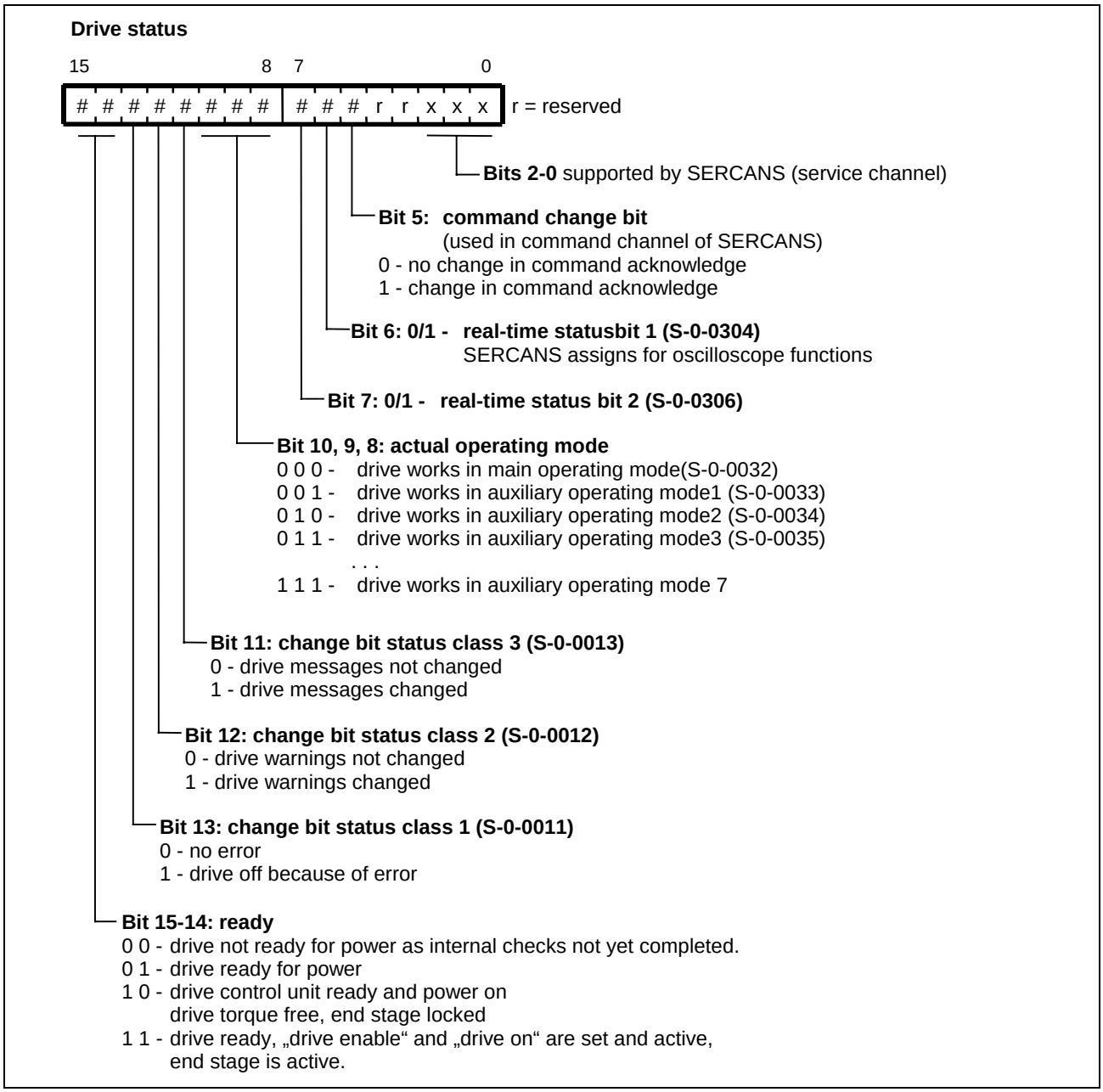


Fig. 7-13: Drive status construction

7.4 Diagnostics Channel

SERCANS makes a diagnostics channel in the DPR available to each drive. The channel is partially operational as of communication phase 2 and completely operational as of communication phase 4.

Changes in drive diagnostics are signalled to the interrupt status register. In the event of an error, an error code is entered in the diagnostic status. The diagnostic status is 0x0000, if there is no error in the diagnostic channel.

SERCANS stores all drive-specific diagnoses in the diagnostics channel.

Diagnostics Channel Structure

The structure of the diagnostics channel is as follows:

Diagnostics channel		
DPR address	**Name**	**Data length**
start addr.+0x6A	diagnostics status	2 bytes
start addr.+0x6C	status class 1 (S-0-0011)	2 bytes
start addr.+0x6E	diagnostic message number (S-0-0390)	2 bytes
start addr.+0x70	diagnostics text length	2 bytes
start addr.+0x72	diagnostics text (S-0-0095)	60 bytes

Fig. 7-14: Diagnostics channel structure

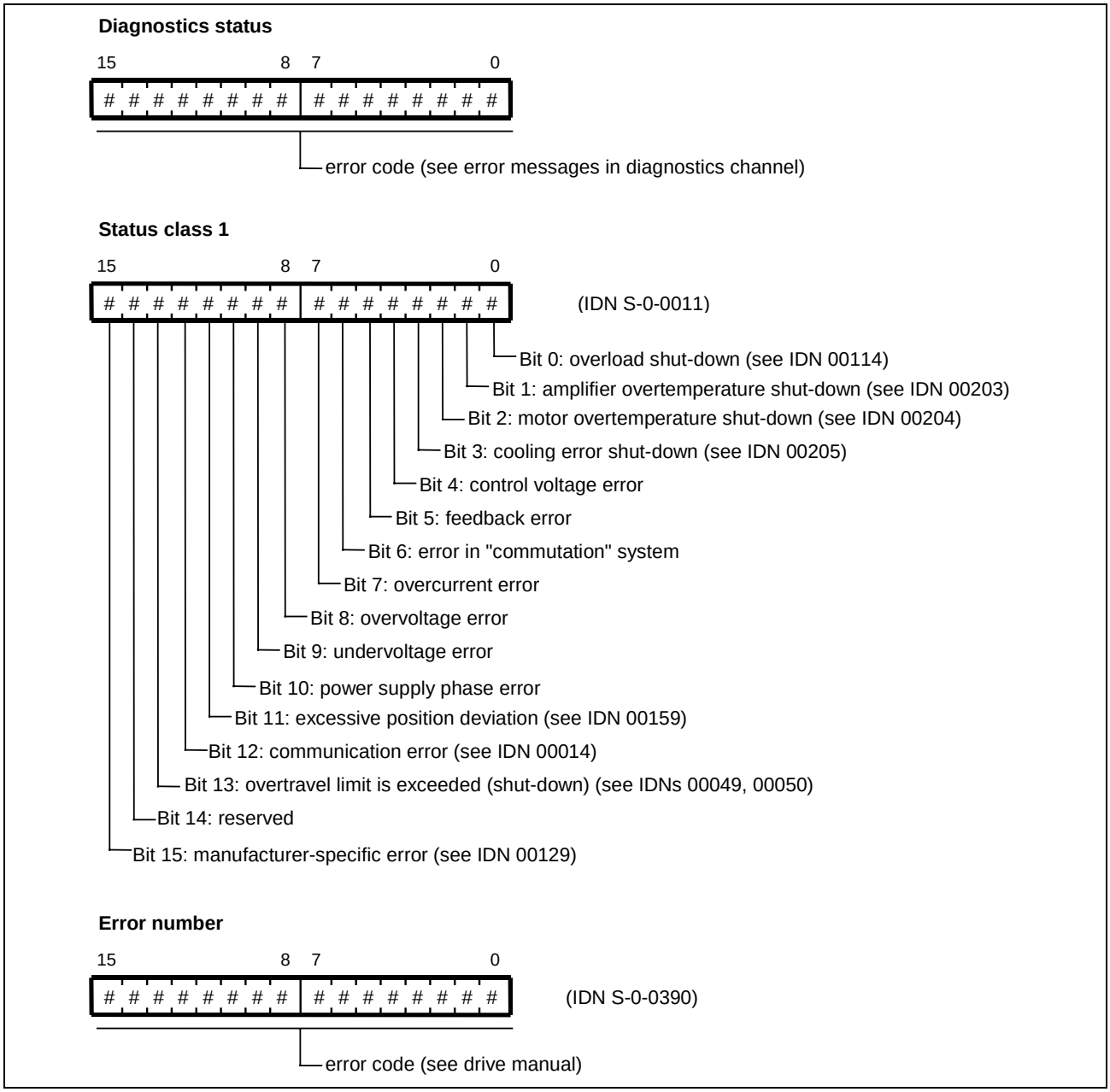


Fig. 7-15: Diagnostics channel structure

Operation of the Diagnostics Channel

Starting with communication phase 2, SERCANS can set an error code in the diagnostics status.

In the event of axis-specific errors, SERCANS reads "class 1 diagnostics" (IDN S-0-0011) from the relevant drives, the "diagnostics message number" (IDN S-0-0390) and the "diagnostics message" (IDN S-0-0095) and then enters this information in the diagnostics channel.

SERCANS then writes the corresponding error code in the diagnostics status and signals it to the NC control unit via the value 0x01nn in the interrupt status register (nn denotes the according axis structure).

After the diagnostics information has been evaluated, the NC control unit can clear the error with the control command "clear error" via the interrupt control register. Should SERCANS continue to signal the above error, then the error must be cleared and the control command "clear error" must be repeated.

If no error is pending, then using the control command "clear error" the diagnostic status is set to 0x0000.

Error Message in the Diagnostics Channel

In Fig. 5-4 "System error" all error messages are listed in the diagnostic status.

7.5 Command Channel

The NC control unit can activate drive-internal commands or functions via the command channel.

Structure of the Command Channel

The structure of the command channel is as follows:

Command channel		
DPR address	**Name**	**Data length**
start addr.+0xAE	command number	2 bytes
start addr.+0xB0	command control word	2 bytes
start addr.+0xB2	command acknowledg.	2 bytes
start addr.+0xB4	initiator register 1	4 bytes
start addr.+0xB8	initiator register 2	4 bytes
start addr.+0xBC	initiator register 3	4 bytes
start addr.+0xC0	return register 1	4 bytes
start addr.+0xC4	return register 2	4 bytes
start addr.+0xC8	return register 3	4 bytes

Fig. 7-16: Structure of the command channels

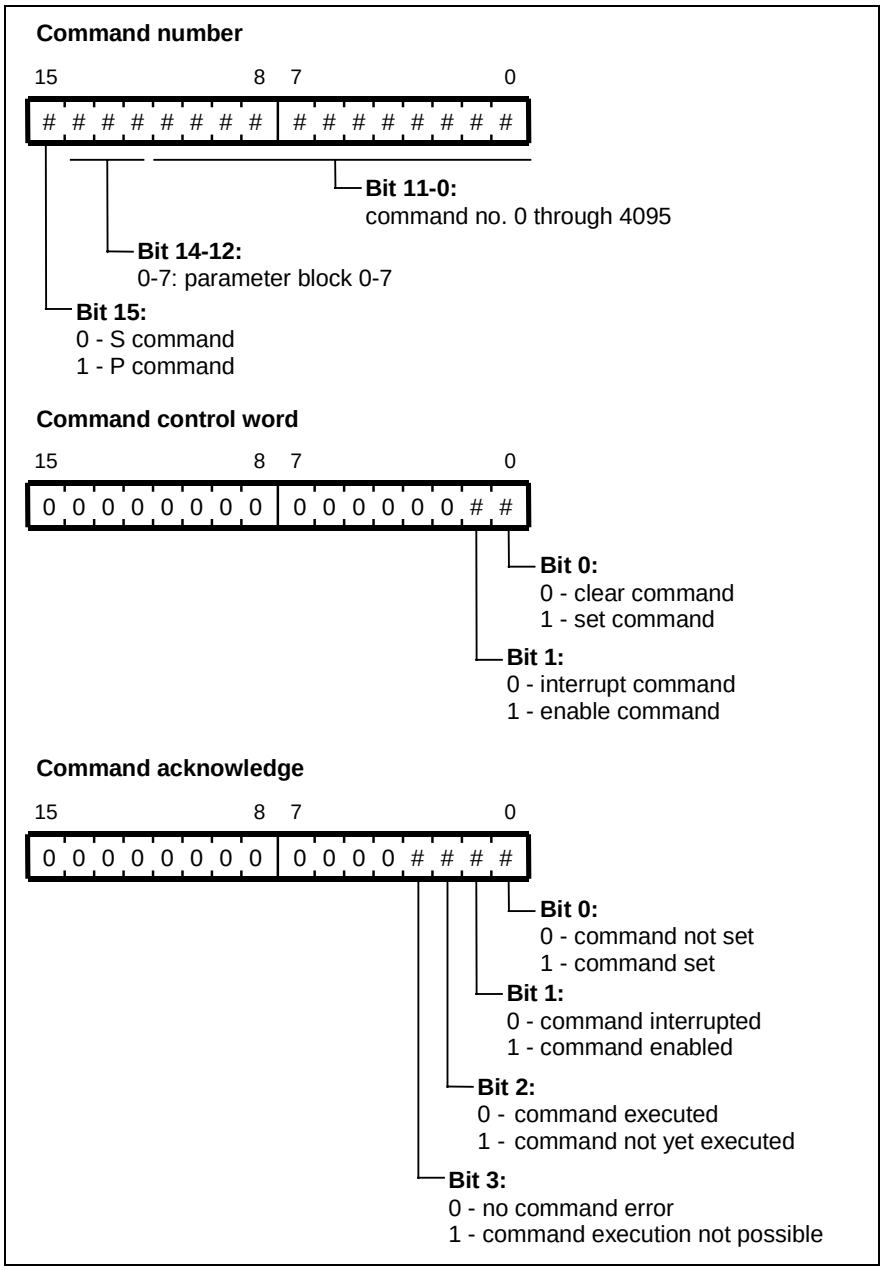


Fig. 7-17: Structure of the command channels

Operational Order in Command Channel

There is a command channel available to each drive. One command can use up to three parameters in the initiation registers and can supply the return register with up to three parameters upon positive execution. To execute a command, the NC control unit writes the possibly needed parameters in the indication registers, writes the command number and the command control word with 0x0003 and triggers the command by writing the value 0x02nn in the interrupt control register.

The following entries in the command control word are possible:

- 0x0000 clear command
- 0x0003 activate command
- 0x0001 interrupt command (set and not released)

The NC control must indicate every change in the command control word to SERCANS via the interrupt control register.

With the exception of the command control word, the NC control shall only write in the command channel if the command is cleared and indicates this with command acknowledge 0x0000.

SERCANS signals the state of the activated command in command acknowledge. The following command acknowledges are generated:

- command in process,
  ⇒ command acknowledge 0x0007
- command executed positive,
  ⇒ command acknowledge 0x0003 (positive)
- command not executed (error),
  ⇒ command acknowledge 0x000F (negative)

SERCANS enters the command acknowledgements 0x0003 and 0x000F and the return register into the command channel. The NC is then informed of the end of the command via the interrupt status register.

Command executions can take up considerable time. The NC control can interrupt running commands via the command control word (0x0001), restart them (0x0003) or clear them (0x0000).

The commands are processed in various ways by the command interpreter of SERCANS. This means that a functional order must be programmed for every command. SERCANS supports the following commands:

- drive-controlled homing procedure command (IDN S-0-0148),
- position spindle procedure command (IDN S-0-0152)

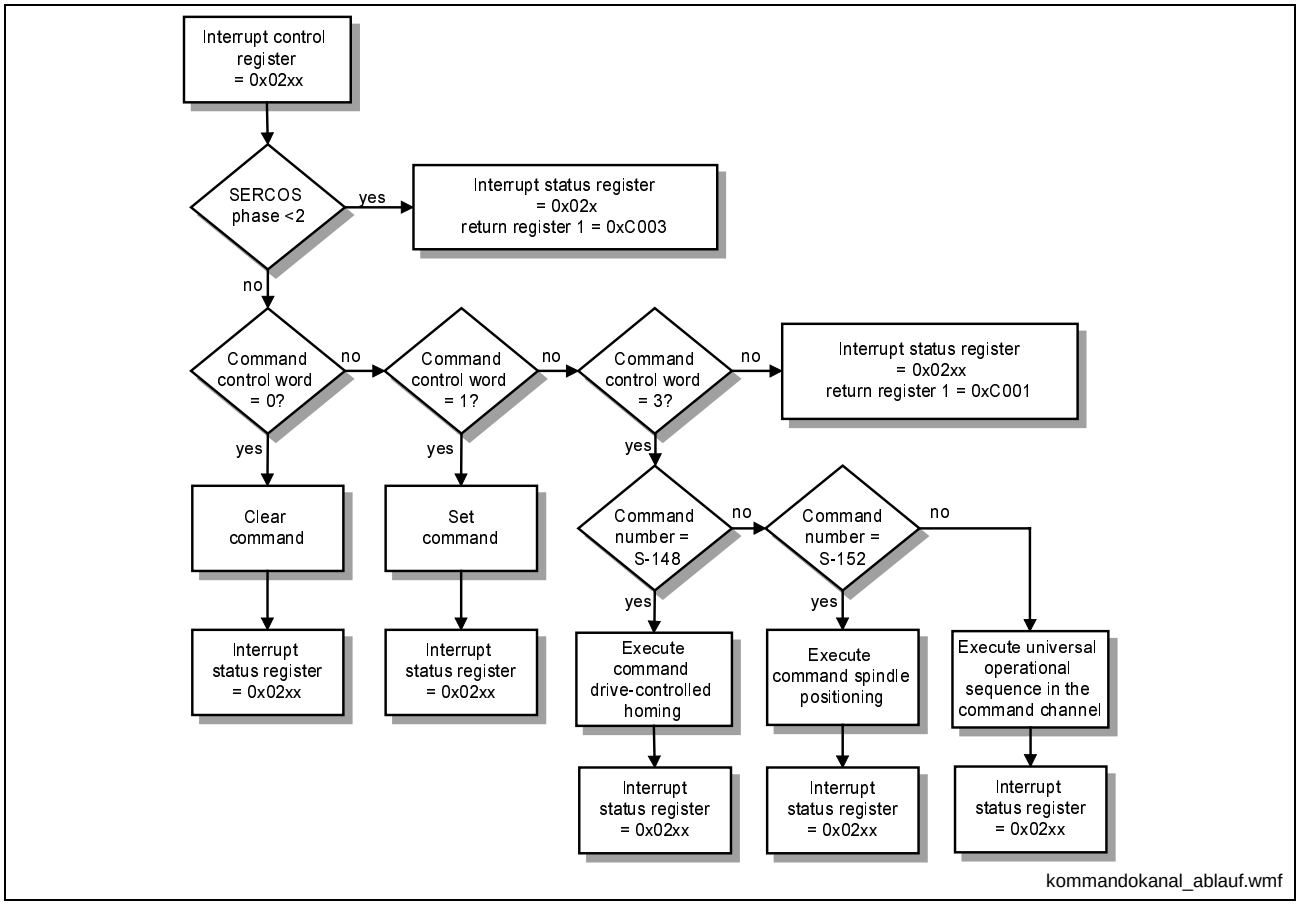


Fig. 7-18: Operational sequence in command channel

Error Messages in the Command Channel

The following table lists all the error messages in the command channel. The error code is written to the return register 1 with a length of four bytes.

Error code in return register 1	Error message in command channel
0x0000 1001	no IDN
0x0000 7005	data presently write protected
0x0000 8006	HS timeout
0x0000 8007	AT failure
0x0000 8009	fiber optic ring disrupt
0x0000 C001	invalid command control word
0x0000 C002	IDN is not a command
0x0000 C003	command channel cannot be activated
0x0000 D004	command cannot be executed in drive

Fig. 7-19: Error messages in command channel

Drive-Controlled Homing (IDN S-0-0148)

Initiation register 1: "Feedrate override" IDN S-0-0108

Return register 1: "Position command value" IDN S-0-0047

If necessary, more parameters must be set in the drive (e.g., “homing parameter", S-0-0147).

Operational order:

After the command has been activated by the NC control unit with the command control word 0x0003, any changes in initiation register 1 are continuously transmitted to the drive. This can be used to alter the homing velocity in the drive.

Command acknowledge without error

With the use of command acknowledge 0x0003, SERCANS indicates positive command execution to the NC control unit. It then reads the "position command value" in return register 1. It writes this into the cyclic data. This sets the coordinate system of the NC control unit to that of the drive. The NC control unit now clears the command.

Command acknowledge with error

A negative command execution is indicated with command acknowledge 0x000F. In this case, SERCANS writes an error code into return register 1, brings the diagnostics channel up to current status and sets the diagnostics status. The control unit can respond with its own error routine, e.g., signal error, display diagnostics and so on. The NC control unit must now clear the command.

Note: To be able to conduct the command it is necessary to first parametrize a valid operating mode (S-0-0032ff) and release the drive.

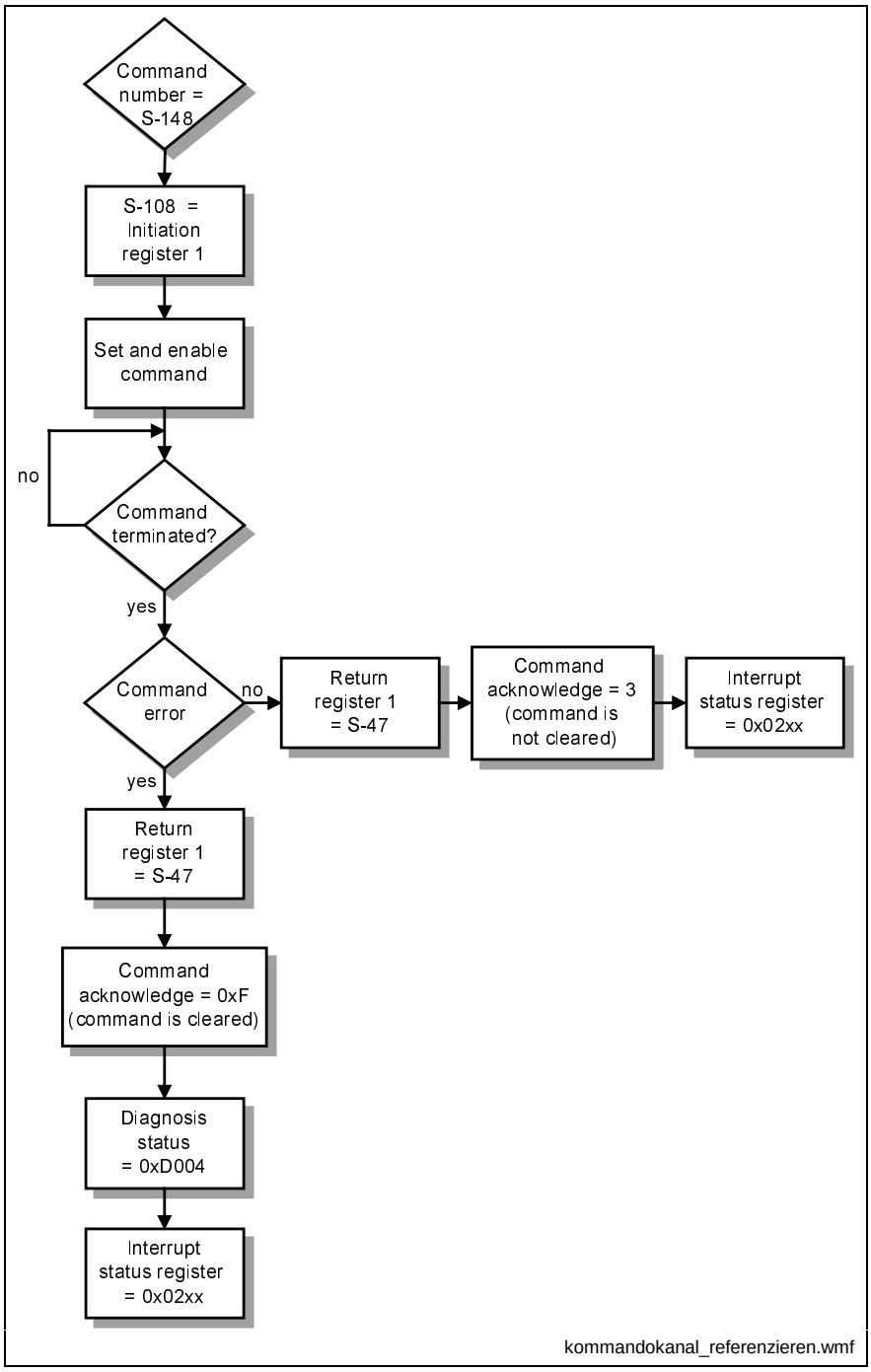


Fig. 7-20: Operational sequence in drive-controlled homing

Spindle Positioning (IDN S-0-0152)

Initiation register 1:	"spindle angle position"	IDN S-0-0153
	or	
	"spindle relative offset"	IDN S-0-0180
Initiation register 2:	"spindle positioning parameter"	IDN S-0-0154
Initiation register 3:	"feedrate override"	IDN S-0-0108
Initiation register 1:	"position command value"	IDN S-0-0047

Operational order:

The NC control unit programs initiation registers 1 through 3 appropriately. Bit 2 in "spindle positioning parameter" indicates which value, i.e., spindle angle position or spindle path, is set in initiation register 1. After the NC control unit has triggered the command, all changes in initiation register 3 are continuously transmitted to the drive. This can be used to change the spindle positioning velocity in the drive.

Command acknowledge without error

With the use of command acknowledge 0x0003, SERCANS informs the NC control of the positive execution of the command. The NC control now reads the "position command value" in return register 1, and then writes it into the cyclic data. This sets the coordinate system of the NC control to that of the drive. The NC control now clears the command.

Command acknowledge with error

A negative command execution is displayed with command acknowledge 0x000F. In this case, SERCANS writes an error code in return register 1, brings the diagnostics channel up to current status and sets the diagnostics status. The NC control unit responds with its own error routine, e.g., signal error, display diagnostics and so on. The NC control unit must then clear the command.

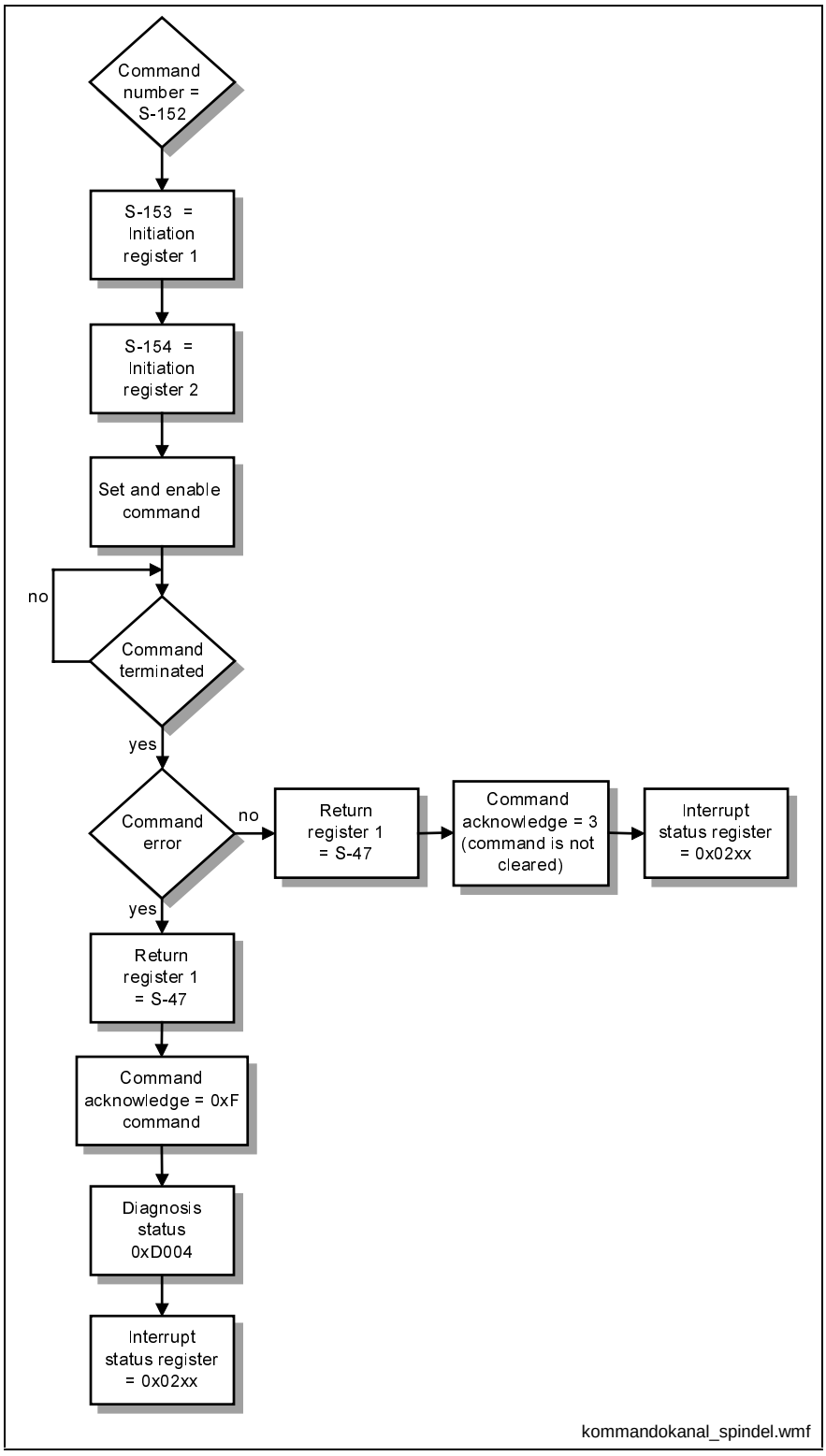


Fig. 7-21: Operational sequence in spindel positioning

Universal Operational Order in the Command Channel

If a command other than IDN S-0-0148 or IDN S-0-0152 shall be executed, then a universal command order without initiation or return register will ensue.

Operational flow:

The command is activated with the control command word 0x0003 via the interrupt control register by the NC control.

Command acknowledge without error

SERCANS informs the NC control of the positive execution of the command by means of command acknowledge 0x0003. The NC control unit must then clear the command.

Command acknowledge with error

A negative command execution is displayed with command acknowledge 0x000F. In this case, SERCANS writes an error code in return register 1, brings the diagnostics channel up to current status and sets the diagnostics status. The NC control unit can respond with its own error routine, e.g., signal error, display diagnostics and so on. The NC control unit must now clear the command.

Note: The command channel should only be used for commands that the drive can independently process. For example, it is advisable to use the NC service channel for such commands as "probing cycle procedure command" (S-0-0170) or "command parking axes" (S-0-0139) because the command usually takes so long.

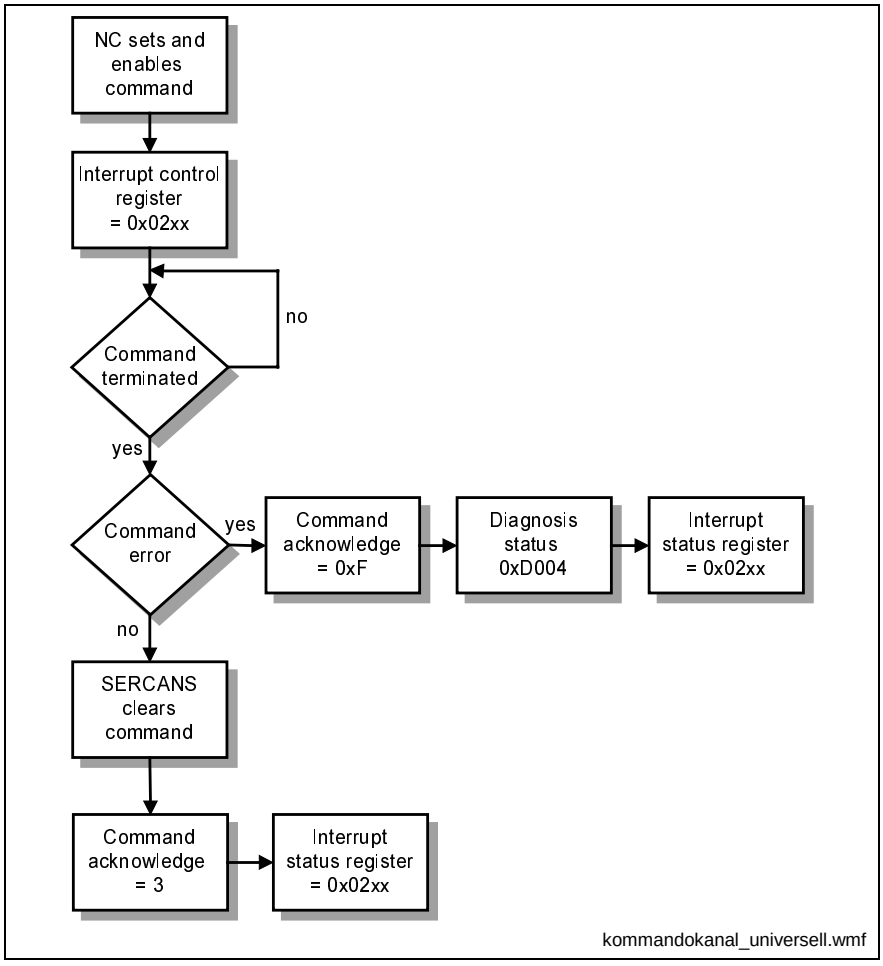


Fig. 7-22: Universal operational sequence in the command channel

7.6 Service Channel

SERCANS makes an NC service channel in the DPR available to the NC control unit for each drive. The length of the transport container is limited to four bytes. The SERCOS interface ident numbers are two bytes long.

The NC service channel is available to the NC control unit starting with communication phase 2. In comparison to the MMI service channel transmission, it has a higher priority. This means that an MMI service channel transmission running with a drive will be interrupted if the same drive is addressed by the NC service channel.

Note: If the NC control unit cyclically, e.g., every 500 ms, reads or writes data via the NC service channel, then it is not possible to work with the MMI service channel or SercTop. It is advisable to configure these data either in the command value or the actual value channel.

The field telegram length indicates the length in bytes of the data to be transmitted. Data exchange via the NC service channel can use an uneven number of characters.

The Structure of the NC Service Channel

The difference between the NC service channel and the MMI service channel lies in the identification number and transport container. It has the following structure:

NC Service Channel		
DPR address	**Name**	**Data length**
start addr.+0xCC	telegram length	2 bytes
start addr.+0xCE	control field	2 byte
start addr.+0xD0	ident number	2 bytes
start addr.+0xD2	transport container	4 bytes

Fig. 7-23: The structure of the NC service channel

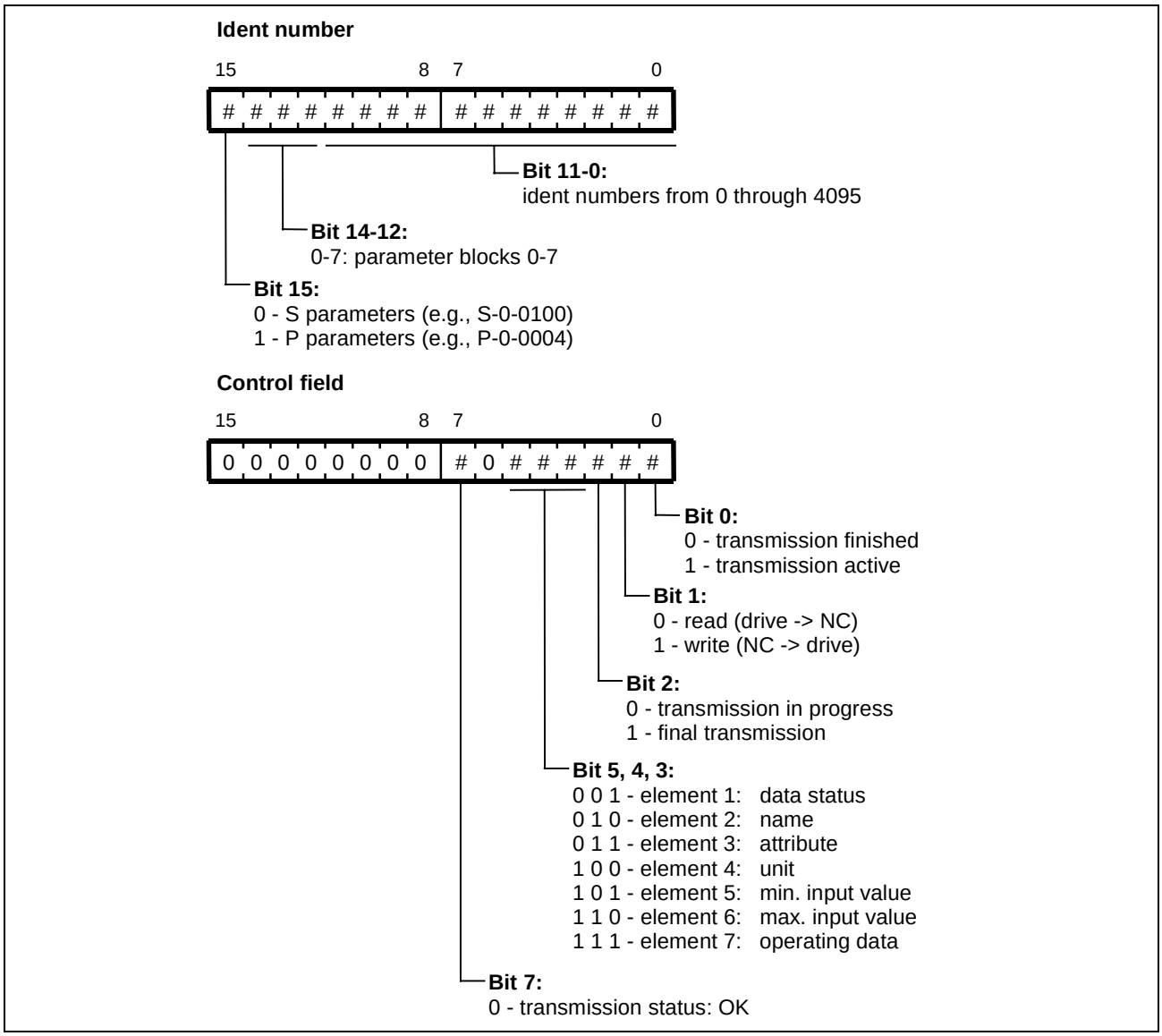


Fig. 7-24: Structure of the NC service channel

Operational Order in the NC Service Channel

Before starting a data transmission,

- the ident number and the
- control field with
  - element number and
  - transmission direction (read/write)

must be appropriately programmed.

When writing

- the length of the data to be transmitted in the telegram length and
- the data in the transport container must be entered,
- and the last or transmission in progress is programmed in the control field.

Note: The NC control unit starts the transmission by setting the bit "transmission active" into the control field (bit 0=1) and then writing a corresponding value (0x04nn) into the interrupt control register. SERCANS acknowledges execution by clearing the bit "transmission complete" in the control field (bit 0=0) and then writing a corresponding value (0x04nn) into the interrupt status register.

Reading element 1-7: Transmitted data from the drive to the NC control unit

- As indicated above, parameter data are written into the NC control channel and transmission triggered.
- Upon successful completion, SERCANS acknowledges in the control field (bit 0=0) and in the interrupt status register. The data are now available in the transport container of the NC service channel.
- The set bit "transmission status: error" in the control field of the NC service channel indicates that there has been a transmission error. In this case, there is an error message in the transport container instead of the expected parameter data.
- If the parameter data are longer than the transport container, then the bit "transmission in progress" in the control field is cleared by SERCANS. The data must be continuously be read until all the data has been transmitted. SERCANS indicates this by setting the bit "final transmission".

Writing element 1-7 : Transmitted data from the drive to the NC control unit

- As indicated above, the parameter data are written onto the NC service channel and then transmission triggered.
- Upon successful completion, SERCANS acknowledges in the control field (bit 0=0) and in the interrupt status register.
- The set bit "transmission status: error" in the control field of the NC service channel indicates that there has been a transmission error. In this case, there is an error message in the transport container.
- If the data are longer than the transport container, then the bit "transmission in progress" in the control field must be cleared by the NC. The data must be written until all data has been transmitted. The NC must indicate this to SERCANS by setting the bit "final transmission".

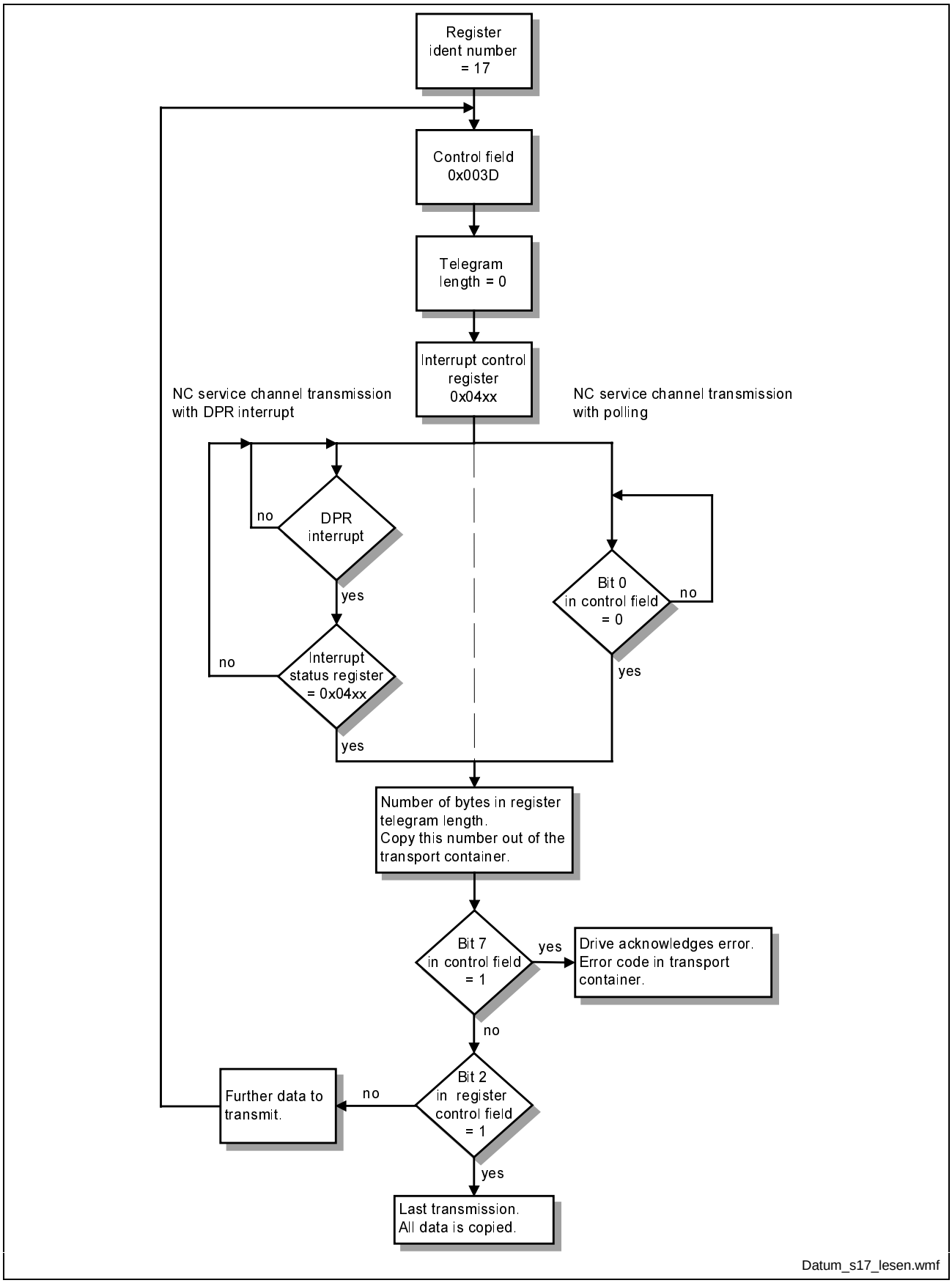


Fig. 7-25: Example: Read data of S-0-0017 (list)

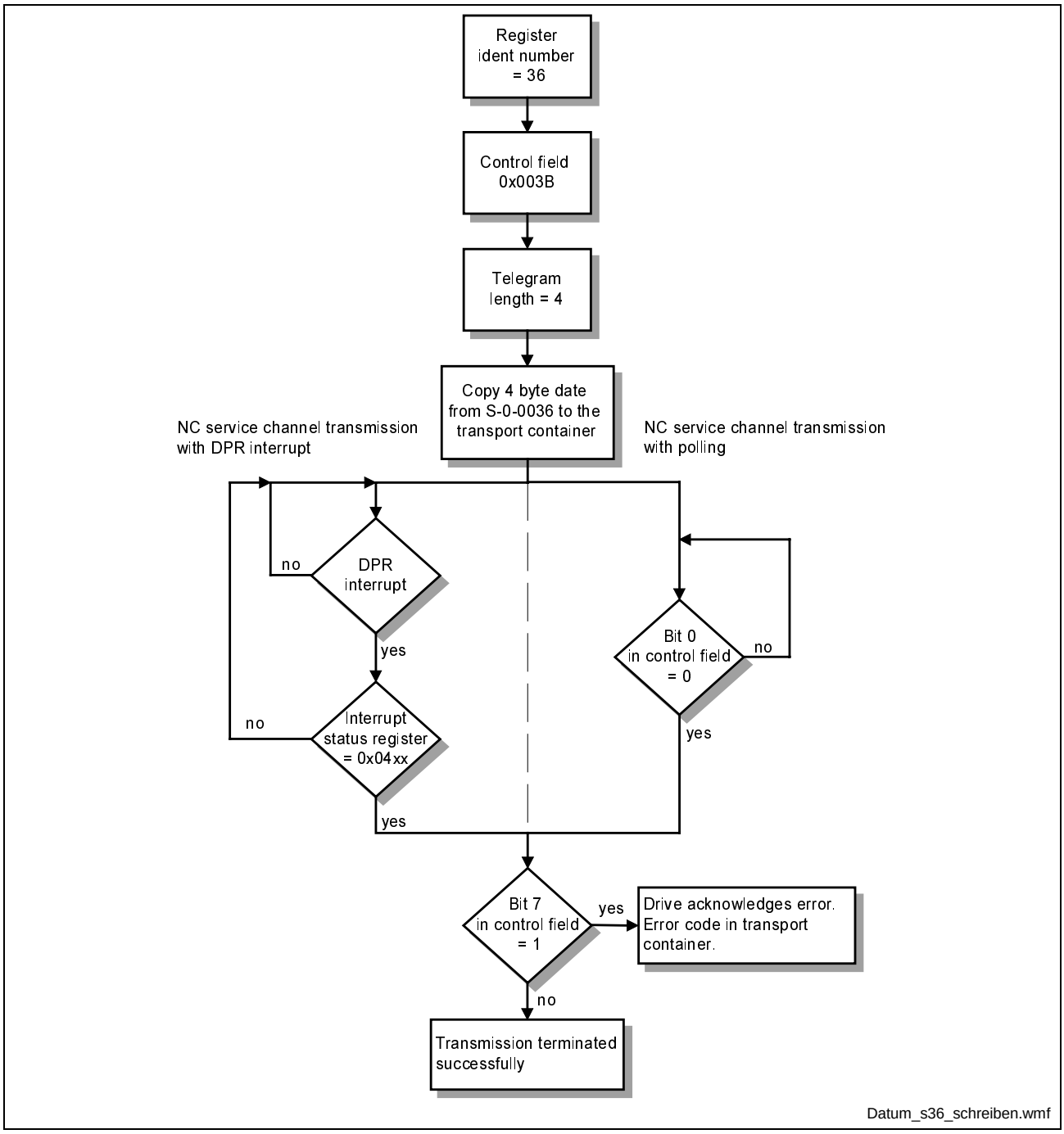


Fig. 7-26: Example: Write data of S-0-0036

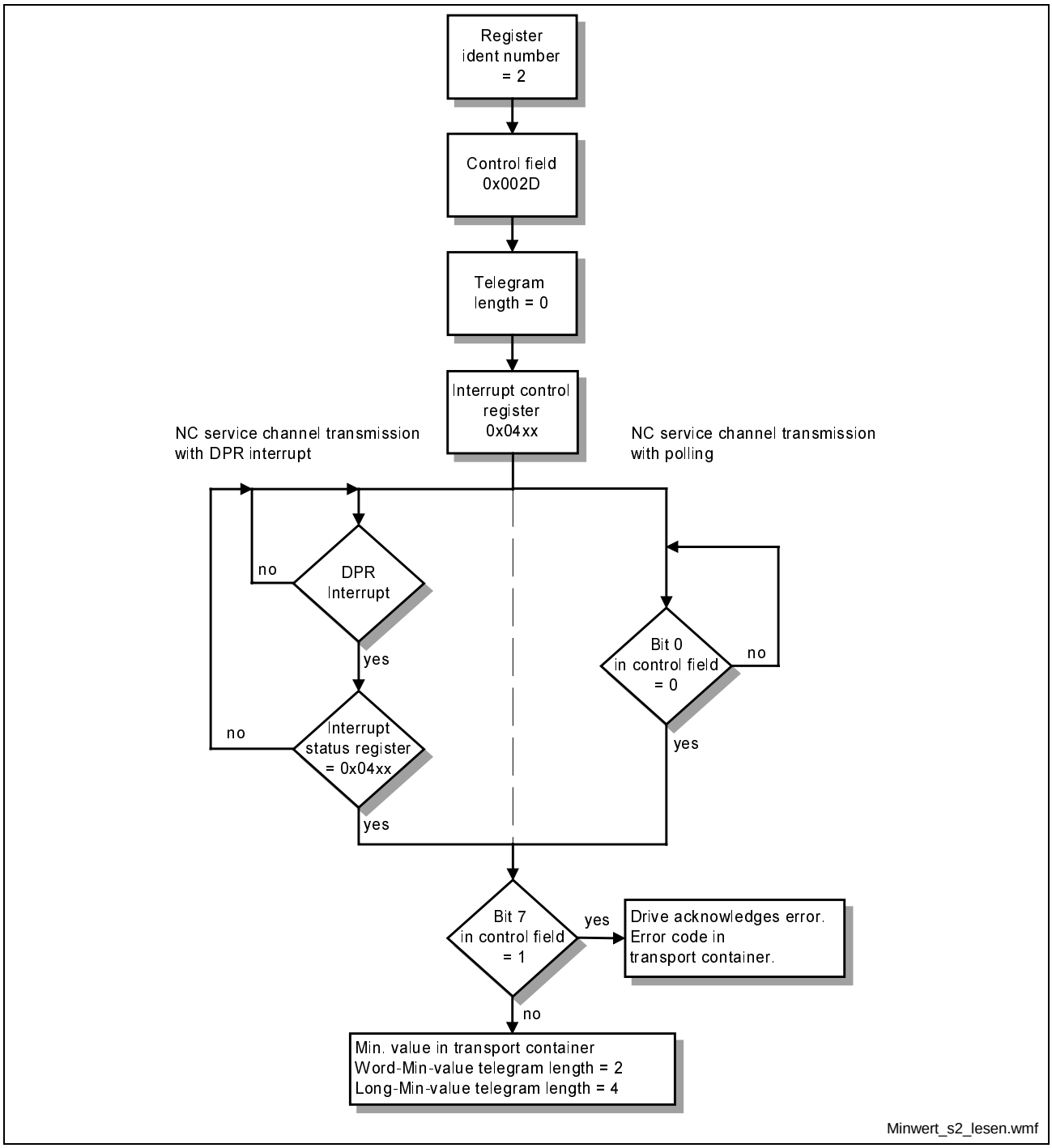


Fig. 7-27: Example: Read minimum value of S-0-0002

Error Messages in the NC Service Channel

The following table lists all error messages of the NC service channel. These error messages are identical to those of the MMI service channel.

The error code is entered in the first word of the transport container with a length of two bytes (see Fig. 7-23).

Error code in the transport container (1st word)	Error message in the NC service channel
0x0000	no error in the NC/MMI service channel
0x0001	NC/MMI service channel not open
0x0009	wrong access to element 0
0x1001	no ident number
0x1009	wrong access to element 1
0x2001	no name
0x2002	name transmission too short
0x2003	name transmission too long
0x2004	name cannot be changed
0x2005	name write-protected at this time
0x3002	attribute transmission too short
0x3003	attribute transmission too long
0x3004	attribute cannot be modified
0x3005	attribute is write protected at this time
0x4001	no units
0x4002	unit transmission too short
0x4003	unit transmission too long
0x4004	unit cannot be changed
0x4005	unit is write-protected at this time
0x5001	no minimum value
0x5002	minimum value transmission too short
0x5003	minimum value transmission too long
0x5004	minimum value cannot be changed
0x5005	minimum value is write-protected at this time
0x6001	no maximum value
0x6002	maximum value transmission too short
0x6003	maximum value transmission too long
0x6004	maximum value cannot be changed
0x6005	maximum value is write-protected at this time
0x7002	data transmission too short
0x7003	data transmission too long
0x7004	data cannot be changed
0x7005	data write protected at this time
0x7006	data smaller than the min. value
0x7007	data greater than the max. value
0x7008	data not correct
0x7009	data write protected by password
0x700A	data cyclic configured at this time
0x700C	data outside the valid number area

0x8001	service channel presently busy
0x8002	problem in service channel
0x8006	HS timeout
0x8007	AT failure
0x8009	fiber optic ring interrupt
0x800B	transmission aborted (higher priority)
0x800C	illegal access (service channel still active)

Fig. 7-28: Error message in the NC service channel

7.7 MMI Service Channel

The MMI service channel supports data transmission when connecting a man-machine interface via an asynchronous serial interface, or the DPR, to an assembly.

For the NC control unit, SERCANS makes an MMI service channel in the DPR available for all drives.

The MMI service channel is available to the NC control unit starting with communication phase 0. In comparison to the NC service channel, it has a lower priority. This means that an MMI service channel transmission running with a drive will be interrupted if the same drive is addressed by the NC service channel.

The field telegram length indicates the length in bytes of the data to be transmitted. Data exchange via the MMI service channel can take place with an uneven number of characters.

Note: The MMI service channel must not be simultaneously addressed via the asynchronous serial interface (user interface) and via the DPR.

The Structure of the MMI Service Channel

The only difference between the MMI service channel and the NC service channel is the parameter number and the transport container. Its structure is as follows:

MMI Service Channel		
DPR address	**Name**	**Data length**
0x0730	telegram length	2 bytes
0x0732	control field	2 bytes
0x0734	parameter number	4 bytes
0x0738	transport container	2048 bytes

Fig. 7-29: MMI service channel

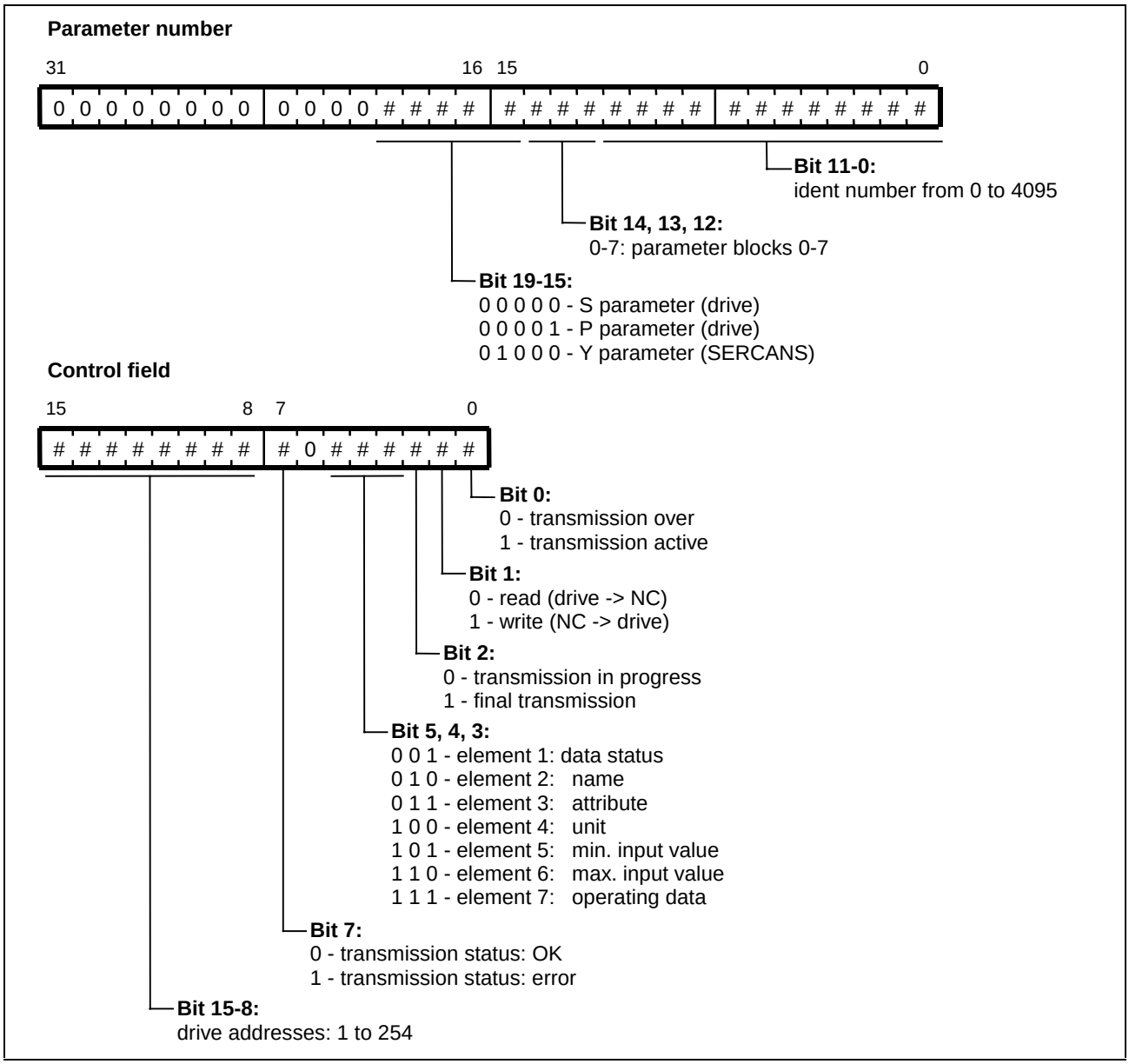


Fig. 7-30: Structure of the MMI service channels

Order in the MMI Service Channel

Before starting a data transmission, it is necessary for the NC control unit to program

- the parameter number and
- the control fields with
  - drive addresses,
  - element number and
  - transmission direction (read/write).

When writing, it is necessary to additionally enter

- the length of the data to be transmitted in the telegram length,
- the data in the transport container and
- the last or transmission in progress is programmed in the control field.

Note: The NC control unit starts the transmission by setting the bit "transmission active" into the control field (bit 0=1) and then writting the value 0x8000 into the interrupt control register. SERCANS acknowledges execution by clearing the bit "transmission complete" in the control field (bit 0=0) and then writing the value 0x8000 into the interrupt status register.

Reading element 1-7: Data transmitted to the NC control unit from the drive or SERCANS

- As indicated above, parameters are written into the MMI service channel and transmission triggered.
- Upon successful completion, SERCANS acknowledges in the control field (bit 0=0) and in the interrupt status register. The data is now available in the transport container of the MMI service channel.
- The set bit "transmission status: error" in the control field of the MMI service channel indicates that there has been a transmission error. In this case, there is an error message in the transport container instead of the expected parameter data.
- If the parameter data are longer than the transport container, then the bit "transmission in progress" in the control field of the MMI service channel must be cleared. The reading of the data must be continued until all data has been transmitted. This is indicated by SERCANS with the set bit "final transmission".

Writing element 1-7: Data transmitted by the NC control unit to the drive or the SERCANS

- As indicated above, the parameter data are written onto the MMI service channel and then transmisison triggered.
- Upon successful completion, SERCANS acknowledges in the control field (bit 0=0) and the interrupt status register.
- The set bit "transmission status: error" in the control field of the MMI service channel indicates that there has been a transmission error. In this case, there is an error message in the transport container.
- If the data are longer than the transport container, then the bit "transmission in progress" in the control field must be cleared by the NC. The writing of the data must be continued until all data has been transmitted. The NC must indicate this to SERCANS by setting the bit "last transmission".

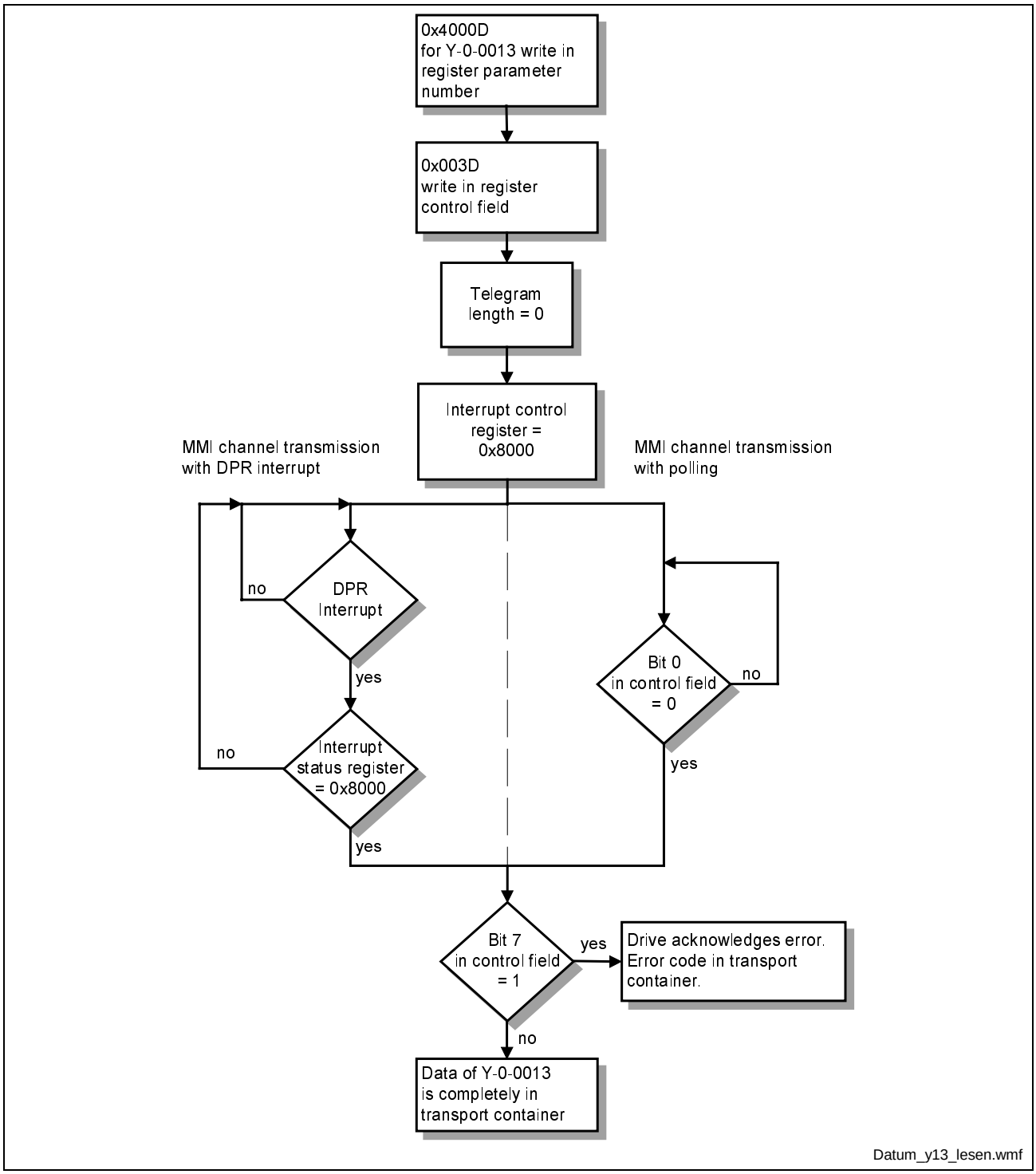


Fig. 7-31: Example: Read data of Y-0-0013

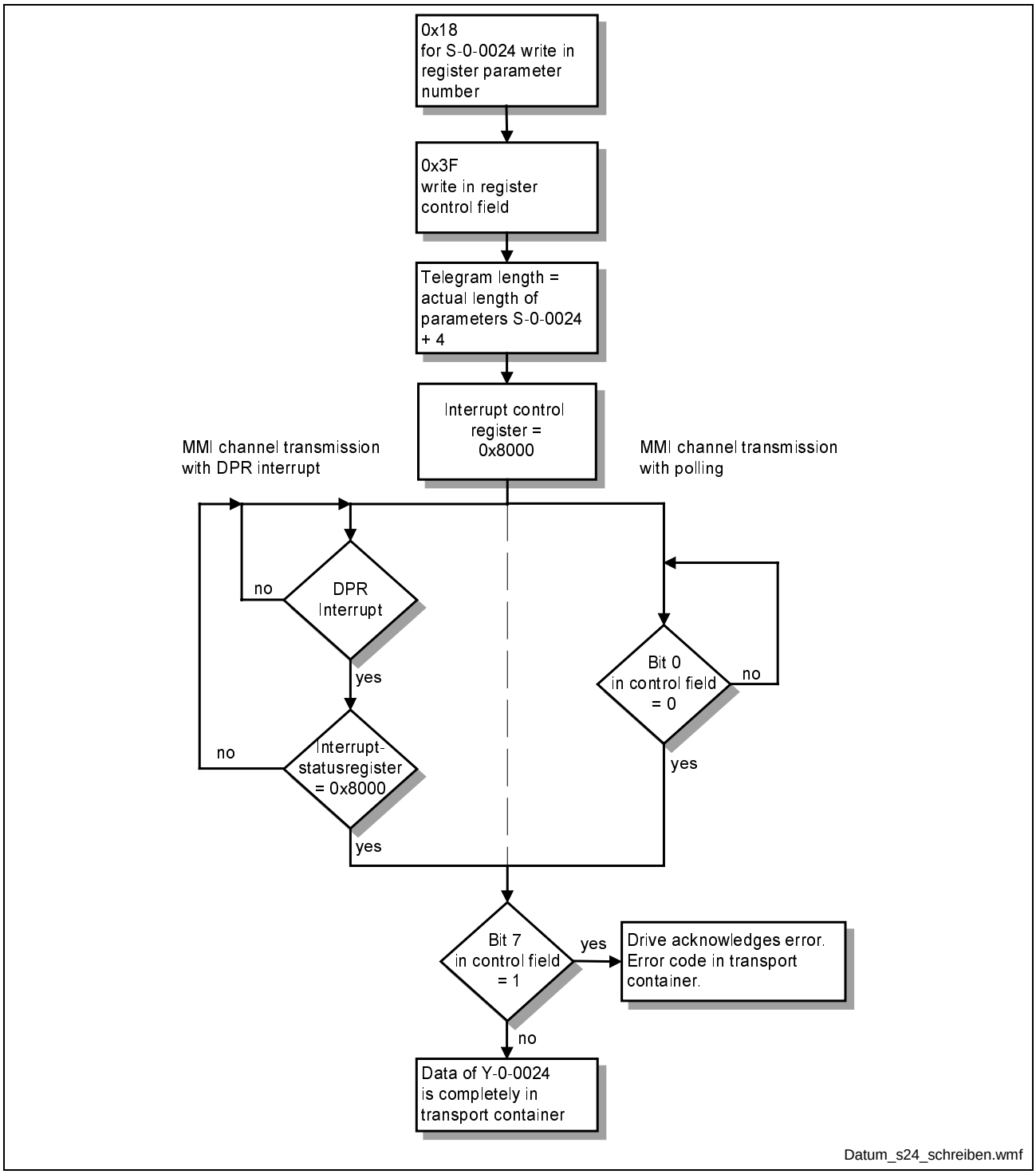


Fig. 7-32: Example: Write data of S-0-0024

Error Messages in the MMI Service Channel

The error messages here are identical with those of the NC service channel (see Fig. 7-29).

The error code is entered with a length of two bytes in the first word of the transport container.

Additionally, there are error messages for accesing command value generators parameters:

Error code in transport container (1st word)	Error messages in MMI service channel
0x9001	enable cannot be executed at selected drive; power not on or no drive selected
0x9002	selected drive is parameter scaled
0x9003	command value generator start without enable
0x9004	command value generator not active

Fig. 7-33: Error messages in MMI service channel

8 Command Value Generator Functions

8.1 Introduction

General

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

The drive receives defined command values during the drive check with command value generator. So 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 control parameters.

The command value generator is a control and optimization tools 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 SERCANS using parameters relevant to the its function. It is activated in the SERCANS user interface "SercTop" in the window of the command generator box. The descriptions of the command value generator parameters are outlined in the section on parameter descriptions (see "Parameter Descriptions", section 10).

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 SERCANS (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).

8.2 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:

- Switch machine into communication phase 2.
- In parameter "command value generator enable" (Y-0-0044) select a command value generator (input 0x0001).
- Regarding to the axis structure used in parameter Y-0-0045 to Y-0-0052 select encoder check mode (input 0x0303).
- Switch machine into communication phase 4.
- Start with parameter "command value generator control word" (Y-0-0053) with command value generator start + drive enable + select axis structure.
- Can be deactivated at any time via Y-0-0053 = 0.

Parameter

The following parameters can be set:

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

8.3 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.

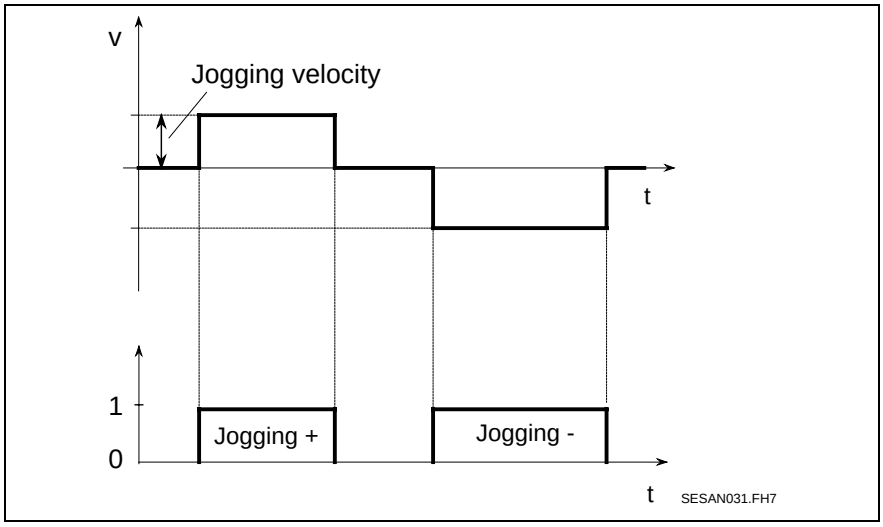


Fig. 8-1: Jogging in velocity control

Activation

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

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.

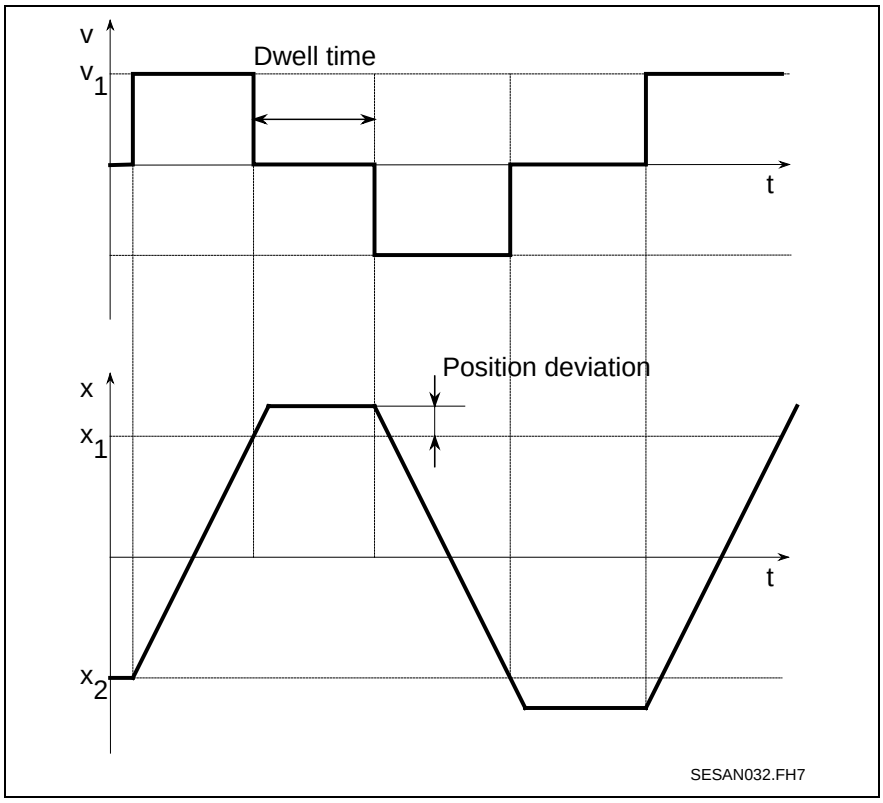


Fig. 8-2: Reversing with velocity control

Activation

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

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.

he resulting position deviation depends on the velocity set.

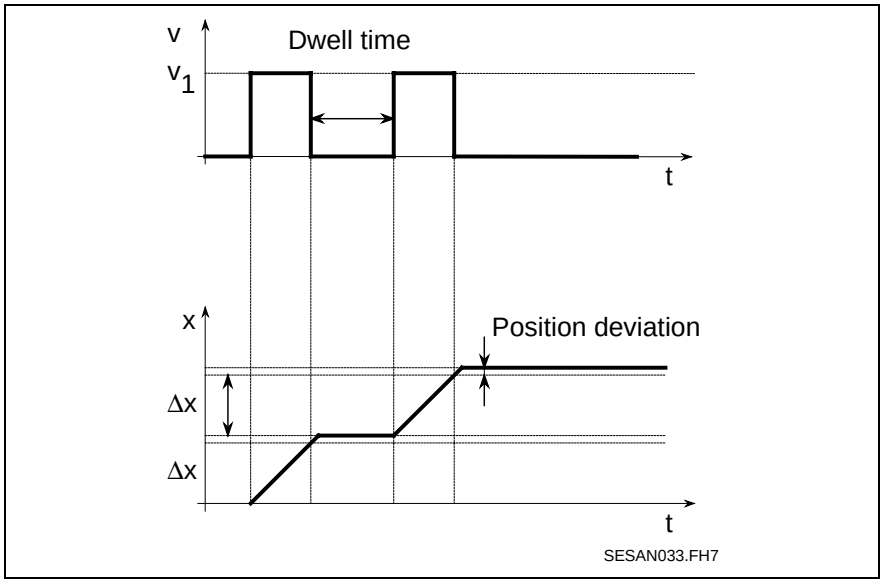


Fig. 8-3: Step mode with velocity control

Activation

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

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)

8.4 Command Value Generator Position Control

Reversing

Function

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

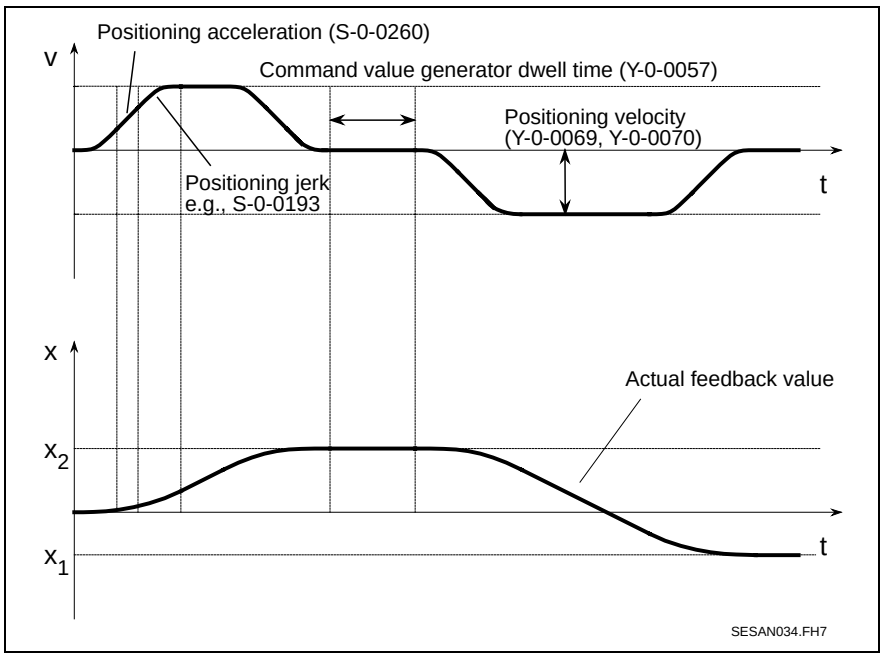


Fig. 8-4: Reversing with position control

The drive reverses between positions x_1 and x_2.

Starting with the present position, the drive accelerates to "positioning velocity translatory" (Y-0-0069) or "positioning velocity rotary" (Y-0-0070). The rise in velocity depends on "positioning acceleration" (S-0-0260) and "positioning jerk" (S-0-0193).

The drive reaches positions x_1 or x_2 precisely.

Motional direction is reversed after dwell time (Y-0-0057).

Activation

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

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)
- "Positioning velocity" (S-0-0259)
- "Positioning acceleration" (S-0-0260)
- "Positioning jerk" (S-0-0193)
- "Command value generator dwell time" (Y-0-0057)
- "Positioning velocity translatory" (Y-0-0069)

The following parameters can be set with rotary axes:

- x_1 : "Command value generator pos. 1 rotary" (Y-0-0060)
- $_2$: "Command value generator pos. 2 rotary" (Y-0-0061)
- "Positioning velocity" (S-0-0259)
- "Positioning acceleration" (S-0-0260)
- "Positioning jerk" (S-0-0193)
- "Command value generator dwell time" (Y-0-0057)
- "Positioning velocity rotary" (Y-0-0070)

Step Mode

Note: This function only for axes with modulo format. The axes only move approximately along the specified travel path Δ x!

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 Δx.

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

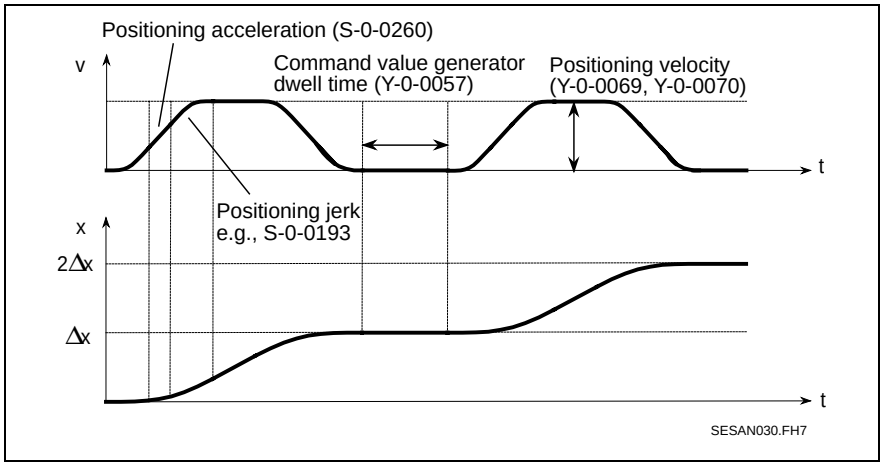


Fig. 8-5: Step mode with position control

First, there is acceleration starting from the present position whilst taking into account "positioning acceleration" (S-0-0260) and "positioning jerk" (S-0-0193) to "positioning velocity translatory" (Y-0-0069) or "positioning velocity rotary" (Y-0-0070).

The drive runs precisely to position Δx.

The procedure is repeated after dwell time (Y-0-0057).

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

Parameter

The following parameters can be set with translatory axes:

- Δx : "Command value generator travel distance translatory" (Y-0-0064)
- "Positioning velocity" (S-0-0259)
- "Positioning acceleration" (S-0-0260)
- "Positioning jerk" (S-0-0193)
- "Command value generator dwell time" (Y-0-0057)
- "Positioning velocity translatory" (Y-0-0069)

The following parameters can be set with rotary axes:

- Δx : "Command value generator travel distance rotary" (Y-0-0065)
- "Positioning velocity" (S-0-0259)
- "Positioning acceleration" (S-0-0260)
- "Positioning jerk" (S-0-0193)
- "Command value generator dwell time" (Y-0-0057)
- "Positioning velocity rotary" (Y-0-0070)

8.5 Noise Generator

General

When starting up a machine axis 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 available a test signal without average available.

Function

The noise generator makes a pseudostatistic 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 translatory axes via parameter "amplitude noise source translatory" (Y-0-0067) or for rotary axes via "amplitude noise source rotary" (Y-0-0068).

The output signal is generated repeatedly about every 8 seconds given a SERCOS cycle time of 2 ms. The repetition time of t_W of the noise generator depends on "SERCOS cycle time" (Y-0-0004) and is computed as follows:

$$t_W = 2^8 \cdot t_{Scyc}$$

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 the drive enable is set. If the drive enable is removed, then the noise generator is stopped.

Parameter The following parameters can be set with rotary and translatory axes:

- "Amplitude noise source translatory" (Y-0-0067)
- "Amplitude noise source rotary" (Y-0-0068)
- "Command value generator control word" (Y-0-0053)
- "Command value generator enable" (Y-0-0044)
- "SERCOS cycle time" (Y-0-0004)
- All parameters for the chosen modes of the command value generator.

9 Memory Map in the Dual Port RAM

9.1 Memory Map Overview

The DPR contains the systems parameters, the MMI service channel, eight axis structures arranged as a field and both interrupt registers.

Hexadecimal numbers are depicted in the documentation in terms of "**0xNNNN**"!

SCS-A01 DPR-address	**SCS-P01** DPR-address	**SCS-V01** DPR-address	**Name**	**Data length**
- - -	- - -	0x0001	VMEbus control register	8 bytes
0x0000	0x0000	0x1000	system parameters	188 bytes
0x0058	0x0058	0x1058	reserved	40 bytes
0x0080	0x0080	0x1080	axis structure for 8 drives	1712 bytes
0x0730	0x0730	0x1730	MMI service channel	2056 bytes
0x0F38	0x0F38	0x1F38	system parameter command value generator	84 bytes
0x0F8C	0x0F8C	0x1F8C	reserved	106 bytes
0x0FF6	0x0FF6	0x1FF6	SYNC register	2 bytes
- - -	0x0FF8	- - -	PC ident register	2 bytes
- - -	0x0FFA	- - -	PC control register	2 bytes
0x0FFC	0x0FFC	0x1FFC	interrupt register	4 bytes

Fig. 9-1: Overview of memory map (SCS-x01)

SCS-A02 DPR-address	**SCS-P02** DPR-address	**SCS-V02** DPR-address	**Name**	**Data length**
0x0000	0x0000	0x0000	system parameter	88 bytes
0x0058	0x0058	0x0058	reserved	40 bytes
0x0080	0x0080	0x0080	axis structure for 8 drives	1712 bytes
0x0730	0x0730	0x0730	MMI service channel	2056 bytes
0x0F38	0x0F38	0x0F38	system parameter command value generator	84 bytes
0x0F8C	0x0F8C	0x0F8C	reserved	106 bytes
0x0FF6	0x0FF6	0x0FF6	SYNC register	2 bytes
- - -	0x0FF8	- - -	PC ident register	2 bytes
- - -	- - -	0x8000	config register 1	2 bytes
0x0FFA	0x0FFA	0x8002	config register 2 / PC control register	2 bytes
0x0FFC	0x0FFC	0x0FFC	interrupt register	4 bytes

Fig. 9-2: Overview of memory map (SCS-x02)

System parameters

DPR address	Name	Parameter number	Data length
0x0000	bus mode	Y-0-0001	2 bytes
0x0002	synchronous Master	Y-0-0002	2 bytes
0x0004	data rate	Y-0-0003	2 bytes
0x0006	SERCOS cycle time	Y-0-0004	2 bytes
0x00008	NC cycle time	Y-0-0005	2 bytes
0x000A	displacement	Y-0-0006	2 bytes
0x000C	dwell time	Y-0-0007	2 bytes
0x000E	phase initiation	Y-0-0014	2 bytes
0x0010	reserved		2 bytes
0x0012	reserved		2 bytes
0x0014	DPR access time command value	Y-0-0010	2 bytes
0x0016	system error	Y-0-0011	2 bytes
0x0018	system status	Y-0-0015	2 bytes
0x001A	optical transmission power	Y-0-0016	2 bytes
0x001C	phase switching locked	Y-0-0017	2 bytes
0x001E	lifecounter difference	Y-0-0018	2 bytes
0x0020	lifecounter SERCANS	Y-0-0019	2 bytes
0x0022	lifecounter NC	Y-0-0020	2 bytes
0x0024	DPR access time actual value	Y-0-0037	2 bytes
0x0026	NC access time	Y-0-0038	2 bytes
0x0028	hardware-version	Y-0-0008	10 bytes
0x0032	software-version	Y-0-0009	16 bytes
0x0042	language selection	Y-0-0041	2 bytes
0x0044	error counter SYNC	Y-0-0043	2 bytes
0x0046	list of telegram type parameter	Y-0-0066	16 bytes
0x0056	powering up target phase	Y-0-0071	2 bytes

Fig. 9-3: System parameters

System Parameters Command Value Generator

0x0F38	command value generator enable	Y-0-0044	2 bytes
0x0F3A	command value generator operating mode axis structure 1	Y-0-0045	2 bytes
0x0F3C	command value generator operating mode axis structure 2	Y-0-0046	2 bytes
0x0F3E	command value generator operating mode axis structure 3	Y-0-0047	2 bytes
0x0F40	command value generator operating mode axis structure 4	Y-0-0048	2 bytes
0x0F42	command value generator	Y-0-0049	2 bytes

	operating mode axis structure 5		
0x0F44	command value generator operating mode axis structure 6	Y-0-0050	2 bytes
0x0F46	command value generator operating mode axis structure 7	Y-0-0051	2 bytes
0x0F48	command value generator operating mode axis structure 8	Y-0-0052	2 bytes
0x0F4A	command value generator control word	Y-0-0053	4 bytes
0x0F4E	command value generator pos. 1 translatory	Y-0-0054	4 bytes
0x0F52	command value generator pos. 2 translatory	Y-0-0055	4 bytes
0x0F56	command value generator velocity translatory	Y-0-0056	4 bytes
0x0F5A	command value generator dwell time	Y-0-0057	2 bytes
0x0F5C	command value generator jogging speed translatory	Y-0-0058	4 bytes
0x0F60	command value generator status word	Y-0-0059	4 bytes
0x0F64	command value generator pos. 1 rotary	Y-0-0060	4 bytes
0x0F68	command value generator pos. 2 rotary	Y-0-0061	4 bytes
0x0F6C	command value generator velocity rotary	Y-0-0062	4 bytes
0x0F70	command value generator jogging speed rotary	Y-0-0063	4 bytes
0x0F74	command value generator travel distance translatory	Y-0-0064	4 bytes
0x0F78	command value generator travel distance rotary	Y-0-0065	4 bytes
0x0F7C	amplitude noise source translatory	Y-0-0067	4 bytes
0x0F80	amplitude noise source rotary	Y-0-0068	4 bytes
0x0F84	positioning velocity translatory	Y-0-0069	4 bytes
0x0F88	positioning velocity rotary	Y-0-0070	4 bytes

Fig. 9-4: Addresses of the command value generator

Axis Structures

Starting address of axis structures		
DPR address	**Name**	**Data length**
0x0080	axis structure 1	214 bytes
0x0156	axis structure 2	214 bytes
0x022C	axis structure 3	214 bytes
0x0302	axis structure 4	214 bytes
0x03D8	axis structure 5	214 bytes
0x04AE	axis structure 6	214 bytes
0x0584	axis structure 7	214 bytes
0x065A	axis structure 8	214 bytes

Fig. 9-5: Starting address of axis structures

Overview of axis structures		
DPR address	**Name**	**Data length**
start addr.+0x00	drive address (Y-0-0012)	2 bytes
start addr.+0x02	command value configuration Y-0-0039, 21, 23, 25, 27, 29, 31, 33, 35	18 bytes
start addr.+0x14	actual value configuration Y-0-0040, 22, 24, 26, 28, 30, 32, 34, 36	18 bytes
start addr.+0x26	command value channel	34 bytes
start addr.+0x48	actual value channel	34 bytes
start addr.+0x6A	diagnostics channel	68 bytes
start addr.+0xAE	command channel	30 bytes
start addr.+0xCC	NC service channel	10 bytes

Fig. 9-6: Overview of axis structures

Command/actual value configuration and command/actual value channel		
DPR address	**Name**	**Data length**
start addr.+0x02	command value header (Y-0-0039)	2 bytes
start addr.+0x04	IDN list (command value) (e.g., Y-0-0021)	16 bytes
start addr.+0x14	actual value header (Y-0-0040)	2 bytes
start addr.+0x16	IDN list (actual value) (e.g., Y-0-0022)	16 bytes
start addr.+0x26	command value channel control word	2 bytes
start addr.+0x28	command value channel data	32 bytes
start addr.+0x48	actual value channel drive status	2 bytes
start addr.+0x4A	actual value channel data	32 bytes

Fig. 9-7: Command/actual value configuration and command/actual value channel

Diagnostics channel		
DPR address	**Name**	**Data length**
start addr.+0x6A	diagnostics status	2 bytes
start addr.+0x6C	status class 1 (S-0-0011)	2 bytes
start addr.+0x6E	diagnostics number (S-0-0390)	2 bytes
start addr.+0x70	length of diagnostics text	2 bytes
start addr.+0x72	diagnostics text (S-0-0095)	60 bytes

Fig. 9-8: Axis structure - diagnostics channel

Command channel		
DPR address	**Name**	**Data length**
start addr.+0xAE	command number	2 bytes
start addr.+0xB0	command control word	2 bytes
start addr.+0xB2	command acknowledge	2 bytes
start addr.+0xB4	initiation register 1	4 bytes
start addr.+0xB8	initiation register 2	4 bytes
start addr.+0xBC	initiation register 3	4 bytes
start addr.+0xC0	return register 1	4 bytes
start addr.+0xC4	return register 2	4 bytes
start addr.+0xC8	return register 3	4 bytes

Fig. 9-9: Axis structure - command channel

NC service channel		
DPR address	**Name**	**Data length**
start addr.+0xCC	telegram length	2 bytes
start addr.+0xCE	control field	2 bytes
start addr.+0xD0	ident number	2 bytes
start addr.+0xD2	transport container	4 bytes

Fig. 9-10: Axis structure - NC service channel

MMI Service Channel

MMI Service Channel		
DPR address	**Name**	**Data length**
0x0730	telegram length	2 bytes
0x0732	control field	2 bytes
0x0734	parameter number	4 bytes
0x0738	transport container	2048 bytes

Fig. 9-11: MMI service channel

SERCANS Register

SERCANS Register		
DPR address	**Name**	**Data length**
0x0FF6	SYNC register	2 bytes
0x0FF8	PC ident register	2 bytes
0x8000	config register 1	2 bytes
0x0FFA or 0x8002	config register 2 or PC control register	2 bytes
0x0FFC	interrupt status register	2 bytes
0x0FFE	interrupt control register	2 bytes

Fig. 9-12: SERCANS register

9.2 Address Table

In the following tables A1..A8 designate the axis structures 1 to 8.

	Command value channel		**Actual value channel**	
	Control word	**Command value**	**Drive status**	**Actual value**
A1	0x00A6	0x00A8 ...	0x00C8	0x00CA ...
A2	0x017C	0x017E ...	0x019E	0x01A0 ...
A3	0x0252	0x0254 ...	0x0274	0x0276 ...
A4	0x0328	0x032A ...	0x034A	0x034C ...
A5	0x03FE	0x0400 ...	0x0420	0x0422 ...
A6	0x04D4	0x04D6 ...	0x04F6	0x04F8 ...
A7	0x05AA	0x05AC ...	0x05CC	0x05CE ...
A8	0x0680	0x0682 ...	0x06A2	0x06A4

Fig. 9-13: Address table 1

	Diagnostics channel	**Command-channel**	**NC service channel**
	(Diagnostics status)	**(Command number)**	**(Telegram length)**
A1	0x00EA	0x012E	0x014C
A2	0x01C0	0x0204	0x0222
A3	0x0296	0x02DA	0x02F8
A4	0x036C	0x03B0	0x03CE
A5	0x0442	0x0486	0x04A4
A6	0x0518	0x055C	0x057A
A7	0x05EE	0x0632	0x0650
A8	0x06C4	0x0708	0x0726

Fig. 9-14: Address table 2

10 Parameter Descriptions

10.1 The General Functions of Systems Parameters

System parameters determine the settings for the normal operational modes of SERCANS and the ring configuration. They can be changed by

- the NC control unit via the DPR,
- the monitor program via the asynchronous serial interface or
- the user interface.

The system parameters are loaded after a reset from the parameter EEPROM onto the dual port RAM. SERCANS uses the systems parameters in the DPR for the initialization of the SERCOS interface and its own software.

10.2 The Structure of the Data Block

There is a data block below each parameter number. It supplies the additional information on the various types of data. This makes it possible for the NC control unit to display and change even anonymous data with the use of a universal routine.

Elements 1, 3 and 7 must be present in every data block. Elements 2, 4, 5 and 6 are optional and supported as needed.

Elements 2 through 7 can be selected via bits 3 through 5 in the control field of the MMI/NC service channel.

Element number	Designation	Length
element 1	parameter number or ident number	4 bytes 2 bytes
element 2	name	60 bytes
element 3	attribute	4 bytes
element 4	unit	12 bytes
element 5	minimum input value	as with element 7
element 6	maximum input value	as with element 7
element 7	operating data	2 bytes 4 bytes or variable

Fig. 10-1: Data block structure

Structure of Parameter Number (Element 1)

These parameters are operated similarly to the SERCOS interface identification numbers, i.e., they are held in SERCANS storage in terms of data blocks with parameter numbers, names, attributes and so on. Analogous to the drive parameters (parameters S and P), the following display format has been used for the system parameters:

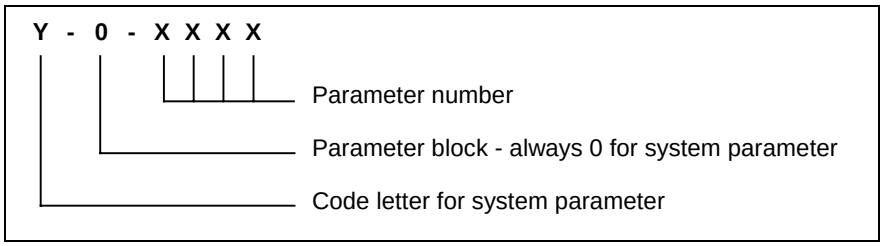


Fig. 10-2: Display format of the parameter number

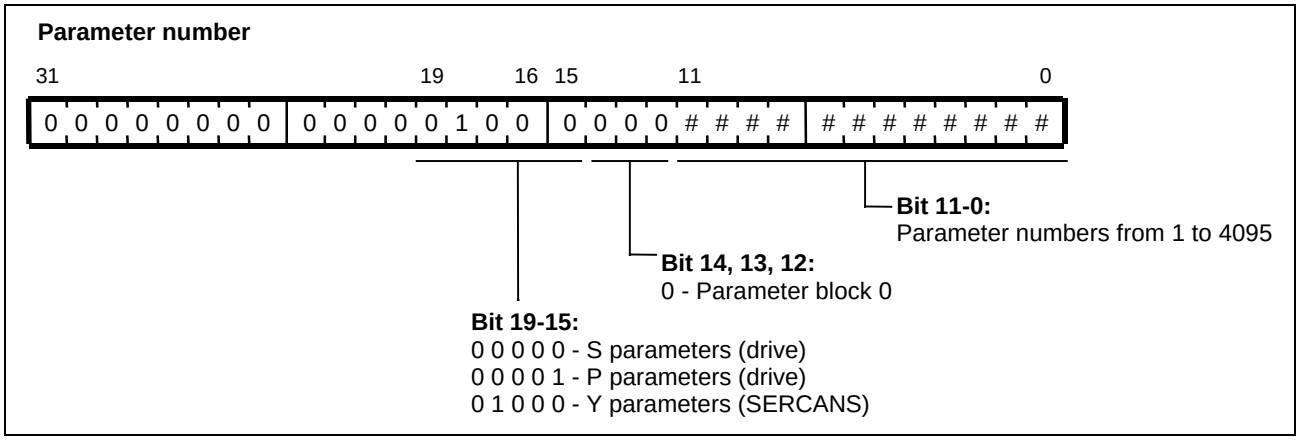


Fig. 10-3: Structure of the parameter number

Structure of the Name (Element 2)

The name is made up of a maximum of 60 ASCII characters (60 bytes).

Structure of the Attribute (Element 3)

The attribute contains all that information needed to depict the operating data in an intelligible fashion. It is the attribute that makes it possible to convert the transmitted operating data into understandable form and vice versa. The conversion in no way affects the data itself.

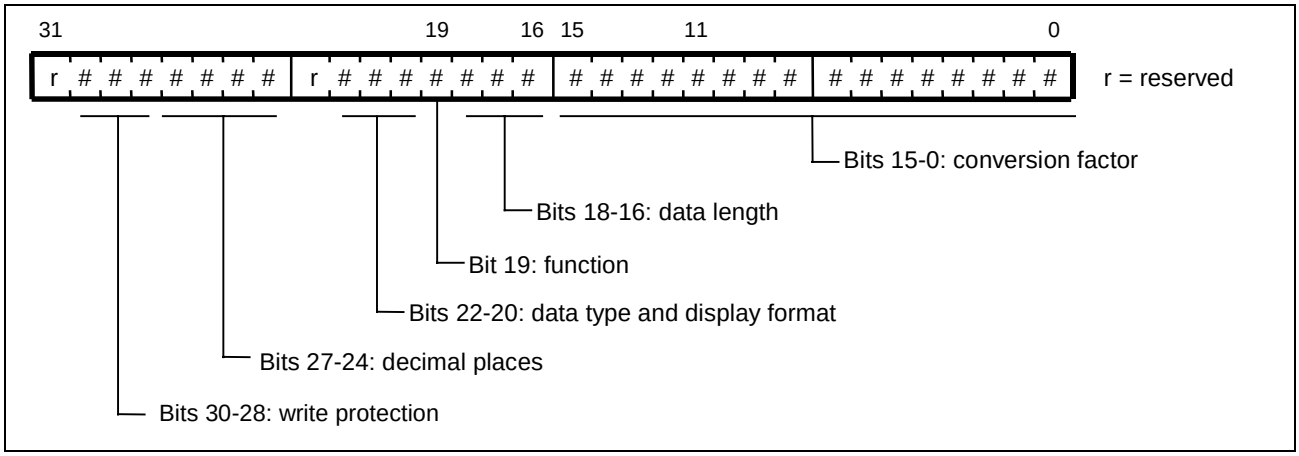


Fig. 10-4: Structure of the attributes

Bits 15-0:

The **conversion factor** is an unsigned integer. Its purpose is to convert numerical data into a display. The conversion factor is set on value 1 when it is not needed for data display, e.g., with a text.

Bits 18-16

The **data length** is required by the NC control unit when writing the data.

0 0 0 - reserved

0 0 1 - operating data is 2 bytes long

0 1 0 - operating data is 4 bytes long

0 1 1 - reserved

1 0 0 - variable length with 1 byte data

1 0 1 - variable length with 2 bytes-data

1 1 0 - variable length with 4 bytes-data

1 1 1 - reserved

Bit 19:

The **function** indicates that this identification number is a command.

0 - parameter

1 - command

Bits 22-20:

Data type and display format are used to convert the operating data as well as the minimum and maximum input values into the correct display form.

Data type	display format
0 0 0 - binary number	binary
0 0 1 - unsigned integer	unsigned decimal number
0 1 0 - whole integer	signed decimal number
0 1 1 - unsigned integer	hexadecimal
1 0 0 - extended character set	text
1 0 1 - unsigned integer	ident number (2 bytes)
1 1 0 - floating point (simple precision) per ANSI/IEEE Std. 754-1985	decimal number with size and exponent (places after decimal not relevant)
1 1 1 - unsigned integer	parameter number (4 bytes)

Fig. 10-5: Data type and display format

Bits 27-24:

The **decimal places** determine the position of the decimal point for display and input of the relevant operating data. This is an additional piece of display information.

0 0 0 0 - no decimal places

...

Bits 30-28:

Write protection specifies write protection of the parameter in the corresponding phases.

Bit 30: write protection in phase 4

0: operating data is writable

1: write protection in phase 4

Bit 29: write protection in phase 3

0: operating data is writable

1: write protection in phase 3

Bit 28: write protection in phase 2

0: operating data is writable

1: write protection in phase 2

Structure of the Unit (Element 4)

A unit consists of a maximum of 12 ASCII characters (12 bytes).

Structure of the Minimum Input Value (Element 5)

The minimum input value is the smallest numerical value which can be processed for this operating data.

If the value of the operating data is smaller than the minimum input value when writing, then the operating data is not changed.

The operating data has no minimum input value if it is a binary number of a character set.

The minimum input value is identical in length to that of the operating data and it is also displayed as if it were operating data.

Structure of the Maximum Input Value (Element 6)

The maximum input value is the largest numerical value which can be processed for this operating data.

If the value of the operating data is larger than the maximum input value when writing, then the operating data is not changed.

The operating data has no maximum input value if it is a binary number of a character set.

The maximum input value is identical in length to that of the operating data and is also displayed as if it were operating data.

Structure of the Operating Data (Element 7)

The length of the operating data is divided into three groups:

- a permanent length of 2 bytes
- a permanent length of 4 bytes
- a variable length of up to 65532 bytes

All velocity and position-dependent data have a length of 4 bytes.

All torque-dependent data have a length of 2 bytes.

Files or tables can be transmitted with operating data of variable lengths, e.g., parameters lists, by the NC control unit to the drives or vice versa.

Summary of the System Parameters

Y-0-0001	bus mode
Y-0-0002	synchronous master
Y-0-0003	data rate
Y-0-0004	SERCOS cycle time (tScyc)
Y-0-0005	NC cycle time (tNcyc)
Y-0-0006	displacement
Y-0-0007	dwell time
Y-0-0008	hardware-version
Y-0-0009	software-version
Y-0-0010	DPR access time command value
Y-0-0011	system error
Y-0-0012	list of drive addresses
Y-0-0013	list of available Y-parameters
Y-0-0014	phase initiation
Y-0-0015	system status
Y-0-0016	optical transmission power
Y-0-0017	phase switching lock
Y-0-0018	lifecounter difference
Y-0-0019	lifecounter SERCANS
Y-0-0020	lifecounter NC
Y-0-0021	command value configuration list axis structure 1
Y-0-0022	actual value configuration list axis structure 1
Y-0-0023	command value configuration list axis structure 2
Y-0-0024	actual value configuration list axis structure 2
Y-0-0025	command value configuration list axis structure 3
Y-0-0026	actual value configuration list axis structure 3
Y-0-0027	command value configuration list axis structure 4
Y-0-0028	actual value configuration list axis structure 4
Y-0-0029	command value configuration list axis structure 5
Y-0-0030	actual value configuration list axis structure 5
Y-0-0031	command value configuration list axis structure 6
Y-0-0032	actual value configuration list axis structure 6
Y-0-0033	command value configuration list axis structure 7
Y-0-0034	actual value configuration list axis structure 7
Y-0-0035	command value configuration list axis structure 8
Y-0-0036	actual value configuration list axis structure 8
Y-0-0037	DPR access time actual value
Y-0-0038	NC access time
Y-0-0039	list of command value header
Y-0-0040	list of actual value header
Y-0-0041	language selection
Y-0-0042	list of invalid Y-parameters
Y-0-0043	error counter SYNC
Y-0-0044	command value generator enable
Y-0-0045	command value generator operating mode axis structure 1
Y-0-0046	command value generator operating mode axis structure 2

Y-0-0047	command value generator operating mode axis structure 3
Y-0-0048	command value generator operating mode axis structure 4
Y-0-0049	command value generator operating mode axis structure 5
Y-0-0050	command value generator operating mode axis structure 6
Y-0-0051	command value generator operating mode axis structure 7
Y-0-0052	command value generator operating mode axis structure 8
Y-0-0053	command value generator control word
Y-0-0054	command value generator pos. 1 translatory
Y-0-0055	command value generator pos. 2 translatory
Y-0-0056	command value generator velocity translatory
Y-0-0057	command value generator dwell time
Y-0-0058	command value generator jogging speed translatory
Y-0-0059	command value generator status word
Y-0-0060	command value generator pos. 1 rotary
Y-0-0061	command value generator pos. 2 rotary
Y-0-0062	command value generator velocity rotary
Y-0-0063	command value generator jogging speed rotary
Y-0-0064	command value generator travel distance translatory
Y-0-0065	command value generator travel distance rotary
Y-0-0066	list of telegram type parameter
Y-0-0067	amplitude noise source translatory
Y-0-0068	amplitude noise source rotary
Y-0-0069	positioning velocity translatory
Y-0-0070	positioning velocity rotary
Y-0-0071	powering up target phase

Fig. 10-6: Overview of system parameters

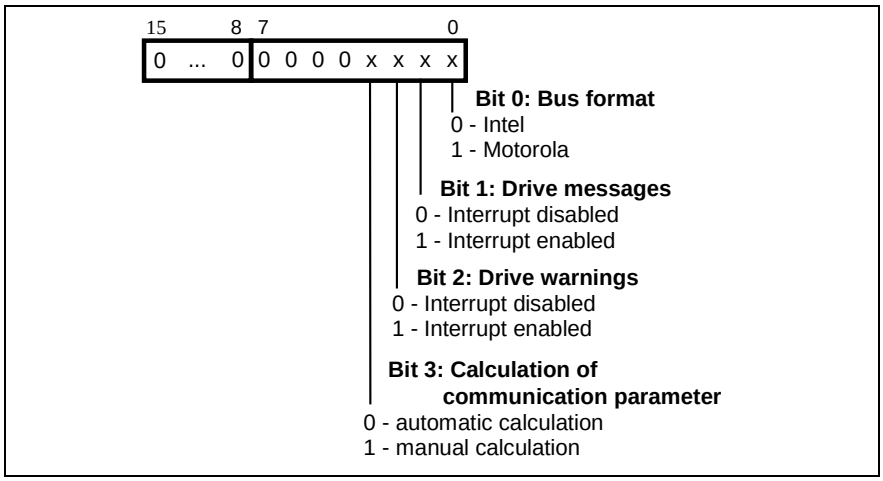
10.3 System Parameter Descriptions

Y-0-0001 Bus mode

Bus mode can be used to institute the following settings:

- Bit 0 is used to allocate low and high words in the DPR with 4 byte values. Either an Intel allocation (‘high word’ to higher addresses) or a Motorola allocation (‘high word’ to lower addresses) is possible. SERCANS takes care of the word allocation specified here. The Intel format is normally used with SCS-P, while Motorola is used with SCS-V.
- Bit 1 can be used to enable or disable the DPR interrupt "drive messages" (class 3 diagnostics) in the interrupt status register (see "Control Commands in Interrupt Register", section 6.2).
- Bit 2 can be used to enable or disable the DPR interrupt "drive warnings" (class 2 diagnostics) in the interrupt status register (see "Control Commands in Interrupt Register", section 6.2).
- Bit 3 makes it possible to switch off the SERCANS internal calculation of time slot parameters (S-0-0006, S-0-0007, S-0-0008, S-0-0089).

Attention! If manual calculation of communication parameters is set in bit 3, then the communication parameters must also be set in all the drives. The standard setting is "automatic computation".



Y-0-0001 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	1
minimum input value:	--
maximum input value:	--
default value:	0
access:	write protected in operating mode

Y-0-0002 Synchronous master

Communication in the SERCOS interface ring and the NC cycle are synchronous. The exchange of real-time data between the SERCANS and the NC control unit via the DPR must also be synchronuos. Using the synchronous master parameter, SERCANS is informed as to which direction the hardware synchronization has.

0 - SERCANS synchronizes the NC control unit (SYNCOUT is active).

>0 - the control unit synchronizes SERCANS (SYNCIN is active)

Y-0-0002 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	65535
default value:	0
access:	write protected in operating mode

Y-0-0003 Data rate

SERCOS interface specifies two data rates, 2MBit/s and 4 MBit/s. One of the two is selected via this parameter. If the data rate is changed, then all the units attached to the ring must be correspondingly adjusted.

The following applies:

0 - 2 MBit/s

>0 - 4 MBit/s

Y-0-0003 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	65535
default value:	0
access:	write protected in operating mode

Y-0-0004 SERCOS cycle time (tScyc)

The cycle time of the interface specifies the time intervals at which cyclic data is transmitted. SERCANS supports the following cycle times: 500µs, 750µs, 1ms, ... up to 32ms in steps of 0.25ms.

SERCANS transmits this parameter in communication phase 2 to all present drives.

Y-0-0004 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 µs
minimum input value:	500
maximum input value:	32000
default value:	2000
access:	write protected in operating mode

Y-0-0005 NC cycle time (tNcyc)

The NC cycle time specifies the cyclic intervals with which NC makes new command values available.

The NC cycle time must be a multiple integer of the SERCOS cycle time.

tNcyc = tScyc x j (j = 1, 2, 3, 4 ...)

SERCANS transmits this parameter in communication phase 2 to all present drives.

Y-0-0005 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 µs
minimum input value:	500
maximum input value:	32000
default value:	2000
access:	write protected in operating mode

Y-0-0006 Displacement

This parameter determines the temporal distance between the active edge of signals SYNCOUT or SYNCIN and the end of the MST. SERCANS calculates this parameter with the help of parameters Y-0-0004, Y-0-0010, Y-0-0038 and S-0-0089 (see "Synchronization", section 3.11).

Y-0-0006 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 µs
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0007 Dwell time

Some drives require a longer initialization period after being powered up. During this period, they can neither send telegrams nor correctly receive them. SERCANS remains in communication phase 0, as per the set dwell time after powering up, before communication phase 1 will be entered.

Y-0-0007 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 ms
minimum input value:	0
maximum input value:	65535
default value:	0
access:	write protected in operating mode

Y-0-0008 Hardware-version

The hardware version of the circuit board can be read via this parameter. There are three circuit boards working with the same software.

Circuit board	Hardware Version (x = A, B or C)
SCS-A	SCS-A01.1x SCS-A01.2x SCS-A02.1x
SCS-V	SCS-V01.1x SCS-V01.2x SCS-V02.1x
SCS-P	SCS-P01.1x SCS-P01.2x SCS-P02.1x

Fig. 10-7: Hardware version

Y-0-0008 Attributes

data length:	1 byte variable length (max: 10 bytes)
display format:	text
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0009 Software-version

The software version can be read via this parameter. The software is the same for all hardware versions.

Software version looks like this:

SERCAN-SER-02V09

Y-0-0009 Attributes

data length:	1 byte variable length (max: 16 bytes)
display format:	text
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0010 DPR access time command value

The copy time which SERCANS requires to transmit the configured command values of all drives from the DPR into the MDT, is stored here. (see Y-0-0006, Y-0-0037 and "Hardware Synchronization", section 3.11).

Y-0-0010 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 µs
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0011 System error

SERCANS signals current system error messages with this parameter. The value 0x0000 is indicated if no system error message is present.

If an error occurs, then the appropriate error code is written into the system error and signalled to the NC control via interrupt status register.

The system error is cleared (0x0000) with control command "clear error", once no error is pending.

System error messages are displayed on the 7 segment display (see Fig. 5-4 System error).

Y-0-0011 Attributes

data length:	2 bytes
display format:	hexadecimal number
scaling / unit:	1
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0012 List of drive addresses

The addresses of all the drives which are in the ring are entered here.

By entering the drive address in the list, the relevant axis structure is activated.

If drive address "0" is entered, then the axis structure is not activated.

If, when running up the SERCOS interface, not all drive addresses entered in the list are found in the ring, then SERCANS will not switch into operating mode but will, instead, remain in parametrization mode.

The drive addresses are stored in the axis structures in the DPR.

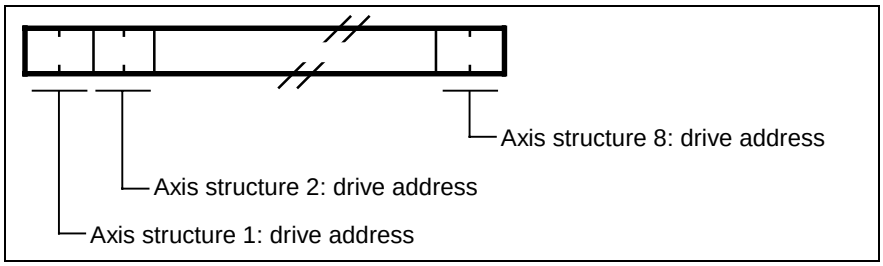


Fig. 10-8: List structure (Y-0-0012)

Y-0-0012 Attributes

data length:	2 bytes variable length (max: 16 bytes)
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	254
default value:	0016 (actual length) 0016 (maximum length) 0001 axis structure 1, drive address 1 0000 axis struct. 2, no drive address, empty . . . 0000 axis struct. 8, no drive address, empty
access:	write protected in operating mode

Y-0-0013 List of available Y-parameters

This list contains the parameter numbers of all available SERCANS system parameters.

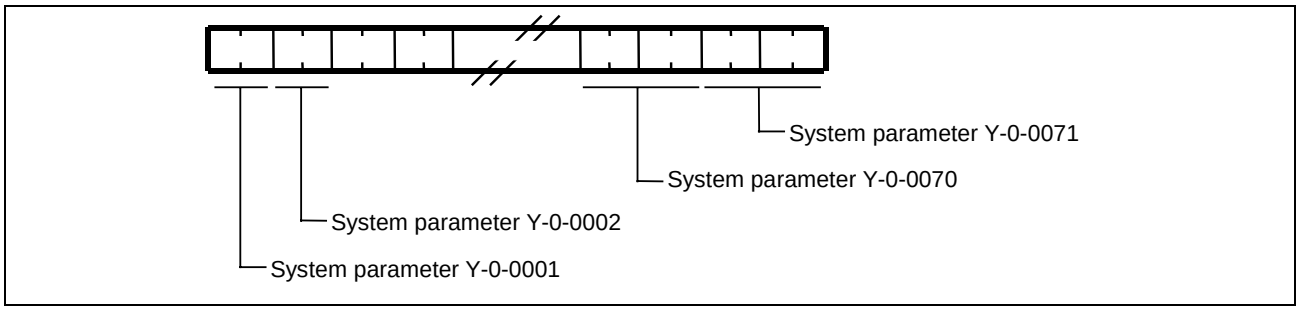


Fig. 10-9: List structure (Y-0-0013)

Y-0-0013 Attributes

data length:	4 bytes variable length (max. 200 bytes)
display format:	parameter number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0014 Phase initiation

The NC control dictates with this parameter the phase which SERCANS must set on the SERCOS interface after a control command in the interrupt register (see change phase, see "Control Commands in Interrupt Register", section 6.2). The current phase is signalled via the system status parameter. During a phase runup, SERCANS automatically runs up to the phase which target phase specifies.

Y-0-0014 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	4
default value:	4
access:	not write protected

Y-0-0015 System status

SERCANS signals the current system status with this parameter.

Any changes in system status are **not** signalled to the NC control unit via the interrupt status register.

System status is displayed on the 7 segment display.

(see "Diagnoses on the 7 Segment Display", page 5-3)

Y-0-0015 Attributes

data length:	2 bytes
display format:	hexadecimal number
scaling / unit:	1
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0016 Optical transmission power

This parameter matches the transmission power of SERCANS to the length of the fiber optic cable. The length indicated refers to the fiber optic cable of the FSMA connection M3 or TX for that drive in the SERCOS ring which is physically the first.

If a fiber optic cable made of glass (200 µm) is used, independant of the real present length a value of 50 m shall be entered.

Y-0-0016 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	0,1 m
minimum input value:	0,1 m
maximum input value:	50,0 m
default value:	5,0 m
access:	write protected in operating mode

Y-0-0017 Phase switching lock

The user interface can change phases with the use of the serial protocol. The NC control unit can lock phase switching via this parameter so that the user interface cannot change phases during operations.

The following applies to phase changeovers:

- **0** = user interface cannot change phases
- **1** = user interface can change phases
- **2** = user interface can change phases only if no drive has drive enable set (bits 14 and 15 in the control word are 0).

Y-0-0017 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	2
default value:	2
access:	write protected in operating mode

Y-0-0018 Lifecounter difference

This parameter programs the maximum difference between "lifecounter SERCANS" and "lifecounter NC". If the difference in phase 4 is greater than the value programmed here, then SERCANS switches to phase 0 and generates a system error.

This function makes it possible for the NC control unit and SERCANS to monitor each other.

If the value of 0 has been programmed into the lifecounter difference, then SERCANS monitoring has been switched off.

(see "Lifecounter", section 3.11).

Y-0-0018 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 (NC cycle)
minimum input value:	0
maximum input value:	65535
default value:	0
access:	not write protected

Y-0-0019 Lifecounter SERCANS

If monitoring has been enabled in the lifecounter difference, then SERCANS increases "lifecounter SERCANS" by 1 in every cycle in phase 4 after the copy of the command values and compares the counter reading to that of "lifecounter NC". If the difference is greater than the programmed "lifecounter difference", then SERCANS switches into phase 0 and generates a system error.

SERCANS clears "lifecounter SERCANS" and "lifecounter NC" in phase 3.

(see "Lifecounter", section 3.11).

Y-0-0019 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	65535
default value:	0
access:	not write protected

Y-0-0020 Lifecounter NC

If monitoring is enabled in the lifecounter difference, then the NC control must compare the counter reading with that of "lifecounter SERCANS" and then incrase "lifecounter NC" by 1 in every cycle in phase 4. If the difference is greater than the "lifecounter difference" programmed, then the NC control unit can respond with its own error routine.

SERCANS clears "lifecounter SERCANS" and "lifecounter NC" in phase 3.

(see "Lifecounter", section 3.11).

Y-0-0020 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	65535
default value:	0
access:	not write protected

Y-0-0021 Command value configuration list axis structure 1

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0021 Attributes

(see Y-0-0035 Attributes)

Y-0-0022 Actual value configuration list axis structure 1

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0022 Attributes

(see Y-0-0036 Attributes)

Y-0-0023 Command value configuration list axis structure 2

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0023 Attributes

(see Y-0-0035 Attributes)

Y-0-0024 Actual value configuration list axis structure 2

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0024 Attributes

(see Y-0-0036 Attributes)

Y-0-0025 Command value configuration list axis structure 3

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0025 Attributes

(see Y-0-0035 Attributes)

Y-0-0026 Actual value configuration list axis structure 3

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0026 Attributes

(see Y-0-0036 Attributes)

Y-0-0027 Command value configuration list axis structure 4

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0027 Attributes

(see Y-0-0035 Attributes)

Y-0-0028 Actual value configuration list axis structure 4

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0028 Attributes

(see Y-0-0036 Attributes)

Y-0-0029 Command value configuration list axis structure 5

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0029 Attributes

(see Y-0-0035 Attributes)

Y-0-0030 Actual value configuration list axis structure 5

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0030 Attributes

(see Y-0-0036 Attributes)

Y-0-0031 Command value configuration list axis structure 6

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0031 Attributes

(see Y-0-0035 Attributes)

Y-0-0032 Actual value configuration list axis structure 6

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0032 Attributes

(see Y-0-0036 Attributes)

Y-0-0033 Command value configuration list axis structure 7

(see Y-0-0035 Command value configuration list axis structure 8)

Y-0-0033 Attributes

(see Y-0-0035 Attributes)

Y-0-0034 Actual value configuration list axis structure 7

(see Y-0-0036 Actual value configuration list axis structure 8)

Y-0-0034 Attributes

(see Y-0-0036 Attributes)

Y-0-0035 Command value configuration list axis structure 8

The ident numbers must be entered into this list in sequential order. The order of the ident numbers, in turn, fixes the order of the command values in the command value channel of the relevant axis structure. The configured command values are cyclically transmitted by the NC control to the drives. A maximum of eight command values per drive can be configured.

These lists are stored in the axis structures in the DPR.

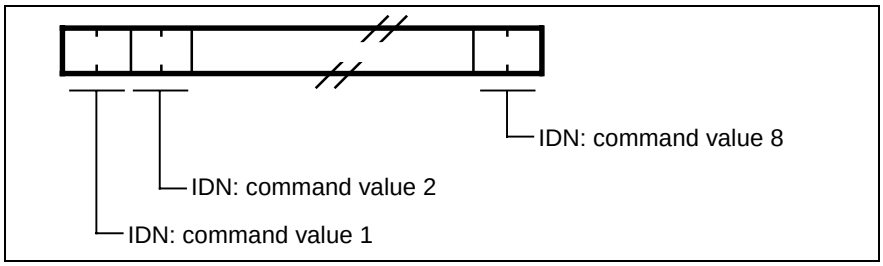


Fig. 10-10: Structure of the command value configuration list

Y-0-0035 Attributes

data length:	2 bytes variable length (max: 16 bytes)
display format:	ident number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	0000 (actual length) 0016 (maximum length)
access:	write protected in operating mode

Y-0-0036 Actual value configuration list axis structure 8

The ident numbers of the actual values are entered into this list in sequential order thereby configuring the actual value channels of the relevant axis. The configured actual values are cyclically transmitted by the drives to the NC control unit. A maximum of eight values can be configured for each drive.

These lists are stored in the axis structures in the DPR.

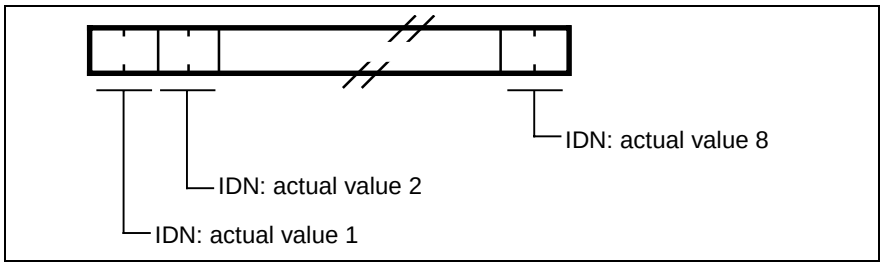


Fig. 10-11: Structure of the actual value configuration list

Y-0-0036 Attributes

data length:	2 bytes variable length (max: 16 bytes)
display format:	ident number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	0000 (actual value) 0016 (maximum length)
access:	write protected in operating mode

Y-0-0037 DPR access time actual value

SERCANS stores the copy time of the actual values in this parameter. This is the time that SERCANS requires to transmit the configured actual values from the final AT into the DPR (see Y-0-0006 and Y-0-0010 and "Hardware Synchronization", section 3.11).

Y-0-0037 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 µs
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Y-0-0038 NC access time

In this parameter, the control must specify the access time in the DPR, i.e., that time needed to write the command values of drives in the DPR as well as to read the actual values. Taking parameters "DPR access time command value" (Y-0-0010) and "DPR access time actual value" (Y-0-0037) into account, an optimum synchronization of control and SERCANS can be achieved (see section 3.11, "Synchronization").

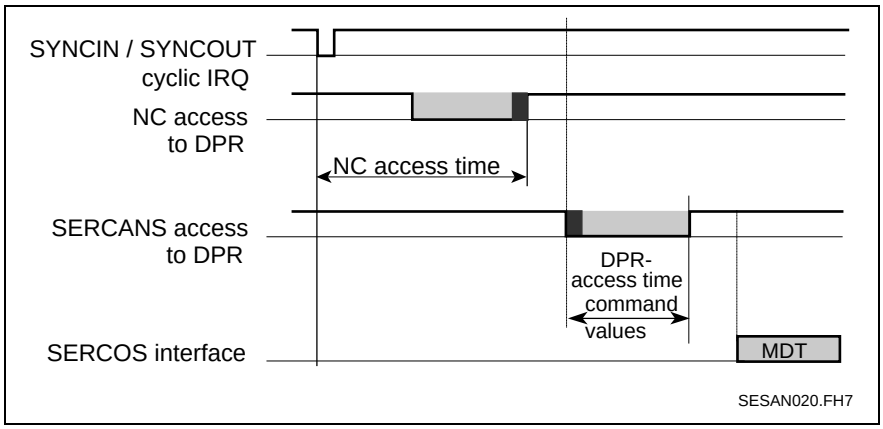


Fig. 10-12: NC access time

Y-0-0038 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 µs
minimum input value:	0
maximum input value:	65535
default value:	150
access:	write protected in operating mode

Y-0-0039 List of command value header

The command value headers of the given axis must be appropriately programmed in this list. Bit 15 in the command value header determines whether the command values are to be configured via ident numbers (in this case, SERCANS determines the length), or whether the user programs the length of the command value channel in bits 0-7.

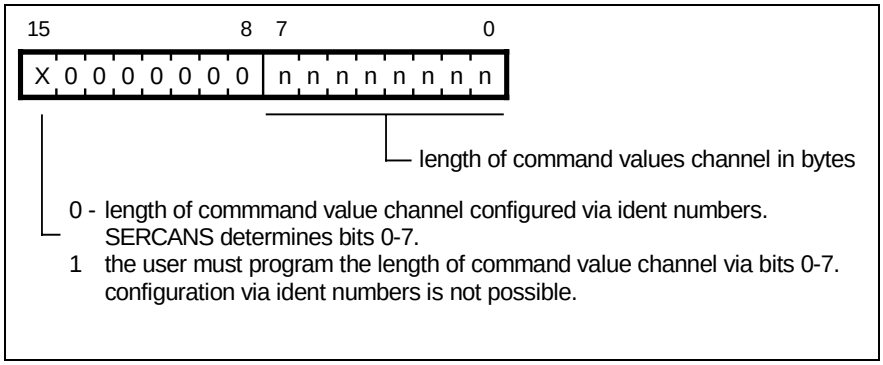


Fig. 10-13: Structure of the command value header

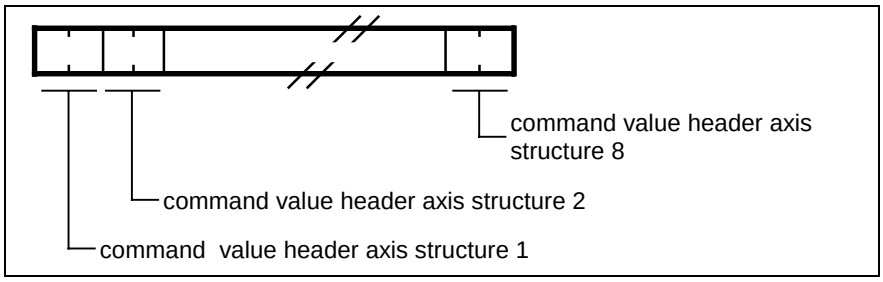


Fig. 10-14: Structure of the list (Y-0-0039)

Y-0-0039 Attributes

data length:	2 bytes variable length (max: 16 bytes)
display format:	hexadecimal number
scaling / unit:	1
minimum input value:	0x0000
maximum input value:	0xFFFF
default value:	0
access:	write protected in operating mode

Y-0-0040 List of actual value header

The actual value headers for all present axes must be appropriately programmed in this list. Bit 15 in the actual value header determines whether the actual values are to be configured via ident numbers (in this case, SERCANS determines the length), or whether the length of the actual value channel is programmed in bits 0-7 by the user.

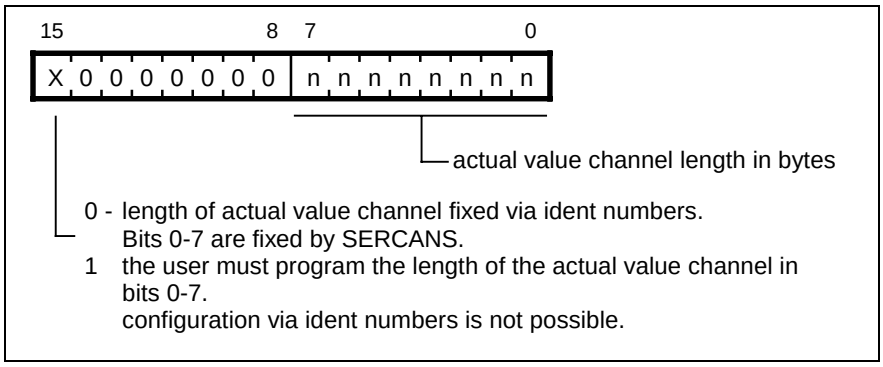


Fig. 10-15: Structure of the actual value headers

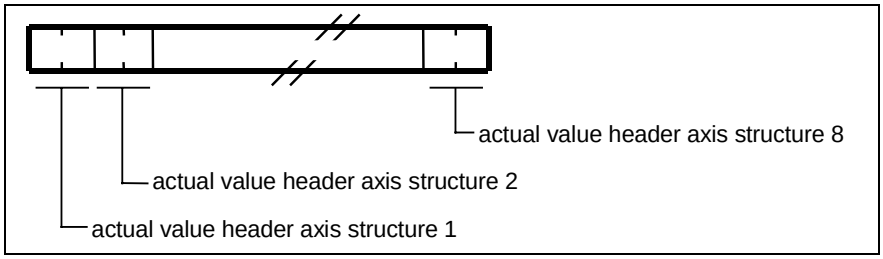


Fig. 10-16: Structure of the list (Y-0-0040)

Y-0-0040 Attributes

data length:	2 bytes variable length (max: 16 bytes)
display format:	hexadecimal number
scaling / unit:	1
minimum input value:	0x0000
maximum input value:	0xFFFF
default value:	0
access:	write protected in operating mode

Y-0-0041 Language selection

The system parameter names have been stored in SERCANS in two languages.

Either German or English can be selected. The selection in SERCANS and in the drives must be separately made using the user interface.

0 - German

1 - English

Y-0-0041 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	1
default value:	0
access:	write protected in operating mode

Y-0-0042 List of invalid Y-parameters

This list details those Y parameters that have been identified as invalid during a checksum test, 'store system parameter' and 'system parameter changed' (see "Control Commands in Interrupt Register", section 6.2).

The invalid Y parameters must now be reprogrammed via the user interface.

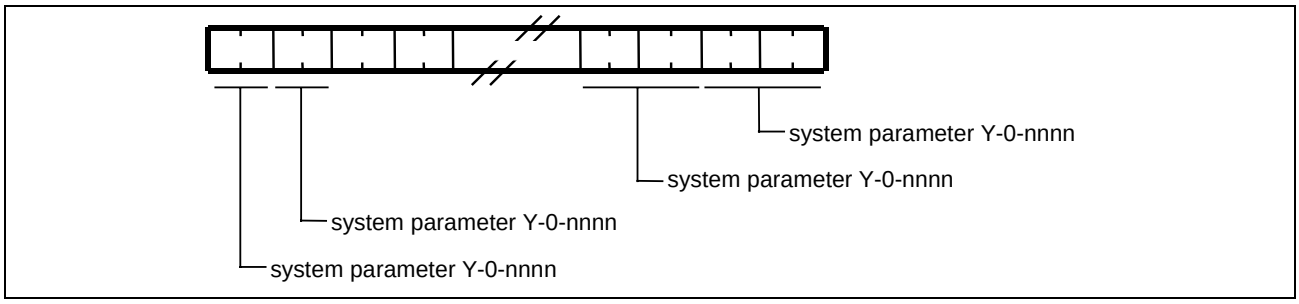


Fig. 10-17: Structure of the list (Y-0-0042)

Y-0-0042 Attributes

data length:	4 bytes variable length (max. 200 bytes)
display format:	parameter number
scaling / unit:	--
minimum input value:	--
maximum input value :	--
default value:	--
access:	write protected

Y-0-0043 Error counter SYNC

In phase 4, SERCANS checks the SYNC register once every NC cycle. If SERCANS detects an error (SYNC register ≠ 0xAA55), then the error counter SYNC is increased by 1.

The SYNC can run up to 65535 and then remains at this value.

The error counter must then be cleared either by the user interface or the NC control unit before a test can be run.

Y-0-0043 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	65535
default value:	0
access:	write protected in operating mode

Y-0-0044 Command value generator enable

The operating data of the command value generator are globally enabled with this parameter.

Note: Motions can be initiated via the parameters of the command value generator if bit 0 is set in this parameter! SERCANS ignores the command values of the control.

To ensure that no motion is triggered, it is necessary to set this parameter to zero! This setting validates the command values of the control in the dual port RAM and are activated by SERCANS.

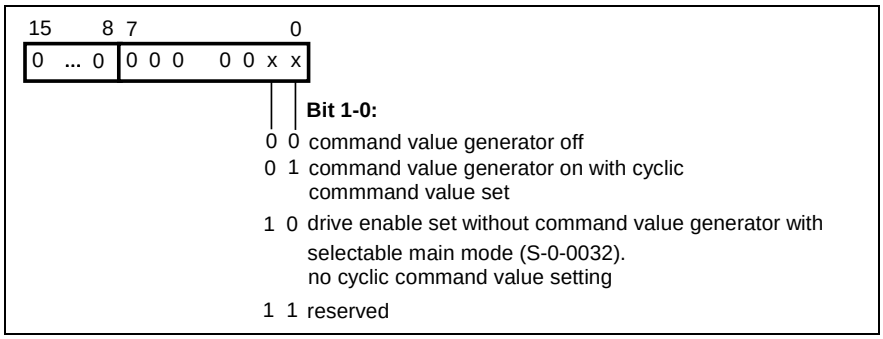


Fig. 10-18: Command value generator enable

This parameter is not used to set the operating modes of the individual axes but it can be used to globally switch the command value generator function on and off.

Y-0-0044 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0045 Command value generator operating mode axis structure 1

This parameter is used to select the modes of the command value generator for axis structure 1.

Note: If the command value generator is switched off in parameter Y-0-0044, then this parameter is dormant.

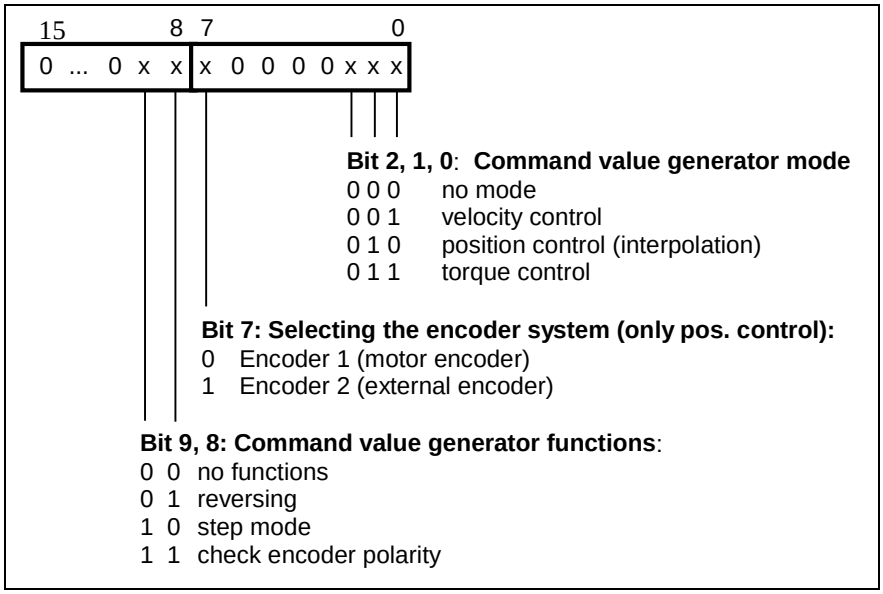


Fig. 10-19: Command value generator operating modes

A specific cyclically configured telegram is needed, but which is needed depends on the activated mode.

If the specified parameters are not configured in the cyclic telegram, then SERCANS will conduct the necessary configuration.

The original command or actual value configuration (Y-0-0021) is stored so that after the command value generator is deactivated, the control can once again control drive movements.

Note: The command value generator changes the communications parameters S-0-0009, S-0-0010, S-0-0015, S-0-0016, S-0-0024 and S-0-0032 during runup.

Parameter S-0-0032 is not restored after the command value generator is deactivated. Either the NC or the user himself must do this.

Y-0-0045 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0046 Command value generator operating mode axis structure 2

(see "command value generator operating mode axis structure 1", Y-0-0045)

Y-0-0046 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0047 Command value generator operating mode axis structure 3

(see "command value generator operating mode axis structure 1", Y-0-0045)

Y-0-0047 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0048 Command value generator operating mode axis structure 4

(see "command value generator operating mode axis structure 1", Y-0-0045)

Y-0-0048 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0049 Command value generator operating mode axis structure 5

(see "command value generator operating mode axis structure 1", Y-0-0045)

Y-0-0049 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0050 Command value generator operating mode axis structure 6

(see "command value generator operating mode axis structure 1", Y-0-0045)

Y-0-0050 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input vaue:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0051 Command value generator operating mode axis structure 7

Y-0-0051 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0052 Command value generator operating mode axis structure 8

(see "command value generator operating mode axis structure 1", Y-0-0045)

Y-0-0052 Attributes

data length:	2 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000
access:	write protected in operating mode

Y-0-0053 Command value generator control word

Note: Bits 0 to 7 of this parameter are not stored resident. The value 0x0 is written into them with each runup and powering up of the system.

This parameter contains the control commands for the command value generator. These commands are only instituted if bit 0 is set in parameter Y-0-0044.

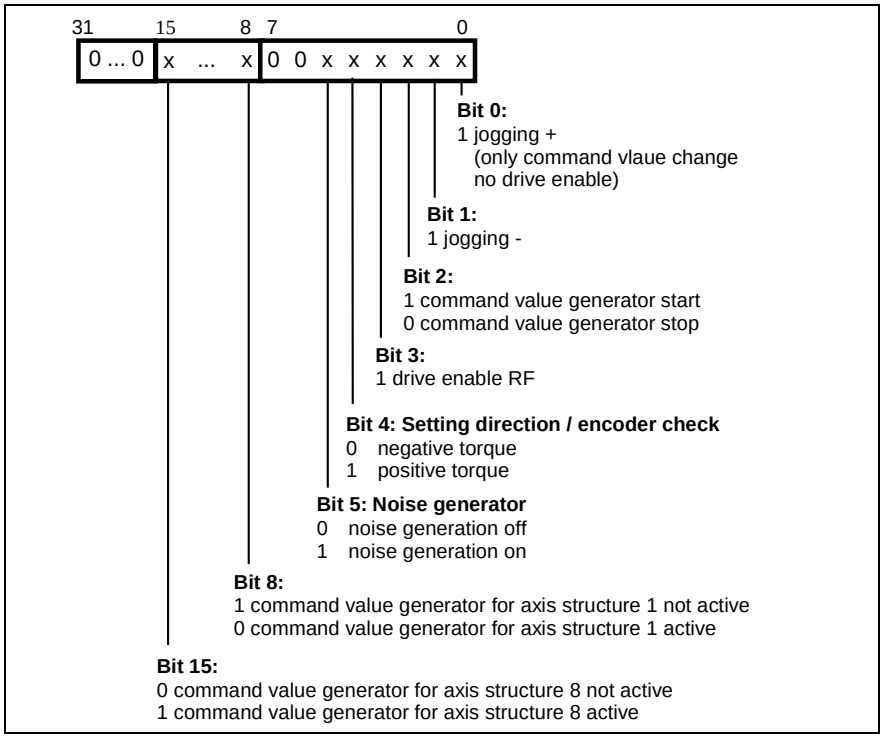


Fig. 10-20: Control word of the command value generator.

The physical drive addresses logically allocated in parameter Y-0-0012 are selected using bits 8 to 15. The choice is made by setting the relevant bit to "1".

Note: The command value generator may not be activated for several axes at the same time.

Y-0-0053 Attributes

data length:	4 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	00000000.00000000.00000000.00000000
access:	not write protected

Y-0-0054 Command value generator pos. 1 translatory

This parameter is active only with translatory scaling of the axis. It has the following definition, depending on the set command value generator function:

Reversing with velocity control Movements with negative velocity value ("command value generator velocity translatory", Y-0-0056) cyclically check whether this position is sucееded. If so, then the velocity command goes to 0.

Reversing with position control Movements with negative value ("command value generator velocity translatory", Y-0-0056) run to this position.

Y-0-0054 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} mm
minimum input value:	-274748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0055 Command value generator pos. 2 translatory

This parameter is only active with translatory scaling of axes.

Reversing with velocity control Movements with positive velocity value ("command value generator velocity translatory", Y-0-0056) are cyclically checked as to whether this position is exceeded. If so, then velocity command goes to 0.

Reversing with position control Movements with positive value ("command value generator velocity translatory") run to this position.

Y-0-0055 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} mm
minimum input value:	-214748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0056 Command value generator velocity translatory

This parameter is only active with translatory scaling of axes and in "velocity control mode“. It specifies the translatory velocity of the drive.

Y-0-0056 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-3} mm/min
minimum input value:	-2147483,648
maximum input value:	2147483,647
default value:	0
access:	not write protected

Y-0-0057 Command value generator dwell time

The duration with which the drive remains at the position last reached before travelling to the next position is set in this parameter. It only affects functions "reversing" and "step mode".

Y-0-0057 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1 ms
minimum input value:	0
maximum input value:	10000
default value:	0
access:	not write protected

Y-0-0058 Command value generator jogging speed translatory

This parameter is only active with translatory scaling of axes and in "velocity control mode“. It specifies the jogging velocity of the drive.

Y-0-0058 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-3} mm/min
minimum input value:	-2147483,648
maximum input value:	2147483,647
default value:	0
access:	not write protected

Y-0-0059 Command value generator status word

This parameter contains the acknowledge of the received control command for the command value generator. The single bits are only set if the command is executed without an error. Bit assignment precisely corresponds to parameter "command value generator control word" (Y-0-0053).

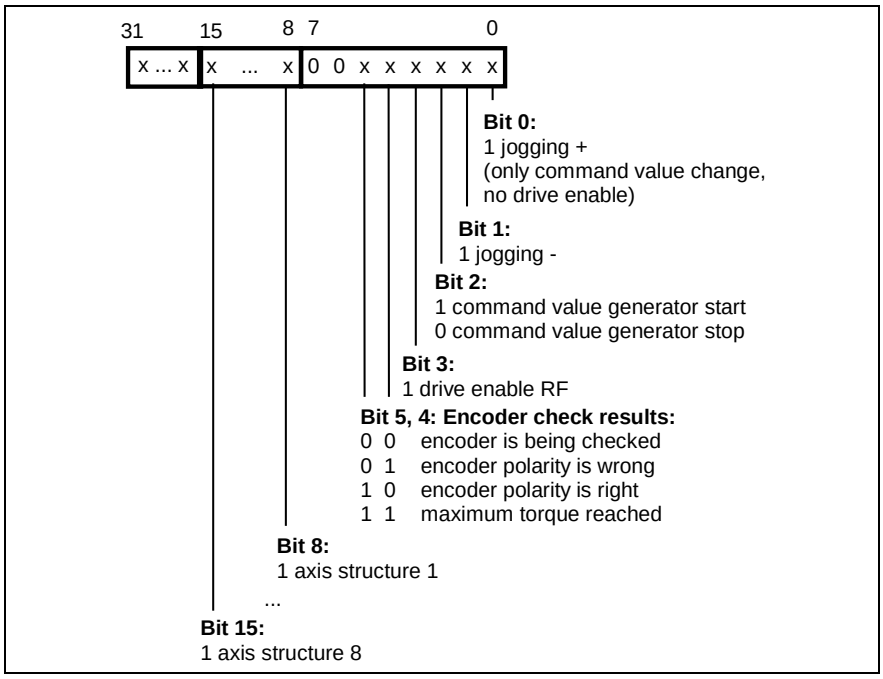


Fig. 10-21: Command value generator status word

Bits 8 to 15 show the physical drive addresses logically allocated in parameter Y-0-0012.

Y-0-0059 Attributes

data length:	4 bytes
display format:	binary number
scaling / unit:	--
minimum input value:	--
maximum input value:	--
default value:	--
access:	write protected

Possible Causes for Non-Acknowledged Control Commands

- Value 0x0000 has been set in parameter Y-0-0044.
- If drive enable is not set or acknowledged, then jogging is not possible and the command value generator not started.
- If jogging is still active, then reverse and step mode cannot be started. The same applies in the opposite case.
- If the drive is receiving no power or if it is signalling an error, then drive enable will not be acknowledged.
- SERCANS firmware checks whether communication via serial interface has occurred. At the end of timeout after the last communication, the command value generator is stopped to avoid unwanted axis motions.

Y-0-0060 Command value generator pos. 1 rotary

This parameter is active only with rotary scaling of the axis. It has the following definition, depending on the set command value generator function:

Reversing with velocity control Movements with the negative velocity value ("command value generator velocity rotary", Y-0-0062) are checked cyclically as to whether position is suceeded. If so, then velocity command value goes to 0.

Reversing with position control Movements with negative velocity value ("command value generator velocity rotary“) run to this position.

Y-0-0060 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} degree
minimum input value:	-214748,3648
maximum input value:	214748,3647
default value::	0
access:	not write protected

Y-0-0061 Command value generator pos. 2 rotary

This parameter is only active with rotary scaling of axes.

Reversing with velocity control Movements with positive velocity value ("command value generator velocity rotary", Y-0-0062) cyclically check whether this position is exceeded. If so, then the velocity command value goes to 0.

Reversing with position control Movements with positive velocity value ("command value generator velocity rotary") run to this position.

Y-0-0061 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} degree
minimum input value:	-214748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0062 Command value generator velocity rotary

This parameter is only active with rotary scaling of axes and in "velocity control mode“. It specifies the rotary velocity of the drive.

Y-0-0062 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} 1/min
minimum input value:	-214748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0063 Command value generator jogging speed rotary

This parameter is only active with rotary scaling of axes and in "velocity control mode". It specifies the jogging velocity of the drive.

Y-0-0063 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} 1/min
minimum input value:	-214748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0064 Command value generator travel distance translatory

This parameter only affects function "step mode". It has the following definition, depending on the operating mode set:

Velocity control Movements with negative or postive velocity values ("command value generator translatory or rotary“) are cyclically checked whether, starting with the present position, the new relative target position Δx has been exceeded. If so, then velocity is set to 0.

Position control Movements with negative or positive velocity values ("command value generator velocity translatory or rotary“) are approached starting with the present position and going to the new relative target position Δx.

Y-0-0064 Attributes

data length:	4 bytes
display format:	unsigned decimal number
scaling / unit:	10^{-4} mm
minimum input value:	0
maximum input value:	429496,7295
default value:	0
access:	not write protected

Y-0-0065 Command value generator travel distance rotary

This parameter is effective with function "step mode“. It has the following definition, depending on the mode set:

Velocity control Movements with negative or positive velocity values ("command value generator translatory or rotary“) are cyclically checked whether, starting with the present position, the new relative target position Δx has been exceeded. If so, then velocity command value is set to 0.

Position control Movements with negative or positive velocity value ("command value generator velocity translatory or rotary“) are approached starting with the present position and going to the new relative target position Δx.

Y-0-0065 Attributes

data length:	4 bytes
display format:	unsigned decimal number
scaling / unit:	10^{-4} degree
minimum input value:	0
maximum input value:	429496,7295
default value:	0
access:	not write protected

Y-0-0066 List of telegram type parameter

The choice can be made in this list between standard telegrams (input 0-6) and application telegrams (input 7).

Configuration of real time data (telegrams) is explained in section 8.

Possible inputs are:

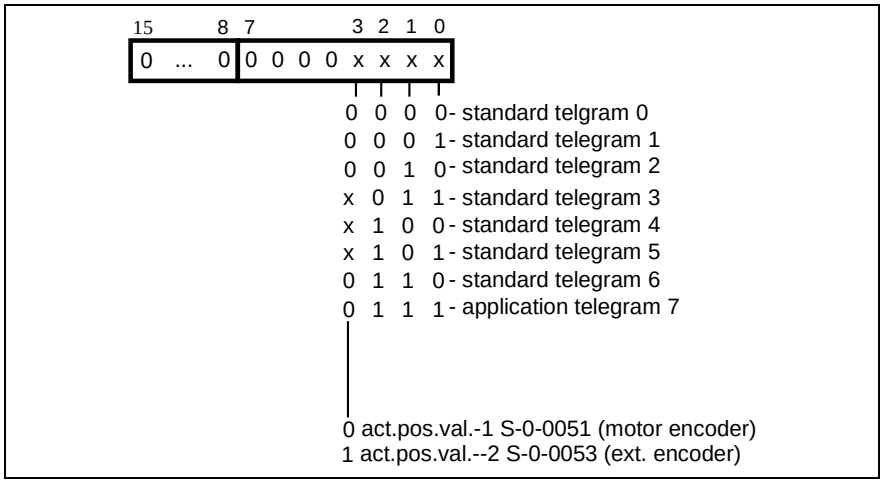


Fig. 10-22: The structure of an element

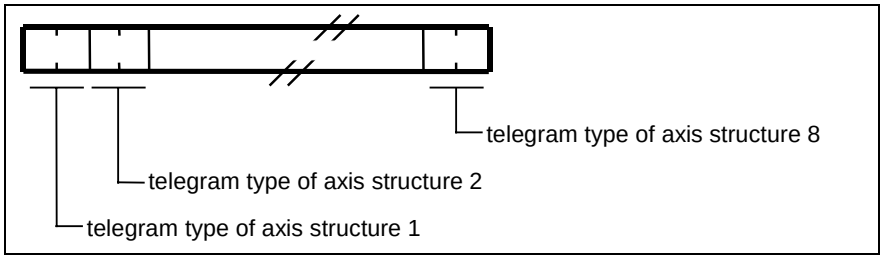


Fig. 10-23: List structure (Y-0-0066)

Y-0-0066 Attributes

data length:	2 bytes variable length (max. 16 bytes)
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	15
default value:	0016 (actual length) 0016 (maximum length)
access:	write protected in operating mode

Y-0-0067 Amplitude noise source translatory

This parameter sets the output amplitude of the noise generator with translatory scaling.

Note: To superimpose a noise signal over the movement of the command value generator it is necessary to switch it on in parameter Y-0-0053.

See "Noise Generator", section 8.5.

Y-0-0067 Attributes

data length:	4 bytes
display format:	unsigned decimal number
scaling / unit:	10^{-3} mm/min
minimum input value:	1
maximum input value:	4294967,295
default value:	1
access:	not write protected

Y-0-0068 Amplitude noise source rotary

This parameter sets the output amplitude of the noise generator with rotary scaling.

Note: To superimpose a noise signal over the movement of the command value generator it is necessary to switch it on in parameter Y-0-0053.

See "Noise Generator", section 8.5.

Y-0-0068 Attributes

data length:	4 bytes
display format:	unsigned decimal number
scaling / unit:	10^{-4} 1/min
minimum input value:	1
maximum input value:	429496,7295
default value:	1
access:	not write protected

Y-0-0069 Positioning velocity translatory

This parameter is only effective with translatory scaling of the axis and command generator modes in position control. It specifies the positioning velocity.

Y-0-0069 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} mm/min
minimum input value:	-274748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0070 Positioning velocity rotary

This parameter is only effective with rotary scaling of the axis and command generator modes in position control. It specifies the positioning velocity.

Y-0-0070 Attributes

data length:	4 bytes
display format:	signed decimal number
scaling / unit:	10^{-4} 1/min
minimum input value:	-274748,3648
maximum input value:	214748,3647
default value:	0
access:	not write protected

Y-0-0071 Powering up target phase

This phase is automatically reached after switching on the SERCANS assembly.

Y-0-0071 Attributes

data length:	2 bytes
display format:	unsigned decimal number
scaling / unit:	1
minimum input value:	0
maximum input value:	4
default value:	4
access:	not write protected

11 SercTop: User Interface for SERCANS

11.1 General Information about SercTop or DriveTop

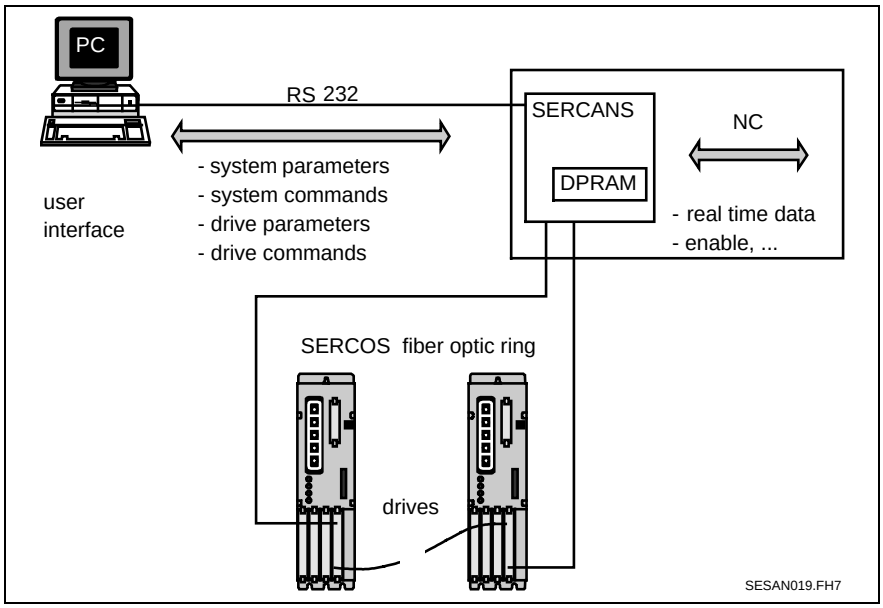


Fig. 11-1: A serial protocol

SercTop or DriveTop is the comfortable user interface on SERCANS assemblies and SERCOS drives which can be run with MS-Windows. SercTop or DriveTop offers the following functions from version 04VRS:

- 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 SERCANS assembly.
- The SERCOS 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 either the entire plant or for a specifically selected drive.
- A context sensitive help system (Ctrl-F1) in connection with the help system drive firmeware of INDRAMAT and the help system SERCANS.
- Dialogues for oscilloscope functions with time and frequency diagram.
- Dialogues for command value generator (only available with the relevant SERCANS firmware from FWA-SERCAN-SER-04VRS-MS).

Note: SercTop or DriveTop is completely compatible to all firmware versions of SERCANS. When starting SercTop or DriveTop, the SERCANS firmware is automatically recognized. Only those dialogues and menu items are visible that are available with this firmware. It is therefore only necessary to install the latest version of SercTop or DriveTop.

11.2 System Prerequisites

SercTop can be run with MS-Windows 3.1 (only SercTop), Windows 95, Windows 98 and Windows 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

11.3 Installing SercTop or DriveTop

Software Installation of SercTop

SercTop is supplied on 3.5“ discs. (DOS format; 1.44MB).

Note: Prior to installation, please make a backup copy of the SercTop disc. Install the software using this backup copy. Keep the original disk in a safe place! To install the program on your PC, it is necessary to use the installation program on the disk.

Please follow the steps below to install SercTop:

- Read this documentation in its entirety.
- Switch PC on and start Windows.
- Insert SercTop disk 1 in disk drive.
- In menu „file“ select command „execute...“.

Note: If SercTop 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 is to be removed from the hard drive, then simply erase the directy in which the relevant „serctop.exe“ is located as well as the icon in the program group.

- In input field „command line enter:“ A:\ SETUP. (if the SercTop disk is in drive A:).
- Now follow the instruction of the installation program.

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

Software Installation of 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 SERCANS

A connecting cable, SYSDA02.1, is needed for the data exchange between SERCANS and the PC.

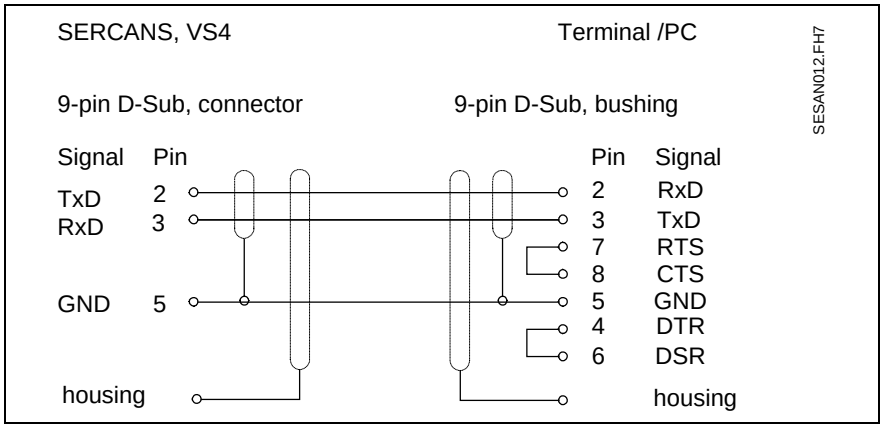


Fig. 11-2: Allocation of the connectors

Start SercTop or DriveTop

Prerequisites:

SercTop or DriveTop has been installed successfully, SERCANS assembly is on and connected to the PC via a serial cable.

Start SercTop or DriveTop in the SERCANS group in the program manager.

SercTop or DriveTop is started and attempts to establish a connecting structure with SERCANS.

11.4 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 SERCANS assemblies.

Submenu storage

The S/P parameters in the drives and the Y parameters of SERCANS 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 SERCANS 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 SERCANS 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 independant Y parameters or axis parameters (Y or 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", "command value box", "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 character set, are located here (japenese only SercTop).

Menu Help

When bringing down the submenus, all drive firmware helps and SERCANS 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 SercTop 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".

12 Allocation of Connectors

In the following allocation of connectors a star ('*') placed in front of the signal name designates an active low-Signal.

12.1 Plug-in Connector X1 (SCS-A)

- Connector type (X1): 48-pin, bushing strip, three rows
- Manufactured by: Panduit (100-348-451)
- Connector assignment (X1):

Pin	Name	Direction	Function
1a	AR1	I	address bit
1b	AR2	I	address bit
1c	DR0	I/O	data bit
2a	AR3	I	address bit
2b	AR4	I	address bit
2c	DR1	I/O	data bit
3a	AR5	I	address bit
3b	AR6	I	address bit
3c	DR2	I/O	data bit
4a	AR7	I	address bit
4b	AR8	I	address bit
4c	DR3	I/O	data bit
5a	AR9	I	address bit
5b	AR10	I	address bit
5c	DR4	I/O	data bit
6a	AR11	I	address bit
6b	*CE	I	16 bit chip enable
6c	DR5	I/O	data bit
7a	R/*W	I	16 bit write/read input as per Motorola
7b	SYNCOUT	O	synchronization output of CON_CLK
7c	DR6	I/O	data bit
8a	*RES	I	reset
8b	*DPRINT	O	combined 16 bit interrupt out of the DPR
8c	DR7	I/O	data bit
9a	*DTACK	O	16 bit *DTACK output per Motorola
9b	-	n.c.	reserved (8 MHz with MPU-1)
9c	DR8	I/O	data bit
10a	VCC	Power	+5 Volt supply
10b	VCC	Power	+5 Volt supply
10c	DR9	I/O	data bit
11a	GND	Power	ground
11b	GND	Power	ground

11c	DR10	I/O	data bit
12a	GND	Power	ground
12b	GND	Power	ground
12c	DR11	I/O	data bit
13a	-	n.c.	reserved (0V M with MPU-1)
13b	SYNCIN	I	Synchronization output at CYC_CLK
13c	DR12	I/O	data bit
14a	-	n.c.	reserved (0V M with MPU-1)
14b	-	n.c.	reserved (0V M with MPU-1)
14c	DR13	I/O	data bit
15a	-	n.c.	reserved (+15 V with MPU-1)
15b	-	n.c.	reserved (+15 V with MPU-1)
15c	DR14	I/O	data bit
16a	-	n.c.	reserved (-15 V with MPU-1)
16b	-	n.c.	reserved (-15 V with MPU-1)
16c	DR15	I/O	data bit

Fig. 12-1: Connection assignments plug-in connectors X1 (SCS-A)

12.2 Plug-In Connector X2 (SCS-A)

- **Connector type (X2):** 50-pin angled flat-ribbon connector, two rows
- Connector assignment (X2):

Pin	name	Direction	Function
1	*BUSY	O	BUSY signal DPR
2	-	n.c.	reserved
3	*NC-RD	I	Intel mode: read
4	-	n.c.	reserved
5	DR15	I/O	data bit
6	VPP	Power	programming voltage for flash EPROM
7	-	n.c.	reserved
8	DR14	I/O	data bit
9	-	n.c.	reserved
10	MOT_MODE	I	1=Motorola mode, 0=Intel mode
11	DR13	I/O	data bit
12	GND	Power	ground
13	SYNCIN	I	Synchronization input at CYC_CLK
14	DR12	I/O	data bit
15	GND	Power	ground
16	GND	Power	ground
17	DR11	I/O	data bit
18	GND	Power	ground
19	GND	Power	ground
20	DR10	I/O	data bit

21	+5V	Power	+5 Volt supply
22	+5V	Power	+5 Volt supply
23	DR9	I/O	data bit
24	*DTACK	O	16 bit *DTACK output per Motorola
25	-	n.c.	reserved
26	DR8	I/O	data bit
27	*RES	I	reset
28	*DPRINT	O	combined with 16 bit interrupt output
29	DR7	I/O	data bit
30	R/*W	I	Motorola: write/read, Intel: write inputs
31	SYNCOUT	O	Synchronization output of CON_CLK
32	DR6	I/O	data bit
33	AR11	I	address bit
34	*CE	I	chip enable
35	DR5	I/O	data bit
36	AR9	I	address bit
37	AR10	I	address bit
38	DR4	I/A	data bit
39	AR7	I	address bit
40	AR8	I	address bit
41	DR3	I/O	data bit
42	AR5	I	address bit
43	AR6	I	address bit
44	DR2	I/O	data bit
45	AR3	I	address bit
46	AR4	I	address bit
47	DR1	I/O	data bit
48	AR1	I	address bit
49	AR2	I	address bit
50	DR0	I/O	data bit

Fig. 12-2: Connector assignment plug-in connector X2 (SCS-A)

12.3 Plug-In Connectors VS11 and VS9 (SCS-P01)

	VS11		VS9	
Pin	Row A assembly side	Row B conductor side	Row C assembly side	Row D conductor side
1	n.c.(*IOCHCK)	GND	*SBHE	*MEMCS 16
2	PCD7	PCRESET	PCLA23	n.c.(*IOCS16)
3	PCD6	+5V	PCLA22	IRQ10
4	PCD5	IRQ2	PCLA21	IRQ11
5	PCD4	n.c.(-5V)	PCLA20	IRQ12
6	PCD3	n.c.(DRQ2)	PCLA19	IRQ15
7	PCD2	n.c.(-12V)	PCLA18	n.c.(IRQ14)
8	PCD1	*OWS	PCLA17	n.c.(*DACK0)
9	PCD0	n.c.(+12V)	n.c.(*MEMR)	n.c.(DRQ0)
10	IOCHRDY	GND	n.c.(*MEMW)	n.c.(*DACK5)
11	n.c.(AEN)	*SMEMW	PCD8	n.c.(DRQ5)
12	n.c.(PCA19)	*SMEMR	PCD9	n.c.(*DACK6)
13	n.c.(PCA18)	n.c.(*IOW)	PCD10	n.c.(*DRQ6)
14	n.c.(PCA17)	n.c.(*IOR)	PCD11	n.c.(*DACK7)
15	PCA16	n.c.(*DACK3)	PCD12	n.c.(DRQ7)
16	PCA15	n.c.(DRQ3)	PCD13	+5V
17	PCA14	n.c.(DACK1)	PCD14	n.c.(MASTER)
18	PCA13	n.c.(DRQ1)	PCD15	GND
19	PCA12	n.c.(*REF)		
20	PCA11	CLOCK		
21	PCA10	IRQ7		
22	PCA9	IRQ6		
23	PCA8	IRQ5		
24	PCA7	IRQ4		
25	PCA6	IRQ3		
26	PCA5	n.c.(*DACK2)		
27	PCA4	n.c.(TC)		
28	PCA3	BALE		
29	PCA2	+5V		
30	PCA1	n.c.(OSC)		
31	PCA0	GND		

Fig. 12-3: Plug-in connectors VS11 and VS9 (SCS-P01)

12.4 Plug-In Connector XA (SCS-P02)

Pin	Row A assembly side	Row B conductor side	Row C assembly side	Row D conductor side
1	*IOCHCK	--	*SBHE	*MEMCS 16
2	PCD7	PCRESET	PCLA23	*IOCS16
3	PCD6	--	PCLA22	IRQ10
4	PCD5	IRQ2	PCLA21	IRQ11
5	PCD4	-5V	PCLA20	IRQ12
6	PCD3	DRQ2	PCLA19	IRQ15
7	PCD2	-12V	PCLA18	IRQ14
8	PCD1	*OWS	PCLA17	*DACK0
9	PCD0	+12V	*MEMR	DRQ0
10	IOCHRDY	--	*MEMW	*DACK5
11	AEN	*SMEMW	PCD8	DRQ5
12	PCA19	*SMEMR	PCD9	*DACK6
13	PCA18	*IOW	PCD10	DRQ6
14	PCA17	*IOR	PCD11	*DACK7
15	PCA16	*DACK3	PCD12	*SCB
16	PCA15	*DRQ3	PCD13	--
17	PCA14	*DACK1	PCD14	*MASTER
18	PCA13	*DRQ1	PCD15	--
19	PCA12	*REF		
20	PCA11	CLOCK		
21	PCA10	IRQ7		
22	PCA9	IRQ6		
23	PCA8	IRQ5		
24	PCA7	IRQ4		
25	PCA6	IRQ3		
26	PCA5	*DACK2		
27	PCA4	TC		
28	PCA3	BALE		
29	PCA2	--		
30	PCA1	OSC		
31	PCA0	--		

Fig. 12-4: Plug-in connector XA (SCS-P02)

12.5 Plug-In Connector X1 (SCS-V02) or J1/P1 (SCS-V01)

- **Connector type (J1/P1):** 96-pin, plug connector in three rows
- Connector assignment (J1/P1):

Pin	Row A	Row B	Row C
1	D00	n.c. (*BBSY)	D08
2	D01	n.c. (*BCLR)	D09
3	D02	n.c. (*ACFAIL)	D10
4	D03	*BG0IN	D11
5	D04	*BG0OUT	D12
6	D05	*BG1IN	D13
7	D06	*BG1OUT	D14
8	D07	*BG2IN	D15
9	GND	*BG2OUT	GND
10	n.c. (SYSCLK)	*BG3IN	*SYSFAIL
11	GND	*BG3OUT	*BERR
12	*DS1	n.c. (*BR0)	*SYSRESET
13	*DS0	n.c. (*BR1)	*LWORD
14	*WRITE	n.c. (*BR2)	AM5
15	GND	n.c. (*BR3)	A23
16	*DTACK	AM0	A22
17	GND	AM1	A21
18	*AS	AM2	A20
19	GND	AM3	A19
20	*IACK	GND	A18
21	*IACKIN	n.c. (SERCLK)	A17
22	*IACKOUT	n.c. (SERDAT)	A16
23	AM4	GND	A15
24	A07	n.c. (*IRQ7)	A14
25	A06	*IRQ6	A13
26	A05	*IRQ5	A12
27	A04	*IRQ4	A11
28	A03	*IRQ3	A10
29	A02	*IRQ2	A09
30	A01	*IRQ1	A08
31	n.c. (-12V)	n.c. (+5V STDBY)	n.c. (+12V)
32	+5V	+5V	+5V

Fig. 12-5: Plug-in connector J1/P1 (SCS-V)

12.6 Part of the circuit diagram SCS-A

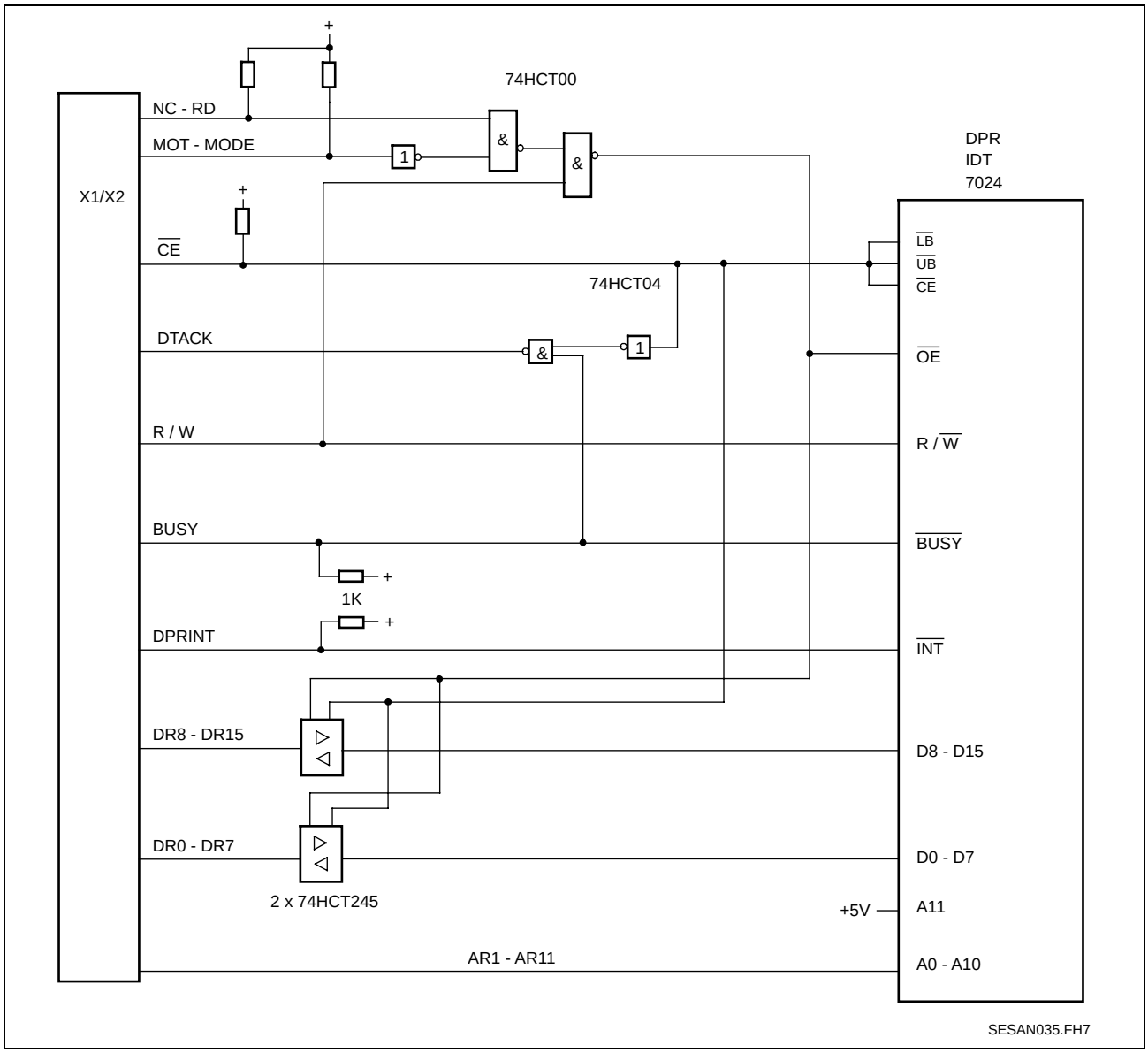


Fig. 12-6: DPR interface connection

13 Mechanics

13.1 Dimension sheet SCS-A02

Mechanical dimensions of assembly SCS-A02.1.

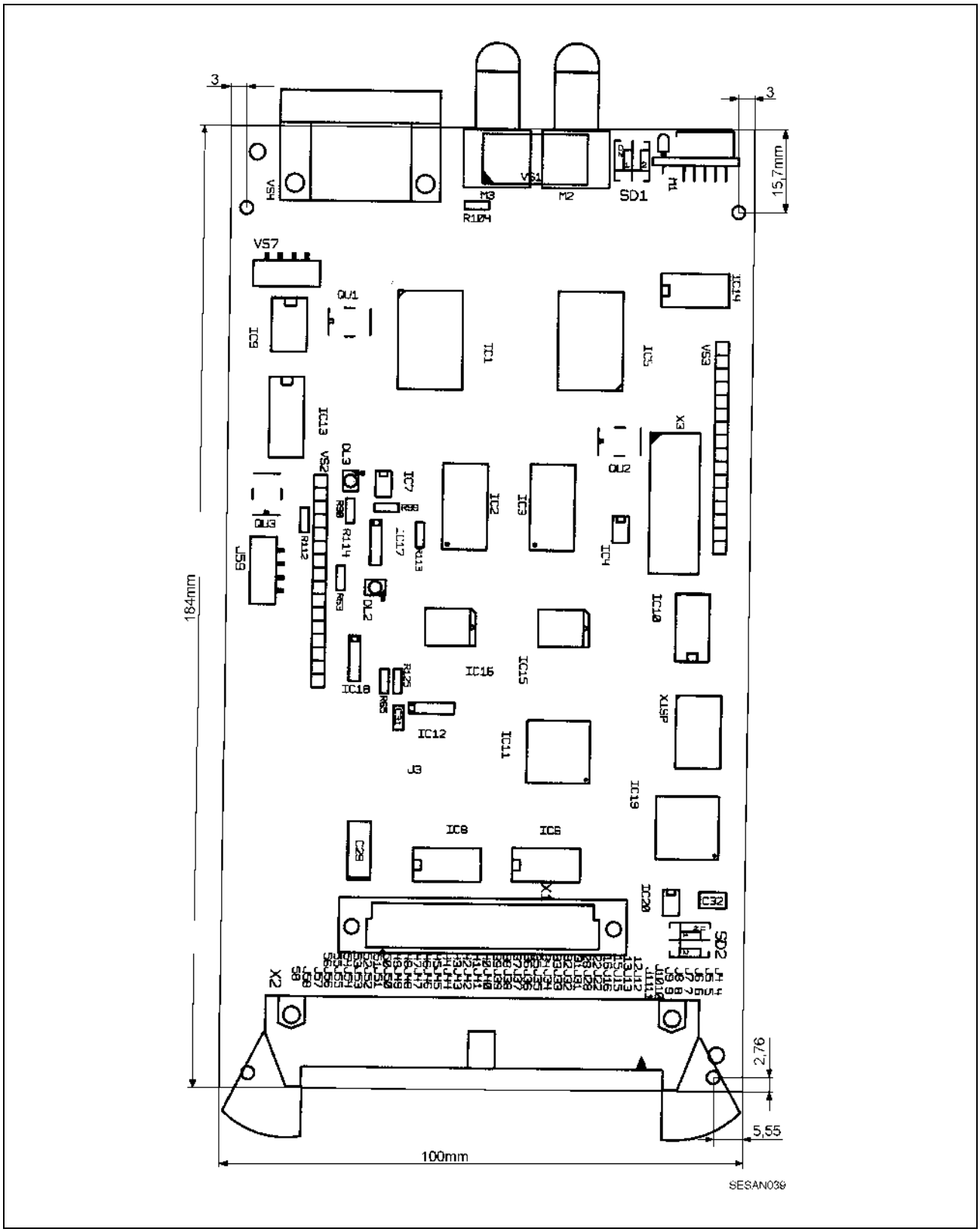


Fig. 13-1: Dimension sheet SCS-A02.1

13.2 Dimension sheet SCS-P01

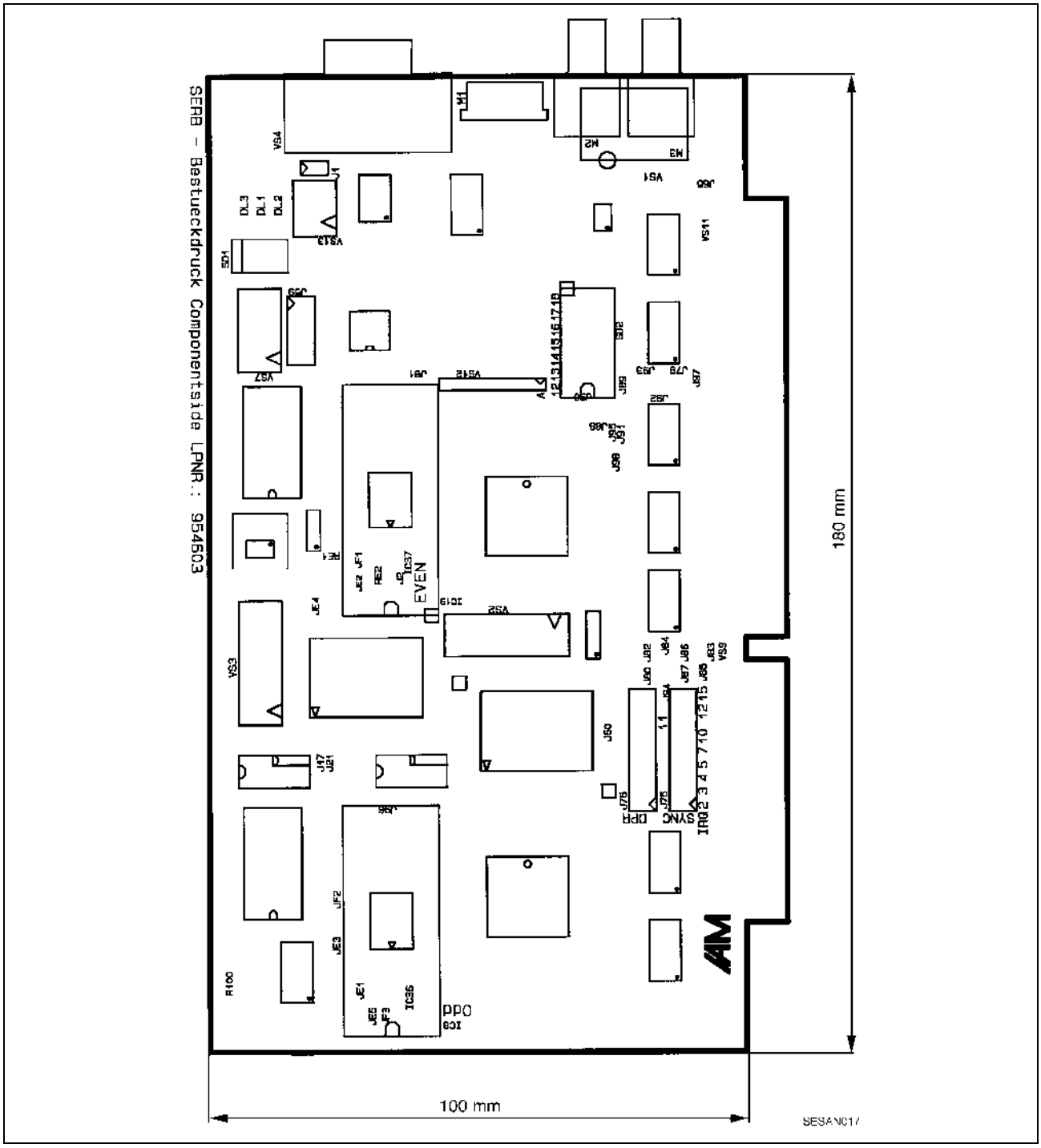


Fig. 13-2: Dimension sheet SCS-P01.2

13.3 Dimensional Sheet SCS-P02

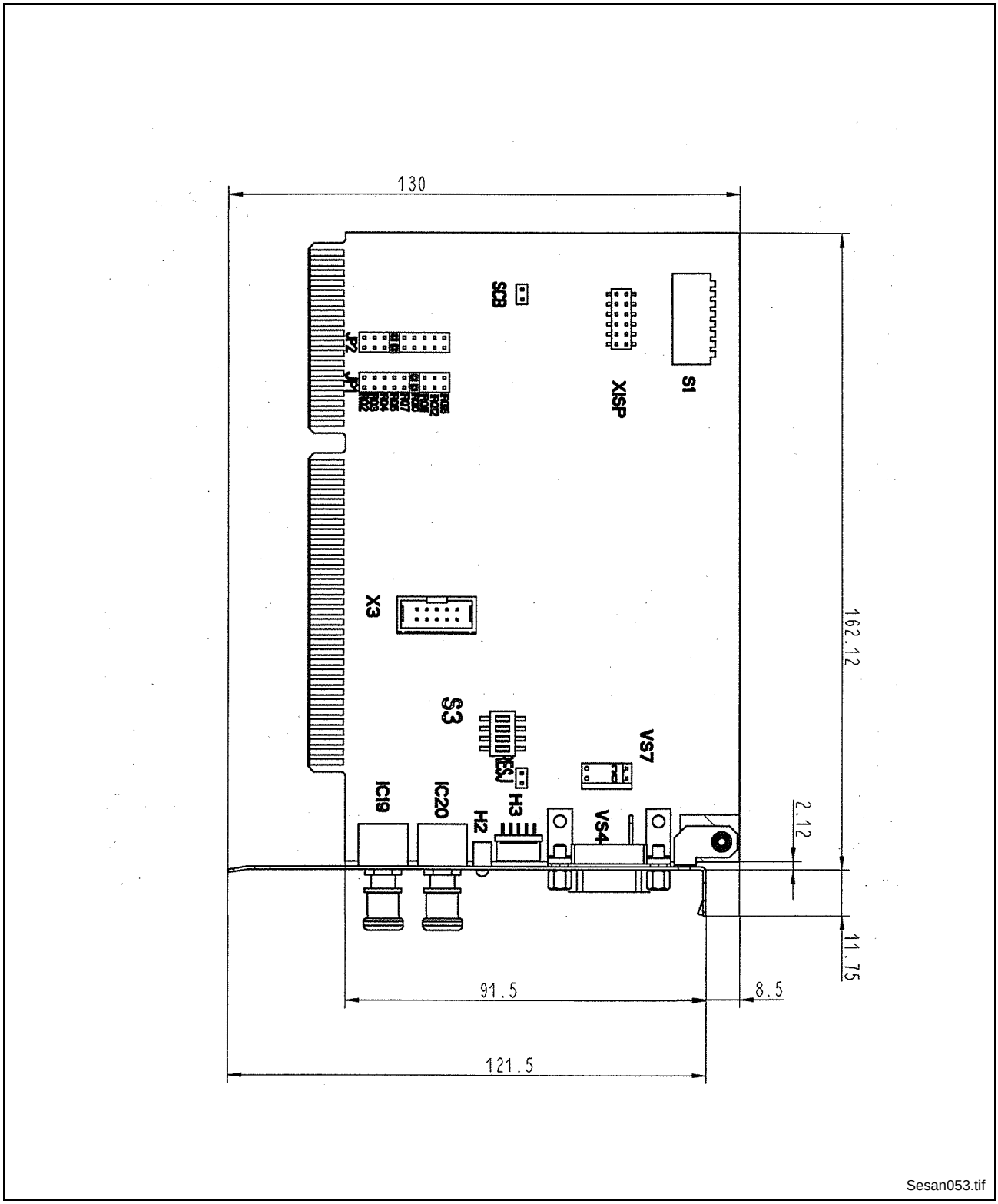


Fig. 13-3: Dimensional sheet SCS-P02.1

13.4 Dimensional Sheet SCS-V01

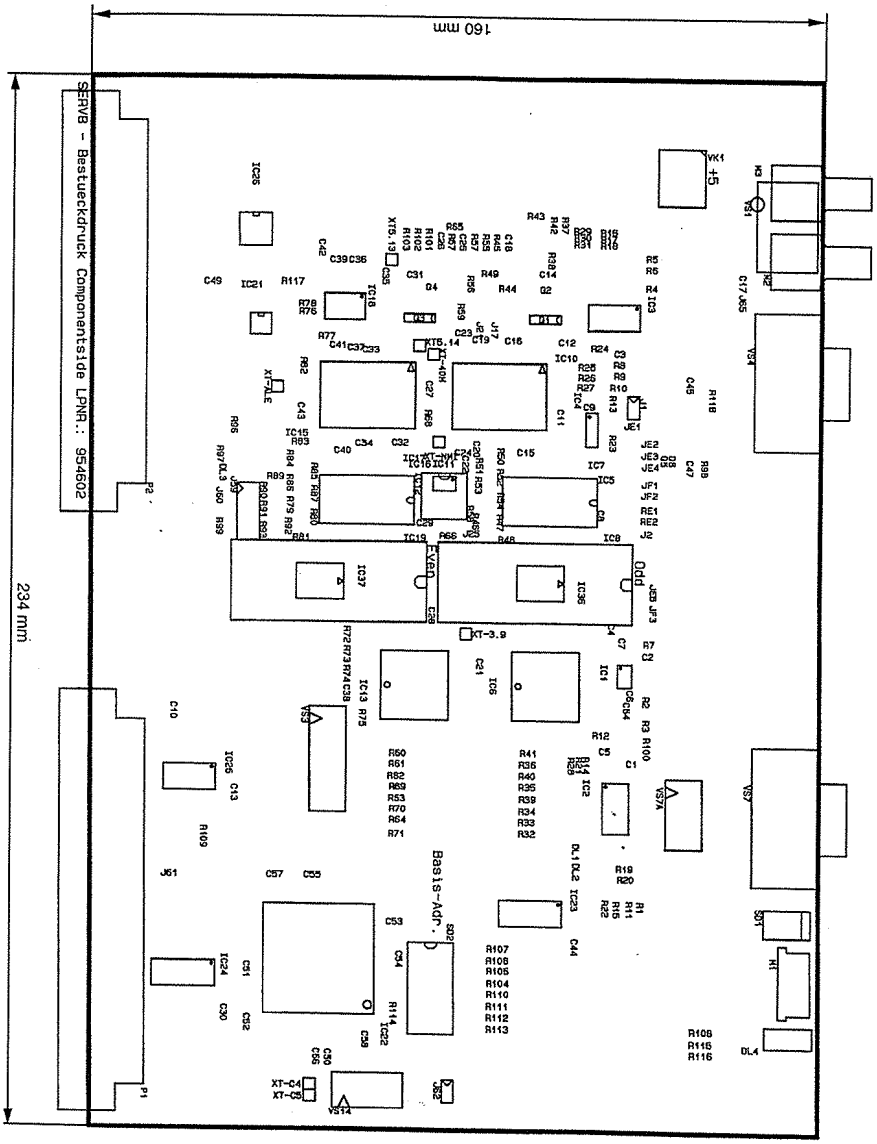


Fig. 13-4: Dimensional sheet SCS-V01.2

13.5 Dimensional Sheet SCS-V02

The mechanical dimensions of assembly SCS-V are determined by single europe format standards (VME U3).

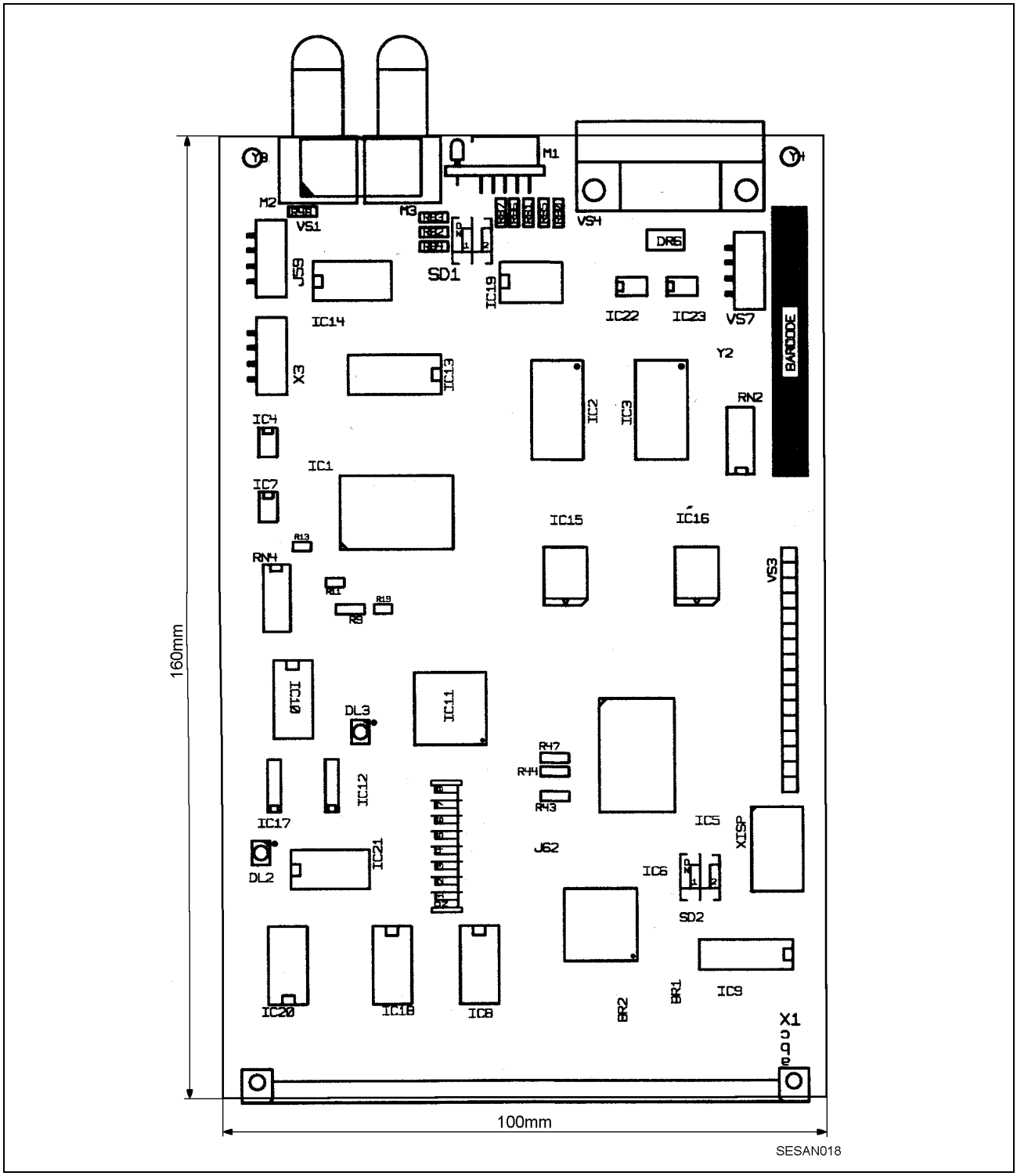


Fig. 13-5: Dimensional sheet SCS-V02.1

14 Index

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15 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland: (0) nach Landeskennziffer weglassen!!
from abroad: don't dial (0) after country code!

Vertriebsgebiet Mitte ☒ SALES Germany Centre ☒ Service	Vertriebsgebiet Mitte ☒ SALES Germany Centre ☐ Service	Vertriebsgebiet Ost ☒ SALES Germany East ☒ Service	Vertriebsgebiet Ost ☒ SALES Germany East ☐ Service
Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 97816 Lohr am Main Telefon: +49 (0)9352/40-0 Telefax: +49 (0)9352/40-4885	Mannesmann Rexroth AG Gesch.ber. Rexroth Indramat Lilistraße 14-18 63067 Offenbach Telefon: +49 (0) 69/82 00 90-0 Telefax: +49 (0) 69/82 00 90-80	Rexroth Indramat GmbH Beckerstraße 31 09120 Chemnitz Telefon: +49 (0)371/35 55-0 Telefax: +49 (0)371/35 55-333	Mannesmann Rexroth AG GB Rexroth Indramat GmbH Holzhäuser Str. 122 04299 Leipzig Telefon: +49 (0)341/86 77-0 Telefax: +49 (0)341/86 77-219
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